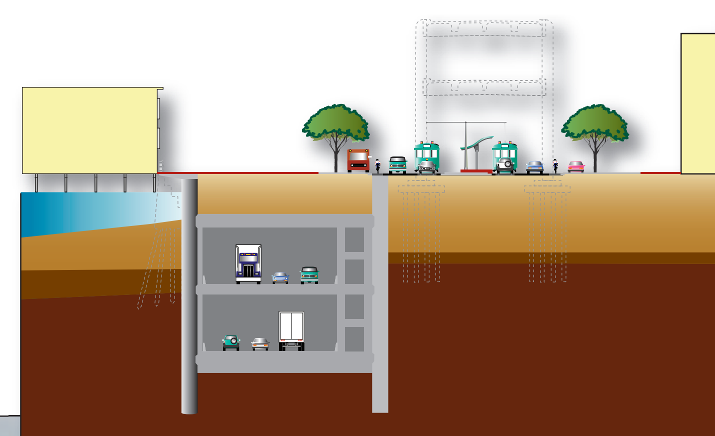
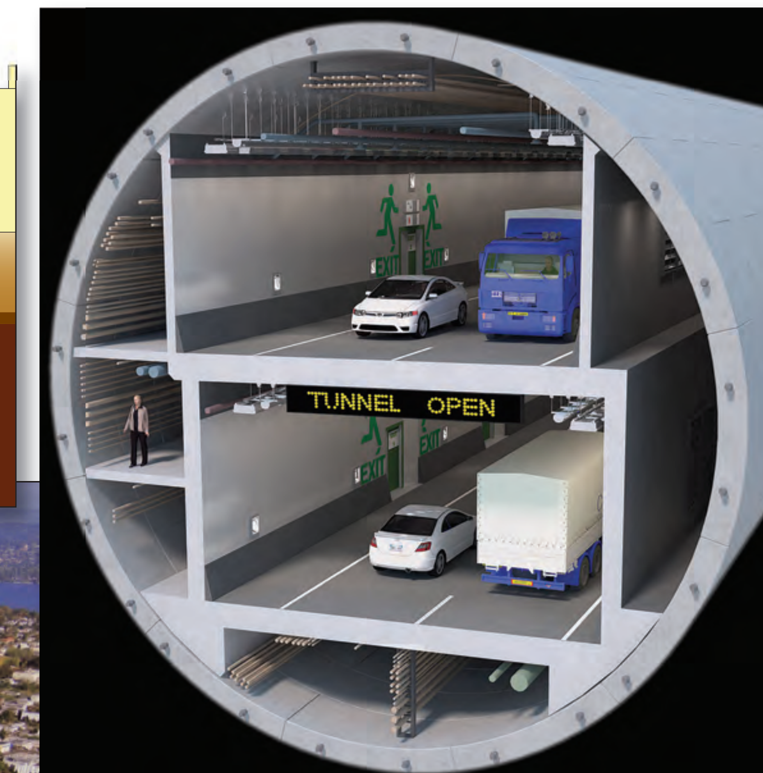
ALASKAN WAY VIADUCT REPLACEMENT PROJECT

Final Environmental Impact Statement and Section 4(f) Evaluation





U.S. Department of Transportation
Federal Highway Administration

Washington State Department of Transportation

City of Seattle

JULY 2011

FHWA-WA-EIS-04-01-F

ALASKAN WAY VIADUCT REPLACEMENT PROJECT

Final Environmental Impact Statement and Section 4(f) Evaluation

Submitted pursuant to:
The National Environmental Policy Act (NEPA)(42 U.S.C. 4322(2)(C))
and
the State Environmental Policy Act (SEPA)(Ch. 43.21 C RCW)
and Section 4(f) of the Department of Transportation Act,
(49 U.S.C. 303(c))
by the
FEDERAL HIGHWAY ADMINISTRATION

and
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

and
CITY OF SEATTLE DEPARTMENT OF TRANSPORTATION

Abstract
The existing Alaskan Way Viaduct (SR 99) was built in the 1950s and was damaged in the 2001 Nisqually earthquake. It is seismically vulnerable and at the end of its useful life—it must be replaced. The Federal Highway Administration, Washington State Department of Transportation, and City of Seattle plan to replace the existing facility to provide a structure capable of withstanding earthquakes and to ensure that people and goods can safely and efficiently travel within and through the project corridor. The Alaskan Way Viaduct provides vital transportation connections into and through downtown Seattle, as well as between various other regional destinations. Failure of the viaduct would create severe hardships for the city and region and could possibly cause injury or death.

The 2004 Draft Environmental Impact Statement (EIS) analyzed five Build Alternatives and a No Build Alternative for their potential effects on the human and natural environment. Based on information presented in the Draft EIS, public comments, and further study and design, the lead agencies reduced the number of alternatives from five to two. The two alternatives, the Tunnel (now the Cut-and-Cover Tunnel Alternative) and Elevated Structure, were then evaluated in the 2006 Supplemental Draft EIS document. In 2009, the Governor, former King County Executive, and former Seattle Mayor recommended replacing the central waterfront portion of the Alaskan Way Viaduct with a single bored tunnel. The 2010 Supplemental Draft EIS analyzed the new Bored Tunnel Alternative, provided information about design changes to the 2006 build alternatives still under consideration, and compared 2006 build alternatives to the Bored Tunnel Alternative.

This Final EIS evaluates the No Build Alternative in addition to the Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative, each with and without tolls, for their potential effects to the natural and built environments. The lead agencies have identified the Bored Tunnel Alternative with tolls as the preferred alternative. No decision will be made on the proposed action until the Record of Decision is published, which is expected in August 2011. If tolling is not authorized by the Washington State Legislature, it could direct WSDOT to request a revised Record of Decision from Federal Highway Administration to authorize the construction of the Bored Tunnel Alternative as a non-tolled facility.

Daniel M. Mathis
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Division Administrator, Washington Division
Federal Highway Administration
Lead for National Environmental Policy Act (NEPA)
06/20/2011
Date of Approval

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Megan White, P.E.
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6/20/2011
Date of Approval

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Director
Seattle Department of Transportation
June 20, 2011
Date of Approval

U.S. Department of Transportation Federal Highway Administration

Washington State Department of Transportation

City of Seattle

JULY 2011

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A Federal agency may publish a notice in the Federal Register, pursuant to 23 USC §139(l), indicating that one or more federal agencies have taken final action on permits, licenses, or approvals for a transportation project. If such notice is published, claims seeking judicial review of those federal agency actions will be barred unless such claims are filed within 180 days after the date of publication of the notice, or within such shorter time period as is specified in the federal laws pursuant to which judicial review of the federal agency action is allowed. If no notice is published, then the periods of time that otherwise are provided by the Federal laws governing such claims will apply.

FACT SHEET

Project Name

SR 99: Alaskan Way Viaduct Replacement Project

Project Description

The SR 99: Alaskan Way Viaduct Replacement Project proposes to replace SR 99 between S. Royal Brougham Way and Roy Street in Seattle, Washington with a facility that has improved earthquake resistance. Damage sustained by the viaduct during the February 2001 Nisqually earthquake compromised its structural integrity. This past damage, along with the age, design, and location of the existing viaduct, makes this facility vulnerable to sudden and catastrophic failure in an earthquake.

SR 99 and Interstate 5 are the primary north-south access routes through downtown Seattle, making the Alaskan Way Viaduct a vital link in the region's highway and freight mobility system, and thus critical to the region's economy. Together with the transit system, light rail and local streets, SR 99 serves regional and local needs.

This Final EIS analyzes and compares the effects of the No Build Alternative, and the Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative, each with and without tolls. The No Build Alternative is evaluated to provide baseline information. The lead agencies have identified the Bored Tunnel Alternative with tolls as the preferred alternative. If tolling is not authorized by the Washington State Legislature, it could direct WSDOT to request a revised Record of Decision from the Federal Highway Administration to authorize the construction of the Bored Tunnel Alternative as a non-tolled facility.

Joint Lead Agencies

Federal Highway Administration
Washington Division
Evergreen Plaza
711 S. Capitol Way, Suite 501
Olympia, WA 98501 - 1284

Washington State Department of Transportation
Alaskan Way Viaduct Replacement Project Office
Wells Fargo Building
999 Third Avenue, Suite 2424
Seattle, WA 98104 - 4019

City of Seattle Department of Transportation
700 Fifth Avenue, Suite 3900
PO Box 34996
Seattle, WA 98124 - 4996

NEPA Lead Agency

The Federal Highway Administration is the lead agency for NEPA.

Responsible NEPA Official

Daniel M. Mathis, P.E.
Division Administrator, Washington Division
Federal Highway Administration
711 S. Capitol Way, Suite 501
Olympia, WA 98501 - 1284

SEPA Lead Agency

The Washington State Department of Transportation is the nominal lead agency and the City of Seattle is a co-lead agency for SEPA.

Responsible SEPA Official

Megan White, P.E.
Director, Environmental Services Office
Washington State Department of Transportation
PO Box 47331
Olympia, WA 98504 - 7331

Document Availability

The Final EIS is available online at:
http://www.alaskanwayviaduct.org

Printed copies of this Final EIS and related appendices (discipline reports) are available at City of Seattle public libraries and neighborhood service centers (see the Distribution List on page 272). These documents are also available for purchase at:

Alaskan Way Viaduct Replacement Project Office
999 Third Avenue, Reception desk on the 22nd Floor
Seattle, WA 98104 - 4019

CDs and the Executive Summary are available at no charge.
Prices for printed volumes do not exceed the cost of printing and are as follows:

Final EIS (17 x 11 color)	$50
Set of Appendices	$75
Final EIS and Appendices	$125

Contact Information

To obtain a copy of the environmental documents, contact:

Angela Angove
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U.S. Department of Transportation Federal Highway Administration
Washington State Department of Transportation
City of Seattle

JULY 2011

FACT SHEET

continued

Permits, Approvals, and Consultations

Federal

- **National Marine Fisheries Service and U.S. Fish and Wildlife Service** – Section 7 Endangered Species Act (ESA) Consultation and Marine Mammal Protection Act Consultation
- **National Marine Fisheries Service** – Magnuson-Stevens Fishery Conservation and Management Act Consultation
- **Federal Highway Administration,** in consultation with the **Washington Department of Archaeology and Historic Preservation** – National Historic Preservation Act, Section 106 Consultation
- **U.S. Department of Transportation** – Section 4(f) Evaluation

State

- **Washington State Department of Ecology** – Model Toxics Control Act, Removal of Underground Storage Tanks
- **Washington State Department of Ecology** – National Pollutant Discharge Elimination System (NPDES), Construction Stormwater General Permit
- **Washington State Department of Ecology** – Coastal Zone Management Act (CZMA), Consistency Certification
- **Washington State Department of Ecology** – Underground Injection Control Registration
- **Washington State Department of Ecology** – Notice of Intent for Installing, Modifying, or Removing Piezometers
- **Washington State Department of Ecology** – Notice of Intent for Installing, Modifying, or Removing Wells
- **Washington State Department of Ecology** – Chemical Treatment Letter of Approval

Local

- **King County** – Industrial Waste Program Wastewater Discharge Permit, if required
- **Seattle City Light** – Clearance Permits
- **Seattle Department of Planning and Development** – Master Use Permit
- **Seattle Department of Planning and Development** – Shoreline Substantial Development Permit
- **Seattle Department of Planning and Development** – Grading Permit[1]
- **Seattle Department of Planning and Development** – Building Permit
- **Seattle Department of Planning and Development** – Demolition Permit
- **Seattle Department of Planning and Development** – Side Sewer Permit
- **Seattle Department of Transportation** – Street Use Permit
- **Seattle Department of Neighborhoods and Pioneer Square Preservation Board** – Pioneer Square Historic District Certificate of Approval
- **Seattle Department of Neighborhoods and Pike Place Market Historic District Commission** – Pike Place Market Historic District Certificate of Approval
- **Seattle Department of Planning and Development** – Major Public Project Construction Variance/Temporary Noise Variance
- **Seattle Department of Planning and Development** – Removal or Abandonment of Underground Storage Tanks

Other Seattle Permits/Approvals

- Mechanical Permit
- Electrical Permit
- Sign Permit
- Elevator Permit
- Fire Alarm Permit

Other Permits/Approvals

- **Puget Sound Clean Air Agency** – Clean Air Act, Air Quality Conformity Review
- **Puget Sound Clean Air Agency** – Notice of Intent for Demolition Activities and Notice of Construction for Constructing a Concrete Batch Plant

Authors and Principal Contributors

Please see the List of Preparers included at the end of the Final EIS.

Date Issued

July 15, 2011

Subsequent Environmental Review

FHWA intends to issue the Record of Decision (ROD) for this project 30 days after publication of a Federal Register notice announcing that the Final EIS has been issued, or as soon after that date as practicable. The Federal Register notice is expected to be published on July 15; when published, it will be posted on the project website at www.alaskanwayviaduct.org. While the lead agencies are not required to request comments on a Final EIS pursuant to 40 CFR 1503.1(b), in order to be fully informed of the interests of all parties, the lead agencies are accepting comments on the Final EIS. If any substantive comments are received prior to the signing of the ROD, FHWA will include responses to those comments in the ROD. Comments must be received by no later than 5:00 pm on Monday, August 15, 2011 for consideration in the ROD. Comments may be submitted by mail to:

Angela Angove
Alaskan Way Viaduct Replacement Project Office
999 Third Avenue, Suite 2424
Seattle, WA 98104 - 4019
or via email at: awv2011FEIScomments@wsdot.wa.gov

1 The City and WSDOT may be exempt from certain permits under some conditions. Even though this grading work may be exempt, the City would still perform a project review to ensure that the project meets City requirements for grading activities.

ALASKAN WAY VIADUCT REPLACEMENT PROJECT

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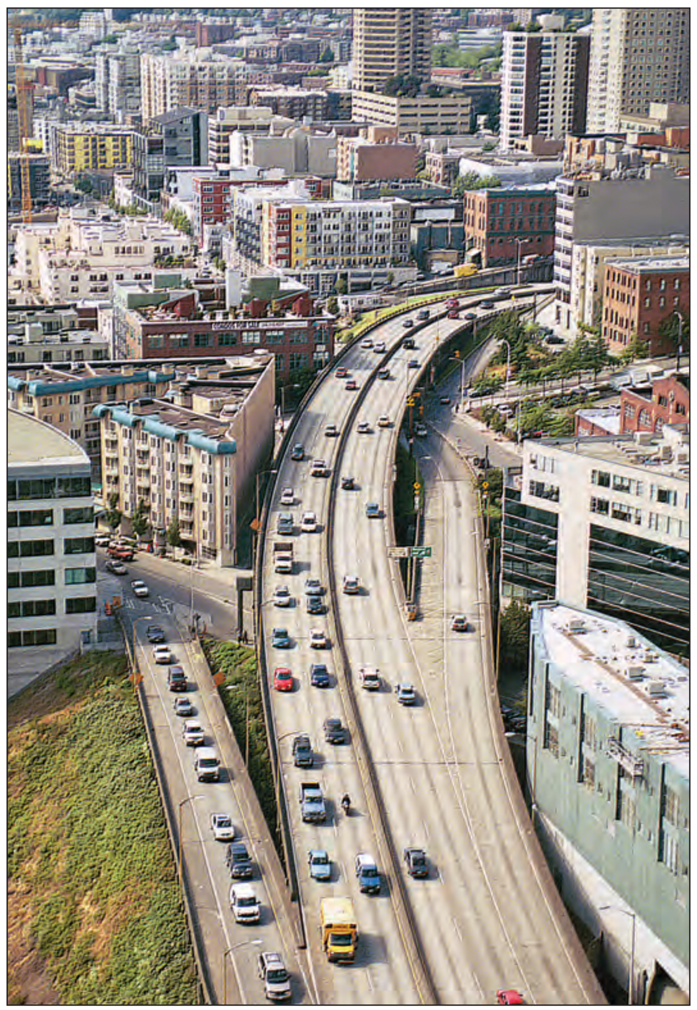

CONTENTS

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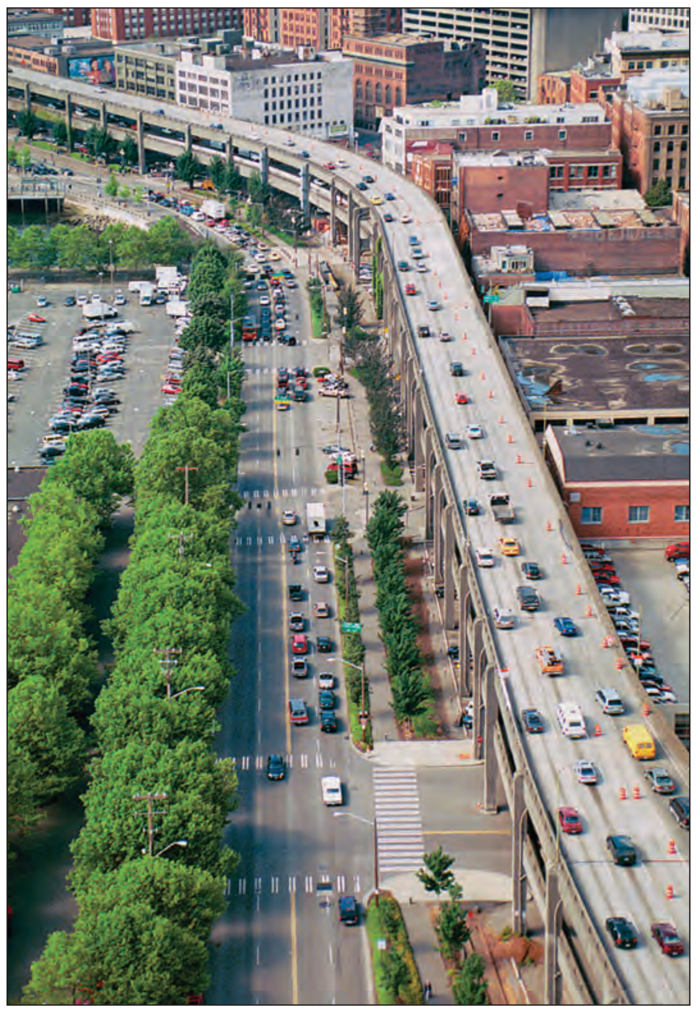

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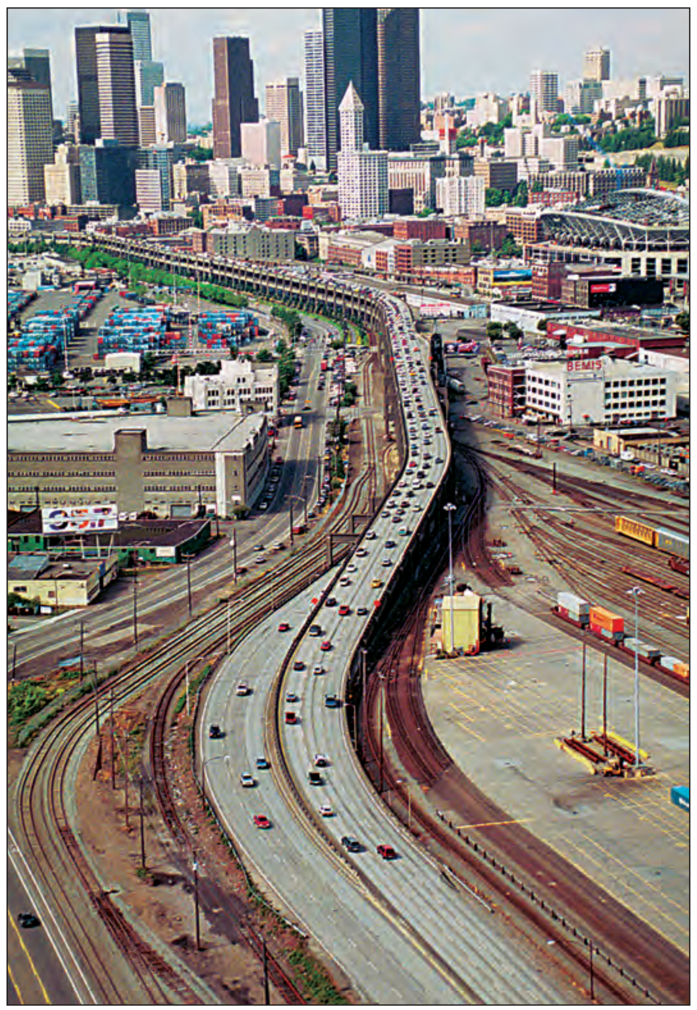

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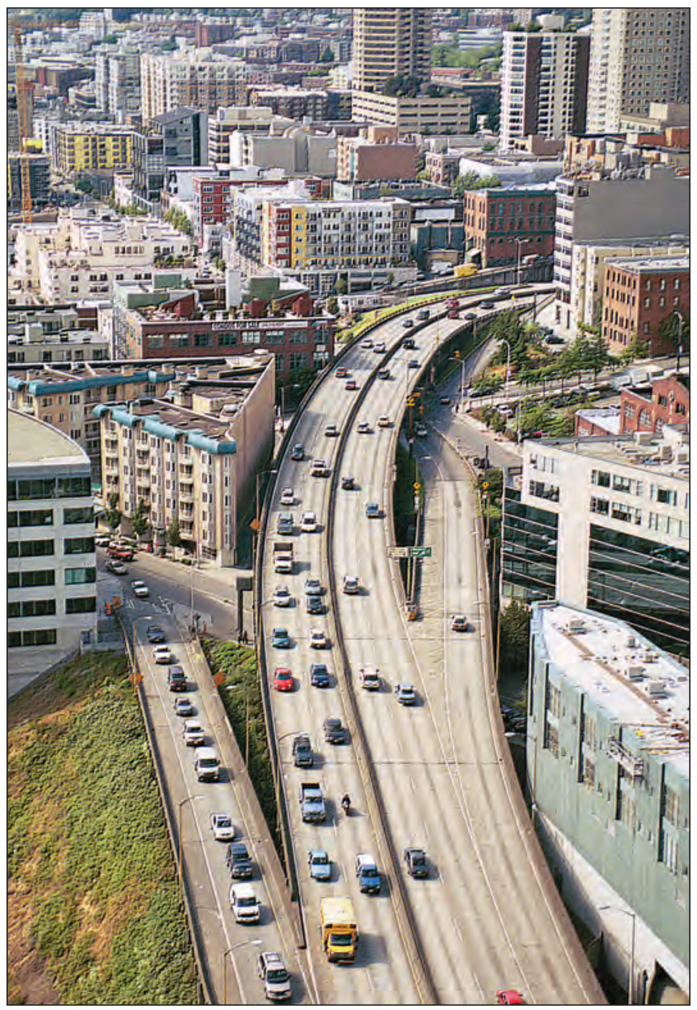

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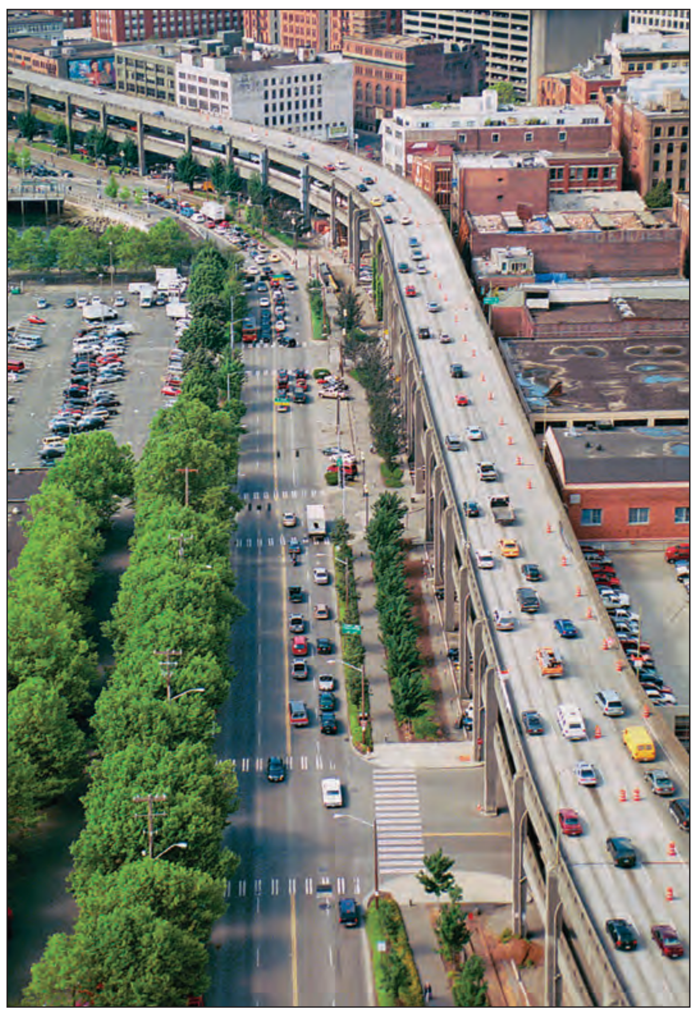

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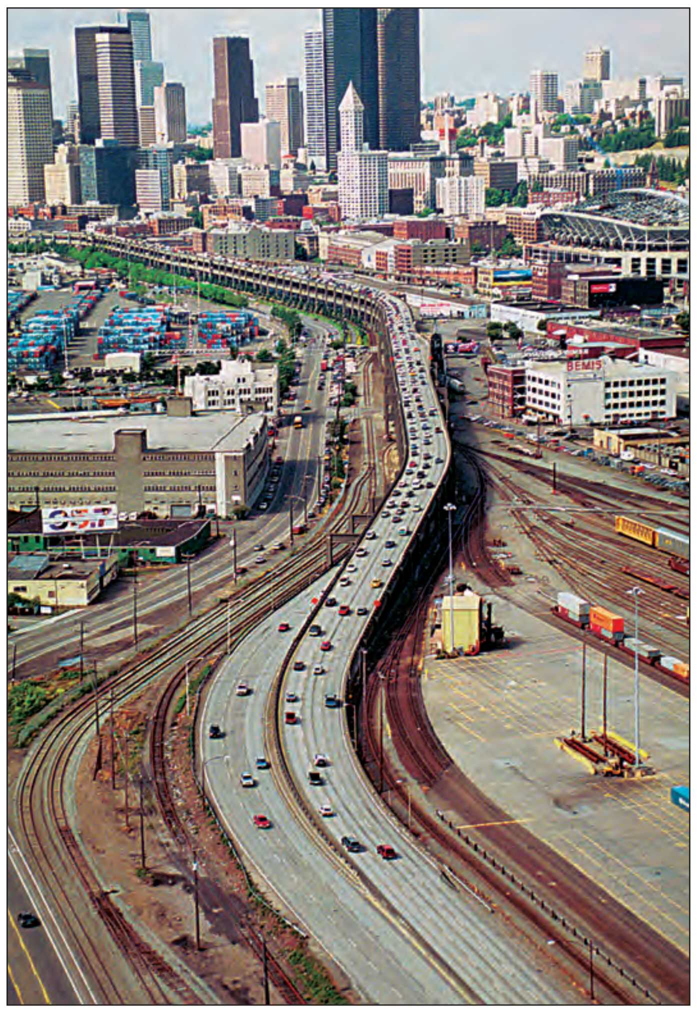


Final Section 4(f) Evaluation

IN MEMORIAM…

This document is dedicated to the memories of Maureen Sullivan (WSDOT), Roland Benito (WSDOT), and James Leonard (FHWA). Their legacy of dedication and contributions to the delivery of the Alaskan Way Viaduct and Seawall Replacement Program is immeasurable. We will carry forward their spirit and commitment towards delivery of this public safety project in their memories.

Cracked Column in the Viaduct

Damaged Rebar in the Viaduct

SUMMARY

What is in the Summary?

This chapter summarizes information contained in the Alaskan Way Viaduct Replacement Project's Final EIS. Specifically, this chapter discusses the permanent effects, construction effects, cumulative effects, and proposed mitigation for the tolled and non-tolled build alternatives.

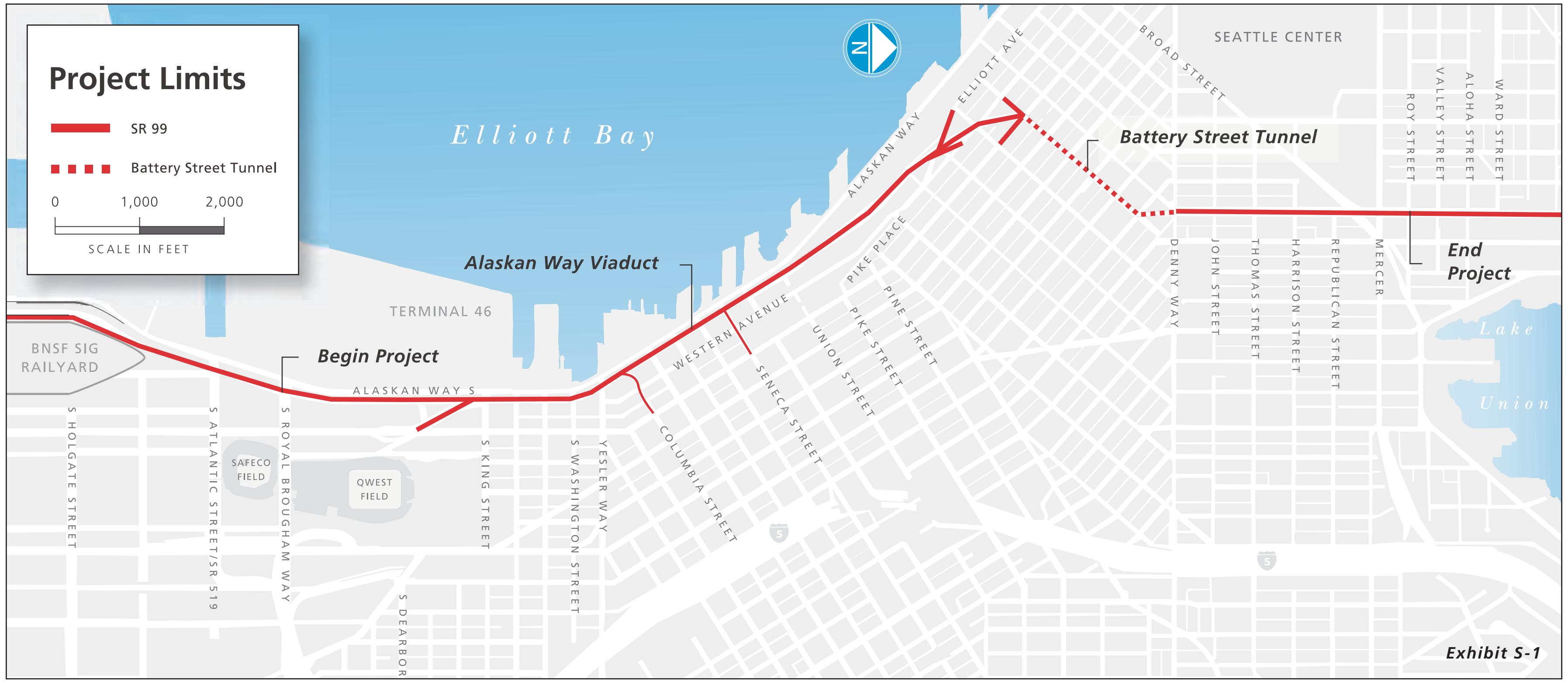


Exhibit S-1

1 What is the Alaskan Way Viaduct Replacement Project?
The Alaskan Way Viaduct Replacement Project (project) is located in downtown Seattle, Washington. The project would replace State Route (SR) 99 from approximately S. Royal Brougham Way to Roy Street and remove the existing viaduct (SR 99) from approximately S. King Street to the Battery Street Tunnel.

2 What are the project limits and why were they selected?
The project limits begin at approximately S. Royal Brougham Way in the south and continue north to Roy Street, as shown in Exhibit S-1. The project limits represent the logical end points (termini) for transportation improvements and environmental review based on identified project needs, which include providing a facility with improved earthquake resistance. S. Royal Brougham Way provides an important link to other regional facilities, such as I-5, I-90, and SR 519, and Roy Street is where traffic exits and enters SR 99.

Elliott Bay represents the project limit to the west and I-5 is the project limit to the east, though the potentially affected area to the west and east depends on the resource.

The project area is located in a highly urban environment where space for construction staging is limited. Because of this, potential staging sites have been proposed outside of the project limits to ensure that sufficient staging areas are available, as shown in Exhibit S-2.

3 Who is leading this project?
This project is being led by a partnership of three agencies: the Federal Highway Administration (FHWA), Washington State Department of Transportation (WSDOT), and City of Seattle (City). FHWA is the federal lead agency for this project and is responsible for ensuring that federal regulations are followed. WSDOT owns SR 99 and the viaduct and is responsible for structural inspections and major maintenance, and for ensuring that state regulations are followed. The City is responsible for viaduct traffic operations and minor maintenance. In addition, the City owns and maintains Alaskan Way, the area underneath the viaduct, and many of the utilities located in the project area.

4 What is the purpose of the Alaskan Way Viaduct Replacement Project and why is it needed?
The Alaskan Way Viaduct is seismically vulnerable and at the end of its useful life. To protect public safety and provide essential vehicle capacity to and through downtown Seattle, the viaduct must be replaced. Because this facility is at risk of sudden and catastrophic failure in

Project Purpose and Need Statement

The full project purpose and need statement is contained in Chapter 1, Question 5 of the *Final EIS*.

an earthquake, FHWA, WSDOT, and the City seek to implement a replacement as soon as possible. Moving people and goods to and through downtown Seattle is vital to maintaining local, regional, and statewide economic health. FHWA, WSDOT, and the City have identified the following purpose and needs the project should address.

The purpose of the proposed action is to provide a replacement transportation facility that will:

- Reduce the risk of catastrophic failure in an earthquake by providing a facility that meets current seismic safety standards
- Improve traffic safety
- Provide capacity for automobiles, freight, and transit to efficiently move people and goods to and through downtown Seattle
- Provide linkages to the regional transportation system and to and from downtown Seattle and the local street system
- Avoid major disruption of traffic patterns due to loss of capacity on SR 99
- Protect the integrity and viability of adjacent activities on the central waterfront and in downtown Seattle

5 What is the history of this project?

Exhibit S-3 summarizes the history of this project and the alternatives evaluated through the environmental impact statement (EIS) process. Interest in replacing the viaduct began in 1995 when a study conducted by WSDOT and the University of Washington determined that the viaduct was vulnerable to soil liquefaction in the event of an earthquake.[1] In early 2001, a team of design and seismic experts began work to consider various options for the viaduct. In the midst of this investigation, a 6.8-magnitude earthquake, called the Nisqually earthquake, shook the Puget Sound region on February 28, 2001.

The earthquake demonstrated the urgent need for replacing the viaduct with a seismically safe facility. As a result, FHWA, WSDOT, and the City initiated the process to evaluate viaduct replacement alternatives by publishing a Notice of Intent (NOI) on June 22, 2001[2] as required by the National Environmental Policy Act (NEPA). The 2001 NOI established that the proposed action would involve improving or replacing the 2 mile-long viaduct structure. At that time, the project did not include replacing the seawall, and project limits were established as the First Avenue South Bridge to north of the Battery Street Tunnel.

As the initial study for the project was underway, concerns were raised about the condition of the Elliott Bay Seawall, which holds back the soil that the viaduct's foundations are embedded in. Because of these concerns, the 2001 NOI was revised on September 26, 2003.[3] The revised NOI included replacing the seawall and moving the southern terminus north from the First Avenue S. Bridge to S. Spokane Street. As a result, 76 viaduct replacement concepts and seven seawall concepts were organized into six groups:

- Viaduct improvements from S. Holgate Street to the Battery Street Tunnel
- Battery Street Tunnel improvements
- Roadway improvements outside of the corridor
- Multi-modal solutions (transit, bicycle, and pedestrian opportunities)
- Related improvements
- Seawall improvements

Then, the best ideas from these six groups were shaped into the five build alternatives evaluated in the 2004 Draft EIS: the Rebuild, Aerial, Tunnel, Bypass Tunnel, and Surface Alternatives.

In late 2004, after the public comment period for the Draft EIS, these five build alternatives were narrowed down to two: a Cut-and-Cover Tunnel and an Elevated Structure. Between 2004 and 2006, design changes were made to the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the project was extended farther north to

Exhibit S-2

Appendix W, Screening Reports

Information about how design concepts were screened is provided in *Appendix W*.

1 WSDOT 1995.

2 Federal Register 2001.

3 Federal Register 2003.

improve access to and from SR 99 and improve local street connections as documented in an NOI[4] on August 3, 2005; and different construction approaches were considered in response to public comments received on the 2004 Draft EIS. These changes required further evaluation in a Supplemental Draft EIS that was published in July 2006.

In December 2006, Governor Christine Gregoire called for an advisory vote for Seattle residents. The Seattle City Council responded by authorizing a vote and placing the Elevated Structure Alternative and a Surface-Tunnel Hybrid Alternative on the ballot. The four-lane Surface-Tunnel Hybrid Alternative differed from the six-lane Cut-and-Cover Tunnel Alternative evaluated in the 2006 Supplemental Draft EIS. The Surface-Tunnel Hybrid Alternative was a four-lane, cut-and-cover tunnel that proposed to use safety shoulders as exit-only lanes and reduce the speed limit during rush hours. On March 13, 2007, the citizens of Seattle voted against both alternatives.

After the March 2007 vote, Governor Gregoire, former King County Executive Ron Sims, and former Seattle Mayor Greg Nickels chose to move forward with critical safety and mobility improvement projects at the north and south ends of the Alaskan Way Viaduct. The letter dated March 14, 2007, is provided in the reference materials at the end of this Final EIS. These projects, called the Moving Forward projects, could proceed because they provide useful improvements that are needed regardless of other decisions, including how to replace SR 99 on the central waterfront.

Following the March 2007 vote, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels committed to a collaborative effort, referred to as the Partnership Process, to forge a solution for replacing the viaduct along Seattle's central waterfront. The Partnership Process looked at how improvements to the broader transportation system (including Seattle surface streets and I-5) could work with various ways to replace the viaduct, including surface streets, a new elevated structure, or a tunnel. The Partnership Process began evaluating eight scenarios or comprehensive solutions to learn what elements worked best together. This evaluation led to the development and analysis of three hybrid scenarios described below:

- I-5, Surface, and Transit Hybrid – SR 99 would be replaced with a pair of north- and southbound one-way streets near Seattle's central waterfront. This scenario included a high level of transit investment and extensive I-5 improvements.

- Elevated Bypass Hybrid – SR 99 would be replaced with two side-by-side, elevated roadways along Seattle's central waterfront. Each structure would have two lanes in each direction. This scenario included some additional transit investments and improvements to I-5 and Alaskan Way.

- Twin Bored Tunnel Hybrid (later refined to a single bored tunnel) – SR 99 would be replaced with two 2-lane bored tunnels between approximately S. Royal Brougham Way and Harrison Street. Evaluation of this hybrid led to the development of a single large-diameter bored tunnel. This scenario included some additional transit investments and improvements to I-5 and Alaskan Way.

In January 2009, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels recommended replacing the central waterfront portion of the Alaskan Way Viaduct with a single, large-diameter bored tunnel. The executives also identified improvements that would complement the bored tunnel. These improvements included a restored seawall; a new waterfront surface street and connection from the waterfront to Western and Elliott Avenues; a waterfront promenade; transit enhancements; and a streetcar on First Avenue. The letter of agreement between Washington State, King County, and the City dated January 13, 2009, is provided in the reference section at the end of this Final EIS.

Exhibit S-3
Project Timeline

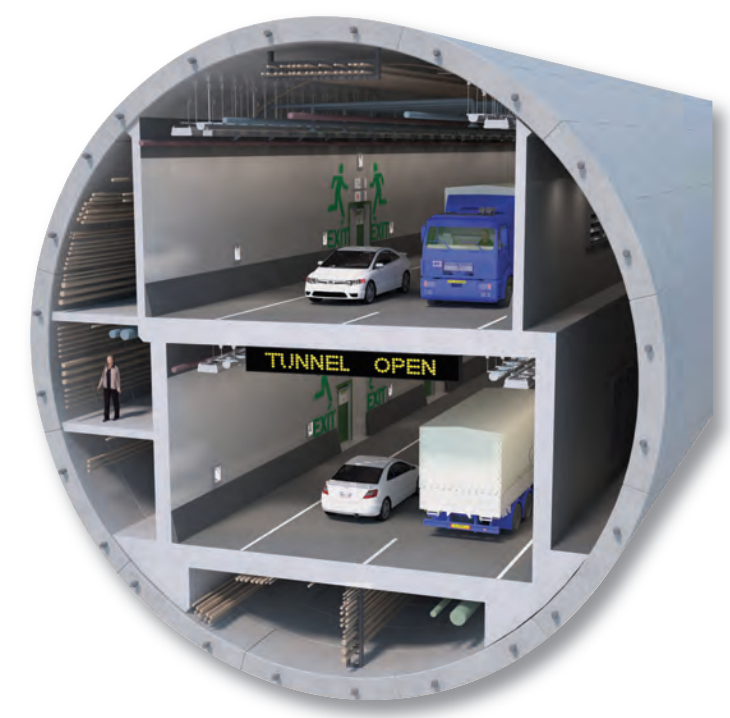
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

- Nisqually Earthquake – Viaduct joints and columns damaged; Alaskan Way surface street settles near aquarium
- Screening Process – 76 Replacement Concepts & 7 Seawall Concepts
- **Draft EIS** – Analyzes 5 Alternatives: Rebuild • Aerial • Tunnel • Bypass Tunnel • Surface
- **Draft EIS published**
- **Preferred Alternative selected** – Cut-&-Cover Tunnel Preferred; Elevated Structure Contingency
- **Supplemental Draft EIS published** – Analyzes 2 Alternatives: Cut-&-Cover Tunnel • Elevated Structure
- Seattle voters reject ballot measures for the elevated and surface-tunnel hybrid alternatives
- Governor Gregoire, King County Executive Sims, and Mayor Nickels announce Moving Forward projects and commit to work collaboratively on a solution for SR 99 in the central waterfront.
- Partnership Process developed and information presented to Stakeholder Advisory Committee for feedback
- **S. Holgate Street to S. King Street Viaduct Replacement Project EA published**
- Governor Gregoire, King County Executive Sims, and Mayor Nickels recommend replacing the central section of the viaduct with a bored tunnel
- **S. Holgate Street to S. King Street Viaduct Replacement Project FONSI published**
- **Second Supplemental Draft EIS published** – Bored Tunnel

6 What is the Preferred Alternative?

The 2010 Supplemental Draft EIS identified the Bored Tunnel as the preferred alternative to replace the Alaskan Way Viaduct but did not state whether or not it would operate with tolls. The lead agencies are now specifying that the preferred alternative includes tolls for the Bored Tunnel Alternative. The Tolled Bored Tunnel Alternative was identified as the preferred alternative because it:

Bored Tunnel Cross-Section



4 Federal Register 2005.

- It is the only alternative that can be constructed without closing or substantially restricting SR 99 for years. Given the importance of the highway to local and regional transportation this is a very important advantage (see Chapter 6).

- The Bored Tunnel Alternative gives the City the most latitude in planning for its central waterfront by removing both above ground and subsurface constraints on development (see Chapter 5, Question 19).

- The Bored Tunnel Alternative integrates with surface streets north of downtown better than either the Cut-and-Cover or Elevated Structure alternatives (see Chapter 5, Question 19).

Tolling does not affect these benefits of the Bored Tunnel Alternative compared to the other two build alternatives, nor does it materially increase or decrease the construction or permanent effects of the Bored Tunnel Alternative compared to the other build alternatives.

The Washington State Legislature has not yet authorized WSDOT to proceed with tolling of this project. Ultimately, tolling will be implemented on SR 99 only if the Legislature authorizes it to be done. While the tolled and non-tolled versions both would be acceptable, the Tolled Bored Tunnel Alternative is designated as the preferred alternative. The reason for designating the tolled version as the preferred alternative is that funding identified by the legislature at this time includes $400 million in revenue from tolling. This approach is more consistent with the region's long-range transportation plan, Transportation 2040, which was adopted by the Puget Sound Regional Council in May 2010. The legislature has authorized WSDOT to commit expending up to $2.8 billion to replace the Alaskan Way Viaduct. This commitment is included in legally-binding agreements between WSDOT and the City. WSDOT will work with the legislature to identify other funding sources if tolling is not authorized in order to meet the State's funding commitment and contractual obligations.

7 What other alternatives are considered in this Final EIS?

In addition to the Bored Tunnel Alternative, this Final EIS analyzes the Cut-and-Cover Tunnel and Elevated Structure Alternatives, each with and without tolls. As required by environmental regulations, a No Build Alternative is also evaluated to provide baseline information about future conditions in the project area if none of the build alternatives were selected for construction. Conditions with the project can then be compared to these future baseline conditions to determine the project's effects. In a typical NEPA document, the No Build Alternative projects existing conditions to a future design year (2030 for this project). For this project, however, we know that if the existing viaduct is not replaced it will be closed, due to its seismic vulnerability and deteriorated condition. Therefore, the Viaduct Closed (No Build Alternative) assesses baseline conditions as if the viaduct were closed between the First Avenue S. ramps and the Battery Street Tunnel.

8 How does the project relate to the Alaskan Way Viaduct and Seawall Replacement Program?

The Alaskan Way Viaduct Replacement Project complements a number of other projects with independent utility that improve safety and mobility along SR 99 and the Seattle central waterfront from the area south of downtown to Seattle Center. These improvements include the Moving Forward projects identified in 2007 and the improvements recommended as part of the Partnership Process. Collectively, these individual projects are referred to as the Alaskan Way Viaduct and Seawall Replacement Program (Program). The individual projects are shown in Exhibit S-4 and listed in Exhibit S-5. Environmental effects of the independent projects will be examined through separate environmental processes.

9 How would the Bored Tunnel Alternative replace the existing viaduct?

The Bored Tunnel Alternative would replace SR 99 between S. Royal Brougham Way and Roy Street as shown in Exhibit S-6.

Alaskan Way Viaduct & Seawall Replacement
Program Elements

Exhibit S-4

Exhibit S-5
Other Projects Included in the Alaskan Way Viaduct & Seawall Replacement Program

Project	ALTERNATIVE Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
INDEPENDENT PROJECTS THAT COMPLEMENT THE BORED TUNNEL ALTERNATIVE			
Elliott Bay Seawall Project	√	Included in alternative	Included in alternative
Alaskan Way Surface Street Improvements	√	Included in alternative	Included in alternative
Alaskan Way Promenade/ Public Space	√	Included in alternative	Included in alternative
First Avenue Streetcar Evaluation	√	Included in alternative	Included in alternative
Elliott/Western Connector	√	Function Provided[1]	Function Provided[1]
Transit Enhancements	√	Not Proposed[2]	Not Proposed[2]
PROJECTS THAT COMPLEMENT ALL BUILD ALTERNATIVES			
S. Holgate Street to S. King Street Viaduct Replacement Project	√	√	√
Mercer West Project	√	√	√
Transportation Improvements to Minimize Traffic Effects During Construction	√	√	√
SR 99 Yesler Way Vicinity Foundation Stabilization	√	√	√
S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project	√	√	√

1 *These specific improvements are not proposed with the Cut-and-Cover Tunnel and Elevated Structure Alternatives; however, these alternatives provide a functionally similar connection with ramps to and from SR 99 at Elliott and Western Avenues.*

2 *Similar improvements included with the Bored Tunnel Alternative could be proposed with this alternative.*


Bored Tunnel Alternative
Southbound SR 99
Northbound SR 99
Egress
Egress
Egress
Vent
Surface
Lowered Roadway
Cut-&-Cover Tunnel
Bored Tunnel
Elevated Roadway
Aerial
Elliott Bay
Olympic Scu
Decommission Battery Street Tunnel
Broad Street Removed
Southbound On
Southbound Off
SR 99
Tunnel Operations Building
Northbound Off
Northbound On
Bored Tunnel
Demolish Viaduct
Railroad
S. Holgate to S. King Street Project
TERMINAL 46
PIER 48
COLMAN DOCK
Southbound On
Northbound On
Street Improvements
Southbound Off
Northbound Off
Tunnel Operations Building
SAFECO FIELD
QWEST FIELD
King St. Station
Union Station
SEATTLE CENTER
QUEEN ANNE AVENUE
FIRST AVENUE N
WARREN AVENUE N
SECOND AV
THIRD AVE
FOURTH AV
FIFTH AVENUE N
TAYLOR AVENUE N
SIXTH AVENUE N
AURORA AVENUE
DEXTER AV
NINTH AVE N
WESTLAKE AVE N
TERRY AVE N
BOREN AVENUE N
FAIRVIEW AVENUE N
MINOR AVENUE N
PONTIUS AVENUE N
YALE AVENUE N
DENNY WAY
JOHN STREET
THOMAS STREET
HARRISON STREET
REPUBLICAN STREET
MERCER
VALLEY STREET
ALASKAN WAY
WESTERN AVENUE
ELLIOTT AVENUE
FIRST AVE
SECOND AVENUE
THIRD AVENUE
FOURTH AVENUE
FIFTH AVENUE
SIXTH AVENUE
SEVENTH AVENUE
EIGHTH AVENUE
NINTH AVENUE
TERRY AVENUE
BOREN AVENUE
MINOR AVENUE
YALE AVE
WESTLAKE AVENUE
BROAD STREET
BAY ST
EAGLE ST
CLAY ST
CEDAR ST
VINE STREET
WALL STREET
BATTERY STREET
BELL STREET
BLANCHARD STREET
LENORA STREET
VIRGINIA ST
STEWART STREET
PINE STREET
PIKE STREET
PIKE PLACE
OLIVE WAY
HOWELL STREET
UNION STREET
UNIVERSITY STREET
SENECA STREET
SPRING STREET
MADISON STREET
MARION STREET
COLUMBIA STREET
CHERRY STREET
JAMES STREET
JEFFERSON STREET
YESLER WAY
S WASHINGTON STREET
S MAIN STREET
S JACKSON STREET
S KING STREET
FIRST AVENUE S
OCCIDENTAL AVENUE S
FOURTH AVENUE S
FIFTH AVENUE S
S ATLANTIC STREET/SR 519
S ROYAL BROUGHAM WAY
5
5
0
1,000
2,000
SCALE IN FEET

Exhibit S-6

South Portal
Full northbound and southbound access to and from SR 99 would be provided in the south portal area with new ramps at S. Royal Brougham Way and Alaskan Way S. A new signalized intersection at Alaskan Way S. and S. Dearborn Street would provide access to and from East Marginal Way S., which would run along the west side of SR 99. A tunnel operations building would be constructed in the block bounded by S. Dearborn Street, Railroad Way S., and Alaskan Way S.

Bored Tunnel
Unlike the existing viaduct, ramps to and from Columbia and Seneca Streets and Elliott and Western Avenues would not be provided. Instead, access to downtown would be provided by ramps constructed at the portals and surface streets.

The bored tunnel shown in Exhibit S-7 would have two lanes in each direction. Southbound lanes would be located on the top portion of the tunnel, and the northbound lanes would be located on the bottom. Travel lanes would be approximately 11 feet wide, with a 2-foot-wide shoulder on one side and an 8 foot-wide shoulder on the other side.

The bored tunnel would be designed to provide emergency access, evacuation routes, ventilation, and fire suppression systems in accordance with National Fire Protection Association standards and other codes and regulations. Emergency tunnel exits would be provided throughout the tunnel, which would lead to secure waiting areas, called refuge areas, and from there to walkways leading out of the tunnel. Refuge areas and the pathways to the refuge areas will be designed to meet Americans with Disabilities Act (ADA) requirements.

This alternative would remove the viaduct along the Seattle waterfront and would close and fill the Battery Street Tunnel after the bored tunnel is constructed.

North Portal
Full northbound and southbound access to and from SR 99 would be provided by new ramps near Harrison and Republican Streets.

Surface streets would be rebuilt and improved in the north portal area:

- Aurora Avenue would be built to grade level between Denny Way and Harrison Street.
- John, Thomas, and Harrison Streets would be connected as cross streets with signalized intersections on Aurora Avenue at Denny Way and John, Thomas, and Harrison Streets.
- Mercer Street would become a two-way street and would be widened from Dexter Avenue N. to Fifth Avenue N.
- Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N.
- A new roadway would be built to extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets.

A tunnel operations building would be constructed between Thomas and Harrison Streets on the east side of Sixth Avenue N.

10 How would the Cut-and-Cover Tunnel Alternative replace the existing viaduct?
The Cut-and-Cover Tunnel Alternative would replace SR 99 from S. Royal Brougham Way to Aloha Street, as shown in Exhibit S-8.

South
In the south portal area, the cut-and-cover tunnel lane configurations and access points are nearly identical to the bored tunnel. Like the Bored Tunnel Alternative, full northbound and southbound access to and from SR 99 would be provided by ramps at S. Royal Brougham Way and Alaskan Way S.; a new intersection at S. Dearborn Street would provide access to East Marginal Way S.; and a tunnel operations building would be constructed in the block bounded by S. Dearborn Street, Railroad Way S., and Alaskan Way S.

Central
The Cut-and-Cover Tunnel Alternative would replace SR 99 with a six-lane cut-and-cover tunnel (three lanes in each direction) from approximately Railroad Way S. to Pine Street. The outer wall of the tunnel would serve as the new seawall from S. Washington Street to Union Street. A tunnel operations building would be constructed in the block bounded by Pine Street, SR 99, and the Alaskan Way Surface Street. Between Pine Street and Virginia Street, a new aerial structure would be built, and SR 99 would connect to the Battery Street Tunnel by traveling under Elliott and Western Avenues. The existing Elliott Avenue on-ramp and Western Avenue off-ramp would be replaced. Because SR 99 would cross under Elliott and Western Avenues, Bell Street could be connected across Western Avenue.

A lid would be built above the new aerial structure from Pine to Virginia Streets. The lid would provide new open space and a pedestrian linkage between Victor Steinbrueck Park and Pike Place Market to the waterfront at about University Street.

Alaskan Way would be replaced east of the existing roadway with at least two lanes in each direction and two waterfront streetcar tracks running in the center travel lanes. Alaskan Way would be lined with expanded open space, a wide waterfront promenade, broad sidewalks on both sides of the surface street, bicycle lanes, and parking. Between Union Street and Broad Street the existing seawall would be replaced.

With the Cut-and-Cover Tunnel Alternative, the Battery Street Tunnel would be retrofitted for improved seismic safety and the tunnel safety systems and facilities would be updated. Tunnel maintenance and ventilation buildings would be built at each end of the Battery Street Tunnel.

Visual Simulation Inside the Bored Tunnel – Northbound

Exhibit S-7

Comparing Features of the Build Alternatives

Unlike the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the Bored Tunnel Alternative does not require construction along Seattle's central waterfront, because the bored tunnel alignment runs inland between Yesler Way and the north portal. Consequently, several components included in the Cut-and-Cover Tunnel and Elevated Structure Alternatives are not included in the Bored Tunnel Alternative, most notably seawall replacement, the new Alaskan Way surface street, the waterfront streetcar replacement, the new Alaskan Way surface street, the waterfront streetcar replacement, and the roadway connection between the waterfront and Elliott and Western Avenues. These projects and others are referred to as "Program Elements" and are discussed in **Question 8** of this summary and also in **Chapter 2** of this *Final EIS*.

Cut-&-Cover Tunnel Alternative

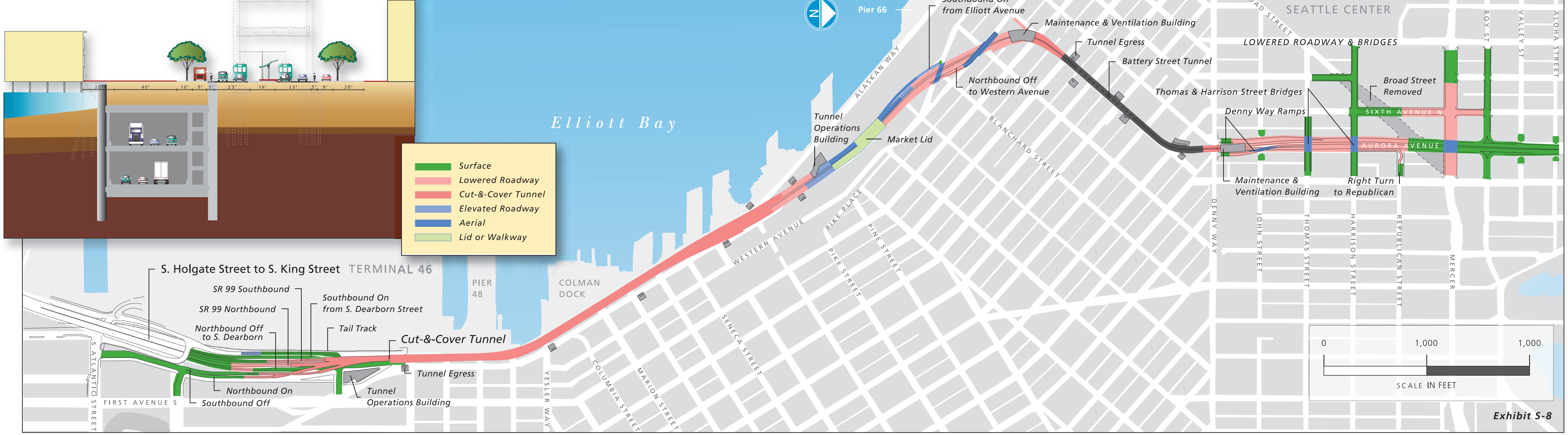


Exhibit S-8

North
North of the Battery Street Tunnel, SR 99 would be improved and widened up to Aloha Street. Access on to SR 99 would be provided at Denny Way and Roy Street, and access off of SR 99 would be provided at Denny Way, Republican Street, and Roy Street. Two new bridges would be built on Thomas and Harrison Streets, spanning SR 99. Broad Street would be closed between Fifth and Ninth Avenues N., allowing the street grid to be connected. Mercer Street would continue to cross under SR 99 as it does today, but it would be widened and converted into a two-way street with three lanes in each direction and a center turn lane.

11 How would the Elevated Structure Alternative replace the existing viaduct?

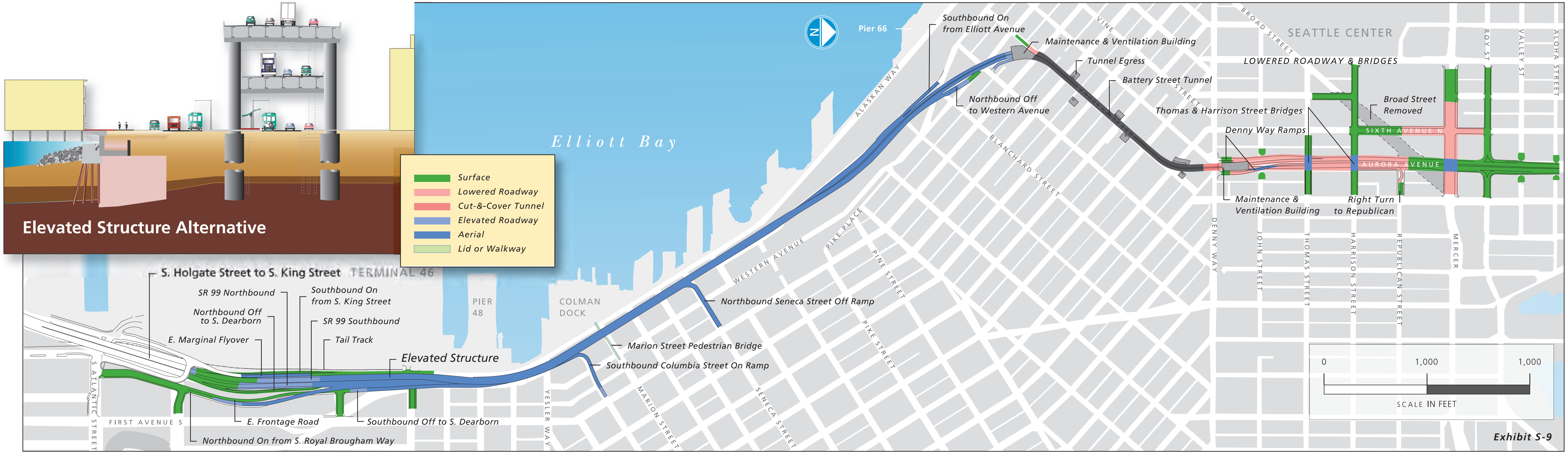
The Elevated Structure Alternative would replace SR 99 from S. Royal Brougham Way to Aloha Street, as shown in Exhibit S-9.

South
In the south area, the Elevated Structure Alternative's lane configurations and access points are nearly identical to the Bored Tunnel and Cut-and-Cover Tunnel Alternative. Like the other build alternatives, full northbound and southbound access to and from SR 99 would be provided by new ramps at S. Royal Brougham Way and Alaskan Way S., and a new intersection at S. Dearborn Street would provide access to East Marginal Way S.

Central
The Elevated Structure Alternative would transition to a stacked aerial structure at approximately S. Main Street along the central waterfront. For the most part, the new aerial structure would have three lanes in each direction, and it would have wider lanes and shoulders than the existing viaduct. Between S. King Street and the ramps at Columbia and Seneca Streets, SR 99 would have four lanes in each direction. The existing ramps at Columbia and Seneca Streets would be rebuilt. SR 99 would cross over Elliott and Western Avenues between Pine Street and the Battery Street Tunnel and the ramps to Elliott and Western Avenues would be rebuilt.

The Alaskan Way surface street would be replaced with at least two lanes in each direction. Northbound lanes would travel under the new viaduct, and southbound lanes would travel west of the new viaduct. The waterfront streetcar would be replaced with two streetcar tracks that would share a travel lane with vehicles. Alaskan Way would be lined with bicycle lanes, sidewalks on both sides, and parking. The seawall would be replaced from about S. Washington Street up to Broad Street.

North
Improvements from the Battery Street Tunnel north would be the same as what was described for the Cut-and-Cover Tunnel Alternative.



12 How much would the project cost?
The cost estimates for the tolled or non-tolled build alternatives are presented below in Exhibit S-10. Project cost estimates include right-of-way acquisition, sales tax, and construction costs. The cost estimates also account for project changes, mitigation, inflation, and risk, which are all factors that could otherwise contribute to cost overruns.

Exhibit S-10
Build Alternatives Costs
in millions

Item	ALTERNATIVE		
	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Construction[1]	$1,778[2]	$3,372[3]	$1,831[3]
Right-of-Way Acquisition	172	146	140
Total	**$1,960**	**$3,518**	**$1,971**

1 *Construction costs include implementation costs, such as design and construction management.*

2 *Bored Tunnel Alternative costs do not include replacement of the Elliott Bay Seawall.*

3 *Includes replacement of the Elliott Bay Seawall.*

The combined cost for the build alternatives plus the other independent projects associated with the Alaskan Way Viaduct and Seawall Replacement Program (Program) have not been calculated because costs for some elements, including the Alaskan Way surface street improvements and the Elliott Bay Seawall Project, are unknown. In the January 13, 2009 letter of agreement, the State agreed to be responsible for funding components of the Program with an estimated cost of $2.82 billion; King County is responsible for funding components with an estimated cost of $190 million in capital and $15 million annual in operating expenses; Seattle is responsible for funding components with an estimated cost of $937 million and Port of Seattle has been asked to contribute $300 million to the Program. These funding commitments were contingent on completion of environmental review requirements.

PERMANENT TRANSPORTATION EFFECTS

13 How would SR 99 access compare?
With all build alternatives, access to and from downtown from the south would be provided by the northbound off-ramp and southbound on-ramp to Alaskan Way S. just south of S. King Street, as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. For the build alternatives, the Elevated Structure Alternative provides SR 99 access that most closely resembles connections provided by the existing viaduct. Compared to the existing viaduct, the Elevated Structure Alternative would remove the northbound on-ramp and southbound off-ramp at Battery Street and change access points north of Denny Way. The Cut-and-Cover Tunnel Alternative provides similar connections as the Elevated Structure Alternative, only it would remove the Columbia and Seneca ramps. In addition to the changes described above, the Bored Tunnel Alternative would remove the northbound Elliott Avenue off-ramp and southbound

Western Avenue on-ramp. Drivers that currently use these ramps could either use Alaskan Way or the bored tunnel and Mercer Street to access SR 99 as shown in Exhibit S-11.

The build alternatives all propose two through lanes in each direction for traffic between S. King Street and Denny Way. The Elevated Structure and Cut-and-Cover Tunnel Alternatives would provide an additional lane in each direction on SR 99 between S. King Street and the ramps connecting to Elliott and Western Avenues.

14 Would regional traffic patterns change?

Measuring person throughput helps us understand how many people would travel through the transportation network. The daily person throughput expected on I-5, SR 99, and local streets at specific locations called screenlines are shown in Exhibit S-12. The results of the screenline analysis at three locations in the study area are shown in Exhibit S-13.

Exhibit S-13
2030 Daily Person Throughput at Screenlines
Daily Volume

Viaduct Closed	Bored Tunnel Non-Tolled	Bored Tunnel Tolled	Cut-&-Cover Tunnel Non-Tolled	Cut-&-Cover Tunnel Tolled	Elevated Structure Non-Tolled	Elevated Structure Tolled
South Screenline – South of S. King Street						
821,800	880,600	885,300	890,900	893,700	899,800	895,700
Central Screenline – North of Seneca Street						
727,600	795,800	798,100	808,200	803,800	814,900	798,700
North Screenline – North of Thomas Street						
839,900	894,700	887,200	880,700	867,800	882,400	865,500

Exhibit S-13 shows that person throughput would be substantially lower across all three screenlines with the Viaduct Closed. Person throughput would decrease with the Viaduct Closed because SR 99 would be closed for safety reasons, which would reduce total person throughput through Seattle's transportation network.

Across the south and central screenlines, person throughput varies among the tolled and non-tolled build alternatives by up to 2 percent. Person throughput is expected to be highest with the Non-Tolled Elevated Structure across the south and central screenlines. Person throughput would be highest with this alternative because

SR 99 Access to and from Northwest Seattle

With the Bored Tunnel — *With the Cut-&-Cover Tunnel and Elevated Structure*

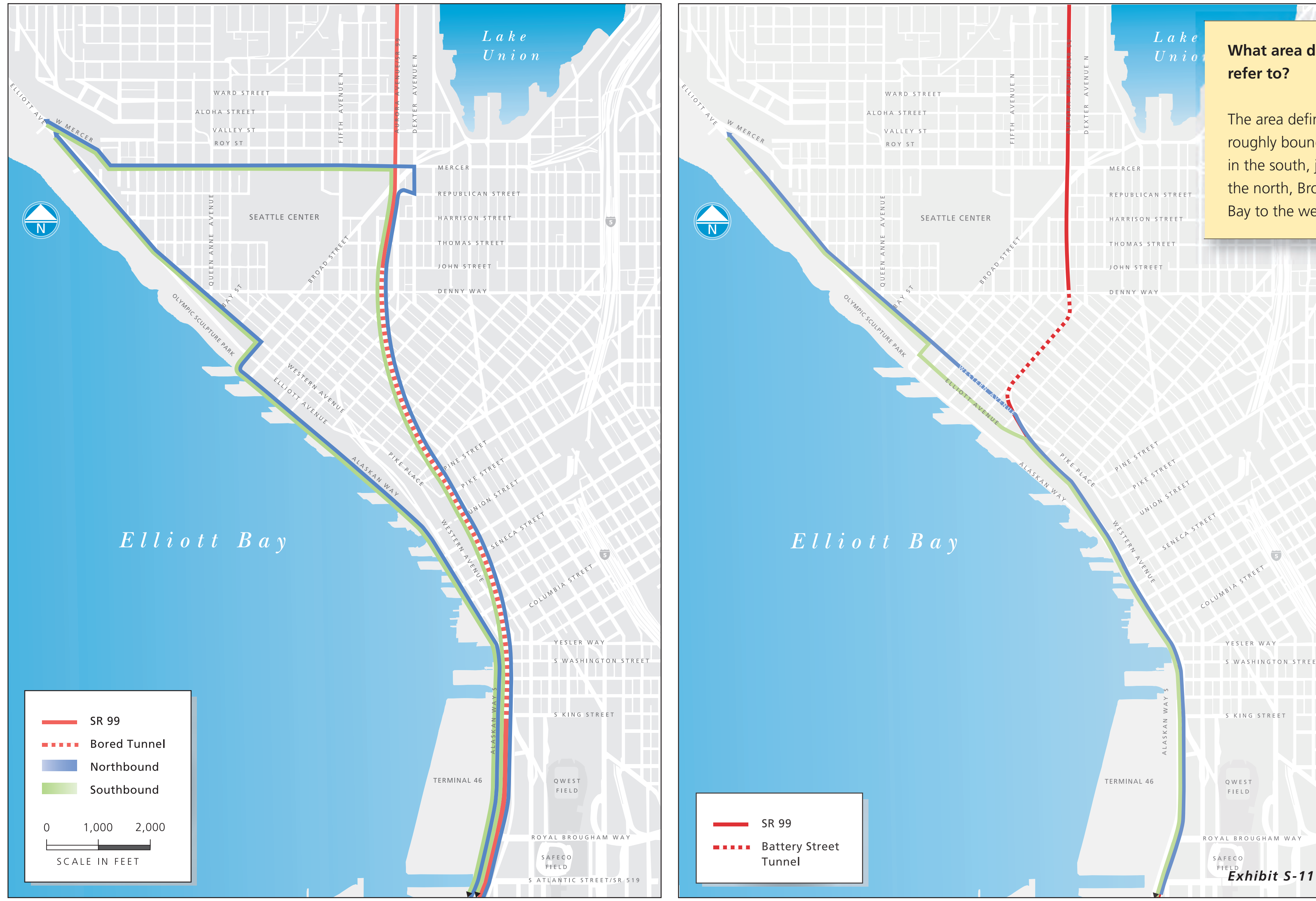


Exhibit S-11

What area does Seattle Center City refer to?

The area defined as Seattle Center is roughly bounded by S. Royal Brougham Way in the south, just north of Mercer Street to the north, Broadway to the east, and Elliott Bay to the west.

it provides more access to and from SR 99 than any of the other build alternatives.

Across the north screenline, differences in vehicle volumes among the tolled and non-tolled build alternatives vary by up to 3 percent. The Non-Tolled Bored Tunnel Alternative is expected to carry the highest number of people across the north screenline because the Battery Street Tunnel, just south of this location would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions, and person throughput in this area would increase.

For the build alternatives, in most cases, person throughput for the non-tolled alternatives is expected to be higher than for the tolled alternatives. However, person throughput varies between the tolled and non-tolled build alternatives by no more than 2 percent for each build alternative with or without tolls. This suggests that tolling has very little effect on the total number of people expected to use the transportation network in the project area; however, the distribution of traffic across SR 99, I-5, and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. Reductions in person throughput across the transportation network for the tolled alternatives are likely attributed to people who choose to eliminate trips or change their destination to avoid proposed tolls.

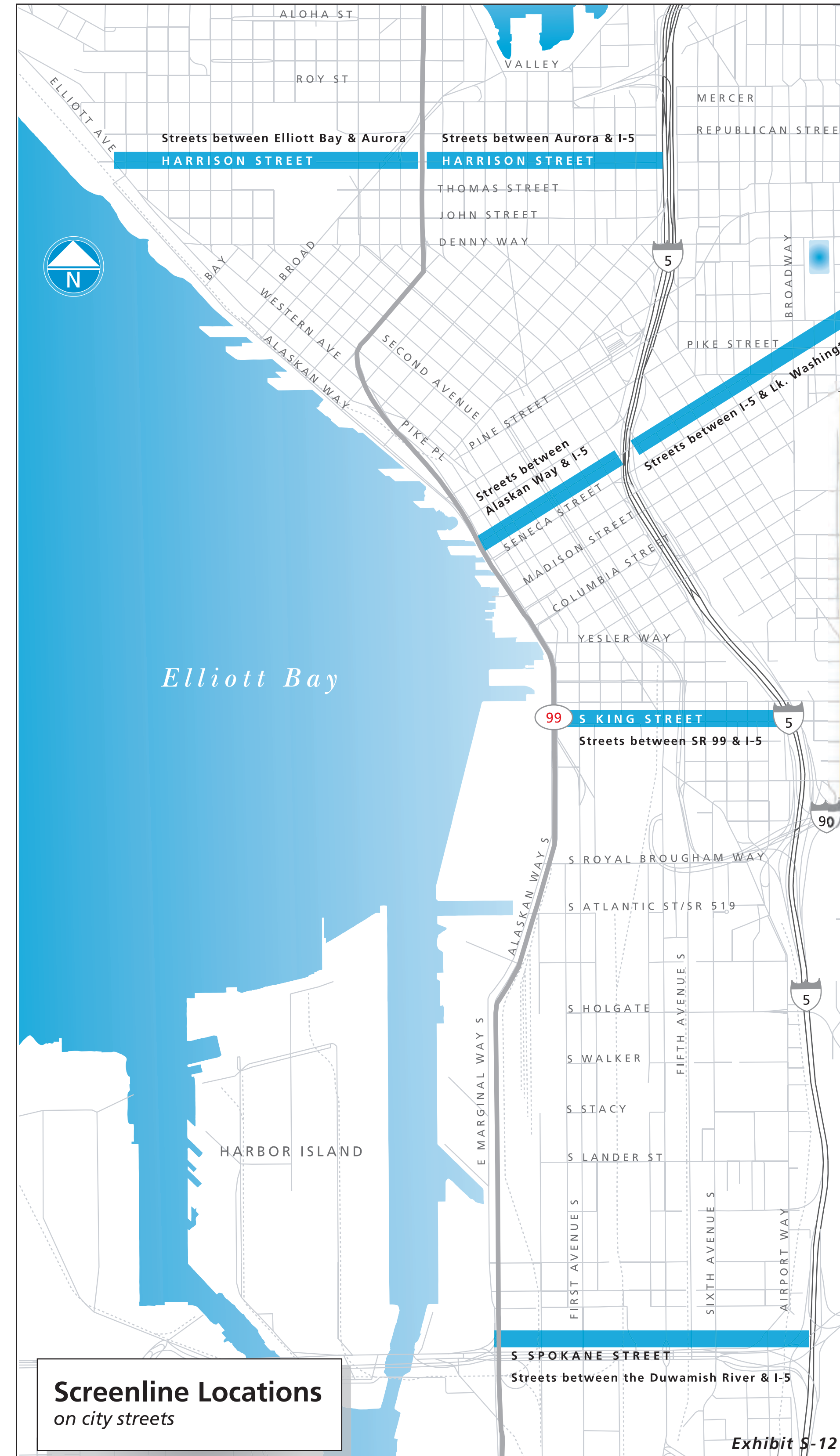
15 How would SR 99 volumes change?

Exhibit S-14 compares average daily traffic volumes on the SR 99 mainline. If SR 99 is not tolled, daily traffic volumes on SR 99 through the south and central sections are projected to be lower for the Bored Tunnel than for the other alternatives, because the Columbia and Seneca ramps and the Elliott and Western ramps would be removed and access would be provided at different locations. North of Virginia Street, near the Battery Street Tunnel, SR 99 daily volumes with the Non-Tolled Bored Tunnel Alternative are expected to be higher than with the other non-tolled alternatives. Traffic volumes would increase near the current location of the Battery Street Tunnel because the Battery Street Tunnel would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions for drivers, and additional traffic would be expected to use the tunnel.

If SR 99 is tolled, SR 99 mainline and ramp volumes would change substantially, since many drivers are expected to divert from SR 99 to other routes such as I-5 and city streets to avoid the toll. For each of the tolled alternatives, tolls would only be charged for through trips, so many northbound drivers are expected to divert from SR 99 near the stadiums or avoid tolls by getting on SR 99 north of Denny Way. Similarly, many southbound drivers are expected to divert from SR 99 north of Denny Way or avoid SR 99 by getting on near or south of the stadiums. Tens of thousands of drivers are expected to divert, and much of this diversion is expected to occur during off-peak travel times when other routes, such as city streets and I-5, are able to accommodate additional vehicles. These added vehicles could increase the number of hours that city streets and I-5 are congested each day. In order to avoid major disruption of traffic patterns and to protect the integrity and viability of adjacent activities on the waterfront and in downtown Seattle, WSDOT and the City will implement a long-term tolling solution to minimize the amount of diverted traffic to optimize operation of the transportation network as described in Chapter 8, Question 1. For the tolled alternatives, the Elevated Structure is expected to carry the highest vehicle volumes in the south and central areas, followed by the Bored Tunnel and Cut-and-Cover Tunnel. North of Virginia Street, the Tolled Bored Tunnel is expected to carry the most vehicles.

16 Would conditions on I-5 change?

I-5 vehicle volumes south of SR 520 show less than a 1 percent difference among the build alternatives, as shown in Exhibit S-15. I-5 vehicle volumes for the Viaduct Closed show up to a 5 percent increase over the proposed build alternatives near Seneca Street and south of I-90.



Screenline Locations
on city streets

Exhibit S-12

How were regional traffic patterns assessed?

Several system-wide transportation measures were assessed to understand and compare the effects the build alternatives would have on the regional transportation network. Of the system-wide measures evaluated, the results of the analysis of person throughput is provided in this summary to show that regional traffic patterns are not expected to change much with the tolled or non-tolled build alternatives.

This increase is to be expected, since SR 99 would be closed.

Exhibit S-15
I-5 Daily Vehicle Volumes in 2030

Viaduct Closed	Bored Tunnel NON-TOLLED	Bored Tunnel TOLLED	Cut-&-Cover Tunnel NON-TOLLED	Cut-&-Cover Tunnel TOLLED	Elevated Structure NON-TOLLED	Elevated Structure TOLLED
I-5 Just South of I-90						
281,900	268,200	276,700	268,200	277,100	266,700	273,000
I-5 Just North of Seneca						
283,200	269,200	281,000	268,600	280,700	268,800	281,200
I-5 Just South of SR 520						
324,900	324,200	326,100	324,700	325,200	325,700	326,300

For the non-tolled build alternatives, I-5 vehicle volumes show very little variation (less than one half of 1 percent) near Seneca Street and south of I-90. If the build alternatives are tolled, additional vehicles are expected to divert to I-5 near Seneca and south of I-90. Near Seneca Street, traffic volumes on I-5 would increase by about 4 percent for the tolled build alternatives compared to the non-tolled build alternatives. I-5 volumes south of I-90 are expected to increase by 2 or 3 percent with the tolled build alternatives. Trips that divert to I-5 because of tolls on SR 99 are expected to divert primarily during off-peak travel times when I-5 can accommodate additional vehicles. Additional traffic on I-5 during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route.

17 Would conditions on area streets change?

Exhibit S-16 shows the intersections that would operate with congested conditions for the tolled and non-tolled build alternatives. Exhibits S-17 and S-18 indicate the number of congested intersections for the tolled and non-tolled build alternatives. If the build alternatives are tolled, increased congestion and delay is expected at many intersections in the project area. This congestion and delay would be caused by higher volumes of vehicles expected on city streets as drivers choose to divert from SR 99 to avoid tolls. The effects of vehicle volume increases due to tolling would be most pronounced in the central (or downtown) area. If the build alternatives are tolled, effects to surface streets would be mitigated as discussed in Chapter 8, Question 1.

Exhibit S-17
Congested Intersections during the AM Peak Hour[1]

	Bored Tunnel NON-TOLLED	Bored Tunnel TOLLED	Cut-&-Cover Tunnel NON-TOLLED	Cut-&-Cover Tunnel TOLLED	Elevated Structure NON-TOLLED	Elevated Structure TOLLED
South Area – South of S. King Street						
	3	1	6	4	4	3
Central Area – North of S. King Street						
	3	8	0	7	0	12
North Area – North of Denny Way						
	8	10	5	10	5	10
Total	**14**	**19**	**11**	**21**	**9**	**25**

Exhibit S-18
Congested Intersections during the PM Peak Hour[1]

	Bored Tunnel NON-TOLLED	Bored Tunnel TOLLED	Cut-&-Cover Tunnel NON-TOLLED	Cut-&-Cover Tunnel TOLLED	Elevated Structure NON-TOLLED	Elevated Structure TOLLED
South Area – South of S. King Street						
	4	5	2	6	2	7
Central Area – North of S. King Street						
	6	13	3	9	5	19
North Area – North of Denny Way						
	9	17	9	14	9	13
Total	19	35	14	29	16	39

1 Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.

Conditions on Streets North of Seneca Street

Exhibit S-19 shows expected daily vehicle volumes on city streets just north of Seneca Street for the build alternatives.

Exhibit S-19
2030 Daily Vehicle Volumes for Screenlines North of Seneca Street
Daily Volume

Viaduct Closed	Bored Tunnel NON-TOLLED	Bored Tunnel TOLLED	Cut-&-Cover Tunnel NON-TOLLED	Cut-&-Cover Tunnel TOLLED	Elevated Structure NON-TOLLED	Elevated Structure TOLLED
Streets between Alaskan Way and I-5 north of Seneca Street						
143,000	114,300	129,100	108,200	130,300	111,600	138,400
Streets between I-5 and Lake Washington north of Seneca Street						
167,400	153,700	167,100	151,700	167,400	152,100	170,400

Expected Conditions for the Tolled Build Alternatives

If the build alternatives are tolled, daily vehicle volumes on city streets between S. King Street and just north of Seneca Street are expected to increase by several thousand vehicles per day as drivers divert from SR 99 to avoid paying tolls. The Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure are expected to have higher vehicle volumes on city streets north of Seneca Street than the Tolled Bored Tunnel. Since the Cut-and-Cover Tunnel and Elevated Structure Alternatives would rebuild and improve Alaskan Way and because drivers would need to pay a toll to use the Elliott and Western ramps, more drivers are expected to divert from SR 99 to city streets to avoid paying a toll with these alternatives.

Among the tolled build alternatives, congestion is expected to increase and cause drivers considerable delay during the morning and evening commutes at multiple intersections as indicated in Exhibits S-16 through S-18. Most of these intersections are located on Second and Fourth Avenues. As a result, travel times in the general purpose travel lanes on Second and Fourth Avenues are expected to increase by 5 to 9 minutes during peak commute hours. Travel times on Second and Fourth Avenues are expected to be similar among the tolled build alternatives, as indicated in Exhibit S-20.

Exhibit S-20
PM Peak Hour Travel Times for the General Purpose Lanes on Second and Fourth Avenues[1]

	Bored Tunnel NON-TOLLED	Bored Tunnel TOLLED	Cut-&-Cover Tunnel NON-TOLLED	Cut-&-Cover Tunnel TOLLED	Elevated Structure NON-TOLLED	Elevated Structure TOLLED
Second Avenue – Wall Street to S. Jackson Street						
Southbound	16	24	14	21	14	23
Fourth Avenue – S. Jackson Street to Battery Street						
Northbound	14	21	13	21	13	21

1 Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel times are not appropriate.

Expected Conditions for the Non-Tolled Build Alternatives

For the non-tolled build alternatives, the Bored Tunnel is expected to have higher daily vehicle volumes on city streets north of Seneca Street as shown in Exhibit S-19. Increased vehicle volumes are expected on these streets due to access changes proposed with the Bored Tunnel Alternative, which would eliminate the Elliott and Western ramps. Increased vehicle volumes on city streets through downtown are expected to result in a few additional congested intersections for the Non-Tolled Bored Tunnel, as compared to the other two non-tolled build alternatives. During the morning commute, three additional congested intersections are expected through downtown and one to

What is the AM peak hour (morning commute) and the PM peak hour (evening commute)?

The AM and PM peak hours occur when traffic is heaviest during the morning and evening commutes. For SR 99, the AM peak hour is from 8:00 a.m. to 9:00 a.m. The PM peak hour is from 5:00 p.m. to 6:00 p.m. Traffic conditions during these peak travel times were modeled to understand traffic conditions and effects when traffic is heaviest on a typical day.

three additional intersections are expected to be congested during the evening commute. Travel times in the general purpose travel lanes on Second and Fourth Avenues are expected to be up to 2 minutes longer with the Non-Tolled Bored Tunnel Alternative as compared to the other non-tolled build alternatives, as shown in Exhibit S-20.

Conditions on Alaskan Way

Exhibit S-21 shows expected daily vehicle volumes on Alaskan Way with the alternatives. Despite increased vehicle volumes expected with the tolled build alternatives and the Non-Tolled Bored Tunnel, intersection congestion would not substantially increase as shown previously in Exhibit S-16.

Exhibit S-21
Daily Vehicle Volumes on Alaskan Way in 2030

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
South of S. King Street						
47,300	33,300	38,200	33,700	47,000	22,500	34,300
North of Seneca Street						
25,300	19,800	25,700	16,800	30,100	16,300	30,500
North of Pine Street						
24,800	18,800	24,900	15,600	27,600	15,400	28,200

Expected Conditions for the Tolled Build Alternatives

If the build alternatives were tolled, daily vehicle volumes on Alaskan Way are expected to increase by several thousand vehicles per day compared to the non-tolled build alternatives as drivers divert from SR 99 to avoid paying tolls. The Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure are expected to have higher vehicle volumes on Alaskan Way north of S. King Street than the Tolled Bored Tunnel; these two build alternatives would rebuild and improve Alaskan Way, which would increase demand if SR 99 were tolled. In addition, more vehicles are expected to divert from SR 99 to other routes with the Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives because drivers would need to pay a toll to use the Elliott and Western ramps. There are other routes, such as Alaskan Way and Mercer Street that drivers would likely use to avoid paying these tolls.

Expected Conditions for the Non-Tolled Build Alternatives

For the non-tolled build alternatives, daily vehicle volumes on Alaskan Way are expected to be highest with the Bored Tunnel. Increased vehicle volumes are expected on Alaskan Way with this alternative because SR 99 would no longer provide ramps to Elliott and Western Avenues. Because of this, Alaskan Way would become one of two possible travel routes for trips heading to and from northwest Seattle, which would increase traffic volumes.

18 How would travel times change?

Travel times for key routes during the AM and PM peak hours are shown in Exhibit S-22. In most cases, travel times are expected to be longer with the tolled alternatives than the non-tolled alternatives. Tolling is expected to increase travel times because many vehicles are expected to divert to surface streets using SR 99 ramps near the stadiums and north of Denny Way to avoid the toll. This diversion will increase congestion on sections of SR 99 approaching these ramps, which will increase travel times for all traffic.

West Seattle Trips to and from Downtown

In all but one instance, West Seattle travel times for the Bored Tunnel Alternative with or without tolls are expected to be slower than the other build alternatives. Travel time differences among the alternatives are due largely to variations in access between the alternatives.

If the build alternatives are tolled, drivers heading in to downtown Seattle are expected to have similar travel times of 32 or 33 minutes during the morning commute. For the evening commute, travel times for drivers leaving downtown are expected to be 2 to 6 minutes longer for the Tolled Bored Tunnel than the other tolled build alternatives.

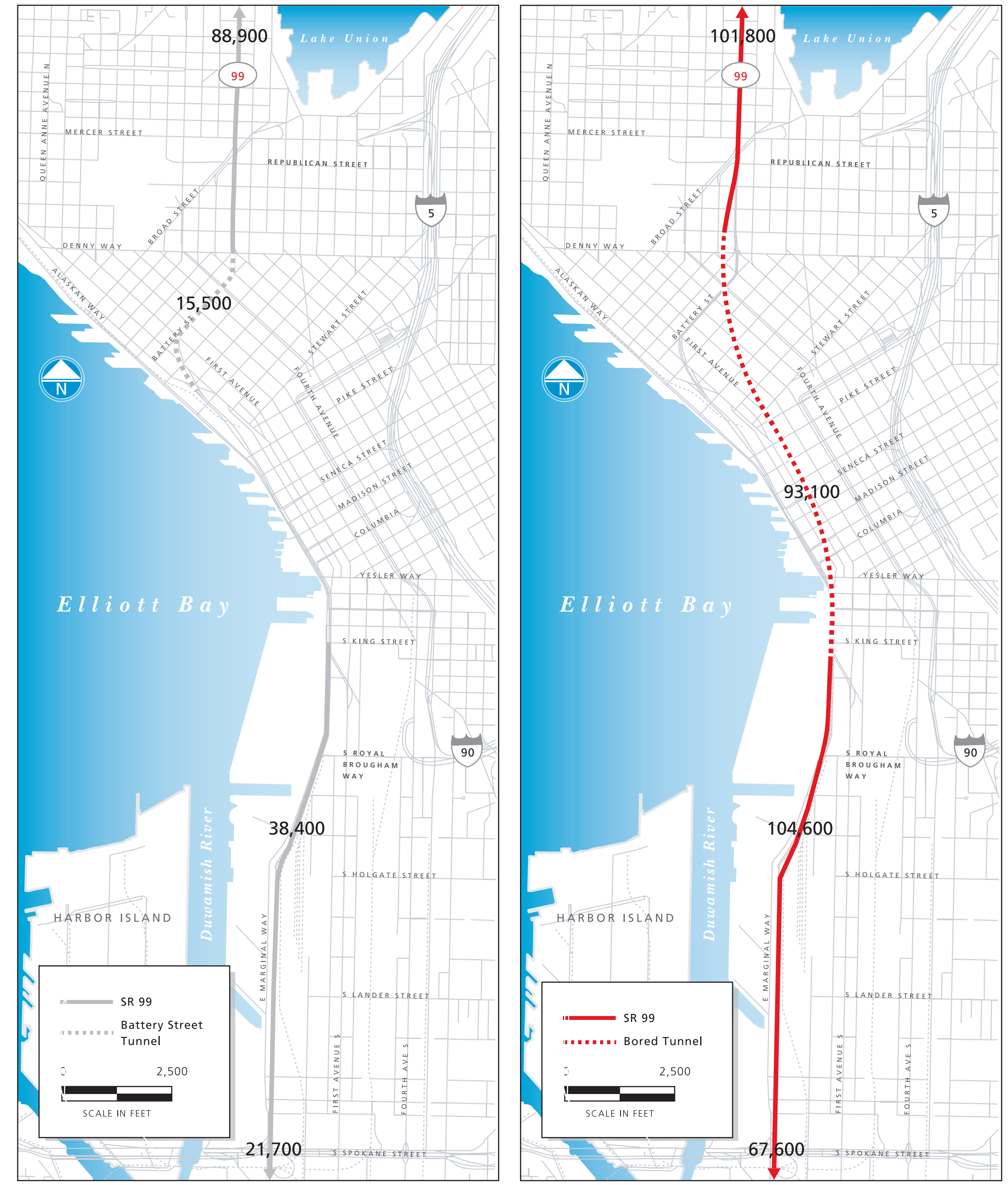
If the build alternatives are not tolled, travel times are expected to be between 3 and 6 minutes longer with the Bored Tunnel than the other build alternatives.

North Seattle Trips to and from Downtown

During the morning commute, travel times are expected to be between 2 and 8 minutes faster with the Bored

Comparison of 2030 SR 99 Volumes

Viaduct Closed *Non-Tolled Bored Tunnel*



Comparison of 2030 SR 99 Volumes

Exhibit S-14

Tunnel than the other build alternatives with or without tolls. The Bored Tunnel is expected to have faster travel times because it would have fewer access points, which would reduce traffic volumes on SR 99. Fewer access points would result in fewer weaving motions than the other build alternatives, which would reduce travel times. In addition, the Bord Tunnel Alternative replaces the Battery Street Tunnel with a new tunnel that has wider lanes and shoulders and less-abrupt curves, which will increase speeds on this section of SR 99. During the evening commute, travel times for the Bored Tunnel are expected to be between 1 and 3 minutes longer than the other build alternatives with or without tolls.

SR 99 Through Trips

In nearly all cases, SR 99 through trips are expected to be the fastest with the Bored Tunnel Alternative. The Bored Tunnel is expected to have faster travel times for through trips because it would have fewer access points, which would reduce traffic volumes on SR 99. If the build alternatives are tolled, during the morning commute SR 99 through trips are expected to be between 2 and 10 minutes faster with the Bored Tunnel than the other build alternatives. During the evening commute, travel times are expected to be up to 4 minutes faster with the Tolled Bored Tunnel than the other tolled build alternatives.

If the build alternatives are not tolled, during the morning commute SR 99 through trips are expected to be 3 or 4 minutes faster with the Bored Tunnel than the other build alternatives in the southbound direction. For the evening commute, southbound trips would be within 1 minute for all of the non-tolled build alternatives. Similarly, northbound SR 99 through trips are expected within 1 minute for all of the non-tolled build alternatives for both the morning and evening commutes.

Northwest Seattle Trips through Downtown

The Bored Tunnel Alternative with or without tolls does not replace the Elliott and Western ramps, which changes access for drivers traveling to and from northwest Seattle and is expected to increase travel times. For trips to and from northwest Seattle, travel times vary depending on the time of travel and the route taken.

If the build alternatives are tolled, travel times are expected to be up to 7 minutes slower for the Bored Tunnel than the other tolled build alternatives in the morning and evening commute. If the build alternatives are not tolled, travel times are expected to be up to 6 minutes slower with the Bored Tunnel than the other non-tolled build alternatives.

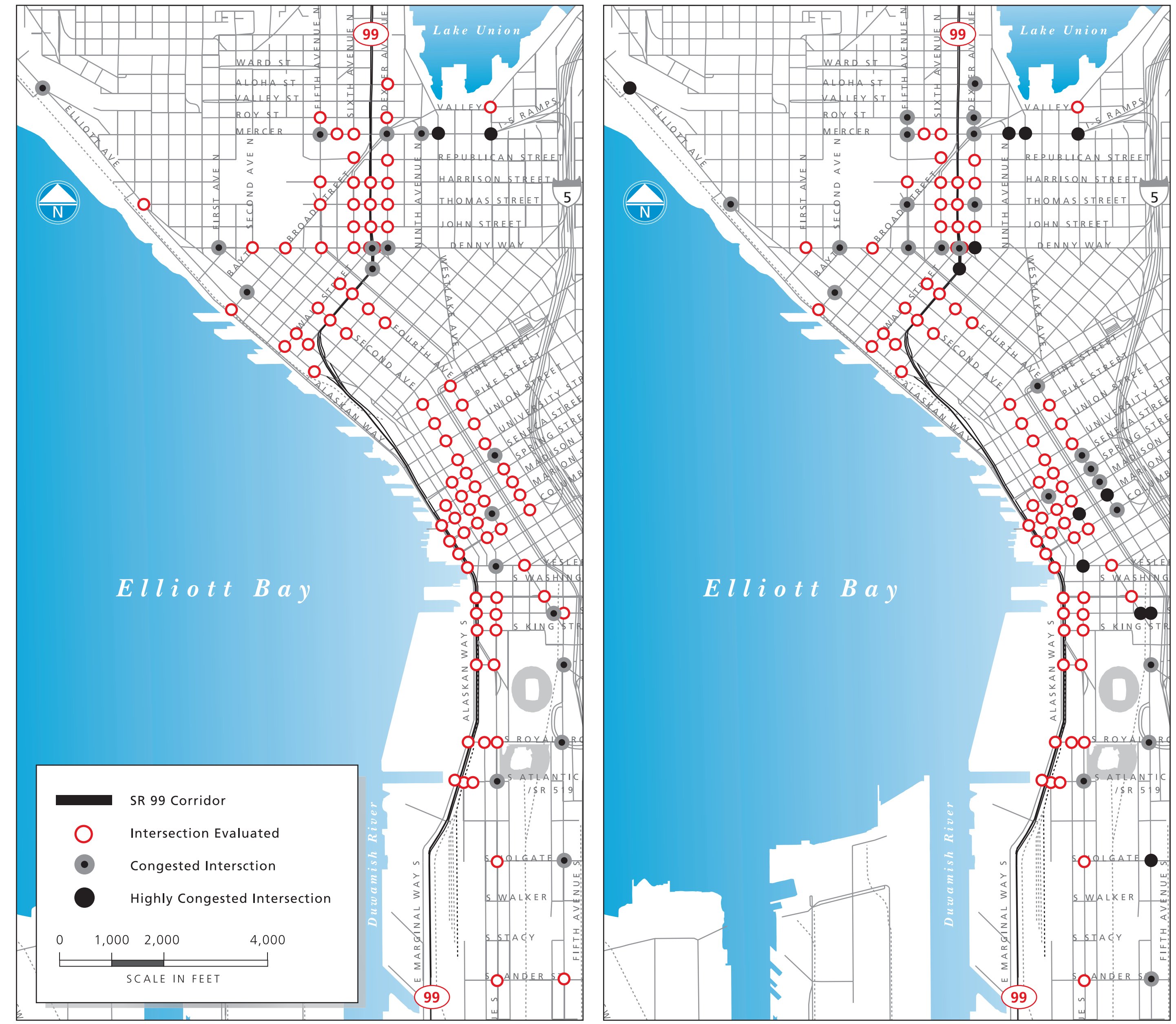
I-5 Trips

Travel times on I-5 are expected to be the same for all of the tolled alternatives except for one trip, which varies by 1 minute. The same is true when comparing I-5 travel times for the non-tolled alternatives. For the one instance when travel times are different, the difference is 1 minute as described in the text below. For the tolled build alternatives in 2030, southbound trips on I-5 during the PM peak hour are expected to take 40 minutes for the Bored Tunnel and Elevated Structure Alternatives as compared to 39 minutes for the Cut-and-Cover Tunnel Alternative. For the non-tolled build alternatives in 2030, northbound trips on I-5 during the PM peak hour are expected to take 35 minutes for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives as compared to 34 minutes for the Elevated Structure Alternative.

Travel times on I-5 are expected to vary between 1 and 2 minutes between the tolled and non-tolled alternatives, which suggests that the build alternatives have similar effects to I-5 and that tolling the build alternatives results in a negligible effect to I-5 operations. Noticeable effects to I-5 are not expected because the additional trips that divert to I-5 due to tolls are expected to divert during off-peak travel times when I-5 can accommodate additional vehicles. This diversion during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route.

2030 Congested Intersections – PM Peak Hour[1]

Non-Tolled Bored Tunnel *Tolled Bored Tunnel*



1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

2030 Congested Intersections – PM Peak Hour[1]

Non-Tolled Cut-&-Cover Tunnel *Tolled Cut-&-Cover Tunnel* *Non-Tolled Elevated Structure* *Tolled Elevated Structure*

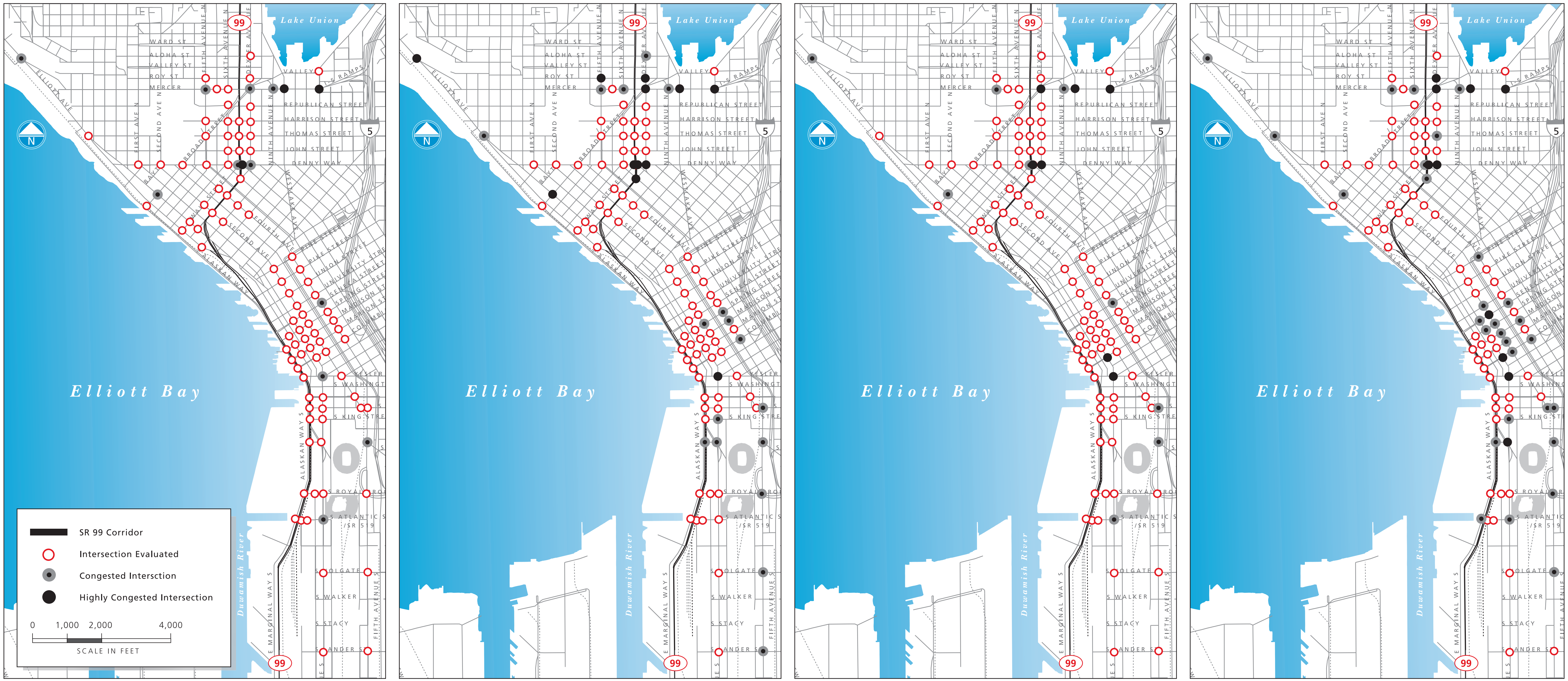


Exhibit S-16

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

2030 Travel Time Comparison[1]

NON-TOLLED/TOLLED

West Seattle Trips to and from Downtown

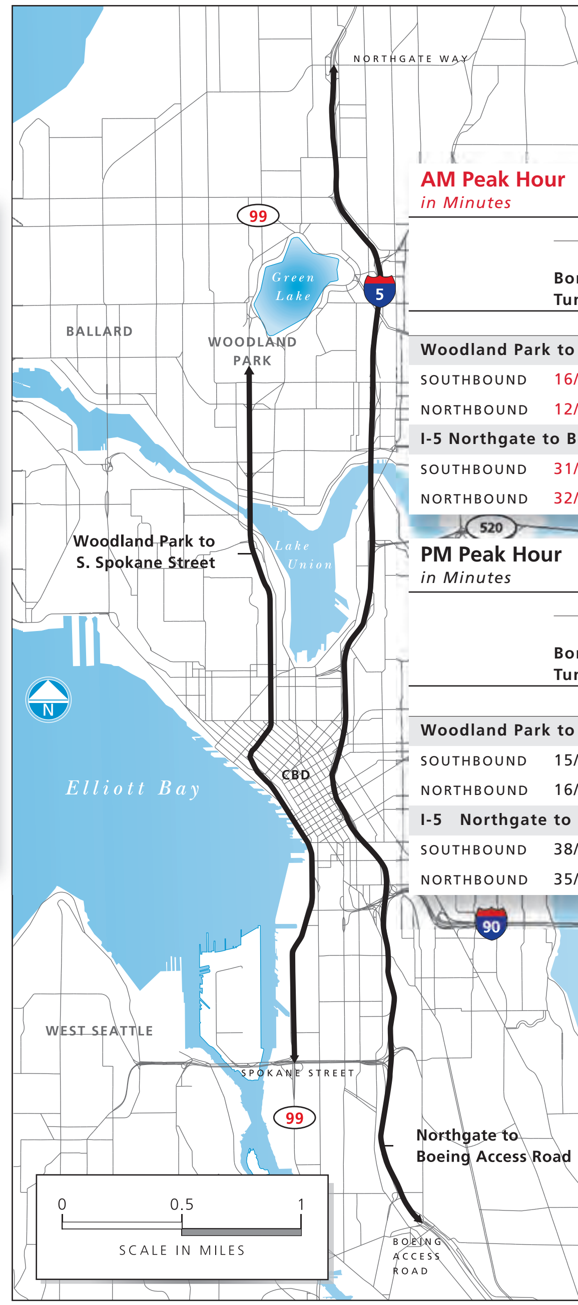
AM Peak Hour
in Minutes

YEAR 2030	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
NON-TOLLED/TOLLED			
West Seattle to Downtown Central Business District			
NORTHBOUND	26/32	23/32	20/33
Woodland Park to Downtown Central Business District			
SOUTHBOUND	22/27	24/35	24/32

PM Peak Hour
in Minutes

YEAR 2030	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
NON-TOLLED/TOLLED			
Downtown Central Business District to West Seattle			
SOUTHBOUND	27/31	24/29	22/25
Downtown Central Business District to Woodland Park			
NORTHBOUND	18/23	17/20	17/20

North Seattle Trips to and from Downtown



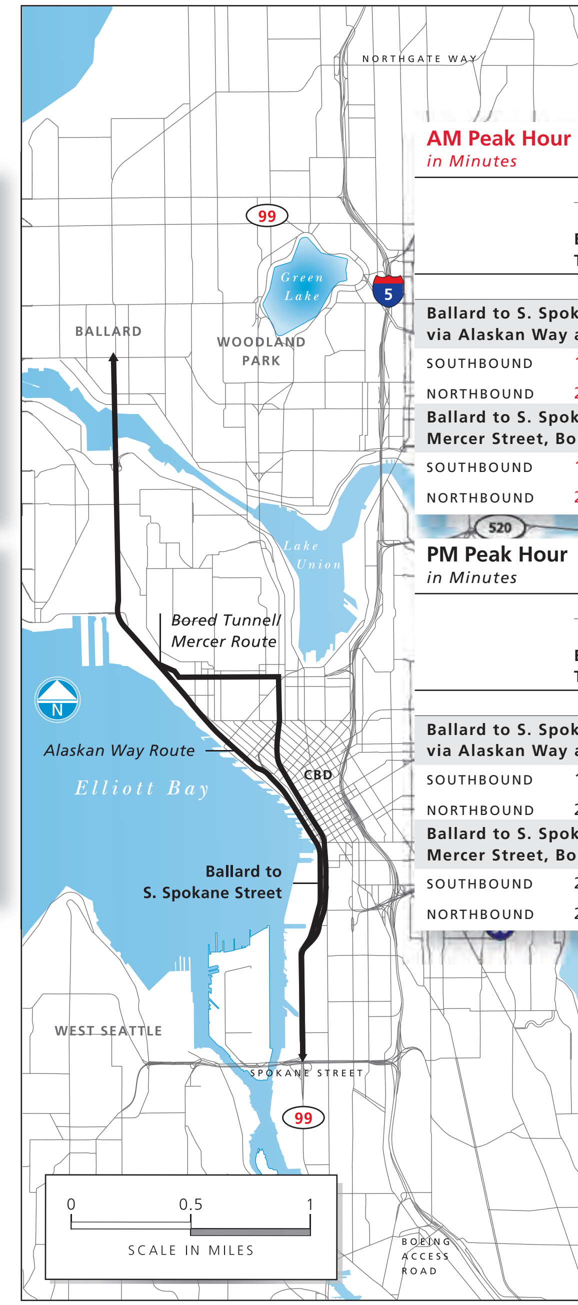
AM Peak Hour
in Minutes

YEAR 2030	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
NON-TOLLED/TOLLED			
Woodland Park to S. Spokane Street			
SOUTHBOUND	16/16	20/22	19/21
NORTHBOUND	12/12	12/14	13/22
I-5 Northgate to Boeing Access Road			
SOUTHBOUND	31/32	31/32	31/32
NORTHBOUND	32/33	32/33	32/33

PM Peak Hour
in Minutes

YEAR 2030	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
NON-TOLLED/TOLLED			
Woodland Park to S. Spokane Street			
SOUTHBOUND	15/14	14/16	15/16
NORTHBOUND	16/15	17/15	16/19
I-5 Northgate to Boeing Access Road			
SOUTHBOUND	38/40	38/39	38/40
NORTHBOUND	35/36	35/36	34/36

SR 99 Through Trips



AM Peak Hour
in Minutes

YEAR 2030	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
NON-TOLLED/TOLLED			
Ballard to S. Spokane Street – via Alaskan Way and Alaskan Way Viaduct			
SOUTHBOUND	17/20	16/16	15/15
NORTHBOUND	21/27	15/17	16/26
Ballard to S. Spokane Street – Mercer Street, Bored Tunnel			
SOUTHBOUND	17/18	NA	NA
NORTHBOUND	25/24	NA	NA

PM Peak Hour
in Minutes

YEAR 2030	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
NON-TOLLED/TOLLED			
Ballard to S. Spokane Street – via Alaskan Way and Alaskan Way Viaduct			
SOUTHBOUND	19/23	21/16	20/17
NORTHBOUND	24/27	23/23	25/25
Ballard to S. Spokane Street – Mercer Street, Bored Tunnel			
SOUTHBOUND	22/24	NA	NA
NORTHBOUND	27/27	NA	NA

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel times are not appropriate.*

Exhibit S-22

19 How would conditions for transit compare?

Downtown transit access to and from the south would likely be similar to existing conditions for the Elevated Structure Alternative with and without tolls, since the Columbia and Seneca ramps would be rebuilt and transit could continue to use these ramps as they do today to access downtown and SR 99 (although transit would have the option to use the ramps to Alaskan Way S. as well). For the tolled and non-tolled tunnel alternatives, downtown transit access to and from the south would change, since the Columbia and Seneca ramps would be relocated. Buses would likely access downtown via the new ramps on Alaskan Way S., and then use S. Main Street and/or S. Washington Street to access the north-south Third Avenue bus "spine." The new ramps would extend transit service coverage to a larger portion of the downtown area, particularly benefitting the Pioneer Square area. Because transit access would be provided a few blocks south of where it is today, transit travel times to areas near the southern portion of downtown could decrease, while transit travel times to areas toward the central or north areas of downtown could increase. Travel times for selected trips are provided in Exhibit S-23. For transit vehicles serving downtown Seattle from the north, transit access is expected to be comparable for the build alternatives.

The number of transit riders is expected to be similar for the tolled and non-tolled build alternatives. This suggests that the overall demand for transit is similar among the build alternatives and that based on our modeling assumptions, tolling does not have much effect on people's decision to take transit.

Transit Travel Times

Transit travel times are compared in Exhibit S-23. If the build alternatives are tolled, slower transit travel times would be expected for transit traveling on Second Avenue, Fourth Avenue, and to and from West Seattle. Transit travel times would slow with tolling due to increased congestion on city surface streets caused by drivers avoiding the tolled portion of SR 99.

For the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure, slower transit travel times would be expected for southbound trips coming into downtown from north Seattle via Aurora Avenue; unlike the Bored Tunnel, these alternatives would not provide a transit-only lane beginning at Harrison Street. If the build alternatives were tolled, travel time increases on Second and Fourth Avenues would not be as pronounced for transit as they would for other drivers because transit-only lanes are provided on Second and Fourth Avenues. On Second Avenue, transit travel times would increase by 1 or 2 minutes compared to the non-tolled build alternatives. Transit travel times on Fourth Avenue would be expected to increase by up to 5 minutes compared to the non-tolled build alternatives. There are two explanations for these travel time increases:

1 Speeds for transit on Fourth Avenue would be reduced because bus drivers must weave between the transit-only and congested general purpose travel lane due to skip stop operations, and

2 Speeds for transit in the transit-only lane on Fourth Avenue would be reduced by a higher number of non-transit vehicles making right turns, as permitted, using the transit-only lane.

If the build alternatives were tolled, effects to transit would be mitigated as discussed in Chapter 8, Question 1.

For the non-tolled build alternatives, most travel times would be within 1 or 2 minutes of each other. The primary exception is for trips heading to and from downtown and West Seattle. These trips are expected to be fastest with the Non-Tolled Elevated Structure and slowest with the Non-Tolled Bored Tunnel. The Non-Tolled Elevated Structure is expected to provide a faster trip because the Columbia and Seneca ramps included in this alternative provide more direct access into downtown than the tunnel alternatives that provide access near S. King Street.

2030 Transit Travel Time Comparison[1]

NON-TOLLED/TOLLED

AM Peak Hour
in Minutes

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Elliott Avenue – *South of Ballard Bridge to Denny Way*			
SOUTHBOUND	8/8	8/8	8/8
NORTHBOUND	7/7	7/8	7/8
Aurora Avenue – *South of Ballard Bridge to Central Business District*			
SOUTHBOUND	6/8	9/15	9/14
NORTHBOUND	7/8	6/6	6/6
Second Avenue – *Wall Street to S. Royal Brougham Way*			
SOUTHBOUND	14/13	14/15	14/16
Fourth Avenue – *S. Royal Brougham Way to Battery Street*			
NORTHBOUND	14/17	13/18	14/17
West Seattle to Downtown Central Business District			
NORTHBOUND	26/32	23/32	20/33
SOUTHBOUND	16/16	14/16	12/14

PM Peak Hour
in Minutes

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Elliott Avenue – *South of Ballard Bridge to Denny Way*			
SOUTHBOUND	8/8	8/8	8/8
NORTHBOUND	8/8	10/12	9/9
Aurora Avenue – *South of Ballard Bridge to Central Business District*			
SOUTHBOUND	5/5	5/9	5/9
NORTHBOUND	7/8	5/5	v
Second Avenue – *Wall Street to S. Royal Brougham Way*			
SOUTHBOUND	15/17	15/16	14/15
Fourth Avenue – *S. Royal Brougham Way to Battery Street*			
NORTHBOUND	14/15	13/17	13/18
West Seattle to Downtown Central Business District			
NORTHBOUND	18/23	19/26	16/23
SOUTHBOUND	27/31	24/29	22/25

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of travel times are not appropriate.*

Exhibit S-23

OTHER PERMANENT EFFECTS

20 Would noise levels permanently change?

Exhibit S-24 compares noise effects among the tolled and non-tolled build alternatives compared to 2015 existing conditions. Traffic noise levels approach or exceed FHWA noise abatement criteria at 53 of the 70 sites under existing conditions. The tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives are expected to reduce the number of sites that would approach or exceed FHWA noise abatement criteria and the tolled and non-tolled Elevated Structure Alternative would increase the number of affected sites. For the Bored Tunnel and Elevated Structure Alternatives, differences between noise levels for the tolled and non-tolled alternatives are within 2 dBA. For the Cut-and-Cover Tunnel Alternative, there is one location where the non-tolled noise level would be 3 dBA higher, but all other locations are within 2 dBA. A change of 2 dBA or less is not noticeable to most listeners, so noise levels between the tolled and non-tolled conditions for each alternative would be very similar.

Exhibit S-24
Range of Noise Effects Compared to 2015 Existing Viaduct

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Sites that are within 1 dBA or exceed FHWA noise criteria	40 of 70 sites	41 of 70 sites	40 of 70 sites	43 of 70 sites	57 of 70 sites	57 of 70 sites
Range in noise levels on the central waterfront	-1 to -16 dBA	-1 to -16 dBA	-1 to -17 dBA	0 to -15 dBA	-2 to +3 dBA	-3 to +2 dBA
Range in noise levels from Lenora Street to the Battery Street Tunnel	-6 to -13 dBA	-6 to -13 dBA	-5 to -12 dBA	-6 to -12 dBA	-1 to +1 dBA	0 to -1 dBA
Range in noise levels north of Denny Way	-6 to +4 dBA	-6 to +6 dBA	-3 to +6 dBA	-3 to +4 dBA	-3 to +6 dBA	-3 to +5 dBA

Bored Tunnel Alternative

For the Bored Tunnel with or without tolls, none of the 70 modeled sites were found to exceed FHWA's severe noise impact criterion of 80 dBA. The number of modeled sites that exceed FHWA's noise abatement criteria would be reduced by 12 sites with the Tolled Bored Tunnel and 13 sites with the Non-Tolled Bored Tunnel compared to existing conditions.

Ventilation System Noise

The Bored Tunnel Alternative with or without tolls would require a ventilation system with several ventilation stacks, which would be included as part of the tunnel operations buildings proposed at the tunnel portals. The ventilation fans would be designed not to exceed either 60 dBA at the nearest commercial uses or 57 dBA at the property line of the nearest residential use during normal operations. Fans that are normally operated during nighttime hours would be designed not to exceed 47 dBA at the property line of the nearest residential use.

Cut-and-Cover Tunnel Alternative

With the Tolled Cut-and-Cover Tunnel Alternative, none of the 70 sites were found to exceed FHWA's severe noise impact criterion of 80 dBA at sensitive land uses. With the Non-Tolled Cut-and-Cover Tunnel Alternative, two of the 70 sites are predicted to have noise levels of 80 dBA, which is the severe noise impact criterion at sensitive land uses. The number of modeled sites that exceed the noise abatement criteria would be reduced by 10 sites with the Tolled Cut-and-Cover Tunnel and 13 sites with the Non-Tolled Cut-and-Cover Tunnel compared to existing conditions.

The Cut-and-Cover Tunnel Alternative with or without tolls would require a ventilation system for both the waterfront tunnel and the Battery Street Tunnel. The ventilation fans would meet the same requirements as described for the Bored Tunnel Alternative.

Elevated Structure Alternative

With the Tolled Elevated Structure, none of the 70 sites were found to exceed FHWA's severe noise impact criterion of 80 dBA at sensitive land uses. With the Non-Tolled Elevated Structure, two sites are predicted to have noise levels of 80 dBA. The number of modeled sites that exceed FHWA's noise abatement criteria would increase by 4 sites with either the Tolled or Non-Tolled Elevated Structure compared to existing conditions.

The Elevated Structure Alternative with or without tolls would require a ventilation system for the Battery Street Tunnel. The ventilation fans would meet the same requirements as described for the Bored Tunnel Alternative.

21 Would views permanently change?

The build alternatives would change views in the project area, particularly along the central waterfront where the Bored Tunnel and Cut-and-Cover Tunnel Alternatives would remove the existing viaduct. Exhibit S-25 shows the view from SR 99 in the south area and Exhibit S-26 shows what the central waterfront would look like with each of the alternatives. Once the viaduct is removed by these alternatives, views to and from the waterfront that are currently obstructed by the viaduct would be substantially improved. Changes to views along the central waterfront for the Elevated Structure Alternative and changes to views at the south and north ends of the project area for all alternatives would not be as dramatic. The tolled build alternatives would have the same effects to views as the non-tolled build alternatives.

22 Would properties or land uses be permanently affected?

All of the alternatives would need to acquire property, as shown in Exhibit S-27. The Bored Tunnel Alternative would have fewer acquisitions on the surface than the other alternatives, but would also require 55 subsurface acquisitions. The Cut-and-Cover Tunnel Alternative would acquire a few more parcels than the Elevated Structure Alternative. Tolling would not affect which parcels are needed for each of the alternatives or land uses.

Exhibit S-27
Summary of Surface Parcels Acquired for the Alternatives

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Partial Acquisitions	6	24	19
Full Acquisitions	6	16	16
Total Properties Affected *in approximate acres*	**12** *7.8*	**40** *9.1*	**35** *9.7*

Note: Effects for the the non-tolled and tolled build alternatives are the same. This does not include subsurface property acquisitions.

The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would be consistent and compatible with existing land use plans. The Elevated Structure Alternative is consistent with existing land use plans but would not support the Central Waterfront Concept Plan.[5]

The Bored Tunnel or Cut-and-Cover Tunnel Alternatives are expected to indirectly effect future redevelopment along the Alaskan Way surface street because the viaduct would be removed. Development would be constrained by land use and building regulations and would likely occur in the form of modest expansions of existing buildings on the east side of the roadway. In addition, removing the viaduct would change the relationship between the waterfront and upland properties leading to the downtown core. To the extent that the existing viaduct has been perceived as a barrier to waterfront uses, new development on vacant or underused property or redevelopment may take place around Alaskan Way along the central waterfront. Also, increased vehicle volumes on Alaskan Way could make achieving the City's access and mobility goals for the central waterfront more difficult.

23 Would the economy be permanently affected?

Local and regional economic effects discussed below would be the same for the build alternatives with or without tolls. However, if SR 99 is not tolled, the state would not be able to recoup a portion of the capital cost from the direct users of the facility. The non-tolled alternatives would place a higher burden on the state to use gas tax and other state funds on the Alaskan Way Viaduct Replacement Project, rather than using these funds for other projects in the state.

The non-tolled build alternatives would not experience traffic diversion from motorists seeking to avoid a tolled facility. The cost of congestion for the non-tolled build alternatives would decrease compared to the tolled alternatives.

Effects to Businesses and Employees

Twelve properties would be acquired for the Bored Tunnel Alternative, 40 for the Cut-and-Cover Tunnel Alternative, and 35 for the Elevated Structure Alternative. Partially acquired properties would retain their existing buildings, maintain their current function, and continue to pay property taxes at a reassessed value.

For the Bored Tunnel Alternative, 4 buildings on fully acquired parcels would be removed. The loss of parcels with buildings would relocate or displace an estimated 152 workers, which represents about 0.08 percent of the total 2010 forecasted workforce in the Seattle Central Business District.

For the Cut-and-Cover Tunnel Alternative, 11 buildings on fully acquired parcels would be removed. The loss of parcels with buildings would relocate or displace an estimated 124 workers, which represents about 0.06 percent of the total 2010 forecasted workforce in the Seattle Central Business District.

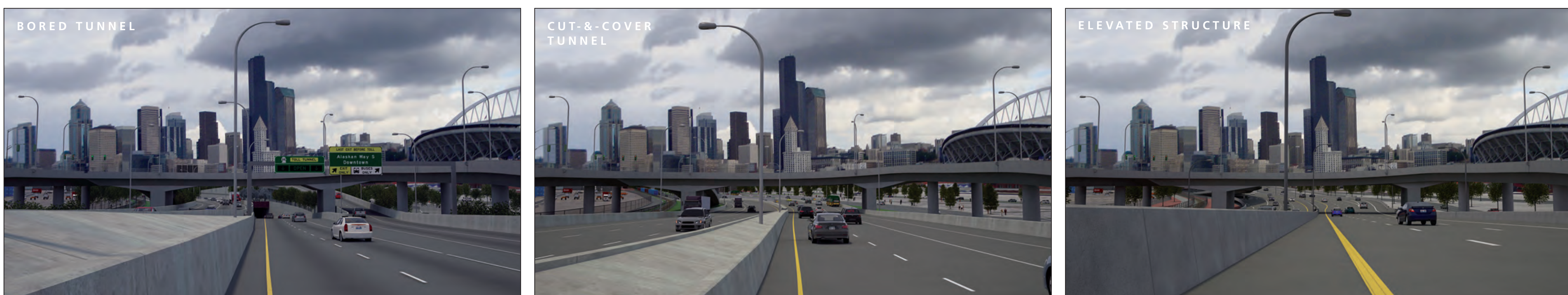
For the Elevated Structure Alternative, 12 buildings on fully acquired parcels would be removed. The loss of parcels with buildings would relocate or displace an estimated 170 workers, which represents about 0.08 percent of the total 2010 forecasted workforce in the Seattle Central Business District.

Effects to Parking

Exhibit S-28 summarizes the total on- and off-street parking losses for each build alternative. All of the build alternatives are expected to reduce parking compared to existing conditions. There would be approximately twice as many parking spaces removed for the Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative as for the Bored Tunnel Alternative. The number of parking spaces affected by each of the alternative would be the

5 City of Seattle 2006.

Existing SR 99



Visual Simulations Looking North at S. Royal Brougham Way

Exhibit S-25

same under both tolled and non-tolled conditions. If any ADA parking spaces are affected, they would be accommodated in accordance with City guidelines and federal requirements.

Exhibit S-28
Public Parking Spaces Removed

	On-Street	Off-Street	Total
Bored Tunnel	390	250	**640**
Cut-&-Cover Tunnel	690	500	**1,190**
Elevated Structure	750	630	**1,380**

Note: Effects for the non-tolled and tolled build alternatives are the same.

In the stadium area, the parking effects are the same for all of the build alternatives. About 110 on-street spaces and 250 off-street spaces would be removed near the stadiums.

Along the central waterfront, the Cut-and-Cover Tunnel and Elevated Structure Alternatives would remove about half of the on-street parking spaces under the viaduct and along Alaskan Way. There would be no long-term effects to existing parking under the viaduct from the Bored Tunnel Alternative; however, future planned projects along the central waterfront may reduce available parking. The Bored Tunnel Alternative would not change the parking supply in the Pioneer Square, central, or Belltown areas.

The parking effects north of the Battery Street Tunnel are the same for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. The Bored Tunnel Alternative would remove about 40 more on-street parking spaces in the north area than the other two alternatives.

Removing parking in these areas is consistent with Seattle's Comprehensive Plan.[6] Goal TG18 indicates that in making decisions about on-street parking, transportation is the primary purpose of the street system. In addition, it is the City's general policy, as described in policy T-42, to replace short-term parking only when the project results in a concentrated and substantial amount of on-street parking loss. The Seattle Department of Transportation will ultimately determine how on-street parking spaces are managed and will likely encourage short-term instead of long-term parking.

24 Would historic resources be permanently affected?
All of the build alternatives would demolish the Alaskan Way Viaduct, which is eligible for the National Register of Historic Places (NRHP). The build alternatives would permanently affect the Battery Street Tunnel, which (as a part of the Alaskan Way Viaduct) is also eligible for the NRHP. Tolling this portion of SR 99 would not change the effects to historic resources.

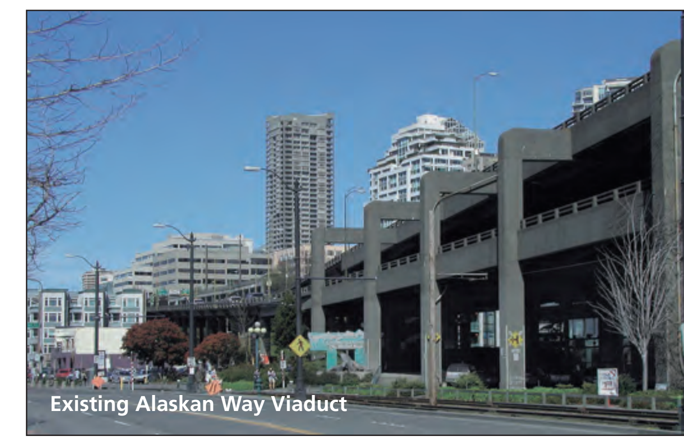
The tolled build alternatives would increase traffic in Pioneer Square compared to the non-tolled build alternatives; however, the additional traffic would not adversely affect the contributing features of the Pioneer Square Historic District that make it eligible for the NRHP.

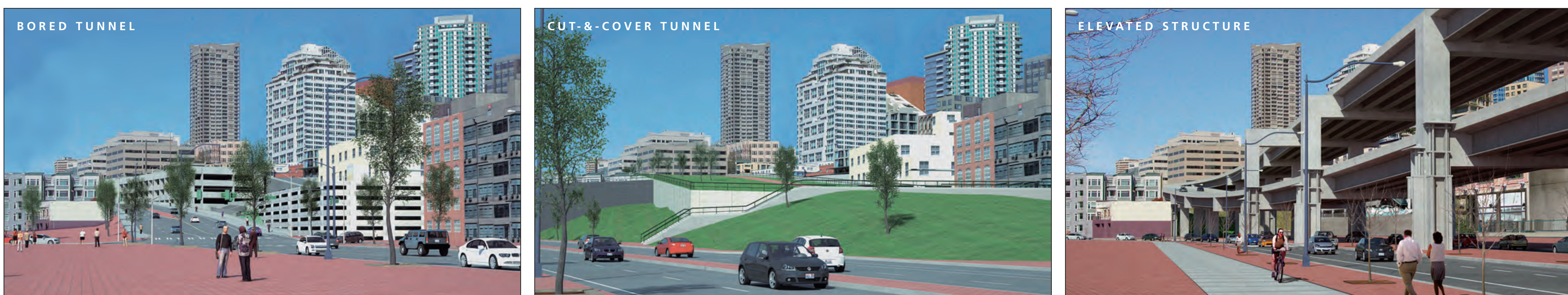
All of the alternatives would also require modifying a manhole shaft connecting to the NRHP-eligible Lake Union sewer tunnel to construct the northbound off-ramp at Republican Street.

Tolled and Non-Tolled Bored Tunnel Alternative
Effects to the Western Building and Polson Building (located within the NRHP-listed Pioneer Square Historic District) would occur during construction of the Bored Tunnel Alternative and are discussed in Question 36 in this summary.

Tolled and Non-Tolled Cut-and-Cover Tunnel Alternative
The Cut-and-Cover Tunnel Alternative would permanently replace the NRHP-eligible Elliott Bay Seawall. The Washington Street Boat Landing would be removed during construction and replaced in approximately the same location. The Cut-and-Cover Tunnel Alternative would also excavate beneath the NRHP-eligible Buckley's (MGM-Loew's) building (formerly known as the McGraw

6 City of Seattle 2005.


Existing Alaskan Way Viaduct



Visual Simulations Looking North on Alaskan Way at Union Street
Exhibit S-26

Kittenger Case Building) and these effects are discussed in Question 36 in this summary.

Tolled and Non-Tolled Elevated Structure Alternative
The Elevated Structure Alternative would permanently replace the NRHP-eligible Elliott Bay Seawall. The Washington Street Boat Landing would be removed during construction and replaced in approximately the same location.

25 What other permanent effects would the alternatives have?

Parks and Recreation
The Bored Tunnel and Cut-and-Cover Tunnel Alternatives with or without tolls would benefit parks and recreational resources by removing the existing viaduct, which would improve access to and enjoyment of park and recreation resources on the waterfront. The Cut-and-Cover Tunnel Alternative would additionally provide a new 130-foot-wide public open space between Stewart and Virginia Streets, creating a continuous park setting and pedestrian connection between Pike Place Market and the waterfront.

Neighborhoods
The build alternatives would generally benefit neighborhoods by providing improved access and surface street connections near the stadiums and the Seattle Center area and enhancing roadway safety north of Denny Way, since arterial connections to and from SR 99 between John and Roy Streets would be consolidated to a fewer set of access points.

Community, Social Services, and Low-Income or Minority Populations
Permanent project effects related to access, property acquisitions, noise, transit, and tolling are not expected to have disproportionately high and adverse effects to environmental justice populations.

For people who work or seek services at downtown area community and social service facilities, access would change only slightly. Some routes might be slightly more circuitous, and travel times may be somewhat longer, while other routes (such as those to the Pioneer Square area) may become more direct and travel times may decrease.

As the Puget Sound region considers implementing tolls on its facilities, the potential effects on low-income populations are important to take into account. While toll payment, by definition, would account for a higher proportion of a low income individual's monthly income, this alone does not constitute a disproportionately high and adverse effect. The analyses of the equity of tolling concluded that the effects would not be disproportionately high and adverse because there would be viable options for avoiding the toll either through using alternate routes or by switching to transit.

In addition, WSDOT will employ measures to improve the accessibility of transponders to low-income and minority populations. These measures are discussed in Chapter 8 of the Final EIS.

Public Services and Utilities
All of the build alternatives would modify the transportation network in and around downtown, but they are not expected to result in significant adverse effects to public services. Depending on the route used, some public service providers would experience increased traffic-related delay while others would experience decreased traffic-related delay.

Although the majority of new utility systems (such as tunnel ventilation or drainage) would be the responsibility of WSDOT to maintain, utility providers would likely experience some increased maintenance responsibilities after the utility relocation process is completed. Many utilities would be redesigned or rerouted to avoid the new SR 99 facilities. As a result, many utilities may need to increase the number of linear feet of pipe, cable, and other materials in their distribution/transmission systems, which would result in increased maintenance responsibilities.

Air Quality
Estimated carbon monoxide (CO) concentrations at intersections for all of the build alternatives are all projected to be below the 1-hour and 8-hour National Ambient Air Quality Standards (NAAQS) of 35 and 9 parts per million, respectively. Even at areas of higher pollutant concentration, such as the tunnel portals and tunnel operations buildings, analysis showed that all estimated concentrations of CO and particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$) would be below the NAAQS for the tolled and non-tolled build alternatives.

Even though the vehicle miles of travel (VMT) in the Seattle Center City area is predicted to increase by 2030, mobile source air toxics (MSATs) are predicted to decrease dramatically as a result of the U.S. Environmental Protection Agency's (EPA's) national control programs. These programs are projected to reduce MSATs by 72 percent nationwide by 2050, even with an estimated 145 percent growth in VMT.

Greenhouse Gas Emissions
Greenhouse gas emissions are measured regionally. None of the build alternatives would substantially affect regional greenhouse gas emissions. Regional greenhouse gas emissions from all of the build alternatives are predicted to be higher in 2030 than for the 2015 Existing Viaduct, but lower than for the Viaduct Closed. Projected increases in greenhouse gases would be due primarily to the increases in future vehicle traffic and fuel use in the region. Tolling would increase greenhouse gas emissions by less than one percent compared to non-tolled operation, which is not a meaningful difference.

Energy Consumption
Energy consumption is measured regionally. None of the build alternatives would substantially affect regional energy consumption. Regional energy consumption from all of the build alternatives is predicted to be higher in 2030 than for the 2015 Existing Viaduct, but lower than for the Viaduct Closed. Projected increases in energy consumption would be due primarily to the increases in

Section 4(f) and Protection of Historic Resources

The project is adjacent to some of Seattle's most well-known historic buildings and neighborhoods. Section 4(f) is a provision of federal law pertaining to transportation projects that requires, among other things, that project proponents carefully consider protection of these resources in order to receive federal funding. The Alaskan Way Viaduct/Battery Street Tunnel and the Lake Union sewer tunnel manhole shaft would be permanently affected by all alternatives.

Additional construction-related and alternative-specific effects to historic and archaeological resources are discussed in **Chapter 6**, **Questions 19** and **20** and in the **Section 4(f) Evaluation** found at the end of document on page 239. The Section 4(f) Supplemental Materials are provided in ***Appendix J*** of the ***Final EIS***.

What is environmental justice?

Environmental justice acknowledges that the quality of our environment affects the quality of our lives, and that minority and low-income populations should not bear an unequal environmental burden. Environmental justice seeks to lessen unequal distributions of environmental burdens (e.g., pollution, industrial facilities, crime) and equalize benefits and access to clean air and water, parks, transportation, etc.

future vehicle traffic and fuel use in the region. Tolling would increase energy consumption by less than one percent, which is not a meaningful difference.

Water Resources

Compared to existing conditions, all build alternatives would reduce the overall amount of pollutant-generating impervious surface within the area that drains to these receiving waters. This is expected to improve water quality. All of the build alternatives would provide water quality treatment for pollutant-generating impervious surfaces.

Fish, Aquatic, and Wildlife Habitat

All build alternatives would improve water quality compared to the Viaduct Closed because stormwater runoff would be treated prior to being discharged. Treating stormwater runoff prior to discharge would reduce potential effects to fish, wildlife, and vegetation resources compared to existing conditions. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would result in additional beneficial effects to aquatic life by moving the seawall landward and creating additional nearshore habitat.

As required under the Endangered Species Act (ESA) the lead agencies have consulted the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS). The determinations made by the NMFS for the Bored Tunnel Alternative in the January 27, 2010 Biological Opinion and USFWS in the December 7, 2010 concurrence letter are provided in Exhibit S-29.

Soils and Groundwater

All of the build alternatives include building retaining walls, tunnels, foundations, excavations, and fills. Groundwater flow may be altered by the presence of the walls supporting the retained cuts, cut-and-cover tunnel sections, and soil improvement areas. Areaways and basements adjacent to the new facilities could also experience leakage or partial flooding if groundwater mounding occurs.

Locally contaminated groundwater may be encountered in the project area. The flow of contaminated groundwater could be altered by the presence of the walls supporting the retained cuts, cut-and-cover portions of the tunnels, and soil improvement areas, particularly in the south area.

Mitigation for Permanent Effects

WSDOT will implement measures to mitigate permanent effects of the project. However, the project will not result in permanent adverse effects for all of the resources considered in this Final EIS. For some resources, the project will result in beneficial permanent effects; and for others, there are no permanent effects. For the resources with beneficial or no permanent effects, mitigation is not proposed. Exhibit S-30 shows the resources where mitigation is proposed for permanent effects. Chapter 8 of the Final EIS presents all the proposed mitigation measures for this project. If mitigation is not proposed for a resource, it is not discussed in the Final EIS.

Exhibit S-30
Mitigation for Permanent Effects

Resource	Permanent Effects
Transportation	X
Noise	No mitigation proposed
Vibration	No mitigation proposed
Views	X
Land Use	No mitigation proposed
Economics	No mitigation proposed
Parking	No mitigation proposed
Historic Resources	X
Archaeological Resources	No mitigation proposed
Parks, Recreation, and Open Space	No mitigation proposed
Neighborhoods and Community Resources	X
Minorities and Low-Income Populations	X
Public Services	No mitigation proposed
Utilities	No mitigation proposed
Air Quality	No mitigation proposed
Energy and Greenhouse Gas Emissions	X
Water Resources	No mitigation proposed
Fish, Aquatic, and Wildlife	X
Soils and Groundwater	X
Hazardous Materials	X

Note: No mitigation is proposed for resources that are not permanently affected or have a beneficial permanent effect.

Exhibit S-29
Species and Critical Habitat Effect Determinations in the Biological Opinion

Species	Federal Status	Effect Determination	Critical Habitat	Critical Habitat Effect Determination
Puget Sound Chinook Salmon *Oncorhynchus tshawytscha*	Threatened	May affect, likely to adversely affect	Designated	May affect, not likely to adversely affect
Bocaccio *Sebastes paucispinis*	Endangered	May affect, not likely to adversely affect	None designated	N/A
Southern Resident Killer Whale *Orcinus orca*	Endangered	May affect, not likely to adversely affect	2,560 square miles of Puget Sound	May affect, not likely to adversely affect
Canary Rockfish *Sebastes pinniger*	Threatened	May affect, not likely to adversely affect	None designated	N/A
Puget Sound Steelhead *Oncorhynchus mykiss*	Threatened	May affect, not likely to adversely affect	None designated	N/A
Yelloweye Rockfish *Sebastes ruberrimus*	Threatened	May affect, not likely to adversely affect	None designated	N/A
Coastal-Puget Sound Bull Trout *Salvelinus confluentus*	Threatened	May affect, not likely to adversely affect	Designated	May affect, not likely to adversely affect
Humpback Whale *Megaptera novaeangliae*	Endangered	No effect	None designated	N/A
Green Sturgeon *Acipenser medirostris*	Threatened	No effect	Designated, but none in action area	N/A
Hood Canal Summer Chum ESU *Oncorhynchus keta*	Threatened	No effect	Designated	No effect
Marbled Murrelet *Brachyramphus marmoratus*	Threatened	No effect	Designated, but none in action area	N/A
Pacific Eulachon *Thaleichthys pacificus*	Threatened	No effect	Designated, but none in action area	N/A
Steller Sea Lion *Eumetopias jubatus*	Threatened	No effect	None designated in Washington	N/A

26 What permanent adverse effects of the project would not be mitigated?

In general, WSDOT avoids, minimizes, or mitigates permanent effects associated with the project. However, the permanent effects discussed below will not be mitigated.

Transportation Changes

The tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives would permanently change travel patterns compared to the existing viaduct. The tolled and non-tolled Elevated Structure Alternative would maintain similar access to the existing viaduct, but the Bored Tunnel and Cut-and-Cover Tunnel Alternatives would change travel patterns compared to existing conditions. Changes to travel patterns may permanently increase travel times for some routes. However, changes to travel patterns, increased travel times, and/or changes to access will not be mitigated.

Appendix U, Final EIS Correspondence

Information about the Endangered Species Act consultations including the NMFS Biological Opinion and the USFWS concurrence letter can be found in *Appendix U*.

Mitigation for Permanent Effects

All the proposed mitigation measures for the build alternatives are presented for **Chapter 8** of this *Final EIS*.

Parking Losses
All three of the build alternatives are expected to reduce parking compared to existing conditions, but there are no proposed mitigation measures for permanent parking losses. No mitigation is proposed because the parking removals are consistent with Seattle's Comprehensive Plan:[7] Goal TG18 indicates that in making decisions about on-street parking, transportation is the primary purpose of the city's street system.

Noise
Compared to 2015 existing conditions, the number of modeled sites that exceed the noise abatement criteria in 2030 would be:

- Tolled Bored Tunnel reduced by 12 sites
- Non-Tolled Bored Tunnel reduced by 13 sites
- Tolled Cut-and-Cover Tunnel reduced by 10 sites
- Non-Tolled Cut-and-Cover Tunnel reduced by 13 sites
- Tolled Elevated Structure increase by 4 sites
- Non-Tolled Elevated Structure increase by 4 sites

No mitigation measures were found to be feasible and reasonable for any of the build alternatives. Non-traditional measures, such as using noise-absorbing materials, were considered during design and rejected as ineffective and prohibitively expensive.

TEMPORARY CONSTRUCTION EFFECTS

Construction effects would be the same for the tolled and non-tolled build alternatives, so this section only discusses effects of three build alternatives.

27 How would the alternatives be constructed?

Construction activities for the build alternatives are expected to begin around August 2011. The construction duration varies among the alternatives as described below:

- **Bored Tunnel Alternative –** Construction would take about 5.4 years (65 months)

- **Cut-and-Cover Tunnel Alternative –** Construction would take about 8.75 years (105 months)

- **Elevated Structure Alternative –** Construction would take about 10 years (120 months)

Expected activities, sequencing, and durations are shown on Exhibit S-31. The activities, sequences, and durations may change as construction plans for the project are finalized with the contractor.

28 How would restrictions to SR 99 compare?

SR 99 Closures and Restrictions
Construction activities, detours, and roadway restrictions are described in Exhibit S-32 for the build alternatives. The total construction duration and length of time SR 99 would be closed completely to traffic varies between the alternatives as shown in Exhibit S-33. Construction of the Bored Tunnel Alternative would keep SR 99 open for all but about 3 weeks of the 5.4-year construction period. The Elevated Structure Alternative would close SR 99 to all traffic for a total of 5 to 7 months. The Cut-and-Cover Tunnel Alternative would close SR 99 for the longest period of time. The alternative would first close southbound SR 99 to traffic for 15 months before closing SR 99 in both directions for a period of 27 months. Then northbound SR 99 would be closed to traffic for an additional 12 months.

Exhibit S-33
SR 99 Closures and Restrictions

	SR 99 Closed	SR 99 Restricted[1]	Total Construction Time
Bored Tunnel	3 weeks	52 months	65 months (5.4 years)
Cut-&-Cover Tunnel	42 months – *Southbound* 39 months – *Northbound*	54 months[2]	105 months (8.75 years)
Elevated Structure	5 to 7 months	120 months	120 months (10.0 years)

1 *Amount of time when SR 99 would be subject to lane and ramp closures. This duration does not include time when SR 99 would be closed to all traffic.*

2 *Includes stages 3 and 5 when SR 99 is closed in one direction and restricted in the other direction.*

SR 99 Detours
When SR 99 is open, construction would restrict traffic to two lanes in each direction in many locations for all of the build alternatives. SR 99 would be reduced to two lanes because there is only enough space for two lanes in each direction through the proposed detour in the south as well as through the area north of Denny Way. Because of these lane restrictions, the speed limit on SR 99 would be reduced from 50 to 40 miles per hour (mph) during construction.

When construction of this project begins in 2011, SR 99 restrictions in the south area would mostly be due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project, which will have already constructed the south end detour on the WOSCA property. The WOSCA detour is shown in Exhibit S-34 and would have a posted speed limit of 25 mph. The WOSCA detour would be in place for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives for a period of about 4.5 years. With the Elevated Structure Alternative, the WOSCA detour would be in place for about 5.75 years.

In addition, the Elevated Structure Alternative would construct the Broad Street detour to route southbound traffic around the Battery Street Tunnel and connect back to SR 99 near Union Street. Southbound SR 99 traffic would be routed onto the Broad Street detour for a period of about 4.25 years to allow improvements to be constructed from Virginia Street through the Battery Street Tunnel.

29 How would traffic be restricted on other roadways during construction?

All of the alternatives would restrict some surface streets in the project area during construction. When construction for this project begins, Alaskan Way S. will be closed between S. Atlantic Street and S. King Street because of the S. Holgate Street to S. King Street Viaduct Replacement Project. This section of Alaskan Way S. would remain detoured between S. King and S. Atlantic Streets to accommodate construction activities for each of the alternatives. For the Bored Tunnel Alternative, this detour would stay in effect for 4.5 years until the tunnel opens. For the Cut-and-Cover Tunnel Alternative, this detour would be in place during the first 2.5 years of construction until Alaskan Way is closed north of S. King Street. For the Elevated Structure Alternative, this detour would be in place for about 9.75 years.

7 City of Seattle 2005.

Construction Activities Chart

STAGE ONE | STAGE TWO | STAGE THREE | STAGE FOUR | STAGE FIVE | STAGE SIX | STAGE SEVEN | FINAL STAGE

Begin August

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

In Months

Bored Tunnel

4 | 5 | 7 | 3 | 16 | 9 | 9 | 12 — 5 years 5 months

STAGE 1 –
- **Relocate Utilities** – occurs periodically throughout all construction stages
- Begin compensation grouting from south portal up to Madison Street

STAGE 2 –
- Prepare WOSCA staging site
- Install shoring systems and excavation at south portal
- Continue compensation grouting up to Madison Street

STAGE 3 –
- Prepare WOSCA staging site
- Install shoring systems and excavation at south portal
- Complete compensation grouting up to Madison Street
- Construct support walls for the north portal and Tunnel Boring Machine (TBM) retrieval pit
- Excavate and construct secant pile walls in the north portal area

STAGE 4 –
- Install shoring systems and excavation at south portal
- Construct cut-&-cover tunnel sections at the south and north portals
- Construct north portal tunnel operations building
- Complete support wall and TBM retrieval pit at north portal
- Excavate and construct secant pile walls in the north portal area
- Widen Mercer from Fifth to Ninth Avenue N
- Construct new SR 99 overcrossing at Mercer

STAGE 5 –
- Construct south portal tunnel operations building
- Assemble TBM and begin boring
- Soil improvements may occur along the the alignment throughout tunnel boring
- Install interior tunnel structures and systems
- Complete construction of cut-&-cover section at the south portal
- Continue constructing north portal tunnel operations building
- Continue construction of cut-&-cover tunnel at north portal
- Construct Harrison ramps

STAGE 6 –
- Continue installing interior tunnel structures and systems
- Continue constructing both tunnel operations buildings
- Complete Harrison ramps
- Continue cut-&-cover section, excavation, and secant pile walls at north portal
- Disassemble and remove TBM
- Complete widening of Mercer
- Complete construction of SR 99 overcrossing at Mercer

STAGE 7 –
- Complete interior tunnel structures and systems
- Complete both tunnel operations buildings
- Complete cut-&-cover section, excavation, and secant pile walls at north portal
- Construct Republican ramps and Sixth Avenue N.
- Connect bored tunnel and Harrison Street ramps to SR 99
- Disassemble and remove TBM

FINAL STAGE –
- Demolish the viaduct from S. King to Battery Street
- Decommission Battery Street Tunnel
- Remove WOSCA Detour
- Restore surface streets and complete landscaping and lighting at both portals

Cut-&-Cover Tunnel

30 | 9 | 15 | 27 | 12 | 12 — 8 years 9 months

STAGE 1 –
- **Relocate Utilities** – occurs periodically throughout all construction stages
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. Holgate to S. King Street Project –
- S. Holgate to S. King construction – *Complete early 2014*

STAGE 2 –
- Complete seawall construction from S. Jackson to Pike
- Start building the tunnel
- Construct retaining wall from Stewart to Blanchard

STAGE 3 –
- Continue tunnel construction
- Remove and replace southbound SR 99 from Pike to Battery Street Tunnel
- Begin construction of Partially Lowered Aurora

STAGE 4 –
- Remove viaduct from S. King to Pike
- Complete southbound tunnel
- Continue SR 99 construction from Pike to Battery Street Tunnel
- Complete Battery Street Tunnel improvements
- Continue north end construction and construct the Mercer and Roy bridges

STAGE 5 –
- Complete northbound tunnel
- Continue seawall construction from Pike to Broad
- Complete the northbound SR 99 from Pike to the Battery Street Tunnel

FINAL STAGE –
- Complete the seawall from Pike to Broad
- Restore Alaskan Way and complete landscaping & lighting
- Complete relocating utilities

Elevated Structure

30 | 9 | 27 | 3 | 24 | 21 | 3 | 3 — 10 years

STAGE 1 –
- **Relocate Utilities** – occurs periodically throughout all construction stages
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. Holgate to S. King Street Project –
- S. Holgate to S. King construction – *Complete early 2014*

STAGE 2 –
- Construct Broad Street Detour
- Build new viaduct columns
- Construct retaining wall from Stewart to Blanchard

STAGE 3 –
- Complete seawall construction from S. Jackson to Pike Rebuild seawall from Pike to Broad
- Widen lower viaduct deck from S. King to Pike
- Remove and construct southbound SR 99 from Pike to the Battery Street Tunnel
- Begin constructing improvements to Battery Street Tunnel
- Begin constructing partially Lowered Aurora

STAGE 4 –
- Demolish upper viaduct from S. King to Pike
- Remove north-bound SR 99 from Pike to Battery Street Tunnel
- Complete partially lowered Aurora

STAGE 5 –
- Construct upper viaduct from S. King to Pike
- Build northbound SR 99 from Pike to the Battery Street Tunnel
- Complete Battery Steet Tunnel Improvements
- Build bridges at Thomas and Harrison

STAGE 6 –
- Demolish and rebuild lower level viaduct from S. King to Pike

STAGE 7 –
Connect structure to S. Holgate to S. King

FINAL STAGE –
- Restore Alaskan Way and complete landscaping and lighting
- Complete relocating utilities

Exhibit S-31

Construction Roadway Closures, Restrictions, and Detours

STAGE ONE | STAGE TWO | STAGE THREE | STAGE FOUR | STAGE FIVE | STAGE SIX | STAGE SEVEN | FINAL STAGE

Begin August

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

In Months

Bored Tunnel

4 | 5 | 7 | 3 | 16 | 9 | 9 | 12 — 5 years 5 months

STAGE 1 –
- SR 99 reduced to 2 lanes in each direction from Battery Street Tunnel to Roy Street, Stages 1 and 2
- Alaskan Way S. closed between S. Atlantic and S. King for all stages
- Periodic lane closures on streets near the north portal

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane Street to Battery Street Tunnel, Stages 1 & 2

STAGE 2 –
- Sixth Avenue closed between Thomas and Broad Streets – Stages 2 through 7
- Harrison Street closed from Sixth Avenue to SR 99 – Stages 2 through 7
- Broad Street eastbound lanes closed
- Periodic lane closures on streets in the north portal area

S. Holgate to S. King Street Project –
- Southbound SR 99 on WOSCA Detour

STAGE 3 –
- SR 99 reduced to 2 lanes in each direction from S. Spokane Street to Roy Street – Stages 3 through 7
- All SR 99 traffic on WOSCA detour
- Broad Street eastbound lanes closed

S. Holgate to S. King Street Project –
- Close SR 99 for one week

STAGE 4 –
- All SR 99 traffic on WOSCA detour
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues
- Broad Street 2 lanes open in each direction

STAGE 5 –
- All SR 99 traffic on WOSCA detour
- Broad Street 1 eastbound, 2 westbound landes open
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues for most of stage

STAGE 6 –
- All SR 99 traffic on WOSCA detour
- Shift southbound SR 99 traffic to revised WOSCA Detour
- Broad Street closed permanently
- Mercer Street open with 2 or 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 7 –
- All SR 99 traffic on WOSCA detour
- SR 99 closed for several weeks at end of Stage
- Bored tunnel open at end of stage

FINAL STAGE –
- Alaskan Way width reduced from S. King to Pike Streets
- Periodic street closures from S. King to Battery Street
- First Avenue S. reduced to 1 lane in each direction from S. Royal Brougham to S. King
- Periodic lane closures on streets near the north portal

Cut-&-Cover Tunnel

30 | 9 | 15 | 27 | 12 | 12 — 8 years 9 months

STAGE 1 –
- Traffic remains on SR 99
- Alaskan Way periodically reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track
- All SR 99 traffic on WOSCA Detour mid-2012
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues end of 2012

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012

STAGE 2 –
- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 2 lanes in each direction from Fifth to Ninth Avenues

STAGE 3 –
- Southbound SR 99 open from S. Spokane to Columbia, closed from Columbia to Denny
- Northbound SR 99 open from S. Spokane to Denny, Western ramp closed
- SR 99 north of Denny is reduced to 2 northbound lanes and 1 southbound lane
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 4 –
- SR 99 closed to all traffic from Royal Brougham to Denny
- SR 99 north of Denny is reduced to 1 northbound lane and 2 southbound lanes
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 5 –
- Southbound SR 99 open to traffic in new tunnel
- Northbound SR 99 closed from Royal Brougham to Denny, open north of Denny
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

FINAL STAGE –
- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

Elevated Structure

30 | 9 | 27 | 3 | 24 | 21 | 3 | 3 — 10 years

STAGE 1 –
- Traffic remains on SR 99
- Alaskan Way periodically reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track
- All SR 99 traffic on WOSCA Detour mid-2012
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues end of 2012

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012

STAGE 2 –
- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way reduced to 1 lane in each direction, Stages 2 through 6
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 2 lanes in each direction from Fifth to Ninth Avenues

STAGE 3 –
- SR 99 reduced to 2 lanes in each direction
- Southbound traffic routed to Broad Street Detour
- Elliott & Western ramps closed
- SR 99 north of Denny reduced to 3 lanes total
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 4 –
- SR 99 closed
- SR 99 north of Denny is reduced to 1 northbound land and 2 southbound lanes
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 5 –
- SR 99 reduced to 2 lanes in each direction on lower viaduct deck
- Southbound traffic routed to Broad Street Detour
- Seneca, Elliott, and Western ramps closed
- Columbia ramp converted to temporary northbound off-ramp
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 6 –
- SR 99 reduced to 2 lanes in each direction on upper viaduct deck
- Columbia & Elliott southbound on-ramps closed
- Seneca & Western northbound off-ramps open
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 7 –
- SR 99 closed
- Alaskan Way periodically reduced to 1 lane in each direction

FINAL STAGE –
- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

Exhibit S-32

In addition, the Cut-and-Cover Tunnel and Elevated Structure Alternatives would require substantial restrictions on Alaskan Way north of S. King Street for many years as indicated in Exhibit S-35. The Bored Tunnel Alternative does not require closing or restricting Alaskan Way north of Yesler Way during construction. However, southbound traffic would be reduced to one lane between S. King Street and Yesler Way for about 4.5 years, which would have a temporary effect on ferry queuing. To alleviate potential queuing backups on Colman Dock during peak ferry travel periods, a second northbound lane of traffic between Yesler Way and Spring Street will be added, and the signal at the intersection of Yesler Way and Alaskan Way will be modified to allow left turns out of the ferry terminal.

Exhibit S-35
Alaskan Way Closures and Restrictions[1]

	Alaskan Way Closed[1]	Alaskan Way Restricted	Total Construction Time
Bored Tunnel	0 months	0 months[2] – cross streets periodically closed	65 months (5.4 years)
Cut-&-Cover Tunnel	63 months	42 months	105 months (8.75 years)
Elevated Structure	0 months	120 months	120 months (10.0 years)

1 *Amount of time Alaskan Way would be restricted or closed north of S. King Street.*
2 *Alaskan Way would not be restricted north of Yesler Way. For southbound traffic, Alaskan Way would be restricted to 1 southbound lane between S. King Street and Yesler Way for about 4.5 years.*

Throughout construction, a number of short-term traffic detours would also be needed on surface streets when activities such as relocating utilities are taking place.

30 How would travel patterns on SR 99, I-5, and city streets be affected during construction?

During construction of the Bored Tunnel Alternative, daily vehicle volumes through the central waterfront section of SR 99 are expected to decrease by about one-third. Vehicles are expected to shift to city streets and, to a lesser degree I-5, and use different access points on SR 99.

Construction of the Cut-and-Cover Tunnel Alternative would have a considerable effect on vehicle traffic patterns in and near the project area, particularly when SR 99 is closed to one or both directions of traffic between the stadium area and Denny Way. While SR 99 is closed, vehicles traveling through downtown will shift to city streets and, to a lesser degree, I-5. Daily volumes on the segments of SR 99 adjacent to downtown are expected to decrease by approximately half south of downtown and by a third north of downtown.

Construction of the Elevated Structure Alternative is expected to reduce daily vehicle volumes through the central waterfront section of SR 99 by about 40 percent. The Broad Street detour would affect the majority of southbound trips, because all SR 99 traffic between Denny Way and Pike Street would have to use surface streets, with a portion of those vehicles connecting back to the SR 99 mainline at Pike Street. Many northbound vehicles on SR 99 are also expected to shift to city streets and, to a lesser degree, I-5 due to increases in congestion and changes in access during construction.

31 How would SR 99 traffic be affected by restrictions and detours?

Temporary lane closures and restrictions on SR 99 would increase congestion, reduce travel speeds, and increase average travel times, particularly during peak commute hours. During construction, traffic on SR 99 would be close to capacity and would be more likely to experience increased delay and congestion when there is a disruption in traffic flow, such as an accident. Where increases in travel times are minimal, it is due in large part to rerouting and reduced demand on SR 99. Demand would be reduced because of expected traffic bottlenecks near the south and north areas of the viaduct that would likely cause many drivers to divert to other city streets, such as Second or Fourth Avenues and I-5, resulting in less overall traffic on SR 99.

SR 99 closures will affect congestion and delay on city streets in the area. Effects to city streets during construction are discussed in Question 33 of this summary.

WOSCA Detour

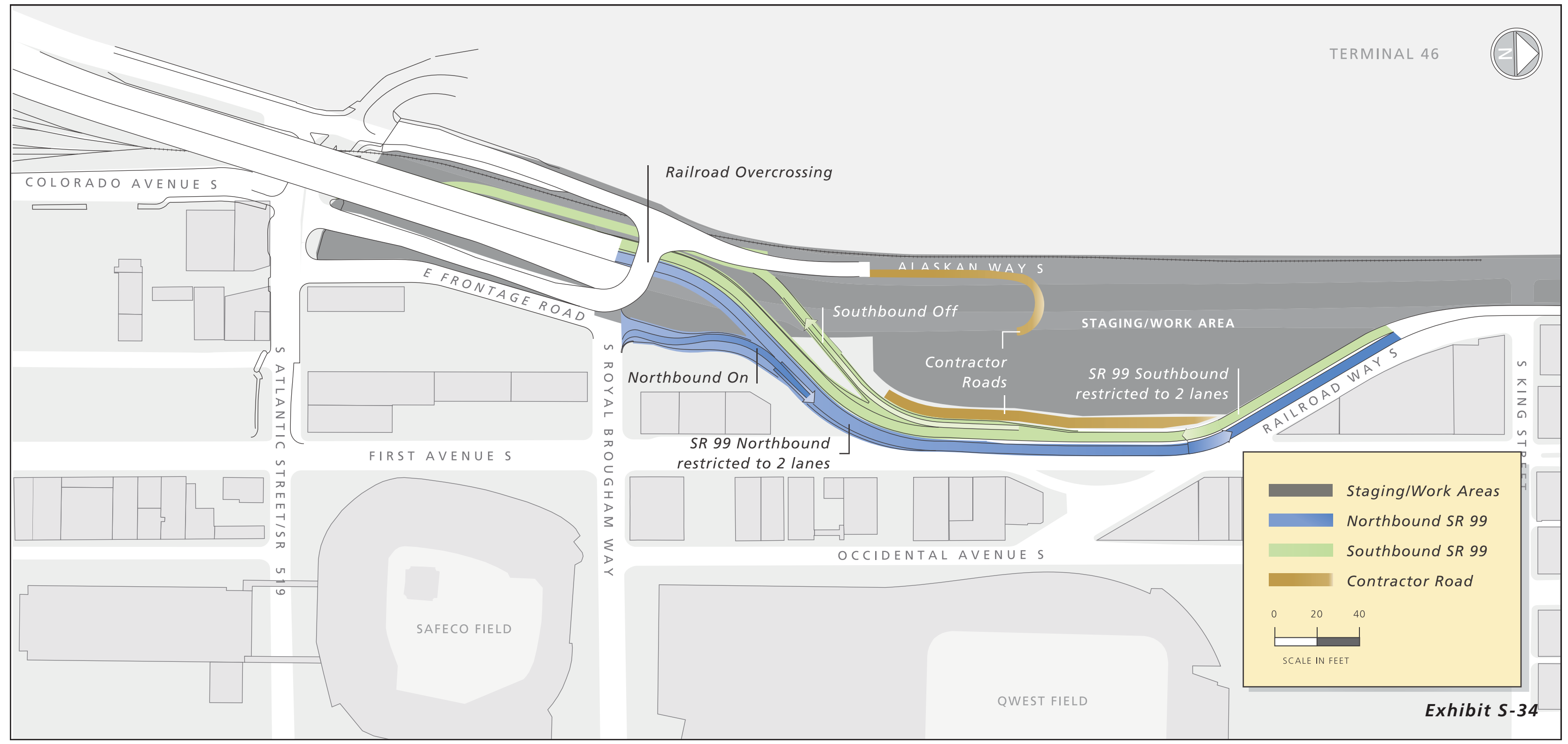


Exhibit S-34

Assumptions for the Construction Traffic Analysis

The transportation analysis for construction modeled conditions during Stage 5 for the Bored Tunnel and Elevated Structure Alternatives and Stage 4 for the Cut-and-Cover Tunnel Alternative, which are considered to be the most disruptive to traffic.

Appendix C, Transportation Discipline Report

Expected travel times during construction are discussed in *Appendix C*, Section 6.6.

Appendix C, Transportation Discipline Report

Construction effects to local streets are discussed in *Appendix C*, Section 6.5.

Noticeable effects to congestion and travel times on I-5 are not expected for reasons discussed in Question 32 of this summary. The Cut-and-Cover Tunnel Alternative would close SR 99 for the longest amount of time, which would affect drivers to a greater degree than the other build alternatives. The Bored Tunnel Alternative would affect drivers the least of the build alternatives because it would keep traffic on the viaduct through the majority of the construction period. The Elevated Structure Alternative would have more effects to SR 99 drivers than the Bored Tunnel Alternative because of the 5- to 7-month closure and lane and ramp restrictions when both directions of traffic are sharing the lower or upper deck of the viaduct.

Average travel times during construction were evaluated for the most disruptive stage of construction. Generally, the most disruptive effects would occur in Stage 5 for the Bored Tunnel and Elevated Structure Alternatives, and Stage 4 for the Cut-and-Cover Tunnel Alternative. During the most disruptive construction stage for each alternative, average travel times were assessed for two typical SR 99 trips: Woodland Park to S. Spokane Street and Ballard to S. Spokane Street via the Alaskan Way Viaduct in the AM peak hour (8:00 a.m. to 9:00 a.m.) and PM peak hour (5:00 p.m. to 6:00 p.m.).

Woodland Park to S. Spokane Street Travel Times

Exhibit S-36 shows the approximate travel times during construction between Woodland Park and S. Spokane Street. During the morning commute, construction travel times in both the southbound and northbound directions are faster for the Bored Tunnel Alternative (16 to 19 minutes) and are substantially slower for the Cut-and-Cover Tunnel Alternative (approximately 50 minutes). Travel times for the Elevated Structure Alternative are slightly slower than those for the Bored Tunnel Alternative. Similar trends are expected for the evening commute. SR 99 travel times are expected to be substantially slower for the Cut-and-Cover Tunnel Alternative because SR 99 and Alaskan Way would be closed during the most disruptive construction stage.

Exhibit S-36
Construction-Related Travel Times from Woodland Park to S. Spokane Street
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
AM Peak Hour				
Southbound	16	19	49	25
Northbound	16	16	51	19
PM Peak Hour				
Southbound	15	18	43	28
Northbound	18	21	49	20

Ballard to S. Spokane Street Travel Times

Exhibit S-37 shows the approximate travel times during construction between Ballard and S. Spokane Street. During the morning commute, both north- and southbound travel times for the Bored Tunnel Alternative during construction are expected to be faster than the other build alternatives. The Cut-and-Cover Tunnel Alternative's travel times are expected to be the slowest, because the alternative would close SR 99 and Alaskan Way along the central waterfront. Travel times for the Cut-and-Cover Tunnel Alternative would range from 45 to 53 minutes compared to a range of 16 to 22 minutes for the Bored Tunnel and Elevated Structure Alternatives. Similar trends are expected for the evening commute.

Exhibit S-37
Construction-Related Travel Times from Ballard to S. Spokane Street
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
AM Peak Hour				
Southbound	16	16	45	18
Northbound	19	21	53	22
PM Peak Hour				
Southbound	16	21	42	18
Northbound	21	23	53	22

32 How would construction affect I-5?

Noticeable effects to I-5 are not expected, because the additional trips that divert to I-5 because of construction are expected to divert during off-peak travel times when I-5 has available capacity. Diversion during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route. Exhibit S-38 shows the approximate percentage of increase for vehicle volumes on I-5 during construction.

Exhibit S-38
Increase in Vehicle Volumes on I-5 during Construction
in percentages

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Near I-90	3%	5%	4%
Near Seneca Street	2%	6%	5%
Near SR 520	0.5%	2%	1%

33 How would traffic on local streets be affected by lane restrictions?

During construction, vehicle delays at some intersections in the project area are expected to increase for any of the build alternatives. For the Bored Tunnel Alternative, increased delays would be influenced by SR 99 restrictions and detours that would reduce speeds, modify access, and lead to the redistribution of SR 99 traffic to local arterials and other parallel roadways such as I-5. This diverted traffic would have little effect on I-5 trips, but it would have a larger effect to local streets south of downtown, Pioneer Square, the Central Business District, Belltown, and the Seattle Center area. Some drivers may choose to use other routes such as First, Second, and Fourth Avenues, which may add congestion and increase delay at intersections along these routes.

For the Elevated Structure Alternative, increased delays would also be influenced by SR 99 restrictions and detours. There would be no southbound on-ramps to SR 99 between Pike Street and S. Spokane Street and the stadium area during the most disruptive construction stage (Stage 5) and the Broad Street detour would be in place. The Broad Street detour would have substantial impacts on traffic north of downtown. These changes are expected to reduce SR 99 capacity, modify access at critical points along SR 99, and increase traffic volumes on I-5 and north-south surface streets through downtown to a greater degree than the Bored Tunnel Alternative.

For the Cut-and-Cover Tunnel Alternative, SR 99 and Alaskan Way along the central waterfront would be closed for a period of 27 months during the most disruptive construction stage (Stage 4), which would increase congestion on local streets and I-5 to a much greater degree than the other build alternatives.

34 How would area noise levels change during construction?

Noise during construction would be disruptive to nearby residents and businesses because it would make it unpleasant to be outside and hard to hold conversations. Construction could occur up to 24 hours a day, 7 days a week and will be determined during final design. A Noise Management and Mitigation Plan that establishes specific noise levels that must not be exceeded for various activities is described in Chapter 8, Mitigation. WSDOT will implement measures to minimize nighttime and weekend construction noise if it exceeds the local ordinance noise levels (except in the case of emergency) during the hours between 10:00 p.m. and 7:00 a.m. on weekdays, or between 10:00 p.m. and 9:00 a.m. on weekends and legal holidays.

The Bored Tunnel Alternative would have fewer noise effects than the Cut-and-Cover Tunnel or Elevated Structure Alternatives because more of the major construction activities would occur underground and the duration of construction is shorter.

Noise levels would depend on the type, intensity, and location of construction activities. For all alternatives, the most common noise sources during all stages of construction would be machine engines such as bulldozers, cranes, generators, and other earth- and material-moving equipment. Temporary large-scale stationary equipment or structures could be located at the WOSCA staging area. Maximum noise levels from construction equipment would range from 69 to 106 A-weighted decibels (dBA) at 50 feet. In comparison, the project area is currently noisy, with peak hour average daytime sound levels that range from 61 to 80 dBA. The majority of construction activities would fall within the range of about 75 to 95 dBA at 50 feet, with some activities like impact pile driving reaching levels just over 100 dBA at 50 feet. Pile driving is not currently proposed and would be used only in instances where less disruptive techniques are not available. The only locations where pile driving may be used are for the cut-and-cover sections near the portals for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. In contrast, the operation of stationary equipment (such as pumps, generators, and compressors) would have sound levels that are fairly constant over time.

35 How would the economy be affected during construction?

Construction would inconvenience or disturb businesses and customers of businesses adjacent to the project area. Construction-related effects would vary considerably over time and area. Effects can also vary according to the methods used to stage and construct the alternatives. The temporary construction effects to businesses would be similar for each alternative in both the north and south areas. The effects would last for a longer period of time with the Cut-and-Cover Tunnel (8.75 years) and Elevated Structure Alternative (10 years) compared to the Bored Tunnel Alternative (5.4 years).

Throughout the project area, trucks servicing businesses would be subject to the same traffic delays that general-purpose vehicles would experience. On-street parking may not be available near the construction areas, which could prevent the use of curbside lanes for truck parking and loading or unloading. Trucks would have to park nearby on side streets. This may inconvenience or disrupt the flow of materials and supplies to and from adjacent businesses.

Along the central waterfront, about 160 active commercial and industrial buildings that would not be acquired for any of the build alternatives are located within 50 feet of the existing viaduct. Many of these buildings are occupied by multiple businesses. The period of active disruption in front of any one building depends on the build alternative. The Bored Tunnel Alternative would have the shortest and the Elevated Structure would have the longest duration of active disruption along the central waterfront. Disruptions could be caused by utility relocations, loss of use of loading areas beneath the viaduct, loss of private parking areas beneath the viaduct, and viaduct demolition. Some of these businesses may suffer little or no adverse effect, whereas others may experience a noticeable decline in sales, increase in costs, and/or decrease in efficiency.

Construction would benefit the economy by directly creating new demand for construction materials and labor over a number of years. The increase in employment leads to additional wages and salaries paid to workers, which fosters higher consumer spending. For all three build alternatives, the average number of jobs directly related to construction would be 450 per year, although up to 480 workers per day could be required during the most intense period of construction. The direct jobs needed to construct the alternatives would generate approximately $60.8 million in direct wages per year.

Effects to Parking

The parking spaces that would be removed during construction generally include the spaces that would be permanently affected, plus those spaces that are needed for construction, staging, or demolition activities.

The Bored Tunnel Alternative would affect fewer parking spaces than the Cut-and-Cover Tunnel and Elevated Structure Alternatives, particularly during Stages 1 through 7, as shown in Exhibit S-39. Stage 8 of the Bored Tunnel Alternative is reported separately because demolition of the viaduct would cause the number of affected parking spaces to increase, compared to Stages 1 through 7. Parking removals during construction would make it more difficult to find parking in the project area. This could result in drivers looking for parking spaces several blocks farther from their destinations, or using pay lots instead of on-street parking.

What is dBA?

Sound levels are expressed on a logarithmic scale in units called decibels (dB). A-weighted decibels (dBA) are a commonly used frequency that measures sound at levels that people can hear.

A 2-dBA change in noise levels is the smallest change that can be heard by sensitive listeners.

What is off-street parking?

Off-street parking includes parking garages and lots where people pay to park. Most off-street parking is privately owned or operated.

What is on-street parking?

There are two types of on-street parking, short-term and long-term. On-street short-term parking includes metered spaces, time-restricted public parking spaces (such as 1-hour parking and loading zones), bus/taxi zones, and spaces reserved for police parking. On-street long-term parking includes unmetered, unrestricted on-street public parking spaces and metered spaces that allow all day parking.

Exhibit S-39
Parking Effects during Construction

Alternative	On-Street SHORT-TERM	On-Street LONG-TERM	On-Street SUB-TOTAL	Off-Street	Total
Bored Tunnel Stages 1-7	350 to 470	280 to 290	**630 to 760**	50 to 90	**680 to 850**
Bored Tunnel Stage 8	Up to 910	Up to 290	**Up to 1,200**	Up to 310	**Up to 1,510**
Cut-&-Cover Tunnel	1,090	230	**1,320**	480	**1,800**
Elevated Structure	1,090	230	**1,320**	610	**1,930**

Note: The maximum number of spaces in each subarea would not be affected at the same time, so the total is not a sum of all of the high ranges.

36 How would historic resources be affected during construction?

The project would have an adverse effect on one or more properties that are on or eligible for the NRHP. These properties are the Alaskan Way Viaduct and Battery Street Tunnel, Western Building, Polson Building, and the Dearborn South Tideland site. Adverse effects for the Bored Tunnel Alternative have been addressed by a Memorandum of Agreement developed in consultation with the State Historic Preservation Officer (SHPO), tribes, and consulting parties. WSDOT, on behalf of FHWA, also determined adverse effects to historic properties for the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

The Alaskan Way Viaduct and the Battery Street Tunnel are collectively a NHRP eligible structure and would be affected by any of the build alternatives. All of the alternatives would demolish the existing Alaskan Way Viaduct. The Battery Street Tunnel would be decommissioned by the Bored Tunnel Alternative and altered as part of the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

Bored Tunnel Alternative

With the Bored Tunnel Alternative, the primary construction effects to historic resources would occur from settlement due to soil subsidence as the tunnel boring machine moves beneath historic buildings.

The anticipated amount of settlement along most of the alignment is small because of the depth of the tunnel boring. However, near the portals where the tunnel is shallower, there is greater potential for settlement. Of particular concern is settlement-related damage to the Western Building (619 Western Avenue) and Polson Building (61 Columbia Street). WSDOT, on behalf of FHWA, determined that settlement damage to the Western and Polson Buildings would result in an adverse effect upon the Pioneer Square Historic District. WSDOT has identified a high potential for settlement damage to the Western Building, since the tunnel boring machine would excavate soils directly beneath the building. Engineering evaluations of the building found it to be in very poor structural condition. WSDOT has defined a program of protective measures that would protect the building by constructing structural reinforcements and bracing for the interior and exterior of the building. The tenants would be relocated and the building would be unavailable for 12 to 20 months during the construction period.

The Polson Building may also experience settlement, if unmitigated. However, this building is in good structural condition and would be protected by compensation grouting to stabilize the surrounding soil before construction. Along with high levels of monitoring during construction, stabilizing the soil underneath the building would prevent major structural damage, and the remaining structural and aesthetic damage could be repaired.

Cut-and-Cover Tunnel Alternative

Construction of the Cut-and-Cover Tunnel Alternative would cause access and traffic disruptions for many years, especially along the central waterfront, affecting nearby historic resources. The impacts to specific historic resources would vary over that time, depending on the work being done and its location.

Potential effects of cut-and-cover tunnel construction include exposure of building occupants and customers to high levels of noise and dust, prolonged limited access, reduced parking, and possible utility disruptions. WSDOT, on behalf of FHWA, determined that the Cut-and-Cover Tunnel Alternative would have adverse effects to the Pike Place Market Historic District and NRHP-eligible Piers 54, 55, 56, and 57 during construction because of the long-term traffic and parking effects.

The Washington Street Boat Landing pergola would also be adversely affected during construction. The pergola and historical markers on the waterfront guardrail would be removed during construction and replaced once construction was completed. Along the central waterfront, temporary pedestrian bridges would be constructed between Piers 54 and 55 and Piers 56 and 57 to help maintain access for customers.

The Buckley's (MGM-Loew's) building at Second Avenue and Battery Street would be adversely affected because it would have to be vacated for safety reasons for approximately 6 months to complete the underpinning work inside the building for construction of the Battery Street Tunnel.

Elevated Structure Alternative

With the Elevated Structure Alternative, the potential traffic impacts and adverse effects would be generally similar to those described above for the Cut-and-Cover Tunnel Alternative, including potential impacts on the areaways.

Construction of the Broad Street detour with temporary trestle over the BNSF railroad tracks would potentially result in adverse effects to the Old Spaghetti Factory, a building that is eligible for listing in the NRHP and for Seattle landmark designation. Vibration associated with the construction of the detour would potentially result in direct impacts on the brick building, as well as visual impacts and economic impacts due to noise, dust, and altered traffic patterns.

37 How would archaeological resources be affected during construction?

Construction effects to archaeological resources and sensitive areas would likely occur during excavation, which would disrupt fill and potentially cultural deposits.

Section 4(f) and Protection of Historic and Archaeological Resources

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic sites. The project is adjacent to some of Seattle's most well-known historic buildings and neighborhoods. Historic and cultural resources that would be subject to use under Section 4(f):

- Alaskan Way Viaduct
- Battery Street Tunnel
- Western Building
- Lake Union Sewer Tunnel – manhole shaft
- Seattle Maintenance Yard – Archaeological Site 45KI958

The **Section 4(f) Evaluation** is located at the end of this *Final EIS* on page 239. The **Section 4(f) Supplemental Materials** are provided in *Appendix J*.

Two archaeological sites would be affected by all of the build alternatives during construction. Construction in the south area would adversely affect an NRHP-eligible archaeological site, the Dearborn South Tideland Site (45KI924). Construction in the north area may adversely affect Native American and historic-period archaeological sites from about Harrison Street north beyond the margins of the Denny Regrade. One historic-period archaeological site has been identified in this area, Seattle Maintenance Yard (Archaeological Site 45KI958). An archaeologically sensitive area with intact peat deposits that date to the time of earliest human occupation of the area, also exist in this location. However, no Native American archaeological sites have been identified.

Bored Tunnel Alternative

In addition to the Dearborn South Tideland Site, construction in the south area just south of S. King Street may adversely affect a sensitive area where Native American and historic-period archaeological deposits that have not been discovered through previous testing. Potential soil improvements from S. King Street to S. Main Street along the bored tunnel alignment may have the potential to adversely affect a sensitive area where Native American archaeological sites associated with the former tidal flats in this location. To avoid potential archaeological deposits, no soil improvements are planned between S. Main Street and S. Washington Street. Soil improvements are also needed in several locations along the bored tunnel alignment between S. Washington Street and Seneca Street, where the soil types are more vulnerable to settlement and the tunnel would be at a relatively shallow depth.

Cut-and-Cover Tunnel Alternative

In addition to the South Dearborn Tidelands and Seattle Maintenance Yard sites, the seawall replacement would probably adversely affect two more archaeological sites (located below the bluff north of Pike Place Market) and two more archaeologically sensitive areas (the Ballast Island area and the area west of the Battery Street Tunnel) during construction.

Elevated Structure Alternative

The effects and potential effects to archaeological resources for the Elevated Structure Alternative are very similar to the Cut-and-Cover Tunnel Alternative. However, between S. Dearborn Street and Pike Street, the area disturbed by building the piles for the Elevated Structure Alternative would be smaller than the area disturbed by the Cut-and-Cover Tunnel Alternative. Therefore, impacts to the former tidal flats areas would be less for the Elevated Structure Alternative.

38 What other effects would there be during construction?

Vibration

Construction activities that would cause the highest levels of vibration are viaduct demolition and the use of impact equipment, such as jackhammers and pile drivers. Buildings along the alignment for each alternative would be evaluated on a case-by-case basis during final project design to determine what specific mitigation measures are needed to minimize vibration and potential damage to older, fragile buildings.

Vibration monitoring will be required at the nearest historic structure or sensitive receiver within 300 feet of construction activities. The monitoring data will be compared to the project's vibration criteria to ensure that ground vibration levels do not exceed the damage risk criteria for historic and non-historic buildings and sensitive utilities. The total number of buildings requiring monitoring will be determined during final design.

For the Bored Tunnel Alternative, the tunnel boring machine (TBM) would also produce some ground vibration. Between S. Royal Brougham Way and S. Main Street, a perimeter of secant piles would be constructed to isolate the TBM as it begins boring. Once the TBM passes north of S. Main Street, the vibration levels would not be noticeable at building level and would not pose a damage risk to buildings due to the depth of the machine. The risk of construction vibration damaging underground and buried utilities would generally be less than the risk of damaging buildings.

Views

The temporary effects to views during construction would be similar in many ways for the build alternative but would occur for different lengths of time. Views would be affected for about 5.4 years with Bored Tunnel Alternative, 8.75 years with Cut-and-Cover Tunnel Alternatives, and 10 years with Elevated Structure Alternative.

Views for drivers and pedestrians during construction would include elements common to construction activities, including staging areas, heavy equipment, scaffolding, cranes, trucks, temporary materials storage and temporary noise barriers. The south area is expected to have extensive staging on the WOSCA property for equipment, materials, and construction offices for all of the alternatives. These elements would be visible from nearby streets. In addition, temporary noise barriers are planned on the eastern side of the WOSCA property extending between S. Royal Brougham Way to Railroad Way S. and on the south side of S. King Street. The barriers would be 16 feet high and would block views from adjacent streets.

For the Bored Tunnel Alternative, a 16-foot-tall temporary noise barrier is planned on the north side of Thomas Street and Sixth Avenue N., which would block views into the construction site.

Views will change as construction progresses. Some heavy equipment and elements such as scaffolding would be needed only during a portion of the construction period. Many pieces of equipment would also move as the construction stages and activities progress.

Properties and Land Use

To facilitate the construction, each of the alternatives would need temporary tieback and construction easements as shown in Exhibit S-40.

Exhibit S-40
Number of Properties Needed for Temporary Tiebacks and Construction Easements

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Temporary Tiebacks	4	27	24
Construction Easements	31	3	6

What is a tieback easement?

A temporary tieback easement allows for temporary use of a property below the surface for a wall shoring system that would be used to build a permanent wall and may be abandoned after the permanent wall is constructed. The tiebacks in the temporary easement areas would be removed or the tension released after construction is completed.

If any occupants are displaced, they would be compensated and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and the Washington Relocation Assistance—Real Property Acquisition Policy Act of 1970, as amended.

Parks and Recreation
Construction could disrupt access to park and recreation facilities in the project area. For instance, in the south area, traffic congestion may cause some people attending events at Safeco or Qwest Fields to use different routes or different modes of transportation; or in the central area, access to the Seattle Aquarium would likely be modified to avoid construction activities. Use of local streets and sidewalks would be periodically restricted during construction and viaduct demolition, disrupting access to specific sites. For the Cut-and-Cover Tunnel and Elevated Structure Alternatives, pedestrian access to the waterfront piers and parks would be maintained throughout construction; however, the appeal of the waterfront would likely be diminished for many years of construction on account of the actual lack or perceived lack of access and parking.

Neighborhoods
For all build alternatives, businesses, government offices, social services, and residents would be inconvenienced by the construction traffic detours, congestion, noise and vibration, light and glare, and dust. Construction would likely be perceived as a barrier to reaching or traveling through a neighborhood. People living or working within approximately two blocks of the construction zone would be able to hear construction noises. During nighttime hours, light and glare would especially affect residents who have direct line-of-sight views to construction zones and staging areas.

Neighborhood linkages, such as pedestrian walkways, bicycle paths, and sidewalks, would be altered intermittently due to temporary road closures. Short-term road closures may cause temporary hardships and stress for some residents. However, the detours and road closures would not adversely affect a neighborhood's sense of community or its ability to function cohesively because they would be temporary and would not entirely eliminate access to a certain part of a neighborhood.

Community and Social Services
Community and social services would be affected by construction noise, vibration, light and glare, dust and exhaust, and truck traffic. In the south area, 13 community or social service providers are located within two blocks of the construction area and would be affected. In the central section, the Western Building's 118 tenants, including artists and community art education program (Youth Art Space), would be permanently relocated. The building would not be available for 12 to 20 months. During the demolition of the existing viaduct an estimated 22 social resources could be affected by noise, vibration, light, glare, dust, and truck traffic during demolition activities. In the north area, 12 social resources are located within approximately two blocks of the construction area. Construction noise could be especially disruptive to services held by religious organizations or to the childcare facilities located in nearby buildings.

Low-Income or Minority Populations
Like the effects on downtown commuters and residents, the construction effects to minority and low-income populations would include increased traffic congestion, travel delays, increased response time for emergency services, changes to transit services, and decreased parking. With the mitigation discussed in Chapter 8, construction would not have a disproportionately high and adverse effect on low-income or minority populations.

Public Services
During construction, public services could be affected by lane closures and increased traffic congestion and delays on roadways in and around the construction area. Response times for police, fire, and emergency medical aid to locations within and near the construction area would likely increase. Fire and emergency medical services outside the project area also could be affected due to changes in traffic patterns on local roads. Increased travel times could be experienced by other public services, such as solid waste and recycling collection and disposal services, postal services, and school bus routes.

Construction in some high-volume traffic and pedestrian areas could require additional police support services to direct and control traffic and pedestrian movements.

Utilities
Some utilities would be relocated during project construction. These relocations would be performed according to agency regulations and permits, utility provider requirements, and appropriate best management practices (BMPs). Several major construction activities could cause temporary interruptions for utility service customers within the project area. Inadvertent damage to underground utilities could also occur during construction. Although such incidents do not occur frequently, they could temporarily affect services to customers of the affected utility while emergency repairs are being made.

Air Quality
Air quality effects during construction would occur primarily as a result of dust and emissions from construction equipment, diesel-fueled trucks, diesel- and gasoline-fueled generators, and other project-related vehicles such as service trucks. The general construction-related effects to air quality would be similar for all the build alternatives.

Because the total construction period for all of the alternatives would be longer than 60 months, the potential impacts on carbon monoxide concentrations are subject to the EPA's Transportation Conformity Rule (40 CFR 93). For the preferred Bored Tunnel Alternative, the results indicate that carbon monoxide concentrations during construction would conform to the National Ambient Air Quality Standards.

Greenhouse Gas Emissions
Daily carbon dioxide equivalent (CO_2e) emissions during construction would come from construction equipment

What are CO_2 equivalents?

Greenhouse gases have different abilities to trap heat. To compare different greenhouse gases, scientists use a weighting factor. CO_2 is used as the standard. Other gases are converted in CO_2 equivalents (CO_2e) using the weighting factor.

and trucks. The daily CO_2e emissions would be the highest for the Bored Tunnel Alternative because of the intense construction activity over a shorter period of time compared to the other build alternatives. However, the 35 metric tons that would be produced by the Bored Tunnel Alternative construction each day is a negligible portion of the total regional emissions of CO_2e projected for the 2015 Existing Viaduct, as shown in Exhibit S-41.

Exhibit S-41
Daily CO_2e Emissions Estimates

Alternative Construction	Metric Tons Per Day
Bored Tunnel	35
Cut-&-Cover Tunnel	20
Elevated Structure	20
2015 Existing Viaduct – Regional	46,997

The total emissions over the duration of construction for each alternative are estimated to be:

- Elevated Structure Alternative – 72,853 metric tons
- Bored Tunnel Alternative – 69,947 metric tons
- Cut-and-Cover Tunnel Alternative – 63,485 metric tons

Energy Consumption

Energy would be used during all construction activities. Common activities that would consume energy are transporting materials and debris, and operating construction equipment.

The current daily energy consumed by vehicles in the city center is 13,221 million British thermal units (BTUs). Exhibit S-42 shows the daily and total amount of energy consumed by this project during construction, which would be just a small percentage of the overall energy consumption in the region. During construction energy consumption would be highest for the Bored Tunnel Alternative because of the energy required for the tunnel boring machine. The current daily energy consumption by vehicles in the city center is 13,221 million BTUs, so the daily energy consumed by any of the build alternatives during construction would be a small percentage of the overall energy consumption in Seattle area.

Exhibit S-42
Construction Energy Consumption
in million BTUs

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Daily	193	120	95
Total *Over Duration of Construction*	**381,341**	**351,046**	**348,362**

Water Resources

Construction staging, material transport, earthwork, stockpiling, and dewatering are all construction activities that could affect water resources in the project area. Construction-related pollutants such as sediment, oil, and grease can increase turbidity and affect other water quality parameters. Also, pH in receiving waters can be altered if runoff comes in contact with curing concrete, for example, which could have serious effects on aquatic species.

For the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, dewatering during construction could result in groundwater flow from adjacent areas being drawn toward excavated areas. For the Cut-and-Cover Tunnel and Elevated Structure Alternatives, soil improvements are proposed behind the Elliott Bay Seawall, which would likely consist of jet grouting, which could seep into Elliott Bay through cracks in the existing seawall and affect water quality.

For all the build alternatives, construction effects related to water resources and water quality would be minimized or prevented through proper selection and implementation of BMPs.

Fish, Aquatic, and Wildlife Habitat

Effects to fish, wildlife, and vegetation in the project area would most likely be associated with construction noise and potential temporary, localized sedimentation and turbidity in Elliott Bay. Increased turbidity could occur due to erosion; spoils handling, stockpiling, dewatering, potential spills. Noise from viaduct demolition could affect wildlife species in the area because it would be shaper than the usual relatively continuous traffic noise.

For the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the replacement of the seawall would require the construction of a temporary access bridge for access to the Seattle Ferry Terminal from Pier 48 and, potentially, temporary overwater pedestrian walkways between some piers. The construction of these structures would require pile driving and removal, and result in shading of subtidal habitat. Pile-driving could potentially harm fish and aquatic species due to the underwater sound impulses generated by the pile driver, and/or disturb other wildlife species due to airborne sound levels. Also, after the new seawall is completed, the old seawall would be removed, which would require in-water work. This in-water work would affect the near shore habitat and associated marine organisms.

As required under ESA, the lead agencies have consulted with NMFS and USFWS. Determinations made by the NMFS in the January 27, 2010 Biological Opinion and USFWS in the December 7, 2010 concurrence letter were presented previously in this chapter in Exhibit S-29.

Soil Excavation and Hazardous Materials

All of the alternatives would excavate soil and material to relocate utilities and construct foundations. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would also excavate soil to build retained cuts and tunnel sections. Excavated materials may be contaminated, which would require special handling and disposal. Exhibit S-43 shows the estimated volume of excavated material and the amount of that material that may be potentially contaminated. All of the build alternatives have been designed to avoid contamination where possible.

Exhibit S-43
Excavated and Contaminated Soil Volumes
in cubic yards

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Excavated Material	1,573,500	2,007,000	806,000
Potentially Contaminated Material	1,451,000	1,437,000	660,920

Excavated material would be hauled away by trucks or railcars, or in the south area conveyed to a barge at Pier 46, the northern edge of Terminal 46. Materials would be

What is a British thermal unit?

A British thermal unit (BTU) is the approximate amount of energy needed to heat 1 pound of water 1 degree Fahrenheit.

removed to a predetermined site. Excavated materials that are barged would likely be disposed of at the Mats Mats Quarry, near Port Ludlow in Jefferson County, Washington. Trucks will be required to follow City-designated truck routes and could cause increased congestion and delay on these routes.

MITIGATION FOR TEMPORARY CONSTRUCTION EFFECTS

39 How would construction effects be mitigated?
All environmental resources analyzed in this Final EIS would be affected by project construction. WSDOT will implement BMPs and carry out specific mitigation measures based on the project's construction effects.

Specific construction mitigation measures are presented in Chapter 8 of the Final EIS. Some of the key measures include:

- WSDOT will prepare a traffic management plan to be approved by the City of Seattle to ensure that construction effects on local streets, property owners, and businesses are minimized.
- Providing $30 million to mitigate parking effects during project construction (specific mitigation strategies are being developed).
- Implementing stabilization measures to prevent damage from settlement and vibration to vulnerable historic buildings.
- Obtaining noise variances and developing a construction noise management and mitigation plan to establish a set of noise limits that protects the public from excessive noise effects.
- Developing an Archaeological Treatment Plan for archaeological investigations, data recovery. The Archaeological Treatment Plan also will include the protocol for handling unanticipated archaeological and human remains discoveries, and archaeological monitoring during project construction.

40 What temporary construction effects would not be mitigated?
WSDOT will implement mitigation measures to avoid or minimize effects during construction for all build alternatives. However, it will not be possible to prevent some effects, even with mitigation. For many of the effects described in this summary, some residual temporary construction effects would remain. For example, mitigation measures will be in place during construction to minimize noise impacts, but people near the construction area will still hear construction activities. Such residual effects are not expected to be substantial and will be temporary.

41 How would this project, the Alaskan Way Viaduct and Seawall Replacement Program, and other downtown projects affect Seattle and surrounding areas?
Cumulative effects represent the total effect of the proposed Alaskan Way Viaduct Replacement Project when added to other past, present, and reasonably foreseeable projects or actions. Cumulative effects are not caused by a single project but by a combination of the trends from past projects along with current and likely future projects.

The cumulative effects analysis for this Final EIS considered potential cumulative effects from the other projects identified as part of the project and Program, in addition to past projects, relevant plans and other planned projects that may be built in a similar timeframe or nearby location. The cumulative effects analysis considered the future "Without the Project" and "With the Project" as shown in Exhibit S-44. "Without the Project" is the Viaduct Closed (No Build Alternative) and means that the viaduct would be closed and not replaced. "With the Project" includes all the build alternatives with or without tolls.

The build alternatives are expected to have few long-term, adverse cumulative effects. Most of the long-term cumulative effects of the Program are expected to be beneficial, particularly to traffic operations in the surrounding transportation network. The projects included in the Program collectively replace failing infrastructure, improve existing transportation facilities, provide improved public amenities, and increase transit capacity and services. Other planned projects, if implemented, would provide additional benefits to the transportation network, complementing the Alaskan Way Viaduct Replacement Project. These projects would benefit numerous drivers traveling to and through downtown Seattle, but specifically these improvements will benefit drivers traveling to and from northwest Seattle. Transit enhancements would benefit numerous transit riders that use the transit system to travel to and through downtown Seattle. Together, these improvements are not expected to provide a substantial benefit to the regional transportation network, but they are expected to accommodate slightly more trips in the downtown Seattle transportation network with slightly less travel delay.

Exhibit S-44
Cumulative Effects by Resource

Resource	Without the Project	With the Project
Land Use	No change	Does not contribute
Visual Quality	No change	Does not contribute
Transportation	Adverse	Beneficial contribution
Noise	No change	Slight beneficial contribution for tunnel alternatives Does not contribute for elevated structure
Economics	Slight adverse	Slight beneficial contribution
Social and Neighborhood Resources	Slight benefit	Slight beneficial contribution
Historic, Cultural, and Archaeological Resources	Slight adverse	Slight adverse contribution
Public Services and Utilities	Slight adverse	Does not contribute
Energy and Greenhouse Gas Emissions	No change	Does not contribute
Water Quality	Slight adverse	Beneficial contribution
Air Quality	No change	Does not contribute
Wildlife, Fish, and Vegetation	No change	Does not contribute
Earth and Groundwater	No change	May have beneficial contribution if contaminated soil or groundwater removed

Note: These cumulative effects are relative to a baseline that reflects existing conditions and trends.

Mitigation for Construction Effects

All the proposed mitigation measures for the build alternatives are presented in **Chapter 8** of ***Final EIS***.

What are cumulative effects?

Cumulative effects are defined as: "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time". (40 CFR 1508.7)

In most cases, the build alternatives are not expected to contribute, or are expected to have a slightly beneficial contribution to future resource trends in the project area as shown in Exhibit S-44. However, a slight adverse contribution is expected to historic, cultural, and archaeological resources. With or without the project, the trend for incremental loss of historic and culturally important resources would continue although the rate of loss is slowing due to increased regulatory protections and awareness of the value of historic structures.

42 What opportunities have we provided for people, agencies, and tribes to be engaged in the project?

The lead agencies have provided numerous opportunities for the public to be engaged, ask questions, and learn about the project since it began in 2001. Opportunities have been provided for the general, interested public as well as businesses, residents, agencies, tribes, minority, and low-income people who may be affected by the project.

Since the project began, the lead agencies have engaged the public by:

- Holding dozens of public meetings
- Giving project briefings at more than 700 community meetings
- Distributing information at community fairs and festivals to more than 21,000 people
- Giving public viaduct tours to more than 1,100 people
- Receiving about 300 information line calls, more than 2,600 e-mails, and web comment forms
- Distributing news releases
- Creating fact sheets and folios in English and several other languages
- Providing updated project information on our project website and via monthly e-mail messages

In addition, WSDOT has provided opportunities for specific groups by:

- Conducting regular meetings with stakeholder working groups
- Notifying property owners and tenants of expected activities and possible disruptions
- Conducting individual meetings with agency staff
- Conducting interviews and holding briefings with social service providers that serve low-income and minority populations
- Inviting tribal nations to various meetings and having individual meetings with tribes
- Hosting events for interested contractors, including Disadvantaged Business Enterprises, to learn about the project

Public Hearings and Comments on the 2010 Supplemental Draft EIS

In addition to the activities discussed above, public hearings were conducted to receive comments on the 2010 Supplemental Draft EIS on the dates and at the locations listed below:

- November 16, 2010 – West Seattle
- November 17, 2010 – Ballard
- November 18, 2010 – Downtown Seattle

Comments on the Supplemental Draft EIS were accepted during the 45-day public comment period through e-mail, letters via regular postal mail, and on comment forms distributed by mail. In addition to the nearly 850 comment letters received on the 2004 and 2006 EISs, 213 comment letters were received on the 2010 Supplemental Draft EIS. Responses to these comments are provided in Appendices S and T of this Final EIS.

43 What comments were made on the 2010 Supplemental Draft EIS?

The number of submitted items (e.g., letters, e-mails, comment forms, oral transcripts) received for each EIS during the public comment periods are presented in Exhibit S-45.

Exhibit S-45
Number of Submitted Items

Type of Commenter	2004 Draft EIS	2006	2010
		Supplemental Draft EISs	
Federal Agency	4	5	5
State Agency	5	1	2
Local Agency	11	7	7
Tribe	2	0	0
Community Organization	46	13	25
Business	18	4	5
Hearing Transcript	38	17	11
Individual	546	131	158
Total	**670**	**178**	**213**

Each submitted item (e.g., letter from an agency) was delineated into individual comments by topic. The result was more than 3,100 comments for all the EISs.

Some of the more common comment topics for each EIS, and the lead agencies' general responses, are presented below:

2004 Draft EIS

- Elimination of Battery Street Flyover Detour – There were numerous comments asking the lead agencies to eliminate this detour from the construction plans. As the design for the Cut-and-Cover Tunnel and Elevated Structure Alternatives moved forward, the Battery Street Flyover detour was eliminated.
- Consideration of Construction Plans – Many people asked the lead agencies to consider more than one construction plan for this project, primarily to see if there was a feasible way to build the project in a shorter amount of time. In response, the 2006 Supplemental Draft EIS evaluated three different

Public, Agency and Tribal EIS Comments and Responses

All public, agency, and tribal comments received during the public comment periods and the lead agencies' responses are provided in *Appendix S, 2004 Draft EIS* and *2006 Supplemental Draft EIS Comments and Responses* and *Appendix T, 2010 Supplemenal Draft EIS Comments and Responses*.

Chapter 9, EIS Comments and Responses

A larger discussion about the comments received in this project's Draft and Supplemental Draft EISs can be found in **Chapter 9** of the *Final EIS*.

construction plans to give people an idea of what could be done to alter the duration of construction.

- Addition of a Tunnel Lid – A lid was incorporated into the design of the 2006 Cut-and-Cover Tunnel Alternative in part due to the numerous comments requesting the lead agencies to consider a lid in the Pike Place/Belltown area.

2006 Supplemental Draft EIS

- Construction Duration – Members of the public, business owners, and government agency officials all were interested in finding better ways to avoid and minimize the extensive construction effects that were anticipated.

- Alternative Concepts Not Considered – The public had comments and questions about other concepts not considered as build alternatives in the EIS. These concepts include retrofitting, other types of elevated structures, and surface street concepts. Design concepts were reevaluated and screened to determine the alternatives that would be evaluated in the 2010 Supplemental EIS.

2010 Supplemental Draft EIS

- Alternatives – This topic category encompasses all comments related to project alternatives, including statements suggesting that more work should be done to identify other possible alternatives; and to further refine or modify the current build alternatives. In response to these comments, the lead agencies have studied a wide range of possible viaduct replacement options and the alternatives development process has been subject to extensive public review. In addition, due to continued interest from some individuals and groups in a surface and transit hybrid concept, the lead agencies evaluated transportation effects of a surface and transit hybrid to test the rationale for screening it out; see Chapter 2 Questions 6 and 7 for this discussion.

- Tolling – In general, the tolling comments request that the lead agencies provide more information about how the toll would be implemented and the associated potential effects. Prior to a final decision about how or if the new facility would be tolled, WSDOT will be working with the Seattle Department of Transportation and other agencies to refine and optimize tolling strategies. In this Final EIS, each of the build alternatives were analyzed with and without tolls.

- Project Costs – Many of the project financial comments are concerned with project cost overruns and who would pay for them. The lead agencies' have completed extensive planning and analysis to minimize the potential for cost overruns and contingencies are included in the project's cost estimates.

- Construction – The long construction period for this project remains a concern to the public. The lead agencies acknowledge that the construction period for this project would be relatively long, but they are committed to implementing mitigation measures to address construction-related effects.

There are also comments about potential effects from tunnel boring, such as settlement, on historic buildings. Historic buildings will be closely monitored during and after tunneling, and, where needed, improvements such as compensation grouting would be used to prevent damage.

- Transportation – Many people commented on each alternative's capacity and questioned the new facility's ability to accommodate all the projected traffic. Other comments in this category are concerned with the alternatives' ability to provide access to the downtown core. In response, all of the build alternatives were evaluated against the project's purpose to provide capacity to and through downtown Seattle, and they meet it to varying degrees.

The temporary and permanent loss of parking spaces is also a topic of concern for those who provided comments. The lead agencies recognize that businesses within the project area rely on the short-term parking in the area. Specific parking mitigation strategies have not yet been determined, but the project has allocated $30 million for parking mitigation.

44 What issues are controversial?

Building an Elevated Structure

Some people and groups feel another elevated structure is the best replacement for the existing viaduct. An elevated structure could keep the same connections at Elliott and Western Avenues and Columbia and Seneca Streets. These connections provide good access to northwest Seattle and into the downtown area and are familiar travel routes. Other people feel strongly that any structure on the waterfront would be a barrier that separates downtown from Elliott Bay.

Replace the Viaduct with a Surface and Transit Concept

Some people and groups feel the viaduct could be replaced by a combination of improvements to surface streets, I-5, and additional transit service. This approach was screened out from further consideration because the lead agencies determined it reduced mobility for trips heading to and through downtown and reduced north-south capacity. The approach remains popular with those who believe it would be less expensive, more consistent with the State's greenhouse gas reduction goals by discouraging use of single occupancy vehicles and encouraging transit.

Tolling

Tolling is controversial because this portion of SR 99 is currently not tolled. The Washington State Legislature directed WSDOT to study how tolls might be charged to help pay for replacing the viaduct. Current funding plans include $400 million from tolls. If tolls are not implemented, then other funding would be needed.

Appendix W, Screening Reports

Results from the transportation analysis for the surface transit hybrid concept are provided in *Appendix W* in the *Final EIS*.

Construction Impacts
Although the Bored Tunnel has substantially fewer construction impacts than any other alternative, it would cause delays for traffic and affect some nearby areas. SR 99 will follow the WOSCA detour from S. Royal Brougham Way to S. King Street for about 4.5 years with the Bored Tunnel and Cut-and-Cover Tunnel Alternatives and about 5.75 years with the Elevated Structure Alternative. Construction of the Cut-and-Cover Tunnel or Elevated Structure would have significantly greater impacts on SR 99 traffic and the central waterfront.

City of Seattle Involvement Since 2010
In November 2009, Seattle elected a new mayor, Mike McGinn. Since taking office in 2010, Mayor McGinn has expressed concerns with the policy direction given from the Seattle City Council. On September 23, 2010, City Council President Richard Conlin signed the 2010 Supplemental Draft EIS on behalf of the City because the Seattle Department of Transportation Director did not sign it. On October 4, 2010, the City Council voted in favor 8 to 1 of Ordinance 123424,[8] which authorized Conlin's signature and maintained the City's co-lead status with WSDOT and FHWA during environmental review in order to protect the City's ability to shape and influence the Final EIS.

After having participated in the development of the 2010 Supplemental Draft EIS, on December 13, 2010, WSDOT received a formal letter from the Seattle Department of Transportation that provided comments on the 2010 Supplemental Draft EIS. FHWA and WSDOT have responded to each of these comments, and they are provided in Appendix T of this Final EIS.

On April 21, 2011, the Seattle Department of Transportation released a document that discusses the effects of tolling the Bored Tunnel Alternative on Seattle streets and potential mitigation. The City of Seattle has requested that the document be included in this Final EIS. FHWA and WSDOT have honored this request, and the document and response to the document is provided in Appendix V of this Final EIS.

45 What issues need to be resolved?
Legislative action would be required to toll SR 99, and it is possible that the project could be built using other funding sources and would not be tolled.

46 What are the next steps?
FHWA intends to issue the Record of Decision (ROD) for this project 30 days after publication of a Federal Register notice announcing that the Final EIS has been issued, or as soon after that date as practicable. The Federal Register notice is expected to be published on July 15th; when published, it will be posted on the project website at www.alaskanwayviaduct.org. While the lead agencies are not required to request comments on a Final EIS pursuant to 40 CFR 1503.1(b), in order to be fully informed of the interests of all parties, the lead agencies are accepting comments on the Final EIS. If any substantive comments are received prior to signing of the ROD, FHWA will include responses to those comments in the ROD. Comments must be received by no later than 5:00pm on Monday, August 15, 2011 for consideration in the ROD. Comments may be submitted by mail to:

Angela Angove
Alaskan Way Viaduct Project Office
999 Third Avenue, Suite 2424
Seattle, WA 98104

or via email at: awv2011FEIScomments@wsdot.wa.gov.

Appendix V

Appendix V of the Final EIS contains the City's document *Additional Review of the Impacts of Deep Bored Tunnel Tolling Diversion on City Streets; Identification of Mitigation* as well as FHWA and WSDOT's response to the information and conclusions presented.

8 City of Seattle 2010, Ordinance 123424.

Cracked Column in the Viaduct

Damaged Rebar in the Viaduct

CHAPTER 1 - INTRODUCTION

What is in Chapter 1?

Chapter 1 describes where the project is located, who is leading the project, the purpose of this document, and the purpose and need for the project.

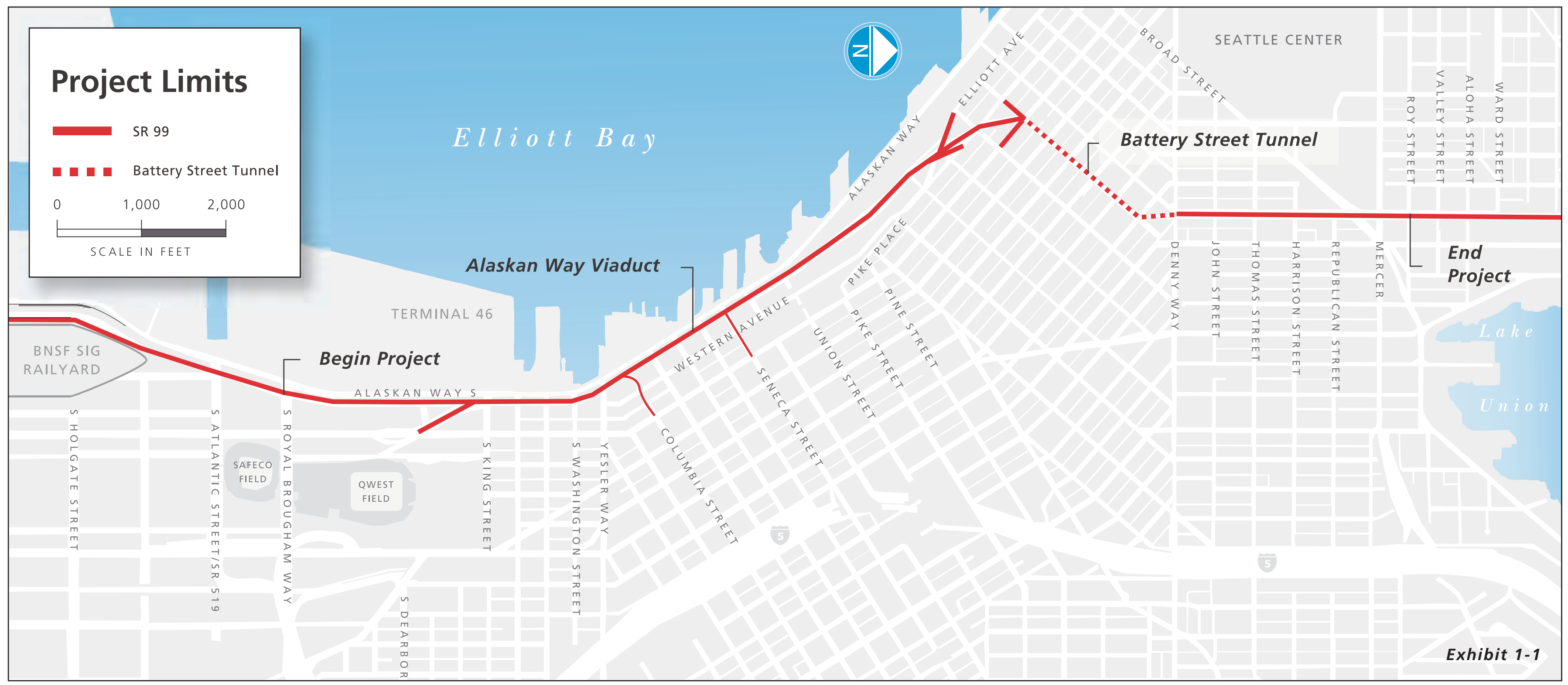


Exhibit 1-1

1 What is the Alaskan Way Viaduct Replacement Project?
The Alaskan Way Viaduct Replacement Project (project) is located in downtown Seattle, Washington. The project would replace State Route (SR) 99 from approximately S. Royal Brougham Way to Roy Street and remove the existing viaduct (SR 99) from approximately S. King Street to the Battery Street Tunnel.

2 What are the project limits and why were they selected?
The project limits begin at approximately S. Royal Brougham Way in the south and continue north to Roy Street, as shown in Exhibit 1-1. The project limits represent logical end points (termini) for transportation improvements and environmental review based on identified project needs, which include providing a facility with improved earthquake resistance. S. Royal Brougham Way provides an important link to other regional facilities, such as I-5, I-90, and SR 519, and Roy Street is where traffic exits and enters SR 99.

Between S. Royal Brougham Way and S. King Street, this project would begin and the S. Holgate Street to S. King Street Viaduct Replacement Project will end; there would be an area of transition between the two projects. The S. Holgate Street to S. King Street Viaduct Replacement Project will be built to transition into the No Build Alternative or any of the proposed build alternatives.

Elliott Bay represents the project limit to the west and I-5 is the project limit to the east, though the potentially affected area to the west and east depends on the resource.

Where would the construction staging sites be located?
Proposed construction staging sites for the project are located both within and outside of the project limits, as shown in Exhibit 1-2. The project area is located in a highly urban environment where space for construction staging is limited. Because of this, potential staging sites have been proposed outside of the project limits to ensure that sufficient staging areas are available. The contractor may identify additional staging sites as needed and would be responsible for obtaining environmental approvals for those sites.

3 Who is leading this project?
This project is being led by a partnership of three agencies: the Federal Highway Administration (FHWA), Washington State Department of Transportation (WSDOT), and City of Seattle (City). FHWA is the federal lead agency for this project and is responsible for ensuring that federal regulations are followed. FHWA has the primary responsibility for the content and accuracy of National Environmental Policy Act (NEPA) documents and has approval authority for all expenditures of

What is the relationship between the S. Holgate Street to S. King Street Viaduct Replacement Project and this project?

Chapter 3, Question 12 explains the relationship between the S. Holgate Street to S. King Street Viaduct Replacement project and the Alaskan Way Viaduct Replacement Project.

federal-aid highway funds. WSDOT owns SR 99 and the viaduct and is responsible for structural inspections and major maintenance. The City is responsible for viaduct traffic operations and minor maintenance. In addition, the City owns and maintains Alaskan Way, the area underneath the viaduct, and many of the utilities located in the project area. WSDOT has the responsibility to evaluate the proposed alternatives under the State Environmental Policy Act (SEPA) and is the SEPA lead agency for
the project.

4 Why are the lead agencies preparing this Final EIS?

This Final Environmental Impact Statement (EIS) is being prepared to meet obligations under NEPA and SEPA. This Final EIS does the following:

- Documents changes made to the proposed build alternatives since the 2010 Supplemental Draft EIS was published
- Identifies the preferred alternative and explains why it is preferred
- Includes responses to public comments on the following environmental documents associated with replacing the Alaskan Way Viaduct:
  - — 2004 Alaskan Way Viaduct and Seawall Replacement Project Draft EIS
  - — 2006 Alaskan Way Viaduct and Seawall Replacement Project Supplemental Draft EIS
  - — 2010 Alaskan Way Viaduct Replacement Project Supplemental Draft EIS

5 What is the purpose of the Alaskan Way Viaduct Replacement Project and why is it needed?

Purpose and Need for the Proposed Action

The Alaskan Way Viaduct is seismically vulnerable and at the end of its useful life. To protect public safety and provide essential vehicle capacity to and through downtown Seattle, the viaduct must be replaced. Because this facility is at risk of sudden and catastrophic failure in an earthquake, FHWA, WSDOT, and the City of Seattle seek to implement a replacement as soon as possible. Moving people and goods to and through downtown Seattle is vital to maintaining local, regional, and statewide economic health. FHWA, WSDOT, and the City of Seattle have identified the following purposes and needs the project should address.

The purpose of the proposed action is to provide a replacement transportation facility that will:

- Reduce the risk of catastrophic failure in an earthquake by providing a facility that meets current seismic safety standards.
- Improve traffic safety.
- Provide capacity for automobiles, freight, and transit to efficiently move people and goods to and through downtown Seattle.
- Provide linkages to the regional transportation system and to and from downtown Seattle and the local street system.
- Avoid major disruption of traffic patterns due to loss of capacity on SR 99.
- Protect the integrity and viability of adjacent activities on the central waterfront and in downtown Seattle.

The following paragraphs provide further information regarding the needs underlying each of these project purposes that are listed above.

Reduce Seismic Vulnerability

Because of its seismic vulnerability, the Alaskan Way Viaduct must be removed. The viaduct is deteriorating and at risk of sudden and catastrophic failure in an earthquake because of its design, age, and location. The viaduct was constructed in the 1950s and conformed to the design

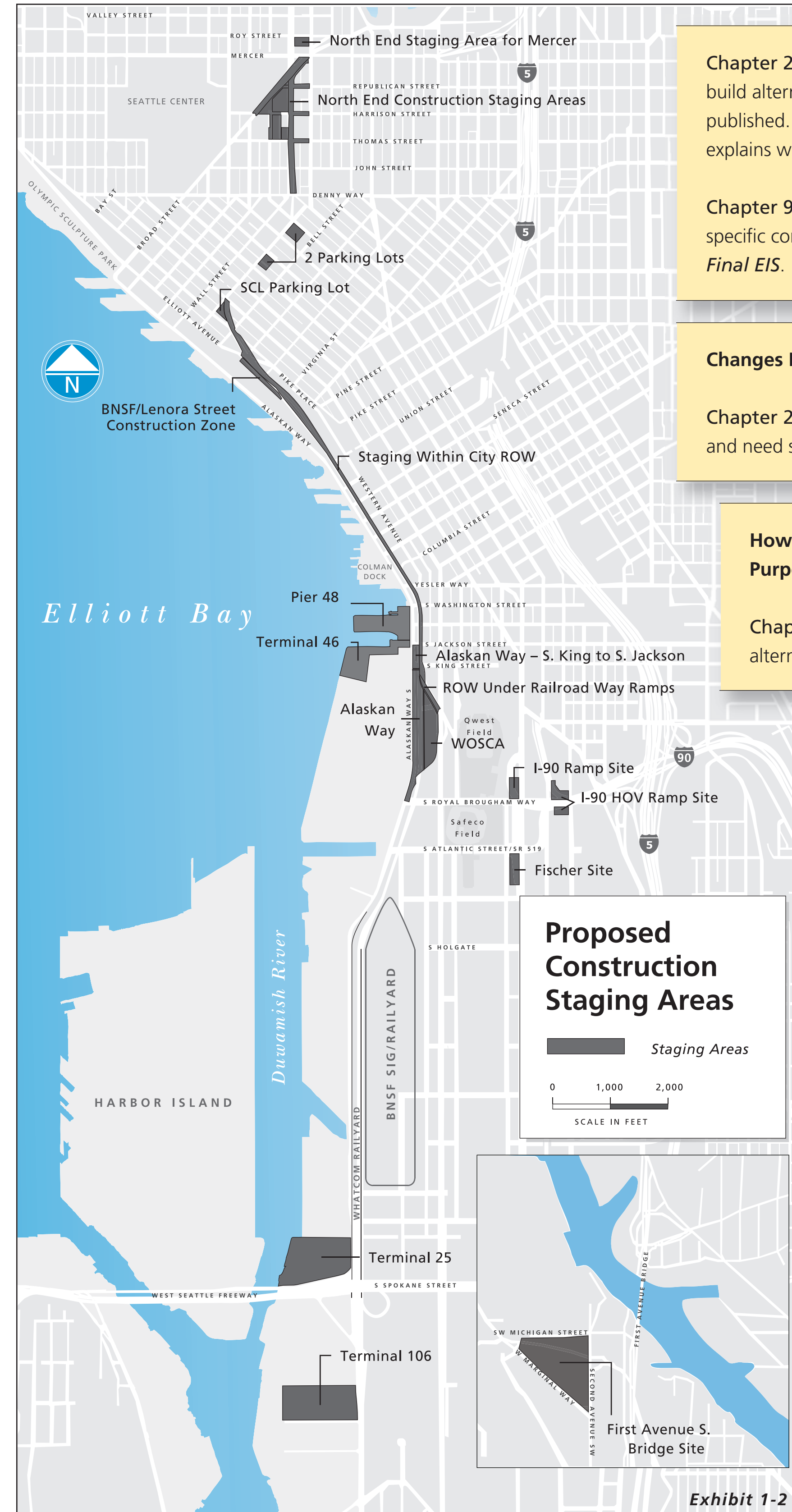


Exhibit 1-2

Chapter 2, Question 7 describes changes made to the proposed build alternatives since the *2010 Supplemental Draft EIS* was published. This question also identifies the preferred alternative and explains why it is preferred.

Chapter 9 discusses responses to public comments. Responses to specific comments are provided in *Appendices S* and *T* of this *Final EIS*.

Changes Made to the Project's Purpose and Need Statement

Chapter 2, Question 6 discusses changes made to the purpose and need statement between 2006 and 2010.

How do the Build Alternatives Meet the Project's Purpose and Need?

Chapter 5, Question 37 explains how the proposed build alternatives meet the purpose and need statement.

standards of that time. The structure was designed to seismic criteria that are less than one-third as stringent as today's criteria.[1] The viaduct's existing foundations are embedded in liquefiable soil, and the structure is deteriorating. These factors make the structure vulnerable to earthquakes and necessitate its removal.[1] The replacement for SR 99 must meet current standards for earthquake resistance.

Improve Traffic Safety
The viaduct and Battery Street Tunnel do not meet current roadway design standards and have deficiencies that need to be improved.[1] Current design standards reflect the latest agreement among the states and FHWA on how to safely design new and upgraded highways. As now configured, the viaduct does not meet current standards for lane width, shoulder width, and stopping sight distance.[1] The Battery Street Tunnel does not meet current standards for lane width, shoulder width,[1] and stopping sight distance.[2] North of the Battery Street Tunnel, several streets connect directly to SR 99 without room for drivers to accelerate or decelerate without affecting traffic flow or safety. These deficiencies result in higher than average collision rates for some segments of SR 99 within the project limits compared to similar facilities.[2] The replacement for SR 99 should meet current standards for roadway design.

Provide Capacity to Move People and Goods
The Alaskan Way Viaduct portion of SR 99 provides essential capacity to and through downtown Seattle, carrying 20 to 25 percent of the traffic traveling through downtown. Together, I-5 and SR 99 through Seattle carry over $80 billion in goods each year.[3]

The central waterfront portion of the SR 99 mainline is one of two primary north-south highway routes through Seattle. Maintaining this north-south through route is critical to supporting a robust, integrated regional transportation system and the economic vitality of the city, Puget Sound region, and state. The through capacity provided by the viaduct cannot be provided elsewhere in the region if the facility were to close. This section of SR 99 also serves as a transit route to and from downtown for local and express bus service. For these and other reasons, the U.S. Congress has identified it as a project of national and regional significance.[4] The replacement for SR 99 should provide sufficient capacity for north-south trips to and through downtown.

Provide Transportation System Linkages
This portion of SR 99 provides important linkages for the regional and local transportation system. Directly south of the central waterfront section of SR 99, the highway interacts with the Port of Seattle and Seattle's Duwamish industrial area. This area is home to one of the West Coast's largest industrial ports and just over 80 percent of Seattle's designated industrial lands.[5] The transportation system in this area plays a crucial role in the movement of freight and goods for the entire state and the Pacific Northwest region. As such, the connection provided by SR 99 to Port facilities and industrial activities is important to the efficient movement of freight and goods to and from Seattle.

Along the central waterfront, SR 99 provides efficient through access for traffic bound for locations north and south of the downtown core. In addition to providing an efficient through connection, the existing viaduct also provides access to and from the south and downtown Seattle via the Seneca Street off-ramp and Columbia Street on-ramp. Further, this section of SR 99 provides a connection for the Interbay, Magnolia, and Ballard neighborhoods in northwest Seattle with areas south of downtown via the Elliott and Western Avenues and Railroad Way on- and off-ramps. This connection is used by many businesses and residents in northwest Seattle and is not easily duplicated by other routes.

Directly north of the central waterfront, SR 99 provides links to the local streets that serve the Seattle Center, a major regional civic center that welcomes more than 12 million visitors each year, generating $1.15 billion in business activity.[6] In this area, SR 99 separates Seattle Center and the Uptown neighborhood from the South Lake Union neighborhood and provides limited connections to these neighborhoods. Improvements to SR 99 should improve these inter-neighborhood connections as well as provide regional access to and from SR 99.

The replacement for SR 99 should provide linkages to the regional transportation system, and to and from downtown Seattle and the local street system.

Avoid Major Disruption of Traffic Patterns
The existing Alaskan Way Viaduct provides substantial capacity for north-south travel to and through downtown Seattle. The loss of substantial capacity on SR 99 for an extended period would adversely affect conditions for through traffic by increasing congestion on I-5 and the adjacent local roadway network. Since many of these adjacent facilities are already congested, extended loss of SR 99 capacity would add substantial delay for the traveling public (including transit) and would cause economic hardships for local and regional businesses. While disruption cannot be completely avoided, there is a need to replace the existing viaduct in a manner that minimizes disruption of traffic patterns by minimizing the time lapse between closure of the existing viaduct and opening of a replacement facility or facilities.

Protect the Integrity and Viability of Adjacent Activities on the Central Waterfront and in Downtown Seattle
The presence of the viaduct impedes the City's ability to implement its vision for redeveloping the central waterfront. The central waterfront section of the Alaskan Way Viaduct travels through and adjacent to downtown Seattle's urban core and the Seattle waterfront. The structure is elevated through the city, providing views of the waterfront to drivers, but substantially impairing views to and from the waterfront to the city. The high volume of traffic carried by the double-level structure contributes substantial noise that affects the adjacent downtown and waterfront areas.

Since the viaduct was constructed in the 1950s, the Seattle downtown waterfront has been transformed from its origins as a working waterfront, characterized by shipping,

1 Parsons Brinckerhoff Quade & Douglas, Inc. 2002.

2 Parsons Brinckerhoff Quade & Douglas, Inc. 2004.

3 Larsen et al. 2005.

4 SAFETEA-LU 2005. Sec. 1301 (m).

5 City of Seattle 2007.

6 City of Seattle 2008.

warehouse, and industrial activities, to an important area for tourism and recreation. The central waterfront now has a mix of uses that include office, retail, hotel, residential, conference center, aquarium, museum, parks, cruise ship terminal, ferry terminal, and various types of commercial and recreational moorage. As such, the view and noise impacts caused by the existing elevated viaduct structure detract from the land uses found on the Seattle waterfront today.

Seattle's vision for the central waterfront is based on reconnecting downtown with the waterfront, enhancing the waterfront's environmental sustainability, increasing views of Elliott Bay and the landforms beyond, facilitating revitalization of Seattle's waterfront, maintaining transportation access to and through the waterfront, and increasing opportunities for the public to access and enjoy the shoreline and waterfront. Therefore, the replacement for SR 99 should support land use plans for the central Seattle waterfront and downtown as described above.

Alternatives Evaluated in the 2004 Draft EIS

Rebuild *Aerial* *Tunnel* *Bypass Tunnel* *Surface*

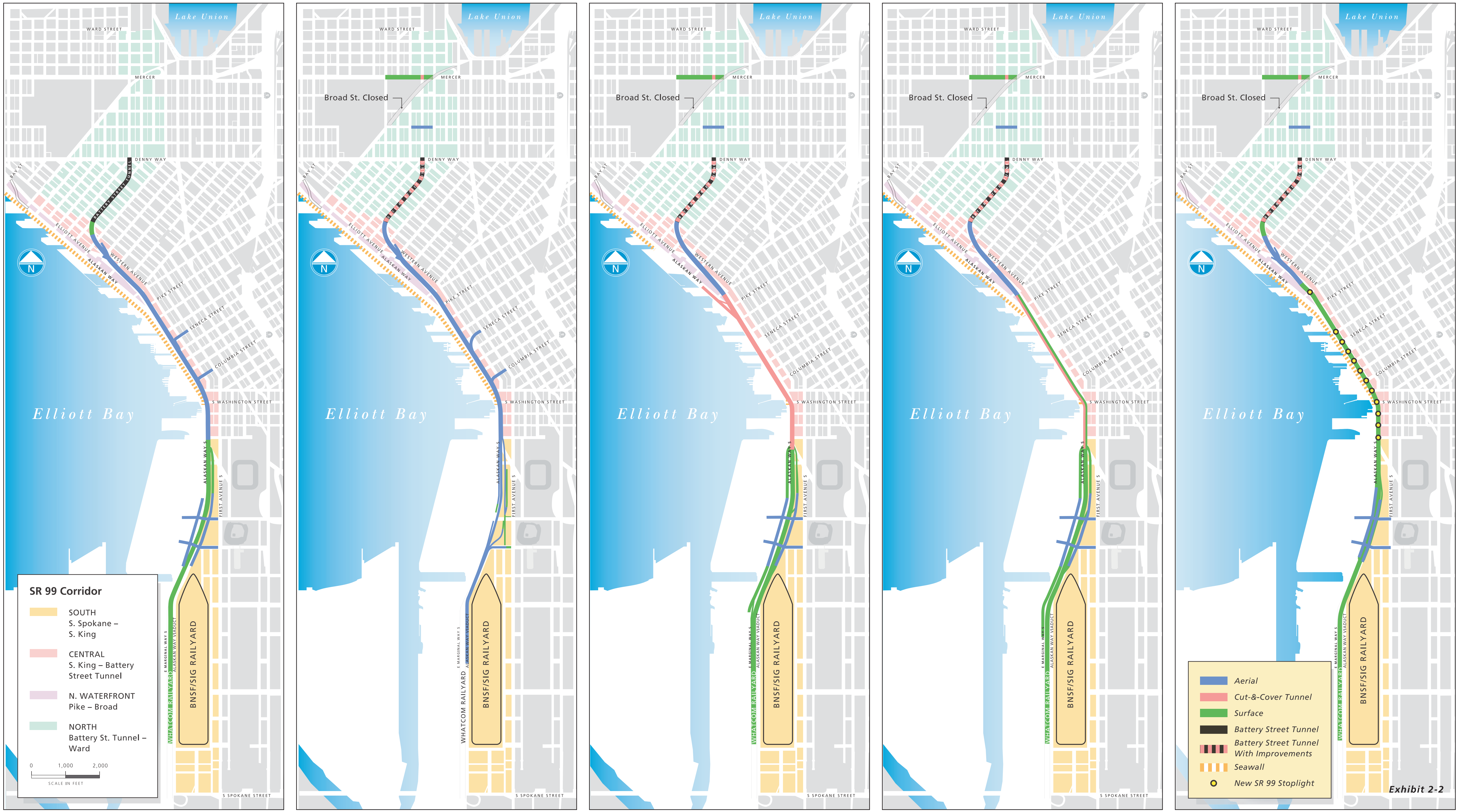


Exhibit 2-2

CHAPTER 2 - ALTERNATIVES DEVELOPMENT

What is in Chapter 2?

This chapter describes the project's history, explains how the alternatives were developed, and describes public coordination efforts.

1 What is the history of this project?

Exhibit 2-1 summarizes the history of this project and the alternatives evaluated through the environmental impact statement (EIS) process. Interest in replacing the viaduct began in 1995 when a study conducted by Washington State Department of Transportation (WSDOT) and the University of Washington determined that the viaduct was vulnerable to soil liquefaction in the event of an earthquake.[1] In early 2001, a team of design and seismic experts began work to consider various options for the viaduct. In the midst of this investigation, a 6.8-magnitude earthquake, called the Nisqually earthquake, shook the Puget Sound region on February 28, 2001.

The earthquake demonstrated the urgent need for replacing the viaduct with a seismically safe facility. As a result, the Federal Highway Administration (FHWA), WSDOT, and the City of Seattle (City) initiated the process to evaluate viaduct replacement alternatives by publishing a Notice of Intent (NOI) on June 22, 2001[2] as required by the National Environmental Policy Act (NEPA). The 2001 NOI established that the proposed action would involve improving or replacing the 2 mile-long viaduct structure. At that time, the project did not include replacing the seawall, and project limits were established as the First Avenue South Bridge to north of the Battery Street Tunnel.

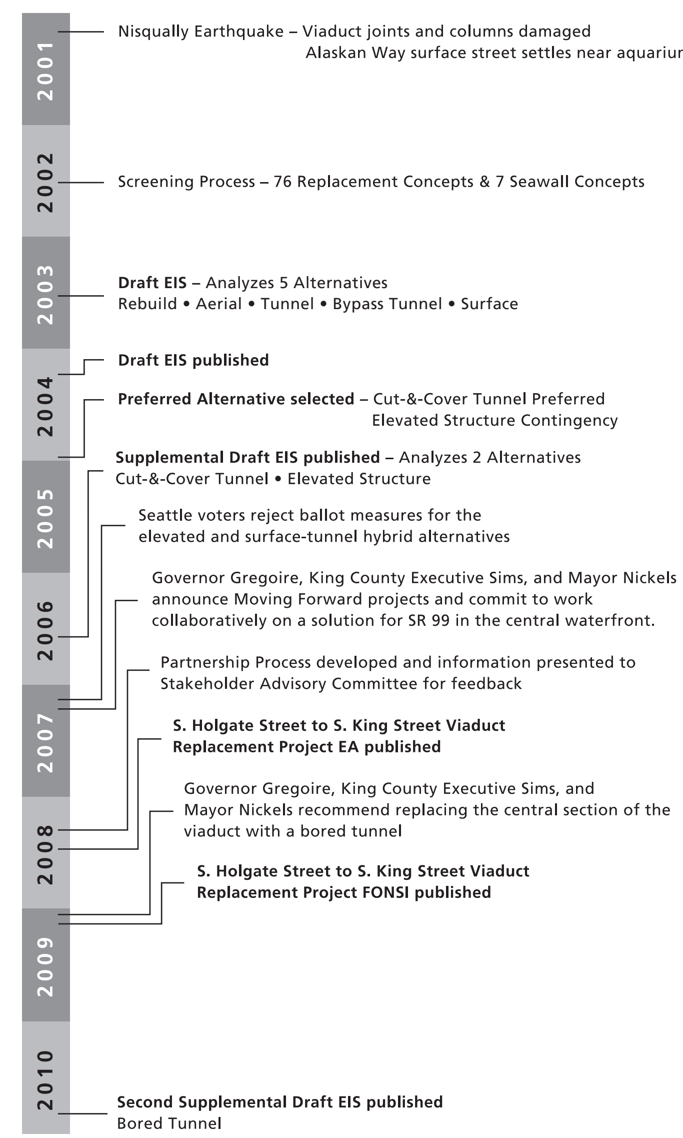
As the initial study for the project was underway, concerns were raised about the condition of the Elliott Bay Seawall, which holds back the soil that the viaduct's foundations are embedded in. Because of these concerns, the 2001 NOI was revised on September 26, 2003.[3] The revised NOI included replacing the seawall and moving the southern terminus north from the First Avenue S. Bridge to S. Spokane Street. As a result, 76 viaduct replacement concepts and seven seawall concepts were organized into six groups:

- Viaduct improvements from S. Holgate Street to the Battery Street Tunnel
- Battery Street Tunnel improvements
- Roadway improvements outside of the corridor
- Multi-modal solutions – transit, bicycle, and pedestrian opportunities
- Related improvements
- Seawall improvements

Then, the best ideas from these six groups were shaped into the five build alternatives evaluated in the 2004 Draft EIS: the Rebuild, Aerial, Tunnel, Bypass Tunnel, and Surface Alternatives.

In late 2004, after the public comment period for the Draft EIS, these five build alternatives were narrowed down to two: a Cut and-Cover Tunnel and an Elevated Structure. Between 2004 and 2006, design changes were made to the Cut-and-Cover Tunnel and Elevated Structure Alternatives; the project was extended farther north to improve access to and from SR 99 and improve local street connections as documented in an NOI[4] on August 3, 2005; and different construction approaches were considered in

Exhibit 2-1
Project Timeline



Appendix W, Screening Reports

Information about how design concepts were screened is provided in *Appendix W*.

1 WSDOT 1995.

2 Federal Register 2001.

3 Federal Register 2003.

4 Federal Register 2005.

response to public comments received on the 2004 Draft EIS. These changes required further evaluation in a Supplemental Draft EIS that was published in July 2006.

In December 2006, Governor Gregoire called for an advisory vote for Seattle residents. The Seattle City Council responded by authorizing a vote and placing the Elevated Structure Alternative and a Surface-Tunnel Hybrid Alternative on the ballot. The four-lane Surface-Tunnel Hybrid Alternative differed from the six-lane Cut-and-Cover Tunnel Alternative evaluated in the 2006 Supplemental Draft EIS. The Surface-Tunnel Hybrid Alternative was a four-lane cut-and-cover tunnel that proposed to use safety shoulders as exit-only lanes and reduce the speed limit during rush hours. On March 13, 2007, the citizens of Seattle voted against both alternatives.

After the March 2007 vote, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels chose to move forward with critical safety and mobility improvement projects at the north and south ends of the Alaskan Way Viaduct. The letter dated March 14, 2007, is provided in the reference materials at the end of this Final EIS. These projects, called the Moving Forward projects, could proceed because they provide useful improvements that are needed regardless of other decisions, including how to replace State Route (SR) 99 on the central waterfront. These projects were advanced while the Governor, former County Executive, and former Mayor worked together through a collaborative public process to develop a solution for replacing the viaduct along the central waterfront that would have broad consensus among the lead agencies, cooperating agencies, tribes, and the public.

The Moving Forward projects consist of the following improvements:

- Column safety repairs on the existing viaduct in the Pioneer Square area
- Electrical line relocation along the viaduct's south end
- Replacement of the viaduct (SR 99) between S. Holgate Street and S. King Street in the south end
- Battery Street Tunnel maintenance and repairs
- Transit enhancements and other improvements

Originally, there was a sixth project that focused on replacing SR 99 between Lenora Street and the Battery Street Tunnel. However, this section was later included as part of the central waterfront's collaborative process discussed below.

Following the March 2007 vote, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels committed to a collaborative effort, referred to as the Partnership Process, to forge a solution for replacing the viaduct along Seattle's central waterfront. The Partnership Process occurred as part of the NEPA process for the Alaskan Way Viaduct Replacement Project as documented in an NOI published in the Federal Register on July 16, 2008.[5]

The Partnership Process looked at how improvements to the broader transportation system (including Seattle surface streets and I-5) could work with various ways to replace the viaduct, including surface streets, a new elevated structure, or a tunnel. The Partnership Process began evaluating eight scenarios or comprehensive solutions to learn what elements worked best together. This evaluation led to the development and analysis of three hybrid scenarios described below:

- **I-5, Surface, and Transit Hybrid –** SR 99 would be replaced with a pair of north- and southbound one-way streets near Seattle's central waterfront. This scenario included a high level of transit investment and extensive I-5 improvements.

- **Elevated Bypass Hybrid –** SR 99 would be replaced with two side-by-side, elevated roadways along Seattle's central waterfront. Each structure would have two lanes in each direction. This scenario included some additional transit investments and improvements to I-5 and Alaskan Way.

- **Twin Bored Tunnel Hybrid (later refined to a single bored tunnel) –** SR 99 would be replaced with two 2-lane bored tunnels between approximately S. Royal Brougham Way and Harrison Street. Evaluation of this hybrid led to the development of a single large-diameter bored tunnel. This scenario included some additional transit investments and improvements to I-5 and Alaskan Way.

In January 2009, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels recommended replacing the central waterfront portion of the Alaskan Way Viaduct and Seawall with a single, large-diameter bored tunnel. The executives also identified improvements that would complement the bored tunnel. These improvements included a restored seawall; a new waterfront surface street and connection from the waterfront to Western and Elliott Avenues; a waterfront promenade; transit enhancements; and a streetcar on First Avenue. The letter of agreement between Washington State, King County, and the City dated January 13, 2009, is provided in the reference materials at the end of this Final EIS. Their recommendation was based on the following considerations:

- The potential for a bored tunnel to meet the six guiding principles established as part of the Partnership Process

- The results of technical analysis for the scenarios and additional work to determine the viability of a single, large diameter bored tunnel

- The support of diverse interests (community groups, businesses, and cause-driven organizations) for the bored tunnel

- The willingness of the partners, with the support of the Port of Seattle, to develop a funding program that supplements the state's committed contribution of up to $2.8 billion

2010 Supplemental Draft EIS Appendix S, Project History Report

A description of the project's development from 2006 through 2009 and details of the scenarios evaluated in the Partnership Process are provided in the ***2010 Supplemental Draft EIS Appendix S, Project History Report***.

What were the six guiding principles for the Partnership Process?

To create a shared vision, the Partnership Process developed the following six guiding principles:

- Improve public safety
- Provide efficient movement of people and goods now and into the future
- Maintain or improve downtown, regional, port, and state economies
- Enhance Seattle's waterfront, downtown, and adjacent neighborhoods as a place for people
- Create solutions that are fiscally responsible
- Improve the health of the environment

5 Federal Register 2008.

2 What alternatives were evaluated in the 2004 Draft EIS?
The five build alternatives that were analyzed in the 2004 Draft EIS, in addition to the required No Build Alternative, are listed below and shown previously in Exhibit 2-2:

- **Rebuild –** Replace the viaduct in its existing location with a structure similar to the existing one. Replace the seawall.
- **Aerial –** Replace the viaduct in its existing location with a structure that meets roadway standards for lane widths and shoulders where feasible. Replace the seawall.
- **Tunnel –** Replace the viaduct and seawall with a cut-and-cover tunnel along the central waterfront. The tunnel would have three lanes in each direction, and the western wall of the tunnel would replace the seawall.
- **Bypass Tunnel –** Replace the viaduct and seawall with a cut-and-cover tunnel along the central waterfront. The tunnel would have two lanes in each direction, and the western wall of the tunnel would replace the seawall.
- **Surface –** Replace the viaduct with an at-grade roadway along the central waterfront. The roadway would have three lanes in each direction with turn pockets between Yesler Way and Pike Street. Replace the seawall.

3 Why were the 2004 Draft EIS alternatives narrowed from five to two?
The lead agencies reduced the number of alternatives from five to two based on information presented in the 2004 Draft EIS, public comments, and further study and design.

As preliminary engineering progressed in 2004, the Tunnel Alternative was refined and elements of the Rebuild and Aerial Alternatives were combined to form an Elevated Structure Alternative. The Bypass Tunnel and Surface Alternatives were dropped from further consideration.

Reasons the Rebuild and Aerial Alternatives Were Combined
The Rebuild and Aerial Alternatives were combined to optimize the benefits offered by each alternative. The Rebuild Alternative proposed to replace the existing structure with a rebuilt structure that would be similar to the current viaduct. It also proposed a construction method that would rebuild SR 99 with lane and ramp restrictions while traffic continued to use it.

The lead agencies determined that it would not be wise to make such a substantial investment to build a narrow roadway that would not meet today's safety standards for the SR 99 mainline; however, they determined that it could make sense to replace the structure with a similar-width structure in certain areas, such as the Columbia Street and Seneca Street ramps, to minimize the footprint of the structure.

The Aerial Alternative evaluated in the 2004 Draft EIS had lane and shoulder widths that would meet today's safety standards, but it also proposed to replace the existing Seneca and Columbia Street ramps with structures that would be much wider than they are today. The Aerial Alternative also proposed to build a large temporary structure next to the existing viaduct as a detour route for traffic during construction. The Elevated Structure Alternative combined elements of the Rebuild and Aerial Alternatives and proposed replacing the viaduct with a new structure that would meet today's safety standards, while minimizing the footprint of the roadway for certain connections, such as the ramps at Columbia and Seneca Streets. The Elevated Structure Alternative also proposed to use a similar construction approach as proposed with the Rebuild Alternative, which would rebuild SR 99 with lane and ramp restrictions while traffic continued to use it.

Reasons the Bypass Tunnel Alternative Was Dropped
The Bypass Tunnel Alternative was eliminated from further study because traffic information presented in the 2004 Draft EIS demonstrated that by 2030, the Bypass Tunnel would increase travel times for some through trips. In addition, the number of hours each day that SR 99 was expected to be congested would have increased by 1 to 2 hours per day by 2030.

For these reasons, the Bypass Tunnel Alternative was found to not meet the project's purpose, which was to "maintain or improve mobility, accessibility, and traffic safety for people and goods along the existing Alaskan Way Viaduct Corridor."

Reasons the Surface Alternative Was Dropped
The Surface Alternative was eliminated because traffic information presented in the 2004 Draft EIS demonstrated that it reduced roadway capacity, which didn't meet the project's purpose as defined in the 2004 Draft EIS. The Surface Alternative proposed to replace the viaduct with a six-lane surface street on Alaskan Way. A six-lane surface street would reduce roadway capacity on SR 99 through downtown by 40 to 50 percent by 2030, leading to projections of increased travel times and congestion for drivers on SR 99 and other parallel roadways such as city streets and I-5. For some trips, travel times with the Surface Alternative would double, and traffic on Alaskan Way itself would have increased nearly sevenfold.

4 What alternatives were evaluated in the 2006 Supplemental Draft EIS?
Between 2004 and 2006, design changes were made to the Cut and-Cover Tunnel and Elevated Structure Alternatives, the project purpose and need was revised to include access and safety improvements to SR 99 and local streets north of the Battery Street Tunnel, and different construction approaches were considered. These changes required further evaluation in a Supplemental Draft EIS that was published in July 2006.

Two alternatives were evaluated in the 2006 Supplemental Draft EIS—the Elevated Structure Alternative and the Cut-and-Cover Tunnel Alternative, as shown in Exhibit 2-3. These alternatives were advanced because they best met the project's purpose, which was to "maintain or improve

2006 Supplemental Draft EIS Alternatives

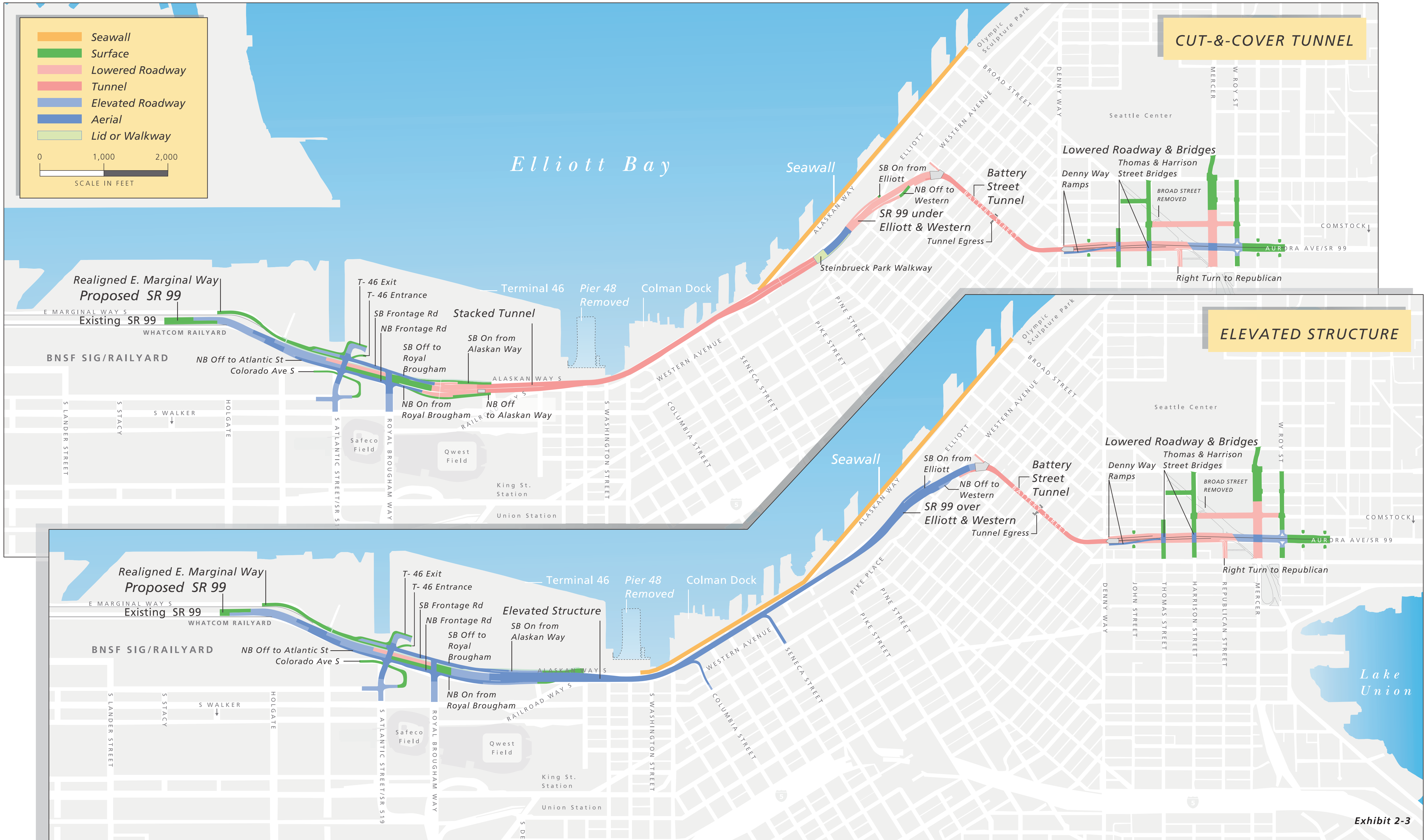


Exhibit 2-3

mobility, accessibility, and traffic safety for people and goods along the existing Alaskan Way Viaduct Corridor."

5 What's happened after the 2006 Supplemental Draft EIS was published?

After the Supplemental Draft EIS was published in July 2006, several studies, evaluations, and events led to the development of the Bored Tunnel Alternative:

- 2006 Supplemental Draft EIS Comments
- 2006 Expert Review Panel Recommendations
- 2006 Updated Project Costs
- 2006 Governor Gregoire's Findings
- 2007 Advisory Vote Results
- 2008 Partnership Process
- 2008 Partnership Process Scenarios Evaluated
- 2008 Stakeholder Advisory Committee Suggestions
- 2009 Recommendation from the Governor, County Executive, and Mayor

2006 Supplemental Draft EIS Comments

About 178 comment items (letters, e-mails, comment forms, and oral testimonies) were submitted in response to the Supplemental Draft EIS published in 2006. The comments covered a wide variety of topics, but two key themes were:

- Continued comments and questions about other possible concepts not considered as build alternatives in the EIS. These concepts include retrofit, other types of elevated structures, and surface street concepts.

- Concern about the duration and intensity of construction effects. The build alternatives evaluated in the 2006 Supplemental Draft EIS required a 7- to 10-year construction period, with extensive closures and roadway restrictions on SR 99 and Alaskan Way. Members of the public, business owners and managers, and government agency officials all were interested in finding better ways to avoid and minimize the extensive construction effects that were anticipated.

These comments, as well as the events described in the following text, explain the process the lead agencies undertook to address these key themes and other concerns raised by the public as part of the 2006 Supplemental Draft EIS process.

2006 Expert Review Panel Recommendations

In early 2006, the Washington State Legislature passed new legislation[6] that required an expert review panel to provide an independent financial and technical review of the Alaskan Way Viaduct and Seawall Replacement Project's financial and implementation plan. The expert review panel was selected by the Governor, the chairs of the State Senate and House Transportation Committees, and WSDOT's Secretary of Transportation. The panel's study included a review of the project's costs, risks, design plans, and environmental process.

The expert review panel reported its findings and recommendations to the Governor on September 1, 2006.[7] The panel found the Project's overall financial plan to be sound and reasonable; however, they were concerned about the Project's 2005 cost estimates. As a result, WSDOT updated the 2005 cost estimates in September of 2006.

2006 Updated Project Costs

In September 2006, WSDOT updated the Project cost estimates to meet the expert review panel's request. The results showed that the costs had increased for both the Elevated Structure and Cut-and-Cover Tunnel Alternatives, as shown in Exhibit 2-4.

Exhibit 2-4
2006 Updated Project Costs
in billions

	Cut-&-Cover Tunnel	Elevated Structure
Cost range estimated in October/November 2005	$2.98 – $3.63	$1.99 – $2.36
Updated cost estimated in September 2006	$4.63	$2.82

Source: *WSDOT 2006b*

Note: *These cost estimates have changed since 2006 and are not directly comparable to the cost estimates for the current build alternatives, because they were based on a different project definition.*

The cost estimates were higher than reported in 2005 because construction costs rose at a higher rate than inflation between 2005 and 2006 due to increasing global demand for materials and rising commodity costs.

2006 Governor Gregoire's Findings

After receiving updated cost information and the expert review panel's findings, the Governor determined that the financial plan for the Elevated Structure Alternative was feasible and reasonable, but that the financial plan for the Cut-and-Cover Tunnel Alternative was not. The Governor also found that the project costs and a lack of consensus surrounding a preferred alternative were contributing to a political stalemate. In an effort to move the project forward, Governor Gregoire called for an advisory vote in December 2006. The advisory vote was intended to allow the citizens of Seattle to provide input on selection of a preferred alternative.[8]

2007 Advisory Vote Results

The City held the advisory vote on March 13, 2007. The ballot included an Elevated Structure Alternative and a Surface-Tunnel Hybrid Alternative. The four-lane Surface-Tunnel Hybrid Alternative differed from the six-lane Cut-and-Cover Tunnel Alternative evaluated in the 2006 Supplemental Draft EIS. The Surface-Tunnel Hybrid Alternative was a four lane, cut-and-cover tunnel that proposed to use safety shoulders as exit-only lanes and reduce the speed limit during rush hours. The citizens voted against both alternatives.

After the March 2007 vote in Seattle, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels chose to move forward with critical safety and mobility improvement projects at the north and south ends of the Alaskan Way Viaduct. These projects were called the Moving Forward projects because they could proceed while the Governor, County Executive, and Mayor worked together through a collaborative public process to develop a viaduct replacement solution for the central waterfront that would have broad consensus among the lead agencies, cooperating agencies, tribes, and the public.

The Partnership Process and NEPA

The Project's NOI was updated July 16, 2008, informing people of the work being done as part of the Partnership Process to reconsider and develop various replacement concepts for the viaduct. The purpose of updating the NOI was to update the public, invite their participation, and incorporate the work done within the Partnership Process as part of expanded scoping under NEPA. After the Partnership Process, an updated NOI was published on June 4, 2009.

6 ESHB 2871.

7 WSDOT 2006a.

8 Gregoire 2006.

2008 Partnership Process

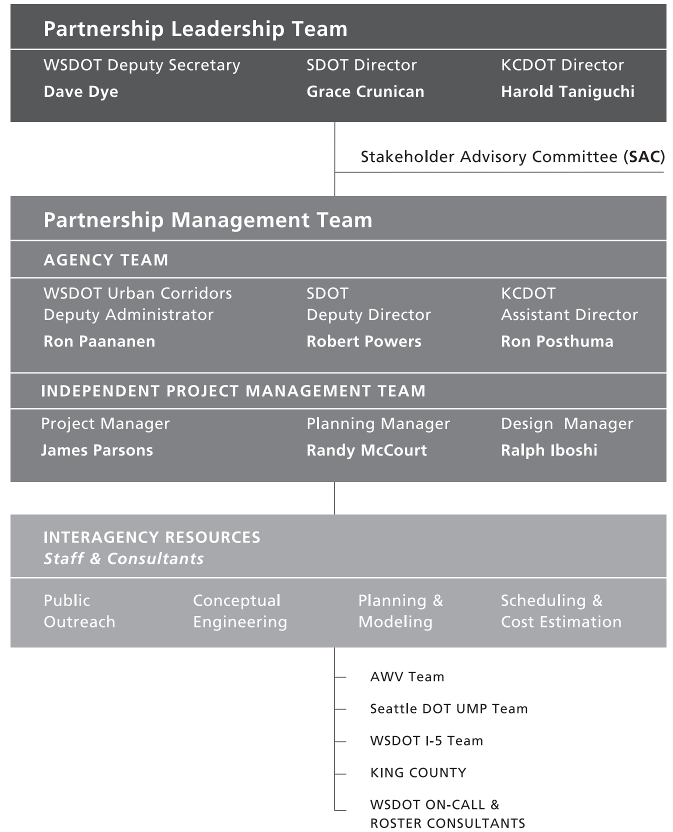
Following the March 2007 vote, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels also committed to a collaborative effort to forge a solution for replacing the viaduct along Seattle's central waterfront. This collaborative effort, referred to as the Partnership Process, was created to resolve the longstanding needs of the Alaskan Way Viaduct, seawall, and related projects in a manner that could be broadly supported and implemented. The three parties formalized this effort in a Memorandum of Understanding in December 2007.

The Partnership Process occurred as part of the NEPA process for the Alaskan Way Viaduct Replacement Project as documented in an NOI published in the Federal Register on July 16, 2008.[9] The Partnership Process looked at how improvements to the broader transportation system could work with different ways to replace the function of the viaduct. To guide the Partnership Process, the agencies implemented the management structure displayed in Exhibit 2-5. This structure supported coordinated decision-making among the agencies and provided multiple opportunities and resources to identify and resolve potential roadblocks. In addition, a 29-member Stakeholder Advisory Committee reviewed and commented on materials and presentations produced by the Partnership Process. The Stakeholder Advisory Committee included representatives from business and economic stakeholders, neighborhoods, and public interest groups.

2008 Partnership Process Scenarios Evaluated

The Partnership Process embraced a new approach that looked more broadly at the Puget Sound region to identify innovative strategies for moving people and goods in and through Seattle. The strategy employed a systems approach and considered a broader study area than just the SR 99 corridor, which had been the focus for developing alternatives through the EIS process that began in 2001. The study area was broadened to an area more or less bounded by the Seattle city limits to the south, N. 85th Street to the north, Elliott Bay to the west, and Lake Washington to the east, as shown in Exhibit 2-6.

Exhibit 2-5
Partnership Process Leadership Chart



The systems approach allowed the Partnership Process to develop and analyze a range of capital and operating improvements for the entire transportation network. The systems approach considered not only SR 99, but also I-5, Seattle's city streets, public transit, and policies and management actions designed to influence transportation choices and demand. The approach also expanded the set of potential solutions to include a combination of transit, bicycle, and pedestrian improvements.

Eight scenarios were created to test the performance of various combinations of SR 99, I-5, surface street, transit, and transportation demand management elements. The intent of this step was not to select a particular scenario, but rather to learn which elements worked best together.

Partnership Process Study Area

Exhibit 2-6

The eight scenarios evaluated as part of the Partnership Process are listed below.

Scenarios Without SR 99 as a Limited-Access/Bypass Facility

- Scenario A: Demand Management and Low Capital Investment
- Scenario B: Surface Boulevard and Transit
- Scenario C: Alaskan Way and Western Avenue One-Way Couplet

Where can I find more information on the Partnership Process?

2010 Supplemental Draft EIS Appendix S, Project History Report, describes the Partnership Process.

9 Federal Register 2008.

Scenarios With SR 99 as a Limited-Access/Bypass Facility

- Scenario D: Independent Elevated
- Scenario E: Integrated Elevated
- Scenario F: Twin Bored Tunnel
- Scenario G: Cut-and-Cover Tunnel
- Scenario H: Lidded Trench

Because the systems approach included improvements to the entire transportation network (not just SR 99), the limited-access bypass scenarios that were considered in the Partnership Process proposed to replace SR 99 with a four-lane bypass facility rather than the six-lane facilities evaluated in previous EISs. For most of the four-lane bypass scenarios, improvements were needed outside of the SR 99 corridor to provide for the efficient movement of people and goods through Seattle. The scenarios were evaluated based on their ability to meet the six guiding principles.

Hybrid Scenarios Developed

After evaluating the eight systems scenarios, it was clear that substantial tradeoffs existed among the various choices. As a result, two classes of hybrids were developed: an I-5, surface, and transit hybrid without a limited-access bypass and hybrids with a limited-access bypass in the SR 99 corridor. The following three hybrid scenarios were developed by assembling the best-performing combinations from the original eight systems scenarios, based on the findings of the evaluation.

- Scenario L: I-5, Surface, and Transit Hybrid
- Scenario M: Elevated Bypass Hybrid
- Scenario O: Twin Bored Tunnel Hybrid

2008 Stakeholder Advisory Committee Suggestions

The Partnership Leadership Team concluded that only two of the three hybrid scenarios were affordable with WSDOT's $2.8 billion budget: Scenario L: I-5, Surface, and Transit Hybrid and Scenario M: Elevated Bypass Hybrid. Scenario O: Twin Bored Tunnel Hybrid had many attractive features, but based on the information available, its total costs would exceed the state's $2.8 billion contribution. The Stakeholder Advisory Committee spent many hours in several meetings discussing the systems scenarios, hybrid scenarios, and what to recommend. When the Partnership Leadership Team presented its recommendations, the following broad themes were generated by the Stakeholder Advisory Committee:

- The state's contribution should be limited to $2.8 billion, and other partners and the region should identify funding sources able to cover costs associated with transit service, improvements to city streets, and other aspects.

- Any solution should reliably meet the area's mobility needs now and in the foreseeable future, but the City should take advantage of this rare opportunity to reconnect the central waterfront with downtown.

- While many members saw the I-5, Surface, and Transit Hybrid as an attractive approach, and possibly a first phase of an ultimate recommendation, there was also interest in taking a bored tunnel forward for further consideration. Many felt that the tunnel's costs might be reduced as a result of evolving technology and that additional funding might be found for a scenario with such broad appeal. At the urging of some members of the Stakeholder Advisory Committee, a panel of independent tunnel experts was convened and reported that with a single bore and new techniques a bored tunnel would likely be less expensive than originally thought.

- There was support from only a handful of Stakeholder Advisory Committee members for an elevated solution.

2009 Recommendation from the Governor, County Executive, and Mayor

In January 2009, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels recommended replacing the central waterfront portion of the Alaskan Way Viaduct with a large-diameter, single-bore tunnel. In addition, they recommended a package of improvements that includes replacing Alaskan Way with a new waterfront surface street and also making other improvements, including a promenade, transit investments, a streetcar on First Avenue, a restored seawall, a one percent motor vehicle excise tax for transit, and downtown city street improvements. Their recommendation was grounded in the potential for a bored tunnel and other improvements to meet the project's six guiding principles; technical analysis; strong support of diverse interests; and the willingness of the partners, with the support of the Port of Seattle, to develop a funding program that supplements the state's contribution of up to $2.8 billion.

In April 2009, the legislature passed Engrossed Substitute Senate Bill (ESSB) 5768, which urged the state to expedite environmental review and authorized state funds to build a replacement tunnel and remove the existing structure. On May 12, 2009, Governor Gregoire signed 5768, which commits no more than $2.8 billion in state funding to the project.

6 What happened after the bored tunnel was recommended?

After the bored tunnel was recommended by the Governor, former County Executive, and former Mayor, the following activities occurred:

- Notice of Intent Updated
- Purpose and Need Statement Updated
- Design Concepts Reevaluated and Screened
- Additional Traffic Analysis Completed for the Surface and Transit Hybrid Concept
- Alternatives Defined for the 2010 Supplemental Draft EIS

Notice of Intent Updated

On June 4, 2009, an updated NOI was published to replace the 2008 NOI informing the public that an additional Supplemental Draft EIS would be prepared. The 2009 NOI[10] reestablished the intent of the FHWA to continue the NEPA process that began with the NOI

Stakeholder Advisory Committee Members

ECONOMIC INTERESTS

Warren Aakervik – Interbay/BINMIC
Bob Donegan – Seattle Historic Waterfront Commission
David Freiboth – King County Labor Council
John Odland – Manufacturing Industrial Council
Peter Philips – Seattle Marine Business Coalition
Susan Ranf – Sports Stadiums
Rob Sexton – Downtown Seattle Association
Herald Ugles – International Longshore & Warehouse Union
Tayloe Washburn – Greater Seattle Chamber of Commerce

COMMUNITIES

Jeff Altman – Northwest County
Carol Binder – Pike Place Market
Mahlon Clements – Ballard/Fremont
John Coney – Uptown/Queen Anne
Mary Hurley – Ballard/Fremont
Don Newby – Southwest County
Jim O'Halloran – Northeast Seattle
Vlad Oustimovitch – West Seattle
John Pehrsen – Belltown
Earl Richardson – Southeast Seattle
Pete Spalding – West Seattle
Sue Taoka – International District

CAUSE-DRIVEN ORGANIZATIONS

Chuck Ayers – Cascade Bicycle Club
Kathy Fletcher – People for Puget Sound
Gene Hoglund – Working Families for an Elevated Solution
Rob Johnson – Transportation Choices Coalition
Mary McCumber – Futurewise
Cary Moon – People's Waterfront Coalition
Mike O'Brien – Sierra Club
Todd Vogel – Allied Arts

published on June 22, 2001. The 2009 NOI announced an important change, which was that the Supplemental Draft EIS would consider one or more alternatives that did not include replacing the seawall located along Elliott Bay. The 2009 NOI also explained that possible design concepts would be reevaluated in light of the updated purpose and need statement to identify alternatives that would be evaluated in the Supplemental Draft EIS. It also explained that at least one new alternative, a bored tunnel, would be introduced and considered. Finally, the 2009 NOI announced dates and locations for NEPA scoping meetings.

Purpose and Need Statement Updated

The project's purpose and need statement was updated to reflect the following new information:

- The revised definition of the proposed action, which is to replace SR 99 between S. Royal Brougham Way and Roy Street.
- Current state and local priorities as expressed through the Partnership Process.
- Comments received from the public, agencies, and tribes following publication of the 2006 Supplemental Draft EIS.

The following primary changes were made to the project's purpose and need statement for reasons identified below:

- The project limits were modified in the south from S. Holgate Street to S. Royal Brougham Way, which is located three blocks farther north. The project limits were moved north because replacing the viaduct in this area was identified as a separate, independent project called the S. Holgate Street to S. King Street Viaduct Replacement Project. The S. Holgate Street to S. King Street Viaduct Replacement Project was identified by Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels as part of the Moving Forward projects that would improve safety and mobility on SR 99. The Moving Forward projects are proceeding independently because they provide useful improvements that are needed regardless of other decisions, including how to replace SR 99 north of S. King Street.
- Replacing the seawall was removed as a purpose of the project because the seismic stability of a viaduct replacement along Seattle's central waterfront does not necessarily require that the seawall be rebuilt or replaced.
- The project's purposes and needs were updated to reflect current state and local priorities as expressed through the Partnership Process.
- Goals and objectives were eliminated and were made part of the project's purposes and needs.

Design Concepts Reevaluated and Screened

After the purpose and need statement was updated, design concepts were reevaluated and screened to determine the alternatives that would be evaluated in the 2010 Supplemental Draft EIS. The purpose of the screening analysis was to:

- Screen the three hybrid design concepts developed as part of the Partnership Process for replacing the Alaskan Way Viaduct.
- Rescreen the five alternatives evaluated in the 2004 Draft EIS and two alternatives evaluated in the 2006 Supplemental Draft EIS based on the updated project purpose and need statement and updated screening criteria.

Ten design concepts were evaluated and screened by the lead agencies using criteria developed based on the project's updated purpose and need statement. The 10 design concepts were organized into three categories based on similar structure types, including elevated structures, surface arterials, and tunnels. None of the concepts met all of the screening criteria. The concepts were evaluated as follows:

1 The screening criteria were applied by first determining if a proposed design concept could meet the first element of the project purpose—providing a facility that meets current seismic safety standards. All of the design concepts considered met this criterion and were advanced.

2 Concepts that satisfied the seismic design criterion were evaluated against the screening criteria for the remaining elements of the project purpose. In this stage of the screening analysis, design concepts were not required to achieve each of the project purposes. Instead, they were evaluated based on their overall ability to achieve the project purposes. In cases where two similar concepts were considered, the concept that better satisfied the screening criteria was advanced and the other was eliminated. For example, the 2006 Supplemental Draft EIS Elevated Structure was carried forward because it better satisfied the screening criteria as compared to the Partnership Process Elevated Bypass Hybrid, which was dropped for reasons listed in Exhibit 2-7. In cases where a concept had substantial deficiencies in its ability to achieve one or more elements of the project purpose, such that it would substantially compromise mobility, or if that concept had other major drawbacks, such as severe impacts on the local community, the concept was designated as unreasonable and was eliminated.

Of the 10 concepts evaluated, seven were dropped as unreasonable alternatives for reasons identified in Exhibit 2-7. The following three were advanced for further evaluation in the 2010 Supplemental Draft EIS:

- 2006 Supplemental Draft EIS Elevated Structure
- 2006 Supplemental Draft EIS Cut-and-Cover Tunnel
- Partnership Process Bored Tunnel Hybrid

Project Purpose and Need Statement

The purpose and need statement for this project is provided in Chapter1, Question 5 of this *Final EIS*.

Where can I learn more about the 2010 Screening Analysis?

Appendix W, *Screening Reports* documents the screening process for the project.

2010 Supplemental Draft EIS Appendix C, Transportation Discipline Report

Results from the transportation analysis for the surface and transit hybrid concept are provided in *2010 Supplemental Draft EIS Appendix C*, Attachment A.

10 Federal Register 2009.

2006 Supplemental Draft EIS Elevated Structure and 2006 Supplemental Draft EIS Cut-and-Cover Tunnel

The screening results for the 2006 Supplemental Draft EIS Elevated Structure and Cut-and-Cover Tunnel are provided below. These concepts were found not to meet the screening criteria in the following areas:

- Design deficiencies related to lane widths, shoulder widths, and sight distance in the Battery Street Tunnel would not be improved.
- This concept would not avoid major disruption to traffic patterns, because construction would substantially disrupt SR 99 and local traffic for many years.

In addition, the 2006 Supplemental Draft EIS Elevated Structure was found not to meet the screening criteria for the reason discussed below:

- This concept proposes to replace the viaduct with a new one that is wider than the current structure, which would not support land use and shoreline plans. A wider structure would preclude expanded visual, physical, and aesthetic connections between downtown and the waterfront.

Even though the 2006 Supplemental Draft EIS Elevated Structure and Cut-and-Cover Tunnel did not meet the screening criteria for the reasons noted above, they were carried forward for further analysis in the 2010 Supplemental Draft EIS for the following reasons:

- They would maintain transportation-related functions of SR 99 by providing connections similar to existing conditions for drivers traveling to and from the waterfront, downtown, and Ballard/Interbay.
- They would improve mobility for some trips, compared to conditions on the existing facility in 2030.

Partnership Process Bored Tunnel Hybrid

The screening results for the Partnership Process Bored Tunnel Hybrid are provided below. This concept does not meet the screening criteria in the following areas:

- In most cases, mobility and transportation connections would be maintained; however, the Elliott/Western ramps would not be replaced. These trips would be accommodated via alternative routes either on Alaskan Way or through the bored tunnel; however, these routes may increase travel times slightly depending on the route taken and the time of day.

Even though this concept does not meet one of the screening criteria for the reasons noted above, it was carried forward for further analysis in the 2010 Supplemental Draft EIS for the following reasons:

- It would improve mobility north of the Battery Street Tunnel, since the Battery Street Tunnel would be replaced with the new bored tunnel, which would improve roadway conditions for drivers with wider lanes and shoulders and improved sight distance. Additionally, the bored tunnel would come to the surface north of Denny Way, providing opportunities to connect the street grid and improve mobility for drivers, bicyclists, and pedestrians.
- It would minimize traffic disruption to SR 99 and the surrounding street grid during construction, since it would allow SR 99 to remain open.
- Construction impacts, particularly along the waterfront, would be much less disruptive, since

About NEPA Screening

In NEPA screening, one evaluates whether the concept meets the purpose and need. In this case, we determined that the Surface, Transit and I-5 scenario did not meet the screening criteria which are based on the purpose and need statement.

Exhibit 2-7
Screening Result Summary Table

Design Concept	Concept dropped because:
ELEVATED STRUCTURES	
2004 Draft EIS Rebuild	• It would not meet existing WSDOT design standards. • Construction would substantially disrupt SR 99 and local traffic for many years. • It would rebuild the existing viaduct, which would not support land use and shoreline plans.
2004 Draft EIS Aerial	• Design deficiencies in the Battery Street Tunnel would not be improved. • Construction would substantially disrupt SR 99 and local traffic for many years. • Assumes a large, temporary aerial structure along the waterfront would be constructed that would substantially affect Seattle's waterfront for many years. • It would replace the viaduct with a new one that is much wider than the current structure, which would not support land use and shoreline plans.
Partnership Process Elevated Bypass Hybrid	• Design deficiencies in the Battery Street Tunnel would not be improved. • This concept is expected to increase travel times for some trips compared to the Partnership Process Bored Tunnel Hybrid because it has a one-lane diverge for the Western Avenue northbound off-ramp. • Construction would substantially disrupt SR 99 and local traffic for many years. • It would replace the existing viaduct with another elevated structure, which would not support land use and shoreline plans. • The 2006 Supplemental Draft EIS Elevated Structure concept (which is carried forward) provides more benefits to mobility with similar impacts during construction and to views once the structure is built.
SURFACE ARTERIALS	
2004 Draft EIS Surface	• Design deficiencies in the Battery Street Tunnel would not be improved. • Mobility for trips heading to and through downtown would be reduced, and for some trips, travel times would increase substantially compared to existing conditions (in some cases, travel times would more than double). • North-south capacity would be reduced, resulting in added congestion on city streets and I 5. • Construction would substantially disrupt SR 99 and local traffic for many years. • Creates a barrier for pedestrian movement between downtown Seattle and the waterfront.
Partnership Process I-5, Surface and Transit Hybrid	• Mobility for trips heading to and through downtown would be reduced, and for some trips, travel times would increase substantially compared to existing conditions or bypass concepts. • North-south capacity would be reduced, resulting in added congestion on city streets and I 5.
TUNNELS	
2004 Draft EIS Bypass Tunnel	• Design deficiencies in the Battery Street Tunnel would not be improved. • Construction would substantially disrupt SR 99 and local traffic for many years. • Of the four-lane, tunnel bypass concepts evaluated, the Partnership Process Bored Tunnel Hybrid best meets project purposes and needs because it is the only concept that addresses Battery Street Tunnel deficiencies and avoids and minimizes disruptions to traffic during construction to the extent practicable.
2004 Draft EIS Tunnel	• Design deficiencies in the Battery Street Tunnel would not be improved. • Construction would substantially disrupt SR 99 and local traffic for many years. • Of the six-lane tunnel concepts considered, the 2006 Supplemental Draft EIS Tunnel better meets project purposes and needs because it maintains the Elliott/Western ramps near their existing location, which better serves travel needs as compared to the ramps at Union Street provided with this concept.

Source: Appendix W, Screening Reports

much of the construction would take place underground.

- It removes the visual barrier along the waterfront, allowing for a variety of urban design options.

These three design concepts represent reasonable alternatives that meet most of the screening criteria, meet identified project needs to varying degrees, and reflect different tradeoffs that warrant further evaluation in an EIS.

Additional Traffic Analysis Completed for the Surface and Transit Hybrid Concept
Some individuals, groups, and leaders have continued to support and show interest in developing and evaluating a surface and transit hybrid concept. Because of this continued interest, the lead agencies evaluated transportation effects of a surface and transit hybrid to test the rationale for screening out the surface and transit hybrid. Specifically, transportation engineers did additional work to conclude that the following reasons for dropping the surface and transit hybrid were valid:

- Mobility for trips heading to and through downtown would be reduced, and for some trips, travel times would increase substantially compared to existing conditions or bypass concepts such at the Bored Tunnel, Cut-and-Cover Tunnel, or Elevated Structure Alternatives with or without tolls.

- North-south capacity would be reduced.

The transportation analysis considered a wide range of possible effects to the transportation system, including effects to system-wide vehicle miles traveled and delay, delay at intersections, effects to traffic volumes, SR 99 travel speeds, and travel times.

Alternatives Defined
The alternatives considered in the 2010 Supplemental Draft EIS included the Viaduct Closed (No Build) Alternative, a four-lane Bored Tunnel Alternative, a six-lane Cut-and-Cover Tunnel Alternative, and a six-lane Elevated Structure Alternative. The Bored Tunnel Alternative was identified as the preferred alternative in the 2010 Supplemental Draft EIS. The 2010 Supplemental Draft EIS addressed tolling-related issues in Chapter 9, Tolling. Chapter 9 informed readers that tolls could be implemented on the SR 99 replacement facility in the future, and included an analysis of the potential effects of tolling. This chapter included a quantitative analysis of tolling on the Bored Tunnel Alternative. It included a brief qualitative assessment of tolling impacts on the Elevated Structure and Cut-and-Cover Tunnel Alternatives.

7 What happened after the 2010 Supplemental Draft EIS was published?

After the 2010 Supplemental Draft EIS was published the following activities took place:

- Public comments received
- Design-build contract awarded
- Build alternatives modified
- Tolling analysis expanded
- Additional traffic analysis completed for the surface and transit hybrid concept
- Tolling added to the preferred alternative

Public Comments Received
The lead agencies held three public hearings and received 213 comment items (letters, e-mails, comment forms, and oral testimonies) on the 2010 Supplemental Draft EIS. Comments spanned a wide range of topics. Many were statements of either support of or opposition to the project or particular alternatives. Some commenters expressed concerns or opinions about tolling, while others focused on the redevelopment of the waterfront once the existing viaduct is removed and concerns about the effects of the project to historic buildings in the project area.

Design-Build Contract Awarded
The traditional process for building highway or highway-related projects is called the design-bid-build process: WSDOT designs the project and advertises for construction bids, and the construction team builds the project as designed. WSDOT also uses the design-build process, which is the approach that has been chosen to complete the preliminary and final design for a portion of the Bored Tunnel Alternative in order to expedite the project and encourage design innovation as early as possible.

In January 2011, WSDOT signed a design-build contract for a portion of the Bored Tunnel Alternative. Under the FHWA regulation on design-build contracting (23 CFR 636.109), a contract can be awarded before the NEPA process is completed. WSDOT will construct other portions of the Bored Tunnel Alternative through design-bid-build contracts. With both contract types, design cannot proceed beyond preliminary design until after FHWA has signed the Record of Decision (ROD). The lead agencies will remain fully responsible for the project's NEPA process, documentation, and ROD under both contacting methods. The design-build contract contains termination provisions in the event that another alternative is selected.

Build Alternatives Modified
Modifications have been made to the designs for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives since the 2010 Supplemental Draft EIS was published.

For the Bored Tunnel Alternative, the design at the south portal was modified to reduce the width of the retained cut and the cut-and-cover tunnel sections. The south portal will be staggered with the entry for the northbound lanes just north of S. Royal Brougham Way and the exit for the southbound lanes just south of S. Dearborn Street. This modification also changed the alignment of the ramps near the stadiums. The northbound SR 99 off-ramp has been shifted slightly south, and it would have a short elevated section where it crosses the northbound on-ramp and southbound off-ramp. The northbound on-ramp and southbound off-ramp were both shifted slightly to the west and would connect to SR 99 slightly farther south than described in the 2010 Supplemental Draft EIS.

Traffic Analysis for the Surface and Transit Hybrid

Results from the transportation analysis for the surface and transit hybrid concept are provided in the ***Final EIS Appendix W***, and ***2010 Supplemental Draft EIS Appendix C***, Attachment A. The 2011 analysis compares the surface and transit hybrid to a Bored Tunnel Alternative with tolls and the 2010 analysis compares the surface and transit hybrid to a Bored Tunnel Alternative without tolls.

In addition, the location and method for launching the tunnel boring machine has been developed further. The launch pit would be located approximately between S. Dearborn and S. Main Streets. To reduce settlement risk, the launch pit for the tunnel boring machine would be surrounded by secant piles to create a "protection box." The secant pile walls would reduce the risks of settlement.

The bored tunnel would be approximately 1.75 miles long, with an internal diameter of 52 feet and an external diameter of approximately 56 feet. The tunnel would have two 11-foot lanes in each direction, with a 2-foot-wide shoulder on one side and an 8-foot-wide shoulder on the other side.

For the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the design for the southbound SR 99 off-ramp near the stadiums was modified. The 2010 Supplemental Draft EIS evaluated a design that proposed for southbound traffic to exit SR 99 near S. Atlantic Street west of SR 99. In the 2010 Supplemental Draft EIS, we evaluated the effects of this design and found that it resulted in long traffic queues that would back-up onto the SR 99 mainline, causing slow travel speeds on southbound SR 99 through downtown. Because of these unfavorable traffic conditions, the design team modified the design so these ramps would touch down on the east side of SR 99 near S. Royal Brougham Way. This modification improves travel times and results in faster travel speeds for some portions of SR 99 than what was reported in the 2010 Supplemental Draft EIS.

Tolling Analysis Expanded

This Final EIS expands on the tolling analysis conducted in the 2010 Supplemental Draft EIS. The 2010 Supplemental Draft EIS included a chapter evaluating the effects of tolling the build alternatives. The transportation analysis presented in the 2010 Supplemental Draft EIS focused on the effects of three possible tolling scenarios for the Bored Tunnel Alternative. The transportation analysis focused on expected transportation conditions in 2015 if the Bored Tunnel Alternative were tolled and presented additional information explaining effects of the tolling scenarios in 2030. Transportation effects for the Cut-and-Cover Tunnel and Elevated Structure Alternatives were discussed in general terms, but specific transportation data was not presented.

This Final EIS evaluates one tolling scenario for all of the build alternatives in the year 2030. The tolling scenario evaluated in this Final EIS is the most conservative of the three scenarios presented in the 2010 Supplemental Draft EIS, meaning that it assumes the highest tolling rate and results in the most diversion from SR 99 to city streets and I-5. Transportation data is presented for all of the build alternatives for the year 2030.

Additional Traffic Analysis Completed for the Surface and Transit Hybrid Concept

In comments received on the 2010 Supplemental Draft EIS, some commenters asked if the surface and transit hybrid should be reconsidered if the Bored Tunnel, Cut-and-Cover Tunnel, or Elevated Structure Alternatives were tolled, since tolling was expected to cause several thousands of trips to divert from SR 99 to I-5 and city streets. Because of this, the rationale for not evaluating the surface and transit hybrid as a build alternative was revisited. The conclusion of that effort is that the surface and transit hybrid concept would:

- Reduce mobility for trips heading to and through downtown, and for some trips, travel times would increase substantially compared to bypass concepts such as the Bored Tunnel, Cut-and-Cover Tunnel, or Elevated Structure Alternatives

- Reduce north-south capacity, which would particularly affect travelers heading through Seattle

The transportation analysis conducted considered a wide range of possible effects to the transportation system, including effects to system-wide vehicle miles traveled and delay, delay at intersections, effects to traffic volumes, SR 99 travel speeds, and travel times. The discussion here presents changes in travel times, which is the primary reason why this concept has been screened out and was not evaluated.

Travel Times

Exhibits 2-8 and 2-9 compare travel times during the AM peak hour (8:00 a.m. to 9:00 a.m.) and PM peak hour (5:00 p.m. to 6:00 p.m.) for the surface and transit hybrid, the Tolled Bored Tunnel Alternative, the Tolled Cut-and-Cover Tunnel Alternative, and the Tolled Elevated Structure Alternative in 2030.

Exhibit 2-8
2030 Travel Time Comparison for the AM Peak Hour
8:00 - 9:00 a.m.

	YEAR 2030			
		TOLLED ALTERNATIVES		
	Surface & Transit Hybrid	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
West Seattle to Central Business District				
NORTHBOUND	35	32	32	33
Woodland Park to S. Spokane Street				
SOUTHBOUND	25	16	22	21
NORTHBOUND	31	12	14	22
Ballard to S. Spokane Street				
SOUTHBOUND	21	20/18*	16	15
NORTHBOUND	33	27/24*	17	26

* *The two travel times for the bored tunnel represent two different routes. The first route shows the estimated travel time for drivers who choose to travel to/from Ballard using the Alaskan Way surface street. The second travel time shows the estimated travel time for drivers who choose to travel to/from Ballard using the bored tunnel and Mercer Street.*

As shown in Exhibit 2-8, the surface and transit hybrid would increase travel times for all trips modeled during the AM peak hour as compared to the Tolled Bored Tunnel, Tolled Cut-and-Cover Tunnel, and Tolled Elevated Structure Alternatives. For trips that are expected to take longer, the range of additional travel time varies between 1 and 19 minutes. The surface and transit hybrid is expected to substantially increase travel times for northbound trips between S. Spokane Street and Woodland Park, and northbound trips between S. Spokane Street and Ballard as compared to the tolled alternatives evaluated. Travel times for northbound trips between Woodland Park and S. Spokane Street would be substantially higher (19 minutes higher) for the surface and transit hybrid than the Tolled Bored Tunnel Alternative.

Appendix W, Screening Reports

Results from the transportation analysis for the surface transit hybrid concept are provided in *Appendix W* of this *Final EIS*.

Exhibit 2-9
2030 Travel Time Comparison for the PM Peak Hour
5:00 - 6:00 p.m.

	YEAR 2030			
		TOLLED ALTERNATIVES		
	Surface & Transit Hybrid	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Central Business District to West Seattle				
SOUTHBOUND	26	31	29	25
Woodland Park to S. Spokane Street				
SOUTHBOUND	25	14	16	16
NORTHBOUND	25	15	15	19
Ballard to S. Spokane Street				
SOUTHBOUND	19	23/24*	16	17
NORTHBOUND	35	27/27*	23	25

* *The two travel times for the bored tunnel represent two different routes. The first route shows the estimated travel time for drivers who choose to travel to/from Ballard using the Alaskan Way surface street. The second travel time shows the estimated travel time for drivers who choose to travel to/from Ballard using the bored tunnel and Mercer Street.*

As shown in Exhibit 2-9, the surface and transit hybrid would increase travel times for most trips during the PM peak hour as compared to the Tolled Bored Tunnel, Tolled Cut-and-Cover Tunnel, and Tolled Elevated Structure Alternatives. Exceptions to this are southbound trips from downtown to West Seattle or southbound trips between Ballard and S. Spokane Street. For trips that are expected to take longer, the range of additional travel time varies between 6 and 11 minutes. In particular, the surface and transit hybrid substantially increases travel times for northbound and southbound trips between S. Spokane Street and Woodland Park compared with the tolled alternatives.

Approximately 45 to 50 percent of travelers who use SR 99 use it to travel through downtown. These travelers would be most affected by losing the SR 99 express route through downtown. The only other express route through downtown is I-5, which is highly congested during peak periods. For through trips, travel times on SR 99 could increase by up to 19 minutes with the surface and transit hybrid as compared to the tolled build alternatives. Travel times for trips to and from downtown would also increase compared to the tolled build alternatives, but to a lesser degree than through trips. Even though the tolled build alternatives are expected to result in trips diverting from SR 99 to I-5 or city streets, drivers would still have the choice to pay a toll to continue to receive travel more quickly and efficiently through downtown using a limited-access roadway. Our traffic analysis indicates that between 55,000 and 68,000 drivers each day are expected to travel on SR 99 if the build alternatives are tolled. With the surface and transit hybrid, there would be no option for SR 99 travelers to obtain an efficient, limited-access trip. Even with improvements made to I-5 to help alleviate bottlenecks and additional improvements to transit, drivers would be forced to travel on congested surface streets with lower speeds and traffic lights through downtown or they would need to travel on I-5, which is highly congested during peak periods.

System-wide traffic analysis was also conducted to understand the implications of the surface and transit hybrid on the local and regional transportation system. The results of evaluating three of these metrics, person throughput, vehicle miles traveled (VMT), and vehicle hours of delay (VHD) are discussed below. Person-throughput examines the combined vehicle travel and transit ridership across all streets located at a particular location (called a screenline). Exhibit 2-10 shows estimated person throughput at three screenlines for the surface transit hybrid and the three proposed build alternatives. The results show that at all screenline locations, the surface and transit hybrid provides less total mobility than the proposed build alternatives. The transit service improvements associated with the surface and transit hybrid were assumed in the modeling assumptions. Even with these improvements to transit, gains in transit ridership would not offset decreases in vehicle throughput; therefore, the surface and transit hybrid moves fewer people through downtown Seattle than the tolled build alternatives.

Exhibit 2-10
Daily Person Throughput at Screenlines in 2030

	YEAR 2030			
		TOLLED ALTERNATIVES		
	Surface & Transit Hybrid	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
South – South of S. King Street				
Daily Volume	837,200	885,300	893,700	895,700
Central – North of Seneca Street				
Daily Volume	766,900	798,100	803,800	798,700
North – North of Thomas Street				
Daily Volume	832,700	887,200	867,800	865,500

VMT measures how many total miles all vehicles travel on a roadway network on an average week day. Exhibit 2-11 shows VMT for the downtown Seattle Center City area as well as for the broader four-county region. In general, the surface and transit hybrid has a slightly lower VMT both in the Seattle Center City and in the four-county region. This is likely due to the reduced capacity for travel through Seattle with the surface and transit hybrid, and therefore, some trips would redistribute to different destinations to avoid the added congestion.

Exhibit 2-11
Daily Vehicle Miles Traveled in 2030

	YEAR 2030			
		TOLLED ALTERNATIVES		
	Surface & Transit Hybrid	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Seattle's Center City				
Daily Miles Traveled	2,334,700	2,534,400	2,540,000	2,551,200
Four-County Region				
Daily Miles Traveled	109,381,900	109,541,400	109,506,800	109,696,600

VHD measures the number of hours lost by travelers due to traveling at less than the posted speed limit during an average weekday. VHD is often used as an indicator of congestion. As shown in Exhibit 2-12, the surface and transit hybrid has a lower VHD than the other build alternatives in the Seattle Center City area and higher than the Tolled Bored Tunnel and Tolled Cut-and-Cover Tunnel for the four-county region. This indicates that with the surface and transit hybrid, fewer vehicle trips would go through the Seattle Center City area due to reduced roadway capacity on SR 99 and more trips would divert to other regional routes or destinations, increasing delay and congestion within the region.

What area does Seattle Center City refer to?

The area defined as Seattle Center City is roughly bounded by S. Royal Brougham Way in the south, just north of Mercer Street to the north, Broadway to the east, and Elliott Bay to the west.

Exhibit 2-12
Daily Vehicle Hours of Delay in 2030

	YEAR 2030			
		TOLLED ALTERNATIVES		
	Surface & Transit Hybrid	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Seattle's Center City				
Daily Hours Delay	35,100	38,700	37,600	38,900
Four-County Region				
Daily Hours Delay	1,377,300	1,364,400	1,358,700	1,384,900

Tolling Added to the Preferred Alternative

The 2010 Supplemental Draft EIS identified the Bored Tunnel as the preferred alternative to replace the Alaskan Way Viaduct but did not state whether or not it would operate with tolls. The reasons for recommending the Bored Tunnel Alternative over the Cut-and-Cover Tunnel or Elevated Structure Alternatives to replace the Alaskan Way Viaduct are:

- It is the only alternative that can be constructed without closing or substantially restricting SR 99 for years. Given the importance of the highway to local and regional transportation this is a very important advantage (see Chapter 6).

- The Bored Tunnel Alternative gives the City of Seattle the most latitude in planning for its central waterfront by removing both above ground and subsurface constraints on development (see Chapter 5, Question 19).

- Finally, the Bored Tunnel Alternative integrates with surface streets north, of downtown better than either the Cut-and-Cover or Elevated Structure alternatives (see Chapter 5, Question 19).

This Final EIS adds tolls to the Bored Tunnel Alternative as the preferred alternative. Tolling does not affect the benefits between the Bored Tunnel Alternative and the other two build alternatives, nor does it materially increase or decrease the construction or permanent effects of the Bored Tunnel Alternative compared to the other build alternatives.

The Washington State Legislature has not yet authorized WSDOT to proceed with tolling of this project. Ultimately, tolling will be implemented on SR 99 only if the Legislature authorizes it to be done. While the tolled and non-tolled versions both would be acceptable, the Tolled Bored Tunnel Alternative is designated as the preferred alternative. The reason for designating the tolled version as the preferred alternative is that funding identified by the legislature at this time includes $400 million in revenue from tolling. This approach is more consistent with the region's long-range transportation plan, Transportation 2040, which was adopted by the Puget Sound Regional Council in May 2010. The long-range transportation plan stated that "in the later years of the plan, the intent is to manage and finance the highway network as a system of fully tolled facilities." Moreover, the plan specifically calls for this project to be tolled:

- Transportation 2040 assumes the conversion of existing high-occupancy vehicle lanes into additional high-occupancy toll lanes in the first decade of the plan. Alongside this network of high-occupancy toll lanes, major highway capacity projects—such as the replacement of the Alaskan Way Viaduct—will be at least partially financed through tolls.

- Transportation 2040 includes the application of tolls on improved highway facilities as new investments are made, and suggests the eventual implementation of a whole system of tolled highways. This approach involves time-of-day variable tolls that are both funding investments and are managing the facilities to ensure reliable operations and travel speeds.

Based on this regional policy as expressed in the PSRC's long-range plan and current funding plans, the Tolled Bored Tunnel Alternative is designated as the preferred alternative. As noted above, this depends on State legislative authorization to proceed with tolling on SR 99. If alternative funding sources are identified WSDOT would likely seek approval for the Bored Tunnel Alternative without tolls.

8 How has the City of Seattle been involved in the project?

The lead agencies, which include the FHWA, WSDOT, and the City of Seattle, have worked collaboratively on this project since it began in 2001. That collaboration has been recorded in various documents including the Draft and Supplemental Draft EISs published and signed by the three lead agencies in 2004, 2006, and 2010. Throughout the environmental process, the lead agencies have worked together to develop the project's purpose and need statement; develop alternatives screening criteria; screen proposed alternatives; complete preliminary design of the proposed alternatives; develop the methods and scope of environmental and engineering analysis; and review environmental analyses and conclusions.

This collaborative effort continued in 2007 as Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels identified the 2007 Moving Forward projects and begin the Partnership Process to forge a solution for replacing the viaduct along Seattle's central waterfront. In a letter signed on January 13, 2009, Governor Gregoire, former King County Executive Sims, and former Seattle Mayor Nickels recommended replacing the central waterfront portion of the viaduct with a single, large-diameter bored tunnel, contingent on the completion of environmental review. On May 12, 2009, Governor Gregoire signed ESSB 5768, which committed up to $2.8 billion of state funding to build a bored tunnel. On October 19, 2009, the Seattle City Council voted 9 to 0 in favor of Ordinance 123133,[11] which identified the Bored Tunnel Alternative as the City's preferred solution for replacing the Alaskan Way Viaduct. Ordinance 123133 authorized the Mayor to execute a Memorandum of Agreement (MOA) between the State of Washington and the City. The MOA outlined the responsibilities of the City and State and expectations about the role of each in the implementation and funding of various elements of the Alaskan Way Viaduct and Seawall Replacement Program.

In November 2009, Seattle elected a new mayor, Mike McGinn. Since taking office in 2010, Mayor McGinn has expressed concerns with the policy direction given from

11 City of Seattle 2009, Ordinance 123133.

the Seattle City Council. On September 23, 2010, City Council President Richard Conlin signed the 2010 Supplemental Draft EIS on behalf of the City because the Seattle Department of Transportation Director did not sign it. On October 4, 2010, the City Council voted in favor 8 to 1 of Ordinance 123424,[12] which authorized Conlin's signature and maintained the City's co-lead status with WSDOT and FHWA during environmental review in order to protect the City's ability to shape and influence the Final EIS.

After having participated in the development of the 2010 Supplemental Draft EIS, on December 13, 2010, WSDOT received a formal letter from the Seattle Department of Transportation that provided comments on the 2010 Supplemental Draft EIS. FHWA and WSDOT have responded to each of these comments, and they are provided in Appendix T of this Final EIS.

On April 21, 2011, the Seattle Department of Transportation released a document that discusses the effects of tolling the Bored Tunnel Alternative on Seattle streets and potential mitigation. The City of Seattle has requested that the document be included in this Final EIS. FHWA and WSDOT have honored this request, and the document and response to the document is provided in Appendix V of this Final EIS.

9 How does the project relate to the Alaskan Way Viaduct and Seawall Replacement Program?

The Alaskan Way Viaduct Replacement Project complements a number of other projects with independent utility that improve safety and mobility along SR 99 and the Seattle central waterfront from the area south of downtown to Seattle Center. These improvements include the Moving Forward projects identified in 2007 and the improvements recommended as part of the Partnership Process. Collectively, these individual projects are referred to as the Alaskan Way Viaduct and Seawall Replacement Program (Program).

The 2004 Draft EIS and 2006 Supplemental Draft EIS did not refer to the Alaskan Way Viaduct and Seawall Replacement Program. The distinction between the Alaskan Way Viaduct Project and the Program came after the Moving Forward projects were announced in 2007.

This Final EIS and the 2010 Supplemental Draft EIS evaluate the short- and long-term environmental effects of the Alaskan Way Viaduct Replacement Project and the cumulative effects of complementary projects included in the Program. Environmental effects of the independent projects will be examined through separate environmental processes as identified in the project descriptions in Question 10.

10 What other projects are included in the Program?

Other projects that are collectively called the Alaskan Way Viaduct and Seawall Replacement Program (Program) are shown in Exhibit 2-13 and listed in Exhibit 2-14.

Exhibit 2-14
Other Projects Included in the Alaskan Way Viaduct & Seawall Replacement Program

Project	ALTERNATIVES Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
INDEPENDENT PROJECTS THAT COMPLEMENT THE BORED TUNNEL ALTERNATIVE			
Elliott Bay Seawall Project	√	Included in alternative	Included in alternative
Alaskan Way Surface Street Improvements	√	Included in alternative	Included in alternative
Alaskan Way Promenade/ Public Space	√	Included in alternative	Included in alternative
First Avenue Streetcar Evaluation	√	Included in alternative	Included in alternative
Elliott/Western Connector	√	Function Provided¹	Function Provided¹
Transit Enhancements	√	Not Proposed²	Not Proposed²
PROJECTS THAT COMPLEMENT ALL BUILD ALTERNATIVES			
S. Holgate Street to S. King Street Viaduct Replacement Project	√	√	√
Mercer West Project	√	√	√
Transportation Improvements to Minimize Traffic Effects During Construction	√	√	√
SR 99 Yesler Way Vicinity Foundation Stabilization	√	√	√
S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project	√	√	√

1 *These specific improvements are not proposed with the Cut-and-Cover Tunnel and Elevated Structure Alternatives; however, these alternatives provide a functionally similar connection with ramps to and from SR 99 at Elliott and Western Avenues.*

2 *Similar improvements included with the Bored Tunnel Alternative could be proposed with this alternative.*

Alaskan Way Viaduct & Seawall Replacement

Program Elements

Exhibit 2-13

Appendix V of the Final EIS

Appendix V of the *Final EIS* contains the City's document *Additional Review of the Impacts of Deep Bored Tunnel Tolling Diversion on City Streets; Identification of Mitigation* as well as FHWA and WSDOT's response to the information and conclusions presented.

What is the Alaskan Way Viaduct and Seawall Replacement Program?

The term "Program" refers to a number of independent but complementary projects that will improve safety and mobility along SR 99 and the Seattle waterfront from the SODO area south of downtown to Seattle Center. These individual projects include the Moving Forward projects identified in 2007, as well as improvements recommended as part of the Partnership Process.

12 City of Seattle 2010, Ordinance 123424.

Exhibit 2-14 shows several independent projects that complement the Bored Tunnel Alternative that either are part of the Cut-and-Cover Tunnel and Elevated Structure Alternatives or are not proposed with these alternatives. The text below describes each of the projects listed in Exhibit 2-14. These projects will be implemented on separate schedules.

Independent Projects That Complement the Bored Tunnel Alternative

Elliott Bay Seawall Project

The Elliott Bay Seawall Project is an effort by the City and the U.S. Army Corps of Engineers to protect the shoreline along Elliott Bay, including Alaskan Way, from seawall failure due to seismic and storm events. The project limits extend from S. Washington Street in the south to Broad Street in the north. The Corps of Engineers and the City are addressing the seawall in a separate NEPA process, which includes an EIS. A revised NOI for the EIS was published on May 28, 2010,[13] and scoping occurred from June 1, 2010 through July 19, 2010. The Elliott Bay Seawall needs to be rebuilt or replaced because it is deteriorating and vulnerable to earthquakes. However, the seismic stability of a viaduct replacement along Seattle's central waterfront does not necessarily require that the seawall be rebuilt or replaced. The Cut-and-Cover Tunnel and Elevated Structure Alternatives include replacing the Elliott Bay Seawall because the alignments for these alternatives are located in close proximity to the failing seawall, which if not repaired, could compromise the seismic stability of the proposed cut-and-cover tunnel or elevated structure. The Bored Tunnel Alternative proposes to construct a new tunnel inland; therefore, the failing seawall does not have the potential to affect the seismic stability of this inland alignment.

As presently scheduled, the seawall project would be built after the ROD is issued for the Alaskan Way Viaduct Replacement Project. The City's goal is to have a portion of the seawall constructed before the viaduct is demolished in 2016.

Alaskan Way Surface Street Improvements

The City is leading this project and its associated environmental review process, which would take place under NEPA and/or SEPA as appropriate. WSDOT has committed to funding replacement of the Alaskan Way surface street. This project involves rebuilding and improving Alaskan Way between S. King Street and Pine Street. The new surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes) to accommodate ferry traffic and four lanes wide between Marion and Pike Streets. In general, the new street would be located east of the existing Alaskan Way surface street where the viaduct is today to create a wider public space along the waterfront. The new street would include sidewalks, bicycle facilities, parking/loading zones, and signalized pedestrian crossings at cross-streets. The new surface street would provide a regional truck route for freight traveling to and from the Duwamish/Harbor Island/SR 519 area and the Ballard Interbay Northend Manufacturing and Industrial Center (BINMIC).

Along the Alaskan Way surface street, extensive construction activities would be required to replace the seawall. Large portions of the Alaskan Way surface street and sidewalks would need to be torn up and replaced. These construction-related effects and overall project costs can be minimized by constructing the Alaskan Way surface street improvements in combination with seawall replacement. For this reason, Alaskan Way surface street improvements are included with the Cut-and-Cover Tunnel and Elevated Structure Alternatives, but they are not included with the Bored Tunnel Alternative.

Alaskan Way Promenade/Public Space

The City is leading this project and its associated environmental process, which would take place under NEPA and/or SEPA review of central waterfront improvements as appropriate. This project would provide a new, expanded public open space to the west of the new Alaskan Way surface street between S. King Street and Pike Street. The open space would vary in width and would serve Piers 48 through 59, which have varying uses, including cruise ship and ferry terminals, restaurants, retail shops, hotels, and regional entertainment such as the Seattle Aquarium. Access to the waterfront piers would be provided by service driveways.

Between Marion and Pike Streets, the open space would be approximately 70 to 80 feet wide. This public space would be designed at a later date. Other potential public open spaces include a triangular space north of Pike Street and east of Alaskan Way, and parcels created by removing the viaduct between Lenora and Battery Streets.

New public open space and a promenade on Alaskan Way are included in the descriptions of the Cut-and-Cover Tunnel and Elevated Structure Alternatives, and they are not included with the Bored Tunnel Alternative for the same reasons provided for the Alaskan Way surface street improvements.

First Avenue Streetcar Evaluation

The City is leading this project and its associated environmental process, which would take place under NEPA and/or SEPA review of central waterfront improvements as appropriate. This project will evaluate a new streetcar line along First Avenue between Pioneer Square and Seattle Center in the City's transit plan. This alignment would pass through several of Seattle's densest neighborhoods, including Pioneer Square, the downtown Central Business District, Belltown, and Uptown. It would serve many tourist and regional attractions, such as Pike Place Market, the Seattle waterfront piers, Seattle Art Museum, Seattle Aquarium, Olympic Sculpture Park, and Seattle Center.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives propose to build a streetcar on Alaskan Way as part of the Alaskan Way surface street improvements. The Bored Tunnel Alternative does not include building a streetcar on the central waterfront. Instead, Governor Gregoire, former Seattle Mayor Nickels, and former County Executive Sims proposed constructing a streetcar on First Avenue as part of their recommendation from the Partnership Process.

Additional information on projects associated with the Alaskan Way Viaduct and Seawall Program can be found on the Internet at:

- Elliott Bay Seawall Project
  http://www.seattle.gov/Transportation/seawall.htm
- Alaskan Way Surface Street Improvements and Alaskan Way Promenade/Public Space
  http://www.waterfrontseattle.org
- S. Holgate Street to S. King Street Viaduct Replacement Project
  http://www.wsdot.wa.gov/Projects/SR99/HolgateToKing/
- Mercer West Project
  http://www.seattle.gov/transportation/mercer_west.htm

13 Federal Register 2010.

Elliott/Western Connector

The City is leading this project and its associated environmental process, which would take place under NEPA and/or SEPA review of central waterfront improvements as appropriate. The Elliott/Western Connector would provide a connection from Alaskan Way to the Elliott/Western corridor that provides access to and from BINMIC and neighborhoods north of Seattle (including Ballard and Magnolia). The connector would be four lanes wide and would provide an overcrossing of the BNSF mainline railroad tracks. In addition, it would provide local street access to Pike Street and Lenora Street and integrate back into the street grid at Bell Street, which would improve local street connections in Belltown. The new roadway would include bicycle and pedestrian facilities.

The Elliott/Western Connector is an independent project that would complement the Bored Tunnel Alternative. Although these specific improvements are not proposed with the Cut-and-Cover Tunnel and Elevated Structure Alternatives, these alternatives provide a functionally similar connection with SR 99 ramps at Elliott and Western Avenues, similar to the existing viaduct structure. The Bored Tunnel Alternative does not include these ramp connections. The Elliott/Western Connector is an independent project that would improve roadway connections for travelers heading to and from northwest Seattle neighborhoods compared to the connections provided by the Bored Tunnel Alternative.

Transit Enhancements

A variety of transit enhancements would be provided to complement planned transportation improvements associated with the Alaskan Way Viaduct and Seawall Replacement Program. Development of the specific improvements is underway, but would include (1) new transit service with Delridge RapidRide, (2) additional service hours for West Seattle and Ballard RapidRide, (3) adding peak-hour express routes to South Lake Union and Uptown, and (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes.

These transit enhancements are proposed only with the Bored Tunnel Alternative, based on the recommendation provided by Governor Gregoire, former Seattle Mayor Nickels, and former County Executive Sims. Environmental review is not required for these enhancements because they would add service hours and would not involve physical improvements.

Projects That Complement All Build Alternatives

S. Holgate Street to S. King Street Viaduct Replacement Project

WSDOT is leading this project that is currently being constructed. The S. Holgate Street to S. King Street Viaduct Replacement Project will replace this seismically vulnerable portion of SR 99 with a seismically sound structure that is designed to current roadway and safety standards. An Environmental Assessment for this project was completed in June 2008,[14] and the Finding of No Significant Impact (FONSI) was published in February 2009.[15] Construction began in mid 2009 and is expected to be completed at the end of 2014.

Mercer West Project

The City is leading this project and its associated environmental review process, which would take place under NEPA and/or SEPA as appropriate. The Mercer West Project includes improvements on Mercer Street between Fifth Avenue N. and Elliott Avenue W. The improvements include reconfiguring Mercer and Roy Streets west of Fifth Avenue N. to accommodate two-way traffic. The proposed improvements would improve access from SR 99 for drivers traveling to Uptown (Lower Queen Anne), Ballard, Interbay, and Magnolia.

Transportation Improvements to Minimize Traffic Effects During Construction

Several transportation improvements are being fully or partially funded by WSDOT to help offset traffic effects during construction of projects included in the Alaskan Way Viaduct and Seawall Replacement Program. These projects are being led by either WSDOT or the City and have already obtained environmental approval or will be reviewed as appropriate under NEPA and/or SEPA. These transportation improvements are completed or underway and include the following projects:

- Adding variable speed signs and travel time signs on I-5 to help maximize safety and traffic flow. This project has been completed.
- Providing funding for construction of the S. Spokane Street Viaduct Widening Project, which is underway. This project includes a new Fourth Avenue S. off-ramp for West Seattle commuters.
- Adding buses and bus service in the West Seattle, Ballard/Uptown, and Aurora Avenue corridors during construction, as well as a bus travel time monitoring system.
- Upgrading traffic signals and driver information signs for the Denny Way, Elliott Avenue W./15th Avenue W., south of downtown, and West Seattle corridors to support transit and traffic flow.
- Providing information about travel alternatives and incentives to encourage use of transit, carpool, and vanpool programs.

SR 99 Yesler Way Vicinity Foundation Stabilization (Column Safety Repairs)

WSDOT was the lead for this project, which was completed in April 2008. Environmental review under NEPA and SEPA occurred prior to project construction. This project strengthened four column footings supporting the existing viaduct between Columbia Street and Yesler Way. To prevent the columns from sinking further, crews drilled a series of steel rods surrounded by concrete into stable soil, and then added a layer of reinforced concrete to tie the new supports to the existing column footings.

S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project (Electrical Line Relocation Along the Viaduct's South End)

WSDOT was the lead for this project, which was completed in December 2009. Environmental review under SEPA was

14 FHWA and WSDOT 2008.

15 FHWA and WSDOT 2009.

completed prior to project construction. Electrical lines between S. Massachusetts Street and Railroad Way S. were relocated from the viaduct to underground locations. The electrical lines needed to be relocated to protect downtown's power supply in the event of an earthquake and to accommodate viaduct replacement.

Battery Street Tunnel Maintenance and Repairs

Battery Street Tunnel maintenance and repair work was identified as one of the Moving Forward projects. However, the need for this work depends on how the tunnel might be used in the future. The Battery Street Tunnel would be used as part of the Cut-and-Cover Tunnel and Elevated Structure Alternatives. With the Bored Tunnel Alternative, the Battery Street Tunnel would not be needed and would be decommissioned. WSDOT and the City are committed to maintaining the Battery Street Tunnel to ensure that it remains safe for drivers for as long as it is needed.

PUBLIC INVOLVEMENT

11 What opportunities have we provided for people to be engaged in the project?

A wide variety of tools and activities have been used to inform, educate, and promote two-way communication with the community since the project began in 2001.

Public Meetings

2001 to 2004

From 2001 leading up to the 2004 Draft EIS publication, 18 public meetings were held as part of the environmental review process to discuss the project scope, alternatives development, transportation demand management, and the five alternatives. In addition, after the Draft EIS was published, three public hearings were held to provide an opportunity for public review and comment of the Draft EIS. More than 260 people attended the hearings. A total of 670 items, including comment letters, e-mail messages, comment forms, and oral testimonies were submitted by individuals, businesses, community groups, tribes, and public agencies. Comments on the 2004 Draft EIS ranged from concerns about construction impacts, traffic capacity, and public safety, as well as urban design ideas.

2005 to 2006

Following publication of the 2004 Draft EIS and leading up to the 2006 Supplemental Draft EIS, seven public meetings were held. In addition, four public hearings were held to provide an opportunity for the public to review and comment on the Supplemental Draft EIS. A total of 165 individuals, businesses, community groups, tribes, and public agencies attended the hearings. During the public comment period, a total of 178 items were submitted. Comments on the 2006 Supplemental Draft EIS ranged from concerns about project cost, construction impacts, and transportation management.

2007 to Present

Between July 2006 and November 2010, 24 public meetings were held to gather community input and provide information. As part of this total, public meetings were held quarterly during the Partnership Process. In addition, approximately seven meetings were held to discuss potential contracting opportunities. With the publication of the second Supplemental Draft EIS in 2010, three public hearings were held within the 45-day public comment period. In total, 213 items were received during the comment period. Comments ranged from questions about tolling and historic resource effects to concerns about transportation elements such as parking, SR 99 access, and roadway capacity.

Other Community Outreach

A variety of other outreach methods have been used to solicit feedback and provide information on the project. Since the project began in 2001, the lead agencies have engaged the public in the following ways:

- Gave project briefings at more than 700 community meetings to various neighborhood groups, business organizations, interest groups, and social service organizations.

- Attended more than 170 community fairs and festivals where we reached more than 21,000 people by distributing project information and answering questions.

- Held public viaduct tours attended by more than 1,100 people.

- Received approximately 294 information line calls and more than 2,590 e-mails or web comment forms.

- Sent approximately 121 news releases to WSDOT's media list since 2003. Approximately 4,160 news stories and blog posts have mentioned the project. In addition, many media tours of the viaduct have been held.

- Created fact sheets and folios. Materials are often translated into Chinese, Spanish, Tagalog, and Vietnamese. All materials, including translated versions, are made available on the project website. Additionally, general project information is provided on the project website in Chinese, Spanish, Tagalog, and Vietnamese.

- Continued to provide updated project information on our project website and via monthly e-mail messages.

12 How have we been engaging businesses and residents located adjacent to the project?

In addition to the activities described in the previous section, the lead agencies have provided information and solicited input from the property owners, tenants, and businesses directly adjacent to the project area. To help keep these people informed, we have conducted the following activities:

- Notified nearby property owners and tenants of expected activities and possible disruptions. Since July 2006, project team members have provided field work notification more than 170 times.

- Engaged local community and business representatives through the Partnership Process via a Stakeholder Advisory Committee.

Appendix A, Public Involvement Discipline Report

Appendix A, Public Involvement Discipline Report contains additional information describing public involvement activities that have taken place since the project began in 2001.

Chapter 9 of this Final EIS

Chapter 9 contains a summary of the comments received on the *2004 Draft EIS* and *2006* and *2010 Supplemental Draft EISs*. *Appendices S* and *T* of this *Final EIS* contain the individual comment letters and responses to all comments received on the project's EISs.

A total of 1,061 items, including comment letters, email, messages, comment forms, and oral testimonies were submitted on the three EISs. These submitted items were delineated into comments by topic, which resulted in more than 3,200 comments. Responses to each of these comments are provided in *Appendices S* and *T* of this *Final EIS*.

- Hosted multiple meetings with tenants of the Western Building as groups and individually. The purpose of these conversations has been to answer questions and provide resources to help tenants relocate should the Bored Tunnel Alternative be built. In addition, WSDOT has created a web page that lists resources for Western Building tenants.

In addition, in April 2009, WSDOT, King County, and the Seattle Department of Transportation established three working groups for the Bored Tunnel Alternative: the south portal working group, central waterfront working group, and the north portal working group. Participants represent neighborhoods, businesses and freight, and other interest groups. The working groups provide comments and feedback on design and mobility issues and they convey information back to their communities. The central waterfront group met twice in 2009, and the south and north portal groups have been meeting several times a year since 2009.

Finally, WSDOT and the City aim to engage the contracting community early and share project information as work progresses. In 2009, WSDOT hosted three events for contractors that were attended by about 370 contractors. WSDOT and the City also formed a work group and outreach effort aimed at keeping Disadvantaged Business Enterprises and Women and Minority Business Enterprises engaged. Since 2006, WSDOT has attended or hosted more than 20 meetings or events to coordinate with these enterprises.

13 How have we been engaging minorities, low-income people, and social service providers?

The lead agencies have continued to coordinate with social service organizations that provide services to disadvantaged, minority, and low-income people in and near the project area. Outreach to social service providers is part of an ongoing effort that began in 2002.

The project team coordinates with social service providers within the project area to ensure that these organizations who serve traditionally underrepresented populations are engaged in the decision-making process and have opportunities to voice their concerns about potential effects to their property or operations. Since 2002, the project team has conducted more than 95 meetings with area social service providers. The purpose of the meetings is to communicate project alternatives and potential effects; learn about the agencies and the groups they serve; discuss concerns the organizations and their patrons have about the project; and identify ways to avoid, minimize, and mitigate project effects to low-income and minority populations. Other outreach activities to low-income and minority populations include leading community briefings, providing project information in languages other than English, attending fairs and festivals, targeting outreach efforts to minority-owned businesses, and including social service agencies in the working groups.

Since 2002, occasional mailings were sent to 170 to 200 organizations within the project area to keep their members informed of project progress. Notification was also sent to social service providers offering a free copy of environmental documents. A mailing was sent in October 2010 notifying more than 200 service providers of the Supplemental Draft EIS public hearings, opportunities to provide comments, and an opportunity to attend a briefing specifically for social service providers. The briefing was held on November 9, 2010. Approximately 200 organizations were invited and representatives from three organizations attended. Participants asked questions to learn more about how homeless populations were identified, how the relocation process works, what are requirements to identify a business as a Disadvantaged Business Enterprise, and if the lead agencies have considered whether removing the viaduct would displace crime.

14 How have we been coordinating with agencies?

The project team has involved agencies since the 2001 NOI and through the development of the 2004 Draft EIS, 2006 Supplemental Draft EIS, and 2010 Supplemental Draft EIS. Agencies have participated in many ways, including the Resource Agency Leadership Forum (which met until 2006) and ongoing consultation and coordination through NEPA scoping, e-mails, phone calls, field visits, and meetings. The agencies also have been given the opportunity to review draft discipline reports and appropriate sections of the Draft EIS and Supplemental Draft EISs prior to publication. The environmental review requirements of Section 6002 of SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) do not apply because this project was initiated before these regulations were enacted.

Cooperating agencies are governmental agencies specifically requested by the lead agencies to participate during the environmental review process because they have jurisdiction or provide special expertise. FHWA's NEPA regulations (23 CFR 771.111[d]) require that agencies with jurisdiction to provide permits or transfer land be invited to be cooperating agencies. The Federal Transit Administration, King County, U.S. Army Corps of Engineers, and Port of Seattle are cooperating agencies for the project.

Interested agencies are agencies and tribal governments that participate in the environmental review process because they have an interest in the project. Interested agencies for this project include the following:

- Confederated Tribes and Bands of the Yakama Nation
- Muckleshoot Indian Tribe
- National Marine Fisheries Service (NMFS)
- Puget Sound Clean Air Agency
- Puget Sound Regional Council
- Snoqualmie Indian Tribe
- Suquamish Tribe
- The Tulalip Tribes
- U.S. Department of Fish and Wildlife
- U.S. Environmental Protection Agency
- Washington Department of Fish and Wildlife
- Washington State Department of Archaeology and Historic Preservation
- Washington State Department of Ecology
- Washington State Department of Natural Resources

Information about how public comment shaped the alternatives is contained in the following locations:

- Chapter 2 (this chapter), Questions 2 through 7
- Chapter 9
- *Appendices S* and *T* of this *Final EIS*

In addition to coordination among the resource agencies and tribes, WSDOT, the City, the County, and the Port of Seattle work together and meet regularly at both management and staff levels to carry the project forward.

15 How have we been coordinating with tribes?

The lead agencies seek to address the concerns of tribal nations using the process outlined in Section 106 of the National Historic Preservation Act and the WSDOT Tribal Consultation Policy adopted as part of the WSDOT Centennial Accord Plan.[16] Section 106 requires federal agencies to consult with tribes where projects could affect tribal areas with historic or cultural significance. As such, the lead agencies consult with tribes that have active cultural interests in the project area. This includes the following tribes:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam
- Lower Elwha Klallam
- Muckleshoot Indian Tribe
- Port Gamble S'Klallam
- Snoqualmie Indian Tribe
- Suquamish Tribe
- The Tulalip Tribes
- Duwamish Tribe (a non-federally recognized tribe), as an interested party

In addition, the lead agencies consult with tribes on potential effects to treaty fishing rights (usual and accustomed areas) near the project area. The following tribes have fishing rights near the project area:

- **Confederated Tribes and Bands of the Yakama Nation –** Duwamish River and tributaries, no saltwater. These fishing rights are subject to the consent of other treaty tribes in whose usual and accustomed fishing places the Yakima Tribe also fished at treaty times.

- **Jamestown S'Klallam –** Marine waters including the Straits of Juan de Fuca, Hood Canal, and waters off the west coast of Whidbey Island. There are no usual and accustomed fishing areas on the east side of Puget Sound. However, excavated materials are proposed to be barged to the Mats Mats quarry in Port Ludlow for off-site disposal. Barges would be crossing the usual and accustomed fishing areas for this tribe.

- **Lower Elwha Klallam –** Marine waters including the Straits of Juan de Fuca, Hood Canal, and waters off the west coast of Whidbey Island. There are no usual and accustomed fishing areas on the east side of Puget Sound. However, excavated materials are proposed to be barged to the Mats Mats quarry in Port Ludlow for off-site disposal. Barges would be crossing the usual and accustomed fishing areas for this tribe.

- **Muckleshoot Indian Tribe –** Elliott Bay.

- **Port Gamble S'Klallam –** Marine waters including the Straits of Juan de Fuca, Hood Canal, and waters off the west coast of Whidbey Island. There are no usual and accustomed fishing areas on the east side of Puget Sound. However, excavated materials are proposed to be barged to the Mats Mats quarry in Port Ludlow for off-site disposal. Barges would be crossing the usual and accustomed fishing areas for this tribe.

- **Suquamish Tribe –** Marine waters of Puget Sound from the northern tip of Vashon Island to Fraser River, including Elliott Bay.

Since the project began in 2001, the lead agencies have continued to communicate with tribes by providing project updates, coordinating and attending meetings, sharing information, and soliciting feedback. The tribes have also been given the opportunity to review and provide input on background project information, including the project purpose and need statement and draft discipline reports. The lead agencies will continue to consult with tribes throughout project development to provide project updates and consult on Section 106 and fishing rights issues.

Key concerns and questions raised by the tribes have been focused primarily on potential historic and cultural resources that may be located in the project area. The project team has conducted archaeological studies of the area to better understand where archaeological sites or areas sensitive for archaeological sites may be located. The purpose of this work was to focus on what can be done to avoid or minimize potential effects to archaeological resources before construction begins. These studies did not identify any archaeological sites associated with tribes that would be affected by the preferred alternative. However, as part of this work, we used historical accounts, geotechnical information, and archaeological testing to identify high-probability areas where archaeological resources may be located. We are using the information gathered from these studies as we work with the tribes and the State Historic Preservation Officer to develop a Section 106 Memorandum of Agreement, which includes provisions for an archaeological treatment plan. The archaeological treatment plan will include detailed discussion of monitoring and treatment for properly addressing archaeological sites identified in our effects analysis for this Final EIS as well as potential archaeological sites discovered inadvertently during construction. The tribes will be provided with an opportunity to review and comment on the archaeological treatment plan during its development.

What are "usual and accustomed" areas?

Usual and accustomed areas are places located within and outside of a tribe's reservation lands where federal treaties safeguard tribal rights, such as fishing rights.

16 WSDOT 2009.


Bored Tunnel Alternative
Southbound SR 99
Northbound SR 99
Egress
Egress
Egress
Vent
Surface
Lowered Roadway
Cut-&-Cover Tunnel
Bored Tunnel
Elevated Roadway
Aerial
Elliott Bay
Decommission Battery Street Tunnel
Broad Street Removed
Southbound On
Southbound Off
SR 99
Tunnel Operations Building
Northbound Off
Northbound On
Bored Tunnel
Demolish Viaduct
S. Holgate to S. King Street Project
TERMINAL 46
PIER 48
COLMAN DOCK
Southbound On
Northbound On
Street Improvements
Southbound Off
Northbound Off
Tunnel Operations Building
Railroad
SEATTLE CENTER
SAFECO FIELD
QWEST FIELD
King St. Station
Union Station
QUEEN ANNE AVENUE
FIRST AVENUE N
WARREN AVENUE N
SECOND AV
THIRD AVE
FOURTH AV
FIFTH AVENUE N
TAYLOR AVENUE N
SIXTH AVENUE N
AURORA AVENUE
DEXTER AV
NINTH AVE N
WESTLAKE AVE N
TERRY AVE N
BOREN AVENUE N
FAIRVIEW AVENUE N
MINOR AVENUE N
PONTIUS AVENUE N
YALE AVENUE N
DENNY WAY
JOHN STREET
THOMAS STREET
HARRISON STREET
REPUBLICAN STREET
MERCER
VALLEY STREET
ALASKAN WAY
WESTERN AVENUE
ELLIOTT AVENUE
BROAD STREET
WESTLAKE AVENUE
OCCIDENTAL AVENUE S
FIRST AVENUE S
FOURTH AVENUE S
FIFTH AVENUE S
S ATLANTIC STREET/SR 519
S ROYAL BROUGHAM WAY
S KING STREET
S JACKSON STREET
S MAIN STREET
S WASHINGTON STREET
YESLER WAY
0
1,000
2,000
SCALE IN FEET

Exhibit 3-1

CHAPTER 3 - ALTERNATIVES DESCRIPTION

What is in Chapter 3?

This chapter describes the alternatives evaluated in this Final EIS. It includes a description of the No Build Alternative, and the build alternatives with and without tolls. It describes how the alternatives would be built and that the Bored Tunnel Alternative has been identified as the preferred alternative.

ALTERNATIVES

1 What alternatives are evaluated in this Final EIS?
This Final EIS analyzes the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives. Each alternative is evaluated with and without tolls. In addition, the Viaduct Closed (No Build Alternative) is evaluated as required by National Environmental Protection Act (NEPA) regulations to provide baseline information about conditions in the project area if none of the build alternatives were selected for construction.

2 What is the Preferred Alternative?
The lead agencies identified the Bored Tunnel Alternative as the preferred alternative in the 2010 Supplemental Draft Environmental Impact Statement (EIS). The Tolled Bored Tunnel Alternative analyzed in this Final EIS is now identified as the preferred alternative. However, because Washington State Department of Transportation (WSDOT) would need authorization from the Washington State Legislature to implement tolling on the bored tunnel, a discussion of the Bored Tunnel Alternative without tolling is also included in this Final EIS.

3 What is the Viaduct Closed (No Build Alternative)?
The Viaduct Closed Alternative describes what would happen if none of the proposed alternatives were developed. By describing conditions without a project, the build alternatives can be compared to the Viaduct Closed Alternative to show the project's effects. In a typical NEPA document, the Viaduct Closed Alternative describes future conditions if none of the build alternatives were built by the design year (2030 for this project). For this project, however, WSDOT has decided that the viaduct must be closed if it is not replaced.

The project area is susceptible to earthquakes that could happen at any time. A small earthquake could make the existing viaduct unsafe, requiring immediate closure. A stronger earthquake could cause the structure to collapse, with potentially catastrophic effects. Even without an earthquake, the viaduct is gradually deteriorating from constant exposure to moist marine air, rain, and vibration from traffic. Multiple studies have found that retrofitting or rebuilding the existing viaduct is not a reasonable alternative.[1, 2, 3, 4] Because of the facility's continued deterioration, even without an earthquake, the roadway will need to be closed at some point in the future.

Although WSDOT cannot predict the exact year when it would be closed, engineers have determined through the studies referenced above that the existing viaduct would be closed well before 2030. Therefore, traffic projections for the existing structure in 2030 are not useful and are not used in this document.

Earthquakes are unpredictable, and the rate at which the structure is deteriorating is not constant. Therefore, for this Final EIS, the Viaduct Closed Alternative describes the consequences of suddenly losing State Route 99 (SR 99) along the central waterfront. These consequences would last until transportation and other agencies could implement a new, permanent solution and businesses and people could adapt. This condition would be comparable to when the viaduct was suddenly closed for days following the Nisqually earthquake in 2001. Congestion spread through the area and lasted throughout the day. These effects spread to other highways in the region as travelers tried to avoid I-5 and downtown Seattle.

The Viaduct Closed Alternative is evaluated using 2030 transportation conditions so that it can be compared to the build alternatives, each of which are analyzed using a 2030 horizon year. The 2030 Viaduct Closed Alternative assesses traffic conditions if the viaduct were closed between the First Avenue S. ramps and the Battery Street Tunnel.

While we can predict the short-term effects of suddenly closing the viaduct, the long-term effects are harder to predict. Our traffic projections for 2030 are based on adopted local and regional land use and transportation plans, which include SR 99. Simply closing SR 99 and expecting all other assumptions about future development patterns to remain unchanged creates a conservative scenario where transportation demand far exceeds the capacity of I-5 and streets through downtown Seattle.

Additional information on 2030 Viaduct Closed (No Build Alternative)

The *Transportation Discipline Report*, *Appendix C*, explains how the 2030 Viaduct Closed (No Build Alternative) was modeled and how transportation and land use could be affected. Traffic data for modeled conditions for the 2030 Viaduct Closed Alternative are provided for most of the traffic conditions that were measured, such as vehicle miles of travel, vehicle hours of delay, and traffic volumes. These measures allow for relative comparisons between the Viaduct Closed and build alternatives. However, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of detailed congestion measures such as travel speeds, travel times, and delays are not appropriate.

In this chapter, information for the 2030 Viaduct Closed shows what would happen if the lead agencies did not replace the existing viaduct and it were closed with little or no warning. To understand what would happen if the viaduct is replaced, the effects were compared among the build alternatives to explain tradeoffs.

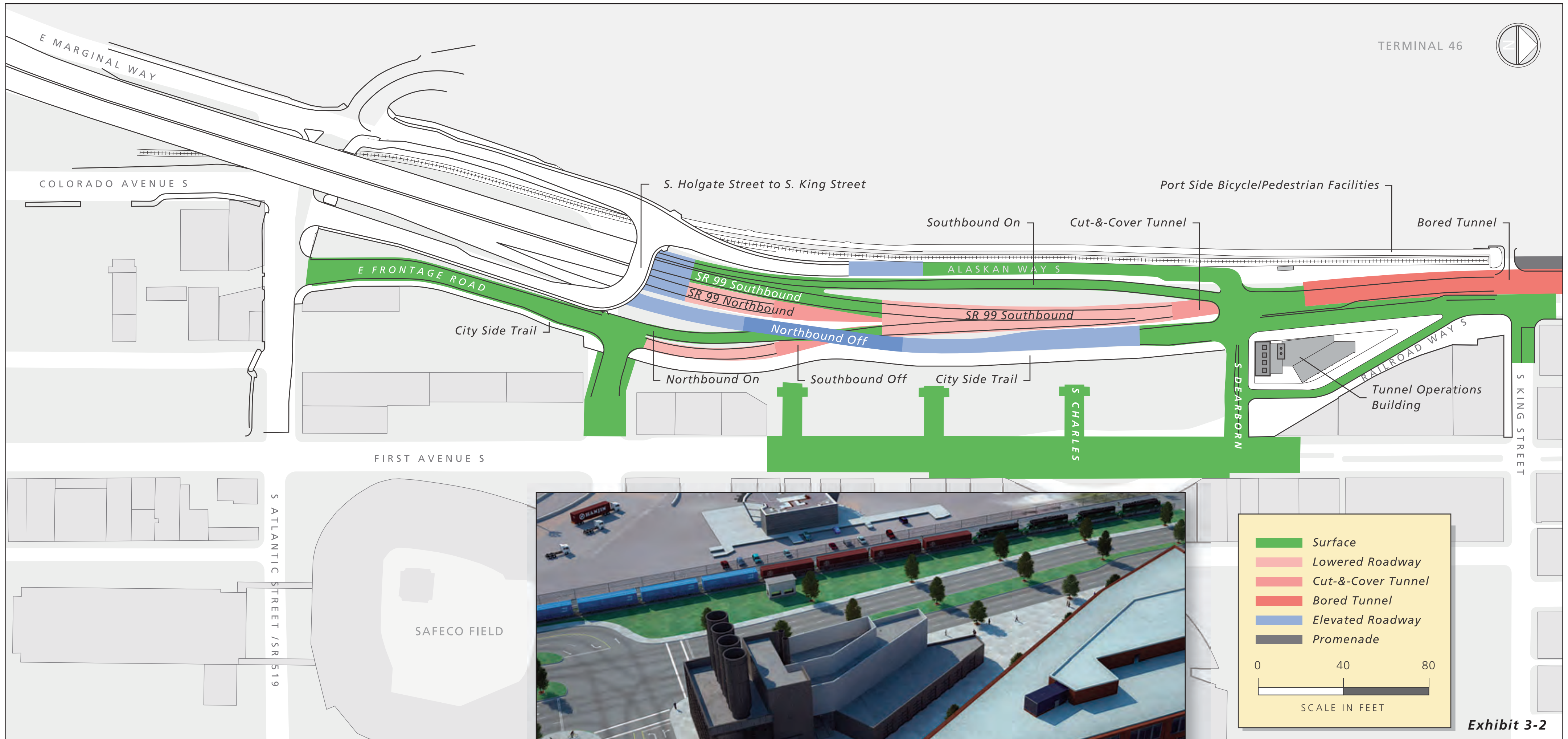
1 TY Lin, International 2005.

2 KPFF Consulting Engineers 2008.

3 American Society of Civil Engineers Review Committee 2006.

4 Parsons Brinckerhoff 2007.

Bored Tunnel South Portal



Tunnel Operations Building

Exhibit 3-2

4 How would the Bored Tunnel Alternative replace SR 99 and the viaduct?

The Bored Tunnel Alternative would replace SR 99 between S. Royal Brougham Way and Roy Street as shown in Exhibit 3-1.

South Portal Area

Full northbound and southbound access to and from SR 99 would be provided in the south portal area between S. Royal Brougham Way and S. King Street. The northbound on-ramp to and southbound off-ramp from SR 99 would be reached from S. Royal Brougham Way at its intersection with the East Frontage Road, as shown in Exhibit 3-2. The southbound on-ramp to and northbound off-ramp from SR 99 would feed directly into a reconfigured Alaskan Way S. The northbound off-ramp would have a general-purpose lane and a peak hour transit-only lane to accommodate transit coming from the south and West Seattle.

The reconfigured Alaskan Way S. would have three lanes in each direction up to S. King Street. A new street, S. Dearborn Street, would be constructed from Railroad Way S. to Alaskan Way S., and would include a new signalized intersection at Alaskan Way S. This intersection

What transportation improvements were assumed for the 2030 Viaduct Closed?

The transportation analysis conducted for the 2030 Viaduct Closed and build alternatives assumed that the following projects would be in place by 2030:

- S. Holgate Street to S. King Street Viaduct Replacement Project
- SR 519 Intermodal Access Project, Phase 2
- S. Spokane Street Viaduct Widening Project
- Mercer East Project from Dexter Avenue N. to I-5
- Third Avenue Transit Exclusivity
- Sound Transit Phase 1 and 2, including Sounder Commuter Rail, ST Express Bus, First Hill Streetcar, South Link, University Link, North Link, and East Link Light Rail
- Existing transit services and new services proposed in agencies' 6-year plans
- King County Transit Now

Appendix B, Alternatives Description and Construction Methods

Additional details about the alternatives and their construction methods are contained in *Appendix B*.

would provide access to and from East Marginal Way S., which would run along the west side of SR 99. A tunnel operations building would be constructed in the block bounded by S. Dearborn Street, Railroad Way S., and Alaskan Way S.

Central Waterfront Area

Access to and from the bored tunnel would be provided via ramp connections at the south portal north of S. Royal Brougham Way and the north portal near Harrison and Republican Streets. Unlike the existing viaduct, ramps to and from Columbia and Seneca Streets and Elliott and Western Avenues would not be provided. This alternative would remove the viaduct along the Seattle waterfront and would decommission the Battery Street Tunnel after the bored tunnel is constructed.

The bored tunnel would have two lanes in each direction. Southbound lanes would be located on the top portion of the tunnel, and the northbound lanes would be located on the bottom. Travel lanes would be 11 feet wide, with a 2-foot-wide shoulder on one side and an 8-foot-wide shoulder on the other side. The 56-foot (outside diameter), single-bore tunnel being proposed for this project is at the technological limit for the industry. The stacked roadway configuration within this diameter has horizontal width limitations when combined with the necessary two lanes, vertical clearance, emergency access points, tunnel systems and traffic barriers. Any additional horizontal and/or vertical clearance requirements would likely have a direct impact on the tunnel bore's diameter, exceeding current tunneling technology and acceptable levels of risk. All deviations proposed to date for this project have been approved by WSDOT and the Federal Highway Administration (FHWA) and any future deviations proposed as final design proceeds will be reviewed in detail by these agencies prior to approval with the goal of assuring that the roadway is built to be the safest facility possible.

The bored tunnel will be constantly ventilated and lit. Radio and cell phone signals will be retransmitted to provide uninterrupted service.

Bored Tunnel North Portal

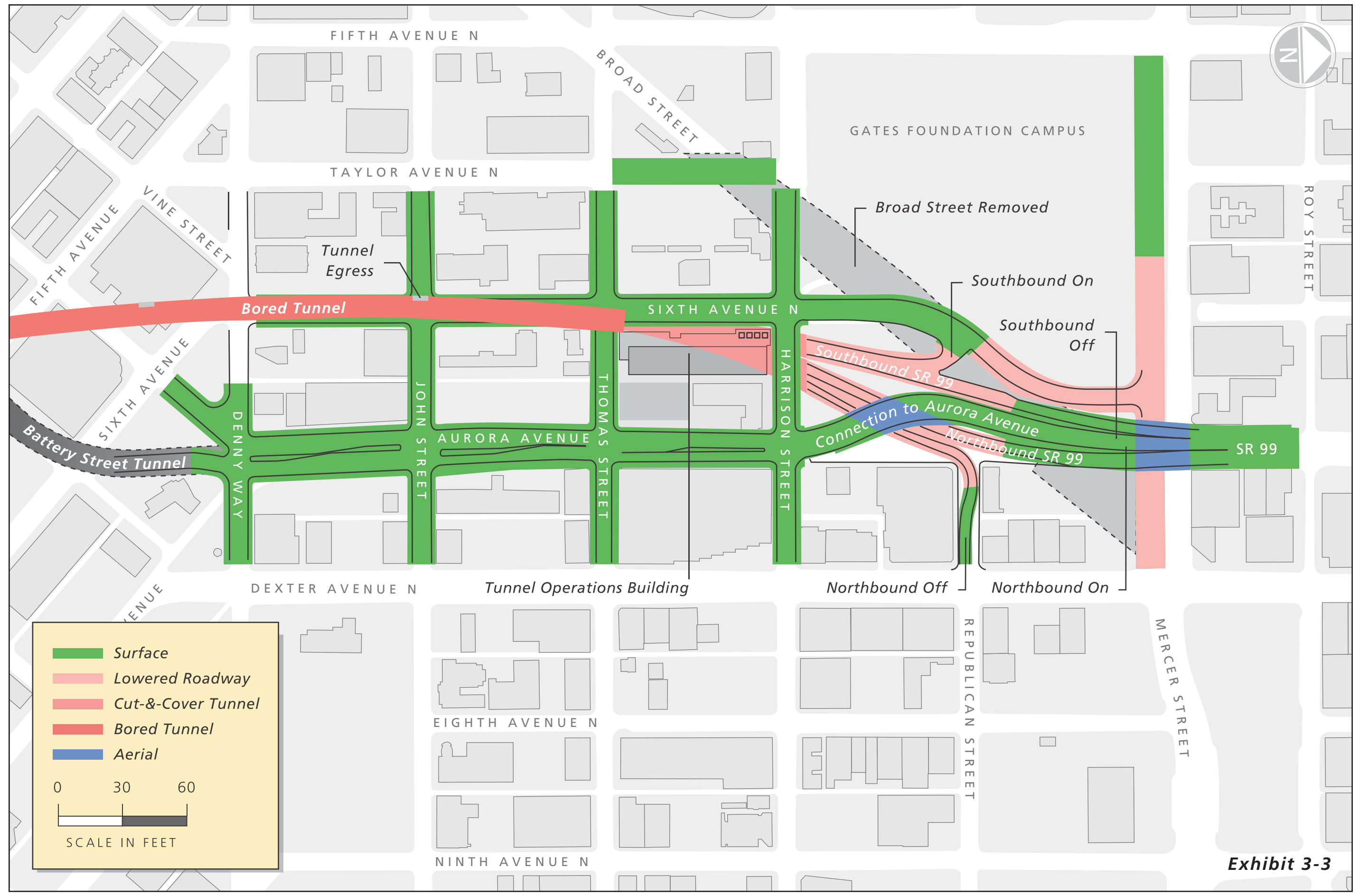


Exhibit 3-3

The bored tunnel would be designed to provide emergency access, evacuation routes, ventilation, and fire suppression systems in accordance with National Fire Protection Association (NFPA) standards and other codes and regulations. Conditions in the tunnel will be monitored constantly by television and traffic sensors. Emergency tunnel exits would be provided throughout the tunnel. In an emergency, travelers would move along the shoulders to reach a doorway into a secure waiting area, called a refuge area. The refuge areas will be located behind 2-hour-rated fire doors, and they would be equipped with sprinklers and separate ventilation and air supply from the roadway tunnel area. The refuge areas would be negatively pressurized to prevent air from the roadway tunnel area from entering the refuge area when the fire door is open. Staircases inside the refuge area would provide access to a walkway that would run the length of the tunnel and would be located between the roadway levels. Signs would point travelers to the nearest exit, where they would either wait for assistance or walk out of the tunnel. Refuge areas would contain emergency telephones. People who are unable to use the stairs to exit the tunnel could wait in the enclosed, protected refuge areas for assisted rescue. Refuge areas will be designed to meet Americans with Disabilities Act (ADA) requirements. The design will meet NFPA 502 standards for road tunnels, and as such meets the key ADA accessibility guidelines for emergency egress.

North Portal Area

Full northbound and southbound access to and from SR 99 would be provided near Harrison and Republican

What are design deviations?

Designers and engineers are faced with many complex tradeoffs when designing highways and streets. A good design balances cost, safety, mobility, social and environmental impacts, and the needs of a wide variety of roadway users. Highway design standards established through years of practice and research form the basis by which roadway designers achieve this balance. Designers are trained to use accepted design standards throughout the project development process. It must be recognized, however, that to achieve the balance described above, it is not always possible to meet design standards. Designers encounter a wide variety of site-specific conditions and constraints. For many situations, there is sufficient flexibility within the design standards to achieve a balanced design and still meet minimum values. However, when this is not possible, a design deviation may be considered.

Streets, as shown in Exhibit 3-3. The existing on- and off-ramps provided at Denny Way would be closed. New ramps at Republican Street would provide northbound access from SR 99 and southbound access to SR 99. The northbound off-ramp to Republican Street would be provided on the east side of SR 99 and routed to an intersection at Dexter Avenue N. Drivers would access the southbound on-ramp via a new connection with Sixth Avenue N. at Republican Street on the west side of SR 99. Access to SR 99 would continue to be available at Roy Street as it is today.

Surface streets would be rebuilt and improved in the north portal area. Aurora Avenue would be built to grade level between Denny Way and Harrison Street. John, Thomas, and Harrison Streets would be connected as cross streets with signalized intersections on Aurora Avenue at Denny Way and John, Thomas, and Harrison Streets. The rebuilt section of Aurora Avenue would connect to SR 99 via the ramps at Harrison Street. The roadway would have two general-purpose lanes in each direction, turn pockets, and right-side transit lanes.

Mercer Street would become a two-way street and would be widened from Dexter Avenue N. to Fifth Avenue N. The rebuilt Mercer Street would have three lanes in each direction with left-hand turn pockets. Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N. A tunnel operations building would be constructed between Thomas and Harrison Streets on the east side of Sixth Avenue N.

A new roadway would be built to extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets, as shown in Exhibit 3-3. The new roadway would have a signalized intersection at the southbound on-ramp.

How would tolls be applied to the Bored Tunnel Alternative?

WSDOT needs authorization from the Washington State Legislature to impose tolls on the bored tunnel. If the legislature grants this authority, WSDOT, Seattle Department of Transportation (SDOT), and other agencies will work to optimize the bored tunnel's toll configuration in order to minimize diversion to city streets while maintaining efficient traffic flow on SR 99 and generating revenue. This optimization process will include recommendations for toll rates, but the final determination of toll rates would be made by the State Transportation Commission. For the sake of analysis, this Final EIS assumes the toll rates shown on Exhibit 3-4, which would be highest during periods of high travel demand (peak commute hours) and lowest during evening and nighttime hours. Because northbound travel demand is typically higher in the morning and southbound in the evening, toll rates would be set correspondingly.

Exhibit 3-4
Assumed Toll Rates by Time of Day

Time of Day	Northbound	Southbound
Morning Commute	$4.00	$3.00
Mid-day	$2.25	$2.25
Evening Commute	$4.00	$5.00
Evening	$1.25	$1.25
Nighttime	$1.00	$1.00

Note: Toll rates are for 2015 based on toll scenario C, which was developed by WSDOT to test revenue generation. Final toll rates would be set by the Washington Transportation Commission.

Tolls would be charged to drivers entering the bored tunnel from either direction. However, tolls would not be charged to drivers using SR 99 to access downtown from the south via the new ramps at Alaskan Way S. or from the north via the new ramps at Harrison Street.

5 How would the Cut-and-Cover Tunnel Alternative replace SR 99 and the viaduct?

The Cut-and-Cover Tunnel Alternative would replace SR 99 from S. Royal Brougham Way to Aloha Street, as shown in Exhibit 3-5.

South Portal Area

In the south portal area, the cut-and-cover tunnel lane configurations and access points are nearly identical to the bored tunnel. Like the Bored Tunnel Alternative, full northbound and southbound access to and from SR 99 would be provided in the south portal area between S. Royal Brougham Way and S. King Street.

Like the Bored Tunnel Alternative, the southbound on-ramp to and northbound off-ramp from SR 99 would feed directly into a reconfigured Alaskan Way S. The northbound off-ramp would have a general-purpose lane and a peak hour transit-only lane to accommodate transit coming from the south and West Seattle. The reconfigured Alaskan Way S. would have three lanes in each direction up to S. King Street. A new street, S. Dearborn Street, would be constructed from Railroad Way S. to Alaskan Way S., which would include a new signalized intersection at Alaskan Way S. This intersection would provide access to and from East Marginal Way S., which would run along the west side of SR 99. A tunnel operations building would be constructed in the block bounded by S. Dearborn Street, Railroad Way S., and Alaskan Way S.

Central Waterfront Area

The Cut-and-Cover Tunnel Alternative would replace SR 99 with a six-lane cut-and-cover tunnel (three lanes in each direction) from approximately Railroad Way S. to Pine Street. The outer wall of the tunnel would serve as the new seawall from S. Washington Street to Union Street. A tunnel operations building would be constructed in the block bounded by Pine Street, SR 99, and the Alaskan Way surface street. Between Pine Street and Virginia Street, a new aerial structure would be built, and SR 99 would connect to the Battery Street Tunnel by traveling under Elliott and Western Avenues, where the existing Elliott Avenue on-ramp and Western Avenue off-ramp would be replaced. Because SR 99 would cross under Elliott and Western Avenues, Bell Street could be connected across Western Avenue.

Above the aerial structure from Pine to Virginia Streets, a lid would provide new open space and a pedestrian linkage between Victor Steinbrueck Park and Pike Place Market to the waterfront.

Alaskan Way would be replaced east of the existing roadway with at least two lanes in each direction and two waterfront streetcar tracks running in the center travel lanes. The center lane would have alternating turn pockets

Comparing Features of the Build Alternatives

Unlike the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the Bored Tunnel Alternative does not require construction along Seattle's central waterfront, because the bored tunnel alignment runs inland between Yesler Way and the north portal. Consequently, several components included in the Cut-and-Cover Tunnel and Elevated Structure Alternatives are not included in the Bored Tunnel Alternative, most notably seawall replacement, the new Alaskan Way surface street, the waterfront streetcar replacement, and the roadway connection between the waterfront and Elliott and Western Avenues. These projects and others are referred to as "Program Elements" for the Bored Tunnel Alternative and are discussed in Chapter 2 of this *Final EIS*.

Cut-&-Cover Tunnel Alternative

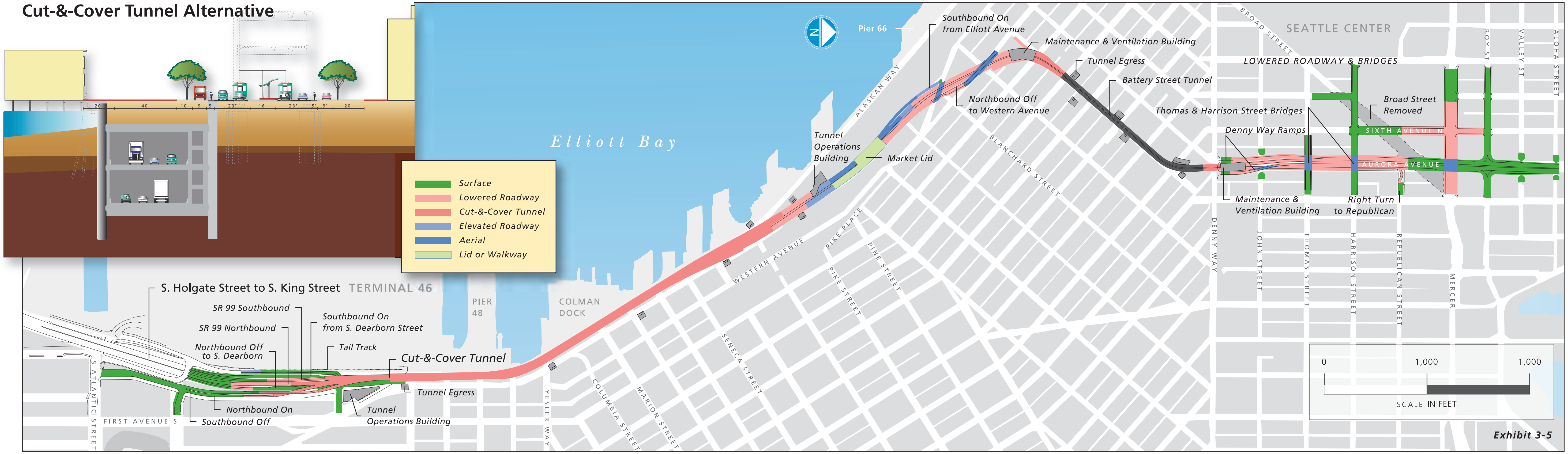


Exhibit 3-5

and streetcar stops. Between Railroad Way S. and Yesler Way, Alaskan Way would have three lanes in each direction. Alaskan Way would be lined with expanded open space, a wide waterfront promenade, broad sidewalks on both sides of the surface street, bicycle lanes, and parking including ADA-compliant spaces. Between Union Street and Broad Street the existing seawall would be replaced.

Like the Bored Tunnel Alternative, ramps to and from Columbia and Seneca Streets would not be provided. Unlike the Bored Tunnel Alternative, ramps to and from Elliott and Western Avenues would be provided. The existing pedestrian bridge at Marion Street from First Avenue to Colman Dock would be removed and replaced with a new ADA-compliant structure.

With the Cut-and-Cover Tunnel Alternative, the Battery Street Tunnel would be retrofitted for improved seismic safety. The existing tunnel safety systems and facilities would be updated with a fire suppression system, ventilation, and new emergency egress structures near Second, Third, Fourth, and Sixth Avenues. The south portal of the Battery Street Tunnel would be widened to accommodate the connection from the new SR 99 roadway. Tunnel maintenance and ventilation buildings would be built at each end of the Battery Street Tunnel to house ventilation, electrical, mechanical, and communications systems.

North of the Battery Street Tunnel

North of the Battery Street Tunnel, SR 99 would be improved and widened up to Aloha Street, as shown in Exhibit 3-6. Access on to SR 99 would be provided at Denny Way and Roy Street, and access off of SR 99 would be provided at Denny Way, Republican Street, and Roy Street. Two new bridges would be built on Thomas and Harrison Streets, spanning SR 99. Broad Street would be closed between Fifth and Ninth Avenues N., allowing the street grid to be connected. Sixth Avenue would be extended between Harrison and Mercer Streets. Mercer Street would continue to cross under SR 99 as it does today, but it would be widened and converted into a two-way street with three lanes in each direction and a center turn lane.

How would tolls be applied to the Cut-and-Cover Tunnel Alternative?

Like the Bored Tunnel Alternative, WSDOT needs authorization from the Washington State Legislature to impose tolls on the Cut-and-Cover Tunnel Alternative, and the specific configuration of these tolls would be determined through coordination between the city, state, and other parties. For analysis, this Final EIS assumes that the same rates described for the Bored Tunnel Alternative would apply to the Cut-and-Cover Tunnel Alternative (see Exhibit 3-4).

Similar to the bored tunnel, tolls would be charged to drivers entering the cut-and-cover tunnel from either direction. However, tolls would not be charged to drivers

Cut-&-Cover Tunnel North Area

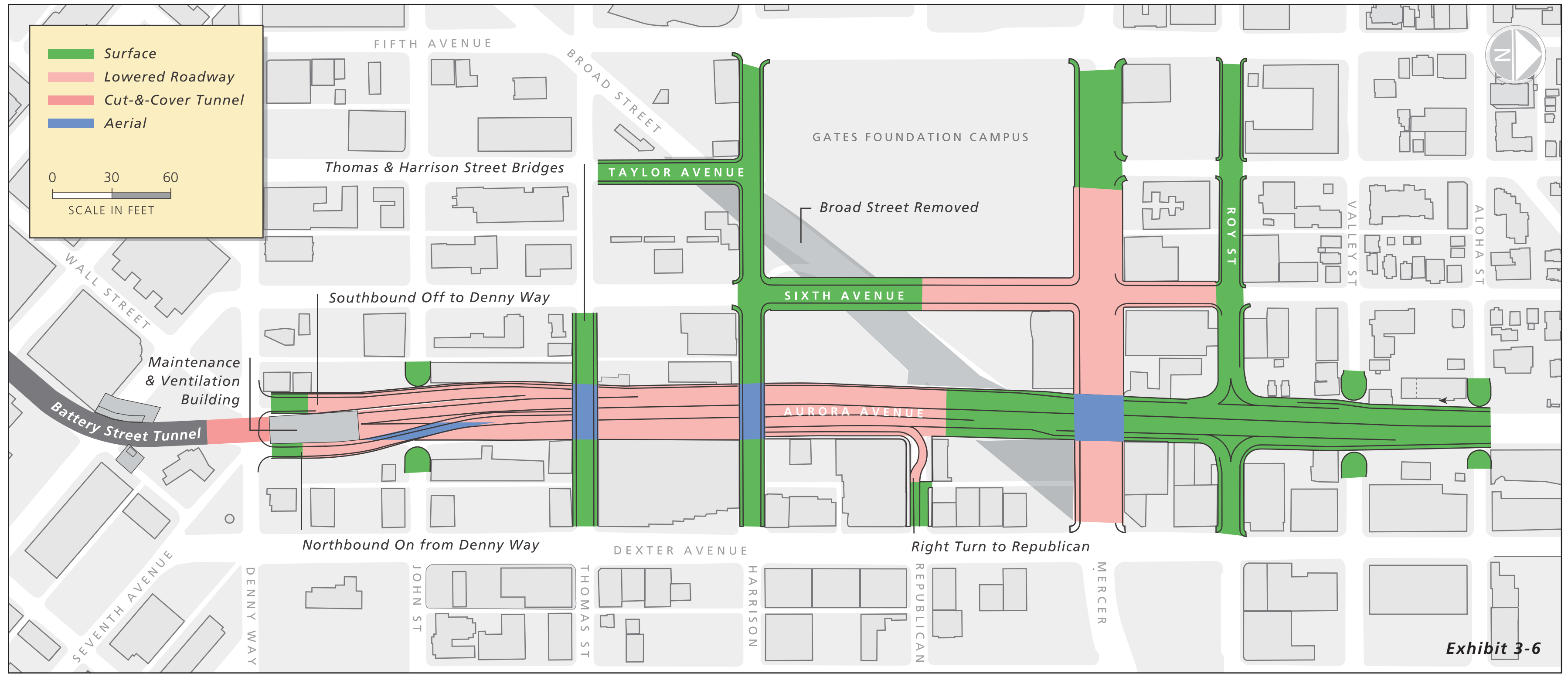


Exhibit 3-6

using SR 99 to access downtown from the south via the new ramps to Alaskan Way S. or from the north via the existing ramps at Denny Way.

6 How would the Elevated Structure Alternative replace SR 99 and the viaduct?

The Elevated Structure Alternative would replace SR 99 from S. Royal Brougham Way to Aloha Street, as shown in Exhibit 3-7.

South Area

In the south area, the Elevated Structure Alternative's lane configurations and access points are nearly identical to the Bored Tunnel and Cut-and-Cover Tunnel Alternative. Like the other build alternatives, full northbound and southbound access to and from SR 99 would be provided in the south area between S. Royal Brougham Way and S. King Street.

Like the other build alternatives, the southbound on-ramp to and northbound off-ramp from SR 99 would feed directly into a reconfigured Alaskan Way S. The northbound off-ramp would have a general-purpose lane and a peak hour transit-only lane to accommodate transit coming from the south or West Seattle. The reconfigured Alaskan Way S. would have three lanes in each direction up to S. King Street. A new street, S. Dearborn Street, would be constructed from Railroad Way S. to Alaskan Way S., which would include a new signalized intersection at Alaskan Way S. This intersection would provide access to and from East Marginal Way S., which would run along the west side of SR 99.

Central Waterfront Area

The Elevated Structure Alternative would be eight lanes wide from S. King Street to S. Main Street where it would transition to a stacked aerial structure. For the most part, the new aerial structure would have three lanes in each direction, and it would have wider lanes and shoulders than the existing viaduct. Between S. King Street and the ramps at Columbia and Seneca Streets, SR 99 would have four lanes in each direction. The existing ramps at Columbia and Seneca Streets would be rebuilt. The SR 99 structure would pass over Elliott and Western Avenues between Pine Street and the Battery Street Tunnel. The ramps to Elliott and Western Avenues would be rebuilt similar to the existing ramps.

The Alaskan Way surface street would be replaced with at least two lanes in each direction. Northbound lanes would travel under the new viaduct, and southbound lanes would travel west of the new viaduct. The waterfront streetcar would be replaced with two streetcar tracks that would share a travel lane with vehicles. Alaskan Way would be lined with bicycle lanes, sidewalks on both sides, and parking including ADA-compliant spaces. Between Railroad Way S. and Yesler Way, Alaskan Way would have three lanes in each direction.

The existing pedestrian bridge at Marion Street from First Avenue to Colman Dock would be removed and replaced with a new ADA-compliant structure.

As with the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would retrofit the Battery Street Tunnel for improved seismic safety, upgrade tunnel safety systems and facilities, and install new emergency egress structures near Second, Third, Fourth, and Sixth Avenues. The south portal of the Battery Street Tunnel would be widened to accommodate the connection from the new SR 99 roadway. Tunnel maintenance and ventilation buildings would be built at each end of the Battery Street Tunnel to house ventilation, electrical, mechanical, and communications systems.

The seawall would be replaced from about S. Washington Street up to Broad Street.

North of the Battery Street Tunnel

Improvements from the Battery Street Tunnel north would be the same as what was described for the Cut-and-Cover Tunnel Alternative.

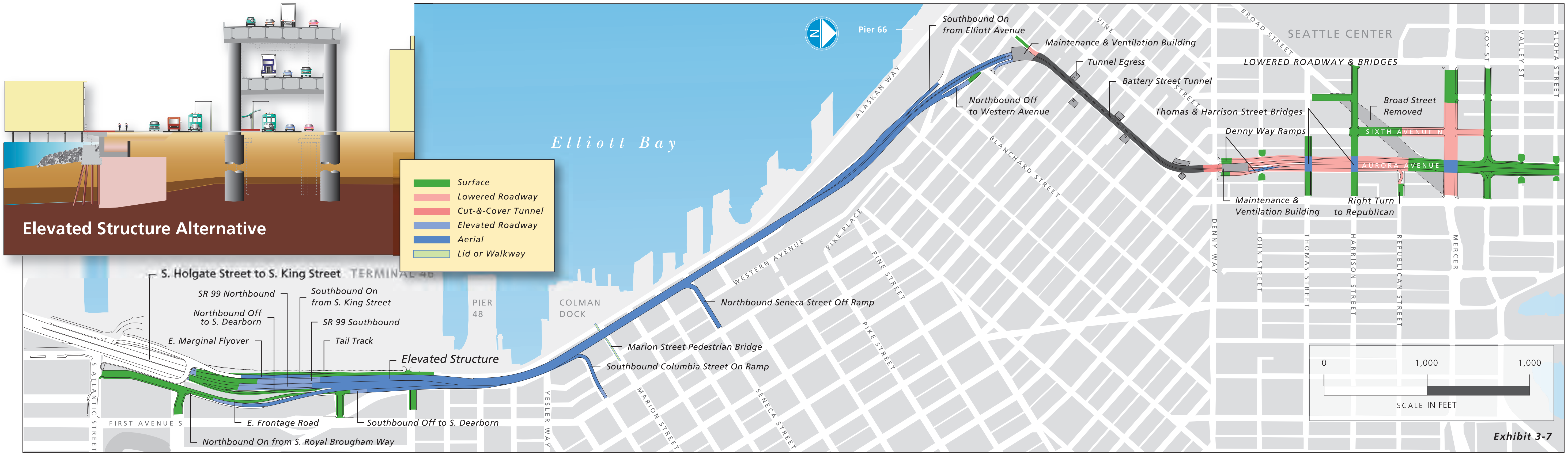


Exhibit 3-7

How would tolls be applied to the Elevated Structure Alternative?
Like other build alternatives, WSDOT needs authorization from the Washington State Legislature to impose tolls on the elevated structure and the specific configuration of these tolls would be determined through coordination between the city, state, and other parties. For analysis, this Final EIS assumes that the same rates described for the Bored Tunnel Alternative would apply to the Elevated Structure Alternative (see Exhibit 3-4).

Tolls would be charged to drivers using the new elevated structure for trips through the city, including drivers using the Elliott Avenue on-ramp and Western Avenue off-ramp. Similar to the other build alternatives, tolls would not be charged to drivers using SR 99 to access downtown from the south via the new ramps to Alaskan Way S., Columbia Street, and Seneca Street or from the north via the existing ramps at Denny Way.

CONSTRUCTION

7 What must happen before construction can begin?
Construction cannot begin until a Record of Decision (ROD) is issued selecting a build alternative and required permits are obtained. The FHWA will sign the ROD no earlier than 30 days after this Final EIS is published. As the project progresses after the ROD, the lead agencies will work to obtain permits, finish right-of-way acquisitions, and procure needed equipment.

8 What construction shifts are proposed?
Construction for all activities could occur up to 24 hours per day, 7 days per week. Proposed construction shifts are likely to vary depending on the location and type of construction activity.

For the preferred Bored Tunnel Alternative, tunnel boring and work at the Washington-Oregon Shippers Cooperative Association (WOSCA) staging area in the south portal area would likely occur in three shifts per day, 6 days a week. Tunnel boring machine (TBM) maintenance activities would be performed 1 day a week when tunnel boring is not occurring. In the north portal area, construction would likely occur 6 days a week with two shifts per day. Viaduct demolition is expected to occur 5 or 6 days a week with two shifts a day. The difference in the number of shifts proposed is due to the varying construction activities.

For the Cut-and-Cover Tunnel Alternative, construction durations assume two 8-hour shifts per day. Construction would occur 5 days a week in the south portal area and 6 days a week along the central waterfront. However, work could occur up to 24 hours per day, 7 days per week if necessary. North of the Battery Street Tunnel, construction would likely occur 6 days a week with two shifts a day. Viaduct demolition is expected to occur 5 or 6 days a week with two shifts a day when SR 99 and Alaskan Way are closed to all traffic.

For the Elevated Structure Alternative, construction would likely occur 6 days a week with two shifts a day. Demolition of the upper level of the viaduct is expected to occur 5 or 6 days a week with two shifts a day when SR 99 is closed to all traffic. The lower level of the viaduct would be demolished after the new upper level is constructed.

9 Where would construction staging occur?
Space for potential on-site construction staging is limited, so some staging areas are proposed outside of the immediate project area. Construction staging areas for the proposed build alternatives are shown on Exhibit 3-8 and described below:

- **Terminal 106 –** This site may be used as a construction staging, materials fabrication, and laydown area. Materials would be fabricated more than 200 feet from the shoreline.

- **Terminal 25 –** This site may be used for contractor parking, construction staging, materials fabrication and concrete debris processing, which would occur more than 200 feet from the shoreline.

- **WOSCA Property –** This property would be used as the primary staging site in the south project area for all alternatives. The WOSCA property is located west of First Avenue S. and extends from S. Royal Brougham Way to Railroad Way S. Part of the site would be used for a traffic detour and for construction offices. The site may be used for a concrete batch plant, if needed. The Elevated Structure Alternative may fabricate materials on this site. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would use this site for supporting tunnel construction. For the Bored Tunnel Alternative, this site would be used to assemble and launch the TBM, hold and transport spoils, serve as a launch site for installing interior tunnel structures, and house a temporary electrical substation to support the TBM.

- **Pier 48 –** This property is located along Alaskan Way S. between S. Jackson and S. Washington Streets and is owned by the State of Washington. The property may be used for contractor parking and staging activities, such as material laydown.

- **Terminal 46 and Pier 46 –** The northwest corner of Terminal 46 would be used as a primary staging area for materials laydown and storage. Pier 46, at the northern edge of Terminal 46, may be used to accommodate excavated materials that would be transported by barge for off-site disposal. The site may be modified to include conveyor and hoppers to transfer materials to a barge. No in-water work would be required. Container activity on the rest of Terminal 46 would not be affected.

- **Interstate 90 (I-90) high-occupancy vehicle (HOV) Ramp Site –** This site is under the HOV ramps between the E-3 Busway and Sixth Avenue would be used primarily for storage.

- **Alaskan Way S., S. King to S. Jackson Street Site –** This site would be used as a construction work area.

- **Railroad Way S. Right-of-Way –** During much of the construction period, the right-of-way along Railroad Way S. under the First Avenue S. ramps would be used to accommodate construction activities in the south project area. During the last year of construction, the area would be used to demolish the existing ramps.

- **Alaskan Way S., S. Royal Brougham Way to S. King Street –** This construction staging and work area would eventually become the location of the new permanent ramps and SR 99 facility.

- **First Avenue S. Bridge Site –** This site would be used primarily for storage.

- **Fischer Site (Fourth Avenue S., formerly an SR 519 project staging site) –** This site would be used

Exhibit 3-8

primarily for storage but could also be used for fabricating materials.

- **I-90 Ramp Site –** This site would be used primarily for storage.
- **Broad Street Right-of-Way –** Once Broad Street is closed, this area may be used for construction staging and storage.
- **City of Seattle Right-of-Way North of King Street –** Portions of the right-of-way along the Alaskan Way S. and the existing viaduct would be used for various construction activities such as secant pile wall construction, soil improvements, and viaduct demolition.
- **BNSF/Lenora Street Construction Zone –** This strip of right-of-way between approximately Pine Street and Bell Street, would be used for materials storage, viaduct demolition, and resurfacing Alaskan Way.
- **Battery Street Staging Areas –** The Seattle City Light parking lot just south of the Battery Street Tunnel and two other small parking lots on Battery Street would be used for construction staging for the Battery Street Tunnel or for materials storage.
- **North End Construction Staging Area –** This area would be used for construction staging, and closing and backfilling of Broad Street. For the Bored Tunnel Alternative, the TBM would be retrieved in this area.
- **North End Staging Area for Mercer improvements –** This site would be used for materials storage and construction office space.

Except for Terminal 106, Terminal 25, Terminal 46, and Pier 46, which are owned by the Port of Seattle, all of the potential staging areas are already owned by WSDOT, have been acquired in advance from willing sellers, or are other public rights-of-way. WSDOT and the Port of Seattle are in the process of developing agreements for the potential use of the Port of Seattle properties.

10 What construction haul routes are proposed?

During construction, City-designated truck routes would be used for transporting construction materials, oversized equipment, and spoils into and out of the construction zones for each of the build alternatives.

In the south project area, the primary construction access to the WOSCA site would be from S. Atlantic Street. Construction vehicles would enter the work area using a temporary construction road that would cross the southbound off-ramp of SR 99 north of Royal Brougham Way S. A temporary traffic signal would be installed at this intersection. Trucks leaving the construction area would merge with traffic on the southbound off-ramp from SR 99 and turn eastbound on S. Atlantic Street. Trucks accessing the WOSCA or T-46/Pier 46 construction staging areas could also use Edgar Martinez Drive S. (the eastern extension of S. Atlantic Street) to access I-5 and I-90. To maintain traffic operations on the temporary SR 99 off-ramp and along the S. Atlantic Street corridor between East Marginal Way S. and I-90, the number of construction trucks entering and exiting the WOSCA staging area would be restricted during weekday peak hours and stadium events. Trucks with over-legal loads could use First Avenue S. to Railroad Way S. to Alaskan Way S.

For the Bored Tunnel Alternative, spoils from tunnel boring would be transported using a conveyor system and hoppers to Terminal 46 and Pier 46 to be loaded on barges and transported to Mats Mats Quarry near Port Ludlow, Washington. Spoils excavated from other areas of the Bored Tunnel Alternative and for the Cut-and-Cover Tunnel or Elevated Structure Alternatives may be transported by trucks to Terminal 46 and Pier 46 to be loaded on barges or hauled on designated truck routes to locations south of the project area. Proposed southbound truck travel routes would be located on Alaskan Way, East and West Marginal Way S., and in some cases, west across the West Seattle Bridge to West Marginal Way SW.

In the north, potential haul routes being considered for each of the alternatives are:

- I-5 to Fairview Avenue N. to Denny Way to Sixth Avenue N. to the north end construction staging area
- I-5 to Mercer Street to the construction staging area

Until Broad Street is closed, another potential haul route from the north area would be to use Broad Street to Alaskan Way, and then south to Terminal 46. SR 99 could also be used as a potential haul route to and from locations north of the north end construction staging area.

11 What construction equipment and activities are common to the alternatives?

A wide variety of construction equipment, including specialized and custom-made machinery, would be needed to construct the build alternatives and demolish the existing viaduct structure. Throughout construction, materials and equipment would be stored primarily within the project area and existing road right-of-way.

Types of equipment that crews would use during construction include, but are not limited to cranes, bulldozers, loaders, excavators, extended-arm trackhoes with concrete-pulverizing attachment (concrete munchers), dump trucks, forklifts, grading and paving equipment, drilling rigs, generators, and welding equipment.

For viaduct demolition activities, crews would most likely use crunching/shearing attachments, concrete saws, concrete splitters, and cutting torches. For soil improvements, work crews would need specialty equipment such as drilling rigs for tunnel wall work, drilling rigs with mixing augers, and slurry processing equipment.

Construction for the Bored Tunnel Alternative would require an earth pressure balance TBM, as well as hoppers, conveyor belts, and barges to transport tunnel spoils.

Appendix C, Transportation Discipline Report

Appendix C, Chapter 4 includes a map of City of Seattle designated major truck routes. A number of streets could be used. The potential haul routes will be further defined by the contractor during final design.

Barges may also be used to transport materials for either the Cut-and-Cover Tunnel or Elevated Structure Alternatives. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would also need special equipment for dewatering processes, such as settlement and pretreatment storage tanks.

The following activities would take place for each of the alternatives:

- Relocate utilities
- Improve soils
- Remove existing viaduct

Relocate Utilities

Utilities in the project area include electric power, communication, water, sanitary, storm sewers, steam, and SDOT's traffic signal system. All underground utility relocations involve similar construction activities. Construction activities associated with underground utility relocations include pavement demolition, excavation, repaving, ground support systems, and groundwater control.

All utilities would be reviewed and approved on a case-by-case basis before they are relocated. In the south project area, major utility relocations will have taken place as part of the separate S. Holgate Street to S. King Street Viaduct Replacement Project, prior to construction for this project.

Utilities attached to the viaduct would be relocated before the viaduct is demolished. These utilities would be relocated underground, which would require excavation under the existing viaduct.

For the Bored Tunnel Alternative, construction of both the south and north portals would require excavation. Utilities within the footprint of both the retained cut and the cut-and-cover sections would need to be relocated, replaced, or protected.

For the Cut-and-Cover Tunnel Alternative, utilities would need to be relocated, replaced, or protected along the tunnel alignment, depending on the depth of the tunnel. Other relocations may occur during the initial stages of construction, and again in the final stage before the surface streets are restored.

For the Elevated Structure Alternative, utilities that do not conflict with the construction of the elevated structure or seawall replacement will remain in operation and be protected in place. The only utilities that would be located on the elevated structure would be those utility services needed for the operational roadway.

Improve Soils

In the south project area, most of the existing soils are soft fill material that could liquefy in an earthquake. Each of the alternatives would need soil improvements in the south project area under proposed aerial structures and retained fills to adequately support them. Soil improvements and stabilizing measures could use the following methods:

- **Compaction grouting –** This is a process that injects grout into soil to form a grouted "bulb" that displaces and consolidates the soil.
- **Compensation grouting –** This is a type of grouting that would use a controlled grout injection process that distributes grout into the ground from either drilled access shafts near the buildings or from the ground surface through small-diameter injection pipes. The pipes could be installed along the perimeter of the buildings and angled to reach the target areas under buildings, filling voids in the soil as shown in Exhibit 3-9.
- **Jet Grouting –** This is a process by which cement grout is injected into weak soils and then mixed to strengthen and stabilize the soil.
- **Ground freezing –** This is a process by which heat is extracted from a water-saturated soil mass, temporarily converting the water to ice, resulting in a consolidated soil mass as long as it remains frozen.
- **Underpinning –** This is a stabilizing measure that involves a building foundation support system to temporarily support vulnerable structures during construction.

For the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, soil improvements and stabilizing measures are needed near the south portal to protect other existing structures and utilities from settlement. Compensation grouting is likely the soil improvement method that would be used in this area. Compensation grouting would also likely be used along the bored tunnel alignment to

Compensation Grouting

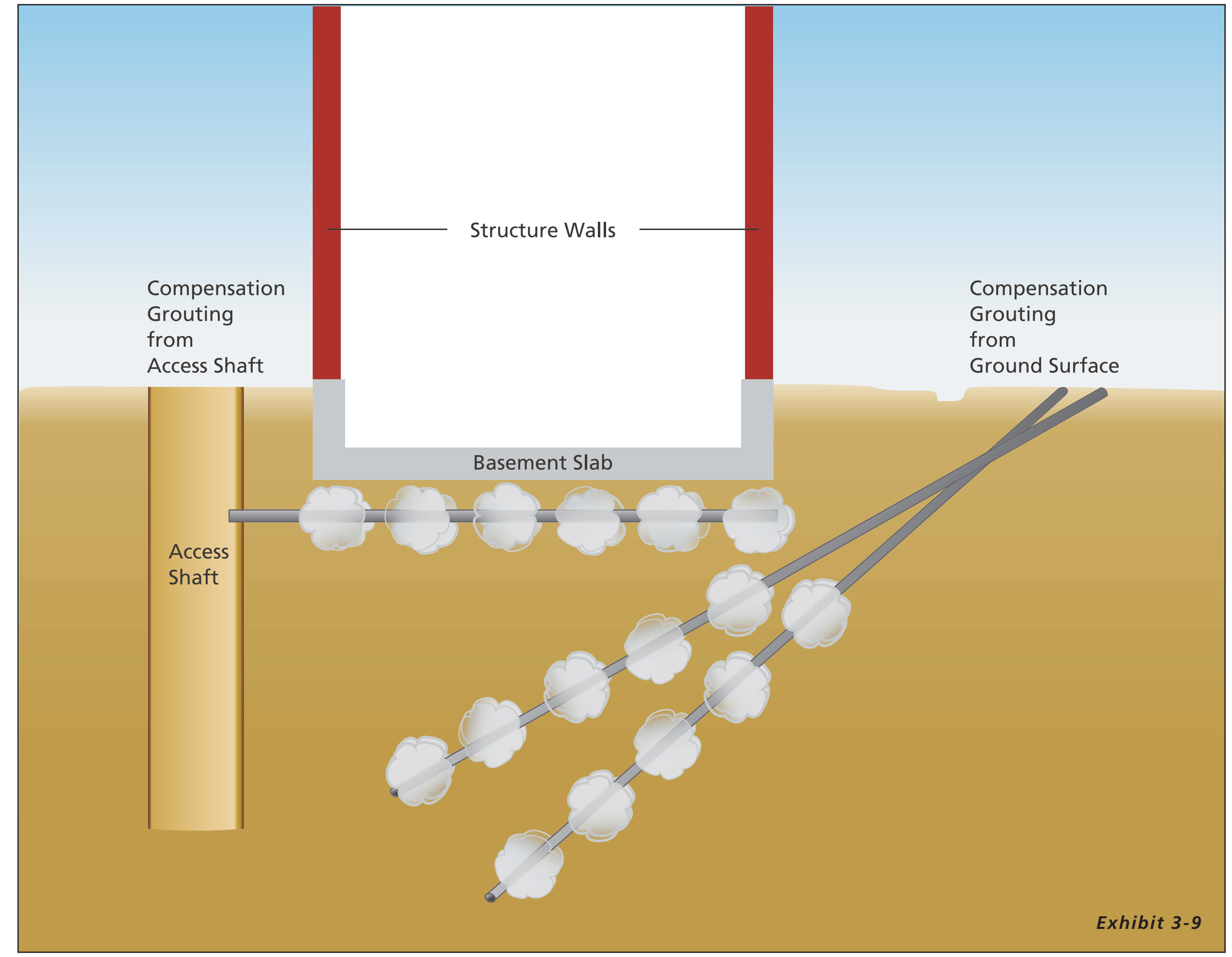


Exhibit 3-9

Appendix K, Public Services and Utilities Discipline Report

Appendix K provides greater detail regarding utility relocations and the construction effects on utilities.

What is grout?

Grout is a cement-like mixture used for filling spaces.

stabilize soft soils around the tunnel and mitigate potential ground loss.

Remove Existing Viaduct

All of the build alternatives would remove the existing viaduct from just south of S. King Street to the Battery Street Tunnel. Viaduct demolition would generate approximately 107,000 cubic yards of material, primarily broken concrete and reinforcing steel that would need to be hauled away and disposed of. Material would be hauled away in trucks, railcars, or barges to a predetermined disposal site. With the Bored Tunnel Alternative, some of the concrete may be used to fill the Battery Street Tunnel.

For the Bored Tunnel Alternative, demolition of the viaduct is anticipated to begin in January 2016 when the bored tunnel opens to traffic. Demolition would take approximately 9 months with two construction teams working at the same time in different locations. The construction teams would work on demolishing segments two blocks at a time, with each segment taking no more than 4 weeks.

For the Cut-and Cover-Tunnel Alternative, viaduct demolition would occur when the SR 99 corridor is closed to all traffic. The viaduct is anticipated to be torn down beginning in January 2016 and take about 6 months.

For the Elevated Structure Alternative, demolition of the viaduct between Pike Street and the Battery Street Tunnel would occur during a 6-month period beginning in late 2014. Traffic would be routed onto the Broad Street detour through this area. Demolition of the upper level of the viaduct between S. King Street and Pike Street would take approximately 3 months in early 2017 when SR 99 is closed to all traffic. Approximately 2 years later, when the new upper level is complete, the lower level of the viaduct would be demolished during about a 6-month period.

12 How would construction of the S. Holgate Street to S. King Street Viaduct Replacement Project relate to this project?

The section of the S. Holgate Street to S. King Street Viaduct Replacement Project from approximately S. Royal Brougham Way to S. King Street is within the same geographic area as this project (Alaskan Way Viaduct Replacement Project). This transition section would be constructed either as part of the S. Holgate Street to S. King Street project, or as part of this project. The two potential scenarios are:

1 If a ROD is issued for this project by late summer 2011 as planned, then the transition section would be constructed as part of this project. This project would then be responsible for connecting SR 99 from approximately S. Royal Brougham Way to the south portal of the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, or to the new aerial facility with the Elevated Structure Alternative.

2 If no decision is made on this project, or if the Viaduct Closed Alternative is selected for this project, then the transition section would be constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. Under this scenario, the transition section would be built to connect to the existing viaduct structure near S. King Street.

Construction in the transition section could occur for both the S. Holgate Street to S. King Street Viaduct Replacement Project and this project from fall 2011 through early 2014. If no decision is made on how to replace the viaduct along the central waterfront, the S. Holgate Street to S. King Street Viaduct Replacement Project would be built to reconnect to the existing viaduct structure near S. King Street with the new ramps to Alaskan Way. However, a ROD on replacing the central waterfront portion of the viaduct is expected in late summer 2011. The Alaskan Way Viaduct Replacement Project would then be responsible for connecting SR 99 from about S. Royal Brougham Way to the south portal of the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, or to the new aerial facility with the Elevated Structure Alternative.

The S. Holgate Street to S. King Street Viaduct Replacement Project is constructing the WOSCA detour. Southbound traffic on the SR 99 mainline will begin to use the WOSCA detour beginning about December 2011, and northbound traffic will begin using the detour beginning about May 2012. This project will also remove the viaduct structure from S. Holgate Street up to about S. King Street in mid-2012.

The WOSCA detour would continue to be used for construction of the Bored Tunnel, Cut-and Cover Tunnel, or Elevated Structure Alternatives.

13 How would the Bored Tunnel Alternative be constructed?

Bored Tunnel Alternative construction activities would begin around August 2011 and would last for 5.4 years (65 months). Construction activities are described in eight stages. Expected activities, sequencing, and durations are shown on Exhibit 3-10. These activities, sequences, and durations may change as the design is finalized with the contractor. SR 99 would remain open to traffic throughout the majority of the construction period. Lane closures would be required on some city streets throughout construction. The Bored Tunnel Alternative would completely close SR 99 only for a few weeks to connect SR 99 to the new bored tunnel.

The Bored Tunnel Alternative would relocate utilities, improve soils, and remove the existing viaduct, which are construction activities common to all alternatives identified in Question 11 of this chapter.

South Portal Construction

Utility relocations and soil improvements would take place as needed in the south project area. As construction begins, the WOSCA site would be prepared to support many of the construction activities for the bored tunnel, including construction material and excavated soil storage

What is the WOSCA Detour?

All of the build alternatives propose to use the WOSCA detour. This detour would route both directions of SR 99 traffic off of the existing viaduct between S. Royal Brougham Way and Railroad Way S. near Qwest Field. The detour would have two lanes in each direction with a temporary southbound off-ramp at S. Atlantic Street and northbound on-ramp at S. Royal Brougham Way. Construction detours and restrictions are further described in **Chapter 6, Question 1** and the WOSCA detour is shown in Exhibit 6-3.

Construction Activities Chart

STAGE ONE | STAGE TWO | STAGE THREE | STAGE FOUR | STAGE FIVE | STAGE SIX | STAGE SEVEN | FINAL STAGE

Begin August

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

In Months

Bored Tunnel

4 | 5 | 7 | 3 | 16 | 9 | 9 | 12 — **5 years 5 months**

STAGE 1 –

- **Relocate Utilities** – occurs periodically throughout all construction stages
- Begin compensation grouting from south portal up to Madison Street

STAGE 2 –

- Prepare WOSCA staging site
- Install shoring systems and excavation at south portal
- Continue compensation grouting up to Madison Street

STAGE 3 –

- Prepare WOSCA staging site
- Install shoring systems and excavation at south portal
- Complete compensation grouting up to Madison Street
- Construct support walls for the north portal and Tunnel Boring Machine (TBM) retrieval pit
- Excavate and construct secant pile walls in the north portal area

STAGE 4 –

- Install shoring systems and excavation at south portal
- Construct cut-&-cover tunnel sections at the south and north portals
- Construct north portal tunnel operations building
- Complete support wall and TBM retrieval pit at north portal
- Excavate and construct secant pile walls in the north portal area
- Widen Mercer from Fifth to Ninth Avenue N
- Construct new SR 99 overcrossing at Mercer

STAGE 5 –

- Construct south portal tunnel operations building
- Assemble TBM and begin boring
- Soil improvements may occur along the the alignment throughout tunnel boring
- Install interior tunnel structures and systems
- Complete construction of cut-&-cover section at the south portal
- Continue constructing north portal tunnel operations building
- Continue construction of cut-&-cover tunnel at north portal
- Construct Harrison ramps

STAGE 6 –

- Continue installing interior tunnel structures and systems
- Continue constructing both tunnel operations buildings
- Complete Harrison ramps
- Continue cut-&-cover section, excavation, and secant pile walls at north portal
- Disassemble and remove TBM
- Complete widening of Mercer
- Complete construction of SR 99 overcrossing at Mercer

STAGE 7 –

- Complete interior tunnel structures and systems
- Complete both tunnel operations buildings
- Complete cut-&-cover section, excavation, and secant pile walls at north portal
- Construct Republican ramps and Sixth Avenue N.
- Connect bored tunnel and Harrison Street ramps to SR 99
- Disassemble and remove TBM

FINAL STAGE –

- Demolish the viaduct from S. King to Battery Street
- Decommission Battery Street Tunnel
- Remove WOSCA Detour
- Restore surface streets and complete landscaping and lighting at both portals

Cut-&-Cover Tunnel

30 | 9 | 15 | 27 | 12 | 12 — **8 years 9 months**

STAGE 1 –

- **Relocate Utilities** – occurs periodically throughout all construction stages
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. Holgate to S. King Street Project –

- S. Holgate to S. King construction – *Complete early 2014*

STAGE 2 –

- Complete seawall construction from S. Jackson to Pike
- Start building the tunnel
- Construct retaining wall from Stewart to Blanchard

STAGE 3 –

- Continue tunnel construction
- Remove and replace southbound SR 99 from Pike to Battery Street Tunnel
- Begin construction of Partially Lowered Aurora

STAGE 4 –

- Remove viaduct from S. King to Pike
- Complete southbound tunnel
- Continue SR 99 construction from Pike to Battery Street Tunnel
- Complete Battery Street Tunnel improvements
- Continue north end construction and construct the Mercer and Roy bridges

STAGE 5 –

- Complete northbound tunnel
- Continue seawall construction from Pike to Broad
- Complete the northbound SR 99 from Pike to the Battery Street Tunnel

FINAL STAGE –

- Complete the seawall from Pike to Broad
- Restore Alaskan Way and complete landscaping & lighting
- Complete relocating utilities

Elevated Structure

30 | 9 | 27 | 3 | 24 | 21 | 3 | 3 — **10 years**

STAGE 1 –

- **Relocate Utilities** – occurs periodically throughout all construction stages
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. Holgate to S. King Street Project –

- S. Holgate to S. King construction – *Complete early 2014*

STAGE 2 –

- Construct Broad Street Detour
- Build new viaduct columns
- Construct retaining wall from Stewart to Blanchard

STAGE 3 –

- Complete seawall construction from S. Jackson to Pike Rebuild seawall from Pike to Broad
- Widen lower viaduct deck from S. King to Pike
- Remove and construct southbound SR 99 from Pike to the Battery Street Tunnel
- Begin constructing improvements to Battery Street Tunnel
- Begin constructing partially Lowered Aurora

STAGE 4 –

- Demolish upper viaduct from S. King to Pike
- Remove north-bound SR 99 from Pike to Battery Street Tunnel
- Complete partially lowered Aurora

STAGE 5 –

- Construct upper viaduct from S. King to Pike
- Build northbound SR 99 from Pike to the Battery Street Tunnel
- Complete Battery Steet Tunnel Improvements
- Build bridges at Thomas and Harrison

STAGE 6 –

- Demolish and rebuild lower level viaduct from S. King to Pike

STAGE 7 –

Connect structure to S. Holgate to S. King

FINAL STAGE –

- Restore Alaskan Way and complete landscaping and lighting
- Complete relocating utilities

Exhibit 3-10

and TBM maintenance. Construction offices would be located on the WOSCA property. If needed, a concrete batch plant may also be placed on the site.

The following activities would take place near the south portal area:

- Strengthen and support the existing viaduct
- Construct the tunnel's south portal
- Build the temporary electrical substation to power the TBM
- Support tunnel boring activities and remove tunnel spoils
- Connect the tunnel portal to SR 99 and restore surface streets

Strengthen and Support the Existing Viaduct

During south portal construction, the existing viaduct would be protected so that it remains safe for traffic. WSDOT and the design-build contractor would determine what measures are needed to strengthen the existing viaduct while construction and tunnel boring activities are underway. Possible methods that may be used are discussed below.

Between the First Avenue S. ramps and Columbia Street, plastic sheets that are reinforced with carbon fibers may be wrapped around the structure to strengthen the beams that support the roadway deck. Steel rods may also be used to strengthen the concrete beams.

Soil improvement methods and stabilization measures may also be used to support the existing viaduct from S. Washington Street to just north of Yesler Way, where the TBM would cross under the structure. Before the tunnel boring begins, columns of jet grout could be injected into soils to prevent the existing viaduct foundations from settling when the TBM bores under the structure. Jet grouting is a process by which cement grout is injected into weak soils and then mixed to strengthen and stabilize the soil as shown in Exhibit 3-11. In addition, hydraulic jacks could be installed on each column. If the column foundations at a location settle differently, the jacks could be raised or lowered to keep the beams that support the roadway deck level.

Construct the Tunnel's South Portal

Construction at the south portal would begin by building secant pile walls to support excavation for the tunnel portal. A deep cut would be excavated in the north end of the WOSCA property, where the TBM would be launched. The perimeter of secant piles would be constructed approximately between S. Royal Brougham Way and S. Main Street. This will reduce the risk of settlement and help to isolate the TBM from soil and groundwater as the tunnel begins boring underground. Two large concrete boxes would be built at either end of this stretch of secant piles. The concrete boxes would frame the TBM launch area to provide safer conditions for construction workers who perform inspections after the initial startup of the machine and for crews being trained to work on the project.

Once the walls are installed, the excavation would begin on the WOSCA property and Alaskan Way, at varying depths from approximately 12 feet to a maximum of 90 feet. Temporary tiebacks (and/or internal bracing struts) would also be installed for additional support. From about S. Main Street to about S. Washington Street, drilled shafts would be installed only along the east side of the tunnel to mitigate potential settlement of the existing viaduct.

Approximately 285,000 cubic yards of material would be generated from proposed excavations in the south portal area. All of this material would likely require off-site disposal. Demolition, foundation installation, and soil improvement activities would also generate some additional spoils, but the quantities are not yet known.

Within the excavation area for the south portal, a base would be built to support the assembly and launching of the TBM. The base would be a concrete and steel cradle that would include an approximately 9-foot-thick reinforced concrete slab.

Jet Grouting

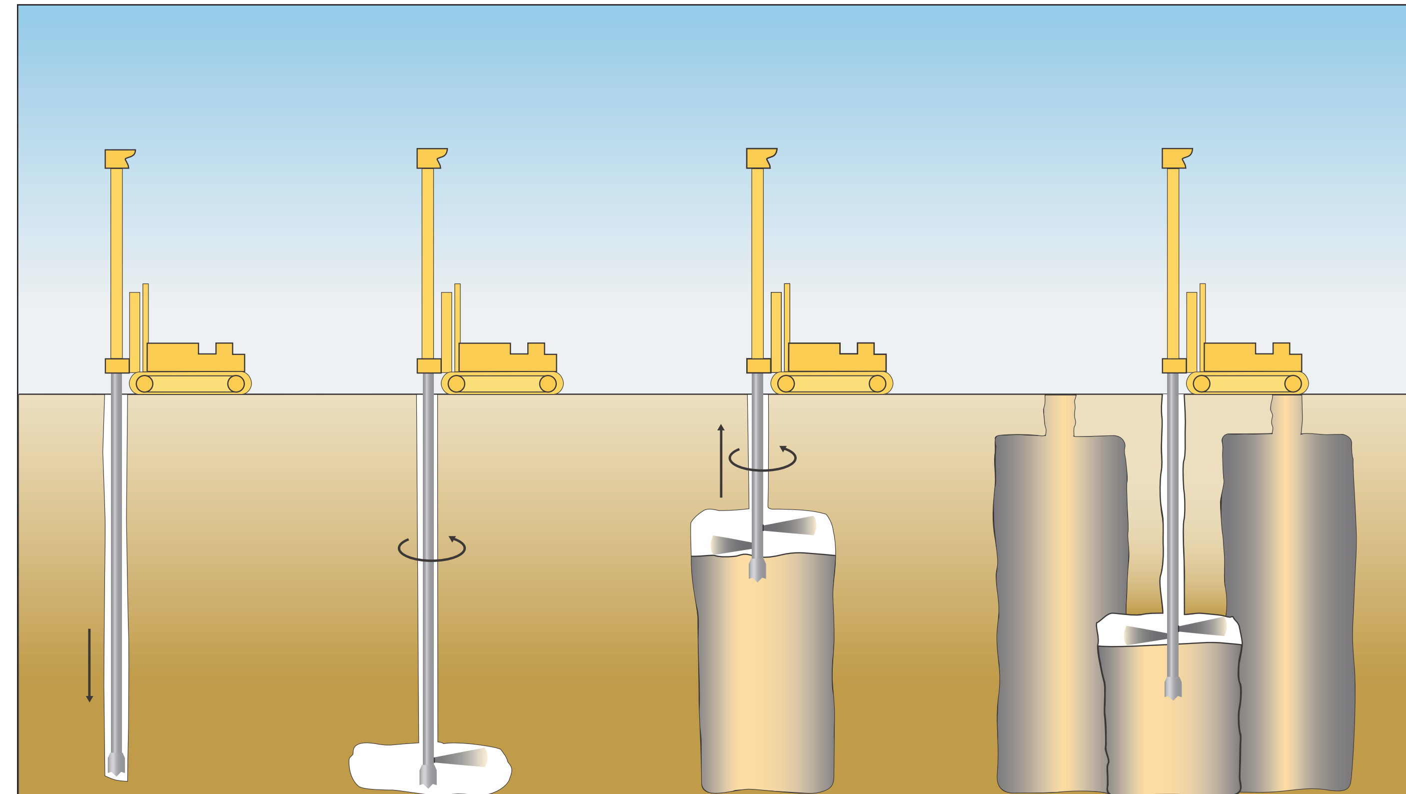


ILLUSTRATION COURTESY OF HAYWARD BAKER, INC.

Exhibit 3-11

Dewatering may be required throughout construction, particularly at the south portal area, to control groundwater flow into the excavated areas that are below the water table. Ground settlement that may result from dewatering activities would be mitigated with reinjection wells near the excavation area, supplied by water from the dewatering operation. If water quality monitoring indicated that the water required treatment, it would be treated prior to being discharged. Excess water would be treated and disposed of in the sanitary sewer under King County Wastewater Discharge Permit or Authorization conditions if necessary.

A tunnel operations building would be constructed near the south portal on the block bounded by S. Dearborn Street, Railroad Way S., and Alaskan Way S.

What are secant pile walls?

A secant pile wall is a type of retaining wall that is built by placing two concrete drilled shafts apart from each other. Then another shaft is placed between the first two shafts. This forms a continuous wall of interlocking shafts, called a secant pile wall.

Secant Pile Wall

Build the Temporary TBM Electrical Substation
The TBM would require its own electrical substation to provide power during construction of the bored tunnel. The TBM substation would be built on the WOSCA property. It would be about 75 feet by 125 feet and no more than two stories tall.

Support Tunnel Boring Activities and Remove Spoils
The south portal area would support tunnel boring activities. It would serve as the launching point for the TBM and the location where excavated material from the bored tunnel would be processed, stockpiled, and transferred into trucks, railcars, or barges for off-site disposal. It would also serve as an assembly site for constructing the tunnel's interior structures.

One building on the northeast corner of Terminal 46 would need to be demolished to accommodate the conveyor system and the handling of excavated materials.

Connect the Tunnel Portal to SR 99 and Restore Surface Streets
Once tunnel boring activities are completed, the on- and off-ramps to SR 99 would be built. A closure of several weeks would be required to connect SR 99 to the new bored tunnel and ramps.

The surrounding surface streets, such as First Avenue S. and Alaskan Way S., would be restored, which could include paving, restriping, and lighting. The East Frontage Road and new surface streets would be constructed between S. Royal Brougham Way and S. King Street, connecting First Avenue S. and Alaskan Way S. Landscaping, trails, and sidewalk improvements would be incorporated into surface roadways.

Bored Tunnel Construction
Bored tunnel construction would include the following activities:

- Procure, assemble, and launch the TBM
- Drive the TBM and remove soil and spoils
- Construct the internal tunnel structure and roadway

Bored Tunnel Potential Settlement Mitigation Locations

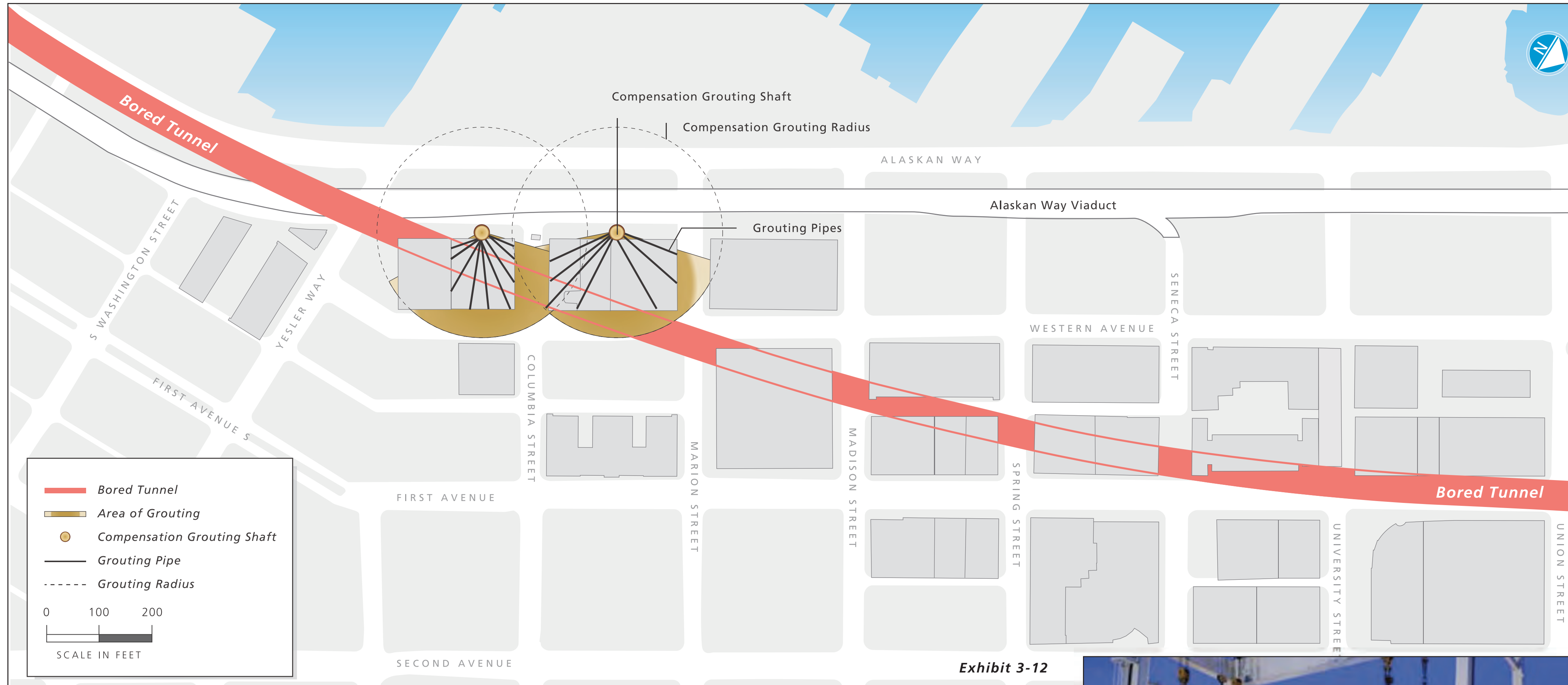


Exhibit 3-12

- Remove the TBM
- Install internal tunnel systems

Procure, Assemble, and Launch the TBM
The type of TBM designed for the Bored Tunnel Alternative would be an earth pressure balance machine. This machine maintains pressure at the face by retaining excavated soil in a chamber behind the cutterhead and balancing the rate of advance of the TBM with the rate of discharge of the excavated material. The TBM would be designed and procured during the first year and a half of construction. The TBM would then be assembled on the WOSCA site, which would take approximately 3 months. The TBM with trailing gear would likely measure at least 400 feet in length and approximately 56 feet in diameter.

The TBM would begin boring the tunnel just south of Railroad Way S.

Drive the TBM and Remove Soils and Spoils
Driving the TBM through the proposed tunnel alignment is estimated to take approximately a year and a half, assuming an average rate of advancement of approximately 30 feet per day. This would produce an average of approximately 2,600 cubic yards of material per day, which would fill approximately six trucks per hour.

While the TBM is advancing, approximately 900,000 cubic yards of soil would be excavated and an additional estimated 49,000 cubic yards of spoils may be generated by soil improvements. Along the south portion of the tunnel alignment, soil improvements would strengthen existing

Tunnel Boring Machine Being Assembled SOURCE: WWW.HERRENKNECKT.COM

What are spoils?

Spoils consist of soil along with other debris that is removed during a construction activity.

soil to better accommodate tunnel construction and protect structures and utilities from settlement. Improvements are needed in two locations along the bored tunnel alignment between Yesler Way and Madison Street, as shown in Exhibit 3-12, where soil types are more vulnerable to settlement and the tunnel would be at a relatively shallow depth. To avoid potential archaeological deposits, no soil improvements are planned along the bored tunnel alignment between S. Main and S. Washington Streets. Near the north portal, between John and Thomas Streets, soil improvements may also be considered. Soil improvement activities and stabilizing measures would occur throughout most of the construction period.

Along with the soil improvements and stabilizing measures described previously, an extensive and continuous monitoring process would be used during construction of the bored tunnel to provide early warning when soils settle beyond specific thresholds. These processes have been used in Europe under historic buildings and have been found to control settlement to within 22 millimeters,[5] about ¾ inch. Advance measures would be taken to prevent settlement, but unanticipated settlement could occur along the bored tunnel. If settlement does occur, emergency measures would be required to repair damage or to minimize further settlement. Emergency measures could require injecting grout from the ground surface to stabilize soils in adjacent areas or from within the tunnel. Soil stabilization measures could require closing traffic lanes, sidewalks, or access to basements of adjacent buildings.

With an earth pressure balance TBM, the excavated spoils would consist of mud with a toothpaste-like consistency. Soils would likely be removed from the tunnel using a conveyor system and hoppers. The material would then be conveyed to Terminal 46 and loaded onto a barge. Barged materials would be disposed of at the Mats Mats quarry in Jefferson County, Washington. Some material may be stockpiled and removed by truck.

Construct Internal Tunnel Structure and Roadway

The tunnel would be lined with precast concrete segments as it is excavated and has an internal diameter of approximately 52 feet. The internal walls and roadway decks may be constructed with a combination of precast components fabricated off site and cast-in-place concrete for specialized tunnel components. Precast components fabricated off site would be trucked to the WOSCA construction staging site using designated haul routes. Two levels of roadway deck would be installed in the tunnel to support two lanes of traffic in each direction.

Remove TBM

Tunnel boring would end near Thomas Street in the north end construction staging area. A retrieval pit would be excavated between Thomas and Harrison Streets so that the TBM could be disassembled and removed.

Install Internal Tunnel Systems

After the internal structures have been completely installed, components relating to mechanical, electrical, and control/instrumentation systems would be installed throughout the bored tunnel and portals. Once the bored tunnel construction is completed, the structures to connect the tunnel to existing SR 99 and the surrounding surface streets would be completed.

North Portal Construction

The following activities would take place near the north portal area:

- Construct the north tunnel portal
- Connect the north tunnel portal to SR 99
- Construct and restore surface streets

Construct the North Tunnel Portal

North portal construction would begin by building retaining walls along the eastern and western boundaries of the new SR 99 alignment between Thomas and Harrison Streets where the TBM would be removed. The interior structures housing the northbound and southbound roadway decks and connections to the tunnel ventilation structures would be built within this excavation. The tunnel operations building would be constructed adjacent to the north portal along the east side of Sixth Avenue between Thomas and Harrison Streets. The bored tunnel transitions to a cut-and-cover section north of Thomas Street, which would transition to a retained cut and finally an at-grade surface roadway at Roy Street. Based on the current level of design, an estimated 233,000 cubic yards of spoils would be generated from proposed excavations in the north portal area.

Connect the North Tunnel Portal to SR 99

At the north portal, a northbound on-ramp and southbound off-ramp would be constructed at the intersection of Harrison Street and Aurora Avenue. A northbound off-ramp would be constructed at Republican Street. A southbound on-ramp would be constructed from the new Sixth Avenue N.

Construct and Restore Surface Streets

Aurora Avenue would be filled and restored to grade between the Battery Street Tunnel and John Street. John, Thomas, and Harrison Streets would be connected across Aurora Avenue. Signalized intersections would be built at Denny Way and John, Thomas, and Harrison Streets.

Sixth Avenue N. would be extended north to connect with Mercer Street. Broad Street would be closed between Dexter and Taylor Avenues N. about 3 years into construction, then backfilled and replaced by the newly connected street grid. Landscaping and sidewalk improvements would be incorporated into the reconstruction of surface roadways and intersections.

Mercer Street would be widened to become a two-way street with three lanes in each direction with left-hand turn pockets. Two lanes would be closed from Dexter Avenue N. to Fifth Avenue N. for about 1.5 years while Mercer Street is widened and a new SR 99 bridge is built over the roadway. This activity would occur approximately 1.5 years into construction of the Bored Tunnel Alternative.

Chapter 6, Construction Effects

Refer to **Chapter 6** where construction closures, restrictions, and detours are discussed.

5 Littlejohn 2009.

What would happen to the Battery Street Tunnel?
The Battery Street Tunnel would be decommissioned and closed after the bored tunnel is open to traffic. As part of the Battery Street Tunnel decommissioning process, the tunnel may require remediation to remove soot containing high levels of lead and to remove asbestos within the tunnel. Decommissioning would also include disconnecting power, water, and drainage lines. The necessary utilities that run through the tunnel would be relocated, and materials such as lighting fixtures would be removed. Then the tunnel would be filled with suitable material (such as the concrete rubble from viaduct demolition), and all street access vents and both portals would be sealed. The rubble would be solidified with a concrete mix. The Battery Street Tunnel portals would be sealed with concrete and barricaded.

14 How would the Cut-and-Cover Tunnel Alternative be constructed?
Construction activities for the Cut-and-Cover Tunnel Alternative would begin around August 2011 and last for about 8.75 years (105 months). Construction activities are described in six stages. Expected activities, sequencing, and durations are shown on Exhibit 3-10. The Cut-and-Cover Tunnel Alternative would completely close SR 99 for 27 months. In addition, southbound SR 99 would be closed for 15 months prior to, and northbound SR 99 would be closed for 12 months after the complete closure. Lane closures would also be required on some city streets throughout construction.

The Cut-and-Cover Tunnel Alternative would relocate utilities, improve soils, and remove the existing viaduct, which are construction activities common to all alternatives identified in Question 11 of this chapter.

As construction begins, the WOSCA site would be prepared to support many of the construction activities for the cut-and-cover tunnel, including storage of construction materials and excavated soils. Construction offices would be located on the WOSCA property. If needed, a concrete batch plant may also be placed on the site.

The following construction activities would take place:

- Build the temporary Colman Dock ferry access bridge
- Rebuild the seawall
- Excavate and construct east tunnel wall
- Dewater, remove tunnel spoils, and construct portals
- Construct section from Pine Street to Battery Street Tunnel
- Upgrade the Battery Street Tunnel
- Construct SR 99 north of the Battery Street Tunnel and restore surface streets

Build the Temporary Colman Dock Ferry Access Bridge
A temporary ferry access bridge between Pier 48 and Colman Dock would be constructed to maintain vehicle access throughout construction. As shown in Exhibit 3-13, the temporary ferry access bridge would be approximately 300 feet long and would require in-water pile-supported foundations with above-water crossbeams in several locations. A barge and crane, a support barge, and pile-driving equipment would likely be used to do this work.

Rebuild the Seawall
Between S. King Street and S. Washington Street, soil improvements and new face paneling would replace the failing bulkhead at Pier 48. From S. Washington Street to where the tunnel ends near Pike Street, the western wall of the tunnel would replace the existing seawall. The western wall of the tunnel would most likely be a secant pile wall built behind the existing seawall. A secant pile wall is a wall of interlocking drilled shafts. The wall would be constructed of 4- or 5-foot-diameter drilled shafts that would extend about 90 feet below the street's surface. The shafts would overlap to form a continuous wall from S. Washington Street up past where the tunnel ends near Pike Street. It would take about 18 months to build the secant pile wall from S. King Street to Pike Street, which would occur at the beginning of construction. Multiple crews would be working at the same time. Construction steps for the secant pile wall are described below.

Temporary Ferry Access Bridge

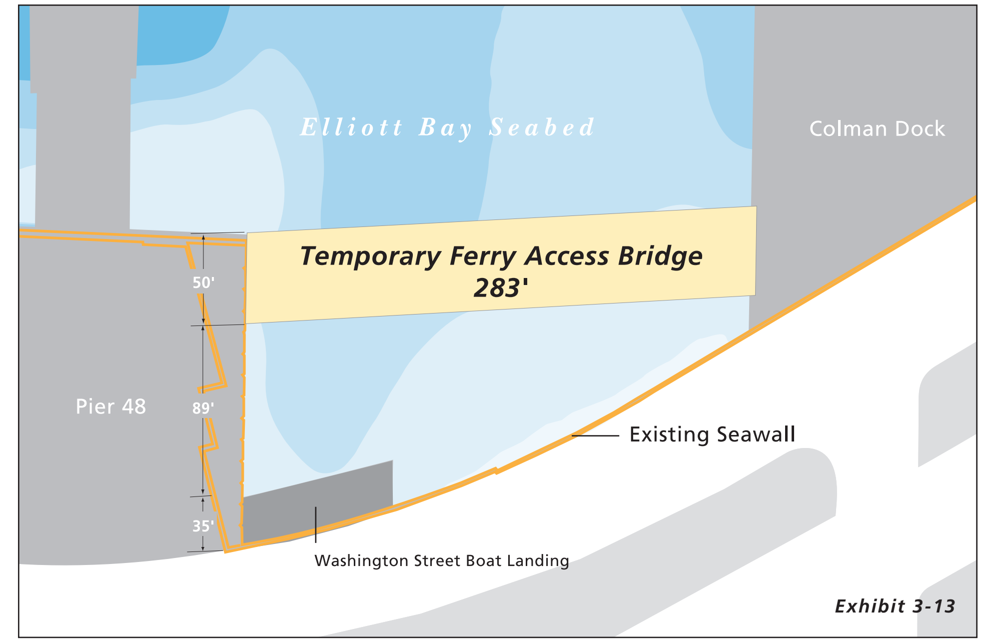


Exhibit 3-13

Step 1, Remove Sidewalk (above seawall) – In areas where the seawall would be rebuilt, crews would remove the existing sidewalk that extends out over the seawall. This activity is expected to take about 2 to 3 days for a 100-foot section of sidewalk. The sidewalk would be removed using concrete saws and cranes. Pedestrian access directly in front of the work zone would be rerouted.

Step 2, Install Protective Wall – Once the sidewalk is removed, crews may remove riprap adjacent to the seawall. During this activity, cranes and excavators would be parked on the landward side of the seawall. Once the riprap is removed, a sheet pile wall, silt curtain, or equivalent protective measure would be installed in front of the existing seawall to prevent construction debris from reaching Elliott Bay. If a sheet pile wall were installed, it would most likely be installed using vibration, rather than impact methods, to limit effects to surrounding aquatic life. These activities would take about 2 to 3 weeks at each 100-foot section.

Step 3, Remove Soil – Crews would excavate down to the seawall's relieving platform, which is about 15 feet below the Alaskan Way surface street. The excavated area would be about 15 feet deep and 40 feet wide. Backhoes and cranes would be used to dig and remove debris, and the material would most likely be removed from the site in trucks. Each 100-foot section would take 2 to 3 days to excavate.

Step 4, Build Secant Pile Wall – Crews would build the secant pile wall from S. King Street to Pike Street, which would be approximately 2,800 feet long. This wall would be constructed by building drilled shafts that overlap to form a secant pile wall. In general, the drilled shafts for this section would be built by drilling soil out of the shafts to the desired size (in this case, the shafts would have a circumference of about 4 to 5 feet and extend as far as 90 feet down to reach competent soil), installing rebar, and filling the hole with the concrete that forms the new drilled shaft.

Approximately 1,500 4- or 5-foot diameter shafts would be required for the secant pile wall. The number of shafts required would depend on the final project design. Engineers expect that it would take about 1 day to build each drilled shaft, although it is possible that up to two shafts could be built each day. Based on these production rates, it would take about 1 month to construct a 100-foot section of the secant pile wall (or a total of 29 drilled shafts). Each shaft needs 3 to 5 days for the concrete to cure before the overlapping shaft is installed, so if a construction crew were building a 100-foot section, they would build about 15 shafts along the entire 100 feet, and then they would come back and build the overlapping shafts to complete the section.

The seawall and SR 99 become separate structures north of Pike Street. For most of the areas between Pike and Broad Streets, the seawall would be replaced by strengthening the soil and replacing the existing seawall with a new face panel and L-wall support structure, as shown in Exhibit 3-14. Near Pier 66, between Blanchard and Battery Streets, only soil improvements are needed, because other improvements have already been made to this section of the seawall.

Excavate and Construct East Tunnel Wall
For the cut-and-cover tunnel, a slurry wall would be constructed to form the eastern tunnel wall. The wall would be about 3 feet wide and 90 feet deep along the entire length of the proposed tunnel. Construction of the eastern wall would most likely lag behind the secant pile wall construction by about 2 to 3 months so that the operations do not conflict. Both walls would be completed about the same time, because the secant pile wall extends farther north as a separate structure from Pike Street to Broad Street.

In general, slurry walls are constructed as described below:

- Concrete guide walls would be constructed on each side of the proposed 3-foot-wide slurry wall. The guide walls are usually constructed in a trench 3 to 5 feet deep.

- Slurry wall excavation would proceed in the trench between the guide walls. Excavated material would be replaced with a slurry mixture, which keeps the walls of the hole from caving in as excavation progresses. The excavation and slurry injection would continue down to the desired depth of the wall (from 75 to 90 feet in the central waterfront).

- Once the area is excavated, rebar (or steel beams) would be lowered into the hole through the slurry mixture.

- The hole would be filled with concrete. As the concrete fills the hole, the slurry material would be pumped out and stored for reuse. Slurry wall construction would continue until the wall is the desired length.

Dewater, Excavate Tunnel, and Construct Portals
Tunnel construction would require dewatering in advance of excavation to keep construction areas dry and to control the stability of the excavation. Water pumped out of the tunnel construction zone would either be reinjected back into the ground or discharged into the combined sewer system. If water quality monitoring indicated that the water required treatment, it would be treated prior to being discharged.

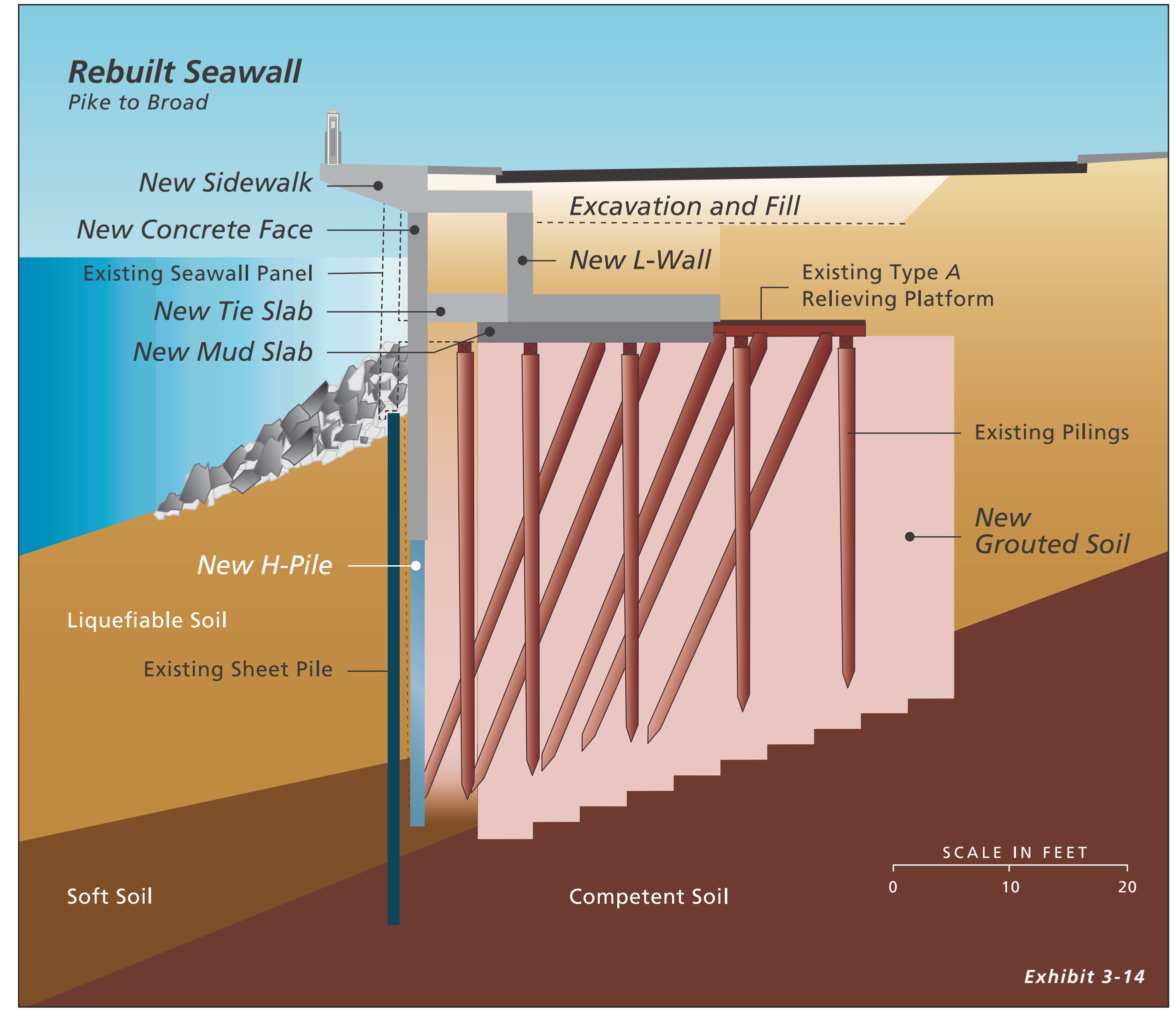


Exhibit 3-14

Construction of the tunnel and its portals would require extensive excavation of soil. Approximately 200,000 cubic yards of material would be excavated in the south area, and 1,235,000 cubic yards of material would be excavated along the central waterfront. Soil would be tested for contamination before being transported to an appropriate disposal facility by truck, rail, or barge.

Construction at both portals of the cut-and-cover tunnel would include building structural retaining walls. At the south portal, a tunnel ventilation and maintenance building would be constructed on the block bounded by

What is a slurry wall?

A slurry wall is a reinforced concrete wall constructed in an excavated trench. During excavation, a sealing mixture called slurry (made of bentonite and water) is used to support the excavated trench. Bentonite is clay that expands to help seal off groundwater flow and support the trench during excavation.

S. Dearborn Street, Railroad Way S., and Alaskan Way S. The ventilation and maintenance building at the north portal would be constructed between Alaskan Way S. and SR 99, just south of Pine Street. Maintenance and ventilation buildings would also be located at each end of Battery Street Tunnel.

Construct Section from Pine Street to Battery Street Tunnel
From about Pine Street north, a new above-grade roadway would connect the new waterfront tunnel to the Battery Street Tunnel, as well as to the Western and Elliott Avenue ramps. A concrete lid would be constructed over the southbound tunnel lanes at Pike Street and connect up to Victor Steinbrueck Park. Between approximately Pine and Virginia Streets, a new aerial structure would build new foundations made of drilled shafts. After crossing over the BNSF rail tracks, a cut section would be excavated under Elliott and Western Avenues and connect to the Battery Street Tunnel.

Upgrade the Battery Street Tunnel
The Cut-and-Cover Tunnel Alternative would improve the Battery Street Tunnel to meet current safety requirements for fire and seismic events, and the tunnel floor would be lowered to increase the vertical clearance in the tunnel to 16.5 feet. Construction activities would take place while SR 99 is completely closed to traffic and include:

- Upgrading the facility to meet seismic safety standards.
- Constructing air intakes on the south and north ends of the existing tunnel.
- Constructing up to four emergency exits (two on each side of the tunnel). These emergency exits are expected to be located near the intersections of Second Avenue and Battery Street and Fourth Avenue and Battery Street.
- Constructing tunnel maintenance and ventilation buildings at each end of the Battery Street Tunnel to house ventilation, electrical, mechanical, and communications systems.
- Replacing and upgrading the lighting system in the tunnel.
- Lowering the existing tunnel floor to increase the vertical clearance to 16.5 feet. The tunnel would be lowered by excavating soil in the existing tunnel and replacing the existing roadway in the tunnel.

Construct SR 99 North of the Battery Street Tunnel and Restore Surface Streets
North of the Battery Street Tunnel, the Cut-and-Cover Tunnel Alternative would include the following construction activities:

- Lowering the roadway profile of SR 99/Aurora Avenue by as much as 45 feet between Denny Way and Republican Street. The northbound lanes of SR 99 (or the east half) would be about 20 feet lower than the southbound lanes to accommodate the northbound on-ramp from Denny Way.
- Widening Mercer Street between Fifth and Dexter Avenues N. to accommodate two-way traffic.
- Connecting the street grid with new bridges over SR 99 at Thomas and Harrison Streets.
- Rebuilding the Denny Way northbound on- and southbound off-ramps.
- Building cul-de-sacs at John, Valley, and Aloha Streets.
- Closing and filling Broad Street from Fifth to Ninth Avenues N.

It would take approximately 36 months to build the improvements north of the Battery Street Tunnel. Construction crews would first relocate utilities and begin building the west half, or southbound lanes, of SR 99. A temporary retaining wall would be built in the middle of SR 99 to support the east half, or northbound lanes, of the roadway while the southbound lanes are under construction. Construction activities for the west half are:

- Building retaining walls from the north portal of the Battery Street Tunnel up to Harrison Street.
- Demolishing the southbound lanes of SR 99.
- Excavating the west half of SR 99 for the new lowered roadway; this could include dewatering if groundwater is encountered.

Once excavated, the new roadway bed would be built and connected to the southbound off-ramp to Denny Way. It would take about 18 months to build the southbound lanes before the roadway is opened to traffic.

Once the west half is completed, then the east half, or northbound lanes, of SR 99 would be constructed. Construction activities would be similar to those described for the west half, except the retaining wall would be deeper for the east side. In addition, a wall would be built between the northbound and southbound lanes from Denny Way to Republican Street. It would take about 12 months to build the northbound lanes.

Broad Street would be closed and backfilled from approximately Fifth Avenue N. to Ninth Avenue N., allowing the street grade to be reconnected. Mercer Street would be widened to seven lanes (three lanes each way, with a center turn lane). Bridges would be built at Thomas and Harrison Streets; and portions of Sixth and Taylor Avenues N. and Harrison, Thomas, and Roy Streets would be restored and constructed. The northbound on-ramp from Denny Way would be built, and utilities would be installed in their final locations.

15 How would the Elevated Structure Alternative be constructed?

Construction activities for the Elevated Structure Alternative would begin around August 2011 and would last for about 10 years (120 months). Construction activities are described in eight stages. Expected activities, sequencing, and durations are shown on Exhibit 3-10. The Elevated Structure Alternative would completely close SR 99 for about 3 months in 2017 and again for about 3 months in 2021. Lane closures would also be required on some city streets throughout construction.

The Elevated Structure Alternative would relocate utilities, improve soils, and remove the existing viaduct, which are construction activities common to all alternatives identified in Question 11 of this chapter.

As construction begins, the WOSCA site would be prepared to support many of the construction activities for replacing the viaduct, including storage of construction materials and excavated soils. Construction offices would be located on the WOSCA property. If needed, a concrete batch plant may also be placed on the site.

The following construction activities would take place:

- Build the temporary Colman Dock ferry access bridge
- Replace the seawall
- Construct Broad Street detour
- Construct new aerial structure
- Upgrade the Battery Street Tunnel
- Construct SR 99 north of the Battery Street Tunnel and restore surface streets

Build the Temporary Colman Dock Ferry Access Bridge
The Elevated Structure Alternative would construct the same temporary ferry access bridge as described for the Cut-and-Cover Tunnel Alternative and shown in Exhibit 3-13.

Replace the Seawall
The Elevated Structure Alternative proposes to replace the seawall from S. Washington Street to just north of Broad Street. The seawall would be replaced by strengthening the soil and replacing the existing seawall with a new face panel and L-wall support structure (shown in Exhibit 3-14). Near Pier 66, between Blanchard and Battery Streets, only soil improvements are needed, because other improvements have already been made to this section of the seawall. This is the same seawall design proposed north of Pike Street for the Cut-and-Cover Tunnel Alternative.

Construct Broad Street Detour
The temporary aerial trestle would be built over the railroad tracks at Broad Street from approximately the intersection of Alaskan Way and Vine Street up to the intersection of Broad Street and Western Avenue. The temporary trestle would be constructed using steel beams and precast concrete segments.

Construct New Aerial Structure
The Elevated Structure Alternative would construct a new viaduct in the central section from S. King Street to the Battery Street Tunnel. The aerial structure would be constructed by building new foundations made of drilled shafts. Driven piles and pile caps may be used in place of drilled shafts where greater structural support is needed. The superstructure would be completely replaced by precast components as much as possible.

Upgrade the Battery Street Tunnel
The Elevated Structure Alternative would have the same construction activities for improving the Battery Street Tunnel as described for the Cut-and-Cover Tunnel Alternative.

Construct SR 99 North of the Battery Street Tunnel and Restore Surface Streets
The Elevated Structure Alternative would have the same construction activities north of the Battery Street Tunnel as described for the Cut-and-Cover Tunnel Alternative.

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MAP COURTESY OF THE UNIVERSITY OF WASHINGTON SPECIAL COLLECTION

City of Seattle in 1891

CHAPTER 4 - THE PROJECT AREA

What is in Chapter 4?

This chapter describes existing conditions in the project area for the alternatives evaluated.

1 Where is the Alaskan Way Viaduct Replacement Project?

The Alaskan Way Viaduct Replacement Project proposes to replace State Route 99 (SR 99) from approximately S. Royal Brougham Way to Roy Street and remove the existing viaduct (SR 99) from approximately S. King Street to the Battery Street Tunnel.

2 What elements of Seattle's history have shaped the project area?

Viaduct replacement will be influenced not only by transportation needs and other uses in the project area, but also by the soil beneath Seattle. This soil forms the foundation of future improvements. For this reason, it is helpful to look at the forces that have shaped the land around and under downtown Seattle. Some of these forces are part of the human history of the project area, like the efforts of Seattleites in the late 1800s and early 1900s to level hills that stood in their way and extend the narrow shoreline where early Seattle took root. Equally important are the natural forces and physical geography of the land in the project area, which continue to affect it today.

Earth Movements

One of the major forces affecting the Seattle waterfront lies far beneath the coastal waters of Washington State. There, an upwelling of molten rock from deep within the earth is forcing apart the solid rock of the earth's crust along a long line that follows the coasts of Washington and Oregon. Over many millions of years, this slow but powerful force has fractured the ocean floor to a depth of several miles, splitting off a large piece of the earth's crust (named the Juan de Fuca Plate) and pushing it eastward on a slow-motion collision course with the coast of Washington.

At the point of collision, the Juan de Fuca Plate is pushed beneath the plate of land that makes up the west coast of the North American continent, as shown in Exhibit 4-1. The entire front edge of the North American Plate is uplifted (something like the prow of a boat being pushed up by a wave), while inland it is tilted downward. The uplifted edge is the Olympic Mountains, and the down-turned area is a trough between the Olympic Mountains and the Cascade Mountains. As the Juan de Fuca Plate slides beneath the North American Plate, friction between them causes both of them to compress, rotate, and fracture into pieces (sometimes miles across) in a broad area that includes the Seattle waterfront. The Seattle Fault Zone is the name for the boundaries between several of these fractured pieces, located at the southern end of the project area, as shown in Exhibit 4-2.

The movement of a great landmass can be gradual and imperceptible, but occasionally it can be sudden and abrupt, causing the entire landmass to shudder violently. This movement is what we experience as earthquakes. The strongest recorded earthquakes in the project area have originated from the Juan de Fuca Plate, after it has been forced far below the overlying North American Plate (to depths of 32 miles and greater). Earthquakes that occurred at these depths include the 1949 Olympia earthquake (magnitude 7.1), the 1965 Seattle-Tacoma

Cascadia Subduction Zone & the Juan de Fuca Plate

What is included in the project area?

The project area includes the overall area that could be affected by the project. The area described for each resource varies as shown in Exhibit 7-2.

Seattle Fault & Liquefaction Areas

earthquake (magnitude 6.5), and the 2001 Nisqually earthquake (magnitude 6.8).

Two other types of earthquakes may occur in the project area. Shallow crustal zone earthquakes occur 12 miles or less beneath the Earth's surface, when fractured pieces of the earth's crust move suddenly in an up/down direction (this is what happens in the Seattle Fault Zone). Interplate earthquakes—potentially the strongest quakes that could affect our area—occur at the interface between the Juan de Fuca and North American Plates. Although no interplate earthquakes have occurred in the project area in recorded history, geologists believe that in the past, this type of quake caused estuaries in our region to rapidly subside, lowering the elevation of coastal areas by several feet.

Rivers of Ice

To find the origin of most of the soil types in and around the project area, one needs to look back in geologic history, to the time when our region was shaped by the ice ages. Geologists have developed maps that show the types of soil found in the project area. The maps show a complicated variety of sand, silt, gravel, clay, peat, boulders, and various combinations of these soil types. Some of this variety is due to Seattleites digging, moving, and importing soil for a century and a half.

Beginning about 2 million years ago, the earth's climate went through at least six periods of cooling that caused glaciers to cover the Puget Sound region with vast sheets of ice flowing slowly in a generally southward direction. Each glaciation deposited new sediments and partially eroded previous sediments. During the intervening periods when glacial ice was not present, normal stream processes, wave action, and landslides eroded and reworked some of the glacial sediments, further complicating the geologic setting.

The last glacier to cover the project area 13,500 years ago is estimated to have been 3,000 feet thick. The massive ice flows bulldozed the land beneath them, gouging valleys, deepening Puget Sound, and pushing up huge piles of gravel and soil that became the hills that we know in present-day Seattle. The steep slopes in the area are a good example of landforms created by the force of these ancient ice flows. As the glaciers melted and retreated from the area in and around the project, they left behind enormous quantities of assorted material that was displaced by the scouring force of glacial movement. Although in a few spots in Seattle one can see bedrock right at the surface, in the project area, glaciers dumped layers of material over the bedrock. Most of this material was tightly compacted by the weight of the glaciers, while some of it was randomly deposited at the foot of retreating ice sheets. In the project area, the randomly deposited (unconsolidated) glacial soils and soils deposited in between glacial events are approximately 1,300 to 3,500 feet thick.[1]

Over the years, rock and soil were gradually weathered and altered by water, wind, and temperature. Creeks were fed by water percolating into the glacial soils. The shoreline in the project area was eroded by the forces of tides and waves. On occasion, the landscape would change dramatically—entire sections of hillside would break off and slide, creating bluffs like the one that can still be seen along the waterfront at Pike Street. Over time, the waters at the edge of Elliott Bay grew shallow and muddy as soils were carried downhill from as far away as Mt. Rainier and deposited near the shoreline, and the Duwamish River released its load of sediment. Periodically, eruptions from Mt. Rainier also instigated soil movement and deposition in tributaries that fed the Duwamish River. Finally, plants recolonized the glacier-scoured landscape, adding organic material to the barren soil and providing habitat for humans and for terrestrial and aquatic wildlife.

Throughout the project area, highly compacted glacial material provides a sturdy foundation for future improvements; however, recent sand and silt deposits lie on top of the glacial material. Most of the recent soil deposits in the project area were naturally washed down from the surrounding hillsides, carried by rivers draining the Cascade Mountains, or were placed as fill by humans much more recently. These deposits tend to be deeper in the south portion of the project area and along the waterfront. Much of the project area's geological story was played out thousands of years ago. To understand the whole story, however, we need to know how and why the land was changed to suit the ambitions of people who lived here before us.

Cultural Resources

More than 5,000 years before 18th-century European explorers first sailed Washington's inland waters, native peoples made their way to the shoreline of what is now downtown Seattle. Some of these peoples passed through, gathering for a while to take advantage of seasonal abundance, while others settled in permanent communities. The story of native peoples who lived in the project area is told largely by the remains of objects they left behind, such as matting, basketry, fish weirs, stone hearths, tools made of bone or stone, and shells and stones used in shellfish processing. Because only the most recent part of this history has been recorded, archaeologists believe that some of these objects may exist in a number of places within the project area, including beaches and tidal flats that have been filled, landslide deposits, former bluff tops, and the site of a ravine that was filled during the regrading of Seattle's hills where part of Belltown is now located.

More recent peoples—both native and European—also left behind physical evidence. Former tidelands and beaches that were filled between 1860 and the early 1900s may contain remnants of piers, wharves, roadbeds, discarded remains of household items, industrial refuse, and ballast dumped from visiting ships before they took on cargo. Former shorelines, areas on or below former bluffs, and areas near the bases of filled ravines may include objects deposited by native peoples who coexisted with the settlers who founded Seattle and the growing numbers of people that followed.

Leveling the Hills

When the first European settlers came to the shores of Elliott Bay, they saw a landscape that was very different from the one we see today. In much of what is now the

What tribes have cultural interests in the project area?

The lead agencies seek to address the concerns of tribal nations through ongoing consultations with tribes that have active cultural interests in the project area. These tribes include the Confederated Tribes and Bands of the Yakama Nation, Jamestown S'Klallam, Lower Elwha Klallam, the Muckleshoot Indian Tribe, the Port Gamble S'Klallam, the Snoqualmie Indian Tribe, the Suquamish Tribe, and the Tulalip Tribes. The lead agencies also consult with the Duwamish Tribe as an interested party.

Throughout the project, the lead agencies have involved the tribes by sending them information, contacting them by phone to discuss the project, requesting their input on tribal issues related to the project, and holding one-on-one meetings. The lead agencies will continue to communicate with the tribes about their concerns through project final design and construction.

For more information about tribal coordination, please see *Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report*.

1 Yount et al. 1985.

project area, bluffs and heavily forested hillsides plunged directly into the waters below, with only a few narrow beaches. Deep ravines along the shore made even a short overland trip difficult.

Because the steep hills were difficult to negotiate and build on, citizens of the growing community had to find inventive ways to make space for homes, businesses, and roads. Much of early Seattle, including wharves, mills, coal bunkers, streets, and railroads, was built out over the tidal mudflats on a jumble of wooden pilings. Much more ambitious was the effort to move soil from slopes too steep for development, and to use it to fill shallow areas along the shoreline.

Over seven decades from the 1870s to the 1930s, entire hilltops were leveled, at first by sluicing soil into tidal areas after removing it with giant jets of pressurized water, and later by using heavy equipment. The best known of these earth moving projects created the Denny Regrade (an area in downtown Seattle), whose name is a reminder that it was not always as flat as it is today. Other types of fill that were used to push the shoreline out into Elliott Bay included sawdust from local mills, ballast from visiting ships, assorted garbage, and sediments dredged from shallow waters to make them deep enough for ships to dock. In all, more than 2,000 acres of useable land were created by filling tidal wetlands and beaches along the waterfront and the Pioneer Square and South of Downtown (SODO) areas.

During an earthquake, this loose fill soil can turn into something very much like quicksand (geologists call the phenomenon "liquefaction"). Soils prone to liquefaction in the area are shown in Exhibit 4-2. As the soil slides and gives way, buildings, bridges, and roads settle, tilt, move around, and even collapse (some of the damage from the Nisqually earthquake was caused this way). The viaduct was built before we knew much about the Seattle Fault and the potential for earthquakes in the Puget Sound region.

3 What is the viaduct's condition today?

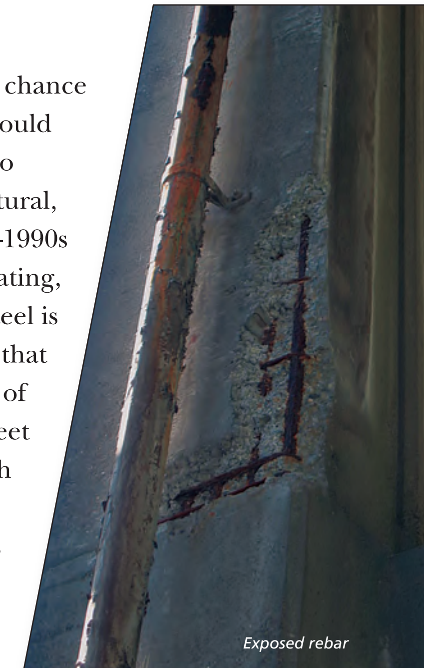
A 2007 study concluded that there is a 1-in-10 chance during the next 10 years that an earthquake could render the viaduct unusable or even cause it to collapse.[2] Investigations by engineering, structural, and seismic consultants beginning in the mid-1990s have clearly found that the viaduct is deteriorating, and vulnerable to earthquakes. Reinforcing steel is corroding and concrete is cracking—all signs that the viaduct is aging and approaching the end of its service life. The viaduct was designed to meet seismic criteria from the 1950s that were much less protective than today's standards. The Nisqually earthquake imposed extreme forces on the viaduct, and these forces were well beyond those the structure was designed for in the 1950s when it was built. At least two consequences of the extreme forces imposed during the Nisqually earthquake continue to affect the structural integrity of the viaduct today:

- Increasing cracks and crack widths
- Continued settlement of the viaduct's foundations

After the Nisqually earthquake, there were indications of early stages of soil liquefaction. As a result, Washington State Department of Transportation (WSDOT) made over $3.5 million of immediate repairs to some sections of the viaduct, particularly a one-block section near S. Washington Street. WSDOT also imposed roadway restrictions for large vehicles such as trucks and buses that remain in effect today. These restrictions prohibit vehicles weighing more than 10,000 pounds from using the two left lanes on each level of the viaduct. They also limit the use of the southbound exit to First Avenue S., which is located on the left side of southbound SR 99. Vehicles weighing more than 105,500 pounds are not allowed to use the viaduct.

In addition, the viaduct has several roadway deficiencies that confront drivers on a daily basis. These deficiencies occur on the main elevated structure, the on- and off-

Viaduct Deterioration


Exposed rebar


Steel reinforcing rods placed in weak columns as supports


Misaligned expansion joint

What is liquefaction?

Liquefaction is what can happen to loose soils when shaking motion from an earthquake causes the soil to turn into a quicksand-like condition. This can cause foundations to fail.

Appendix C, Transportation Discipline Report

The transportation safety concerns and collision rates associated with the existing viaduct are further described in *Appendix C*, Section 4.12.

2 Parsons Brinckerhoff 2007.

ramps, and in the Battery Street Tunnel. Viaduct roadway deficiencies include the following:

- **Narrow lane widths –** In some places, lanes are too narrow (less than 10 feet wide). Highways built to today's standards usually have lanes that are 11 or 12 feet wide.

- **Narrow shoulder widths –** Narrow shoulders or no shoulders.

- **Insufficient merge lane lengths and/or auxiliary lanes –** The length of the merge lanes to and from the ramp connections are too short, which makes it difficult for drivers using the ramps to safely enter and exit SR 99.

- **Inadequate guardrails –** The railing on the viaduct is not as strong as barriers used for modern construction.

- **Inadequate sight distance –** In some locations, drivers cannot see far enough ahead of their vehicles to react to roadway conditions.

These deficiencies contribute to SR 99 having a higher collision rate than the average urban, limited-access highways in the state. The majority of accidents on SR 99 are fixed-object or rear-end collisions. Fixed-object accidents were most common on the SR 99 mainline, most likely due to barriers close to moving traffic. Most of the accidents on ramps were rear-end collisions. Traffic backups due to signals near SR 99 off-ramps and design deficiencies such as ramps with inadequate acceleration/deceleration lengths can contribute to rear-end accidents.

4 What are key features of Seattle's downtown roadway network?

The transportation study area examined depends on the transportation metric examined. The primary transportation study area examined for this Final Environmental Impact Statement (EIS) is roughly bounded by Interstate 5 (I-5) to the east, Elliott Bay to the west, S. Spokane Street to the south, and Aloha Street to the north. This area includes a range of multimodal transportation facilities, including limited-access highways (I-5 and SR 99), connections to limited access highways (SR 519), local streets, high-occupancy vehicle (HOV) facilities (e.g., Downtown Seattle Transit Tunnel), transit and ferry services, nonmotorized facilities, and freight corridors.

Seattle's Center City is also a useful area for reference. The Seattle Center City area represents the core of Seattle, in terms of geography and density of jobs and housing. This area is roughly bounded by S. Royal Brougham Way in the south, just north of Mercer Street to the north, Broadway to the east, and Elliott Bay to the west. Modeled changes in travel patterns outside the primary study area were studied, and include broader areas such as the four-county region (King, Pierce, Snohomish, and Kitsap counties).

SR 99

SR 99 is an important part of the local and regional transportation network, as shown in Exhibit 4-3. Within the project area, it provides access to and through downtown for many parts of the western neighborhoods of Seattle and provides freight access between the Interbay/Ballard areas and the SODO and Duwamish industrial areas. It is an important alternative route parallel to I-5, the most heavily used highway in the Pacific Northwest. SR 99 also provides an important link to major league sports stadiums at the south end of downtown and access to I-90 for trips coming from northwest Seattle.

Access to and from SR 99 is currently provided by ramps at First Avenue S. near the stadiums, at Columbia and Seneca Streets, at Elliott and Western Avenues, and at Denny Way just north of the Battery Street Tunnel. There are also a number of streets where drivers can access SR 99 via right-on and right-off maneuvers in the South Lake Union area. The S. Holgate Street to S. King Street Viaduct Replacement Project will provide additional access to and from SR 99 via a new on-ramp and off-ramp that will connect to Alaskan Way near S. King Street.

In the project area, SR 99 provides two lanes in each direction for through traffic. Additional lanes in the south, central, and north sections collect and distribute traffic to destinations near the stadiums and Pioneer Square,

Regional Roadway Network

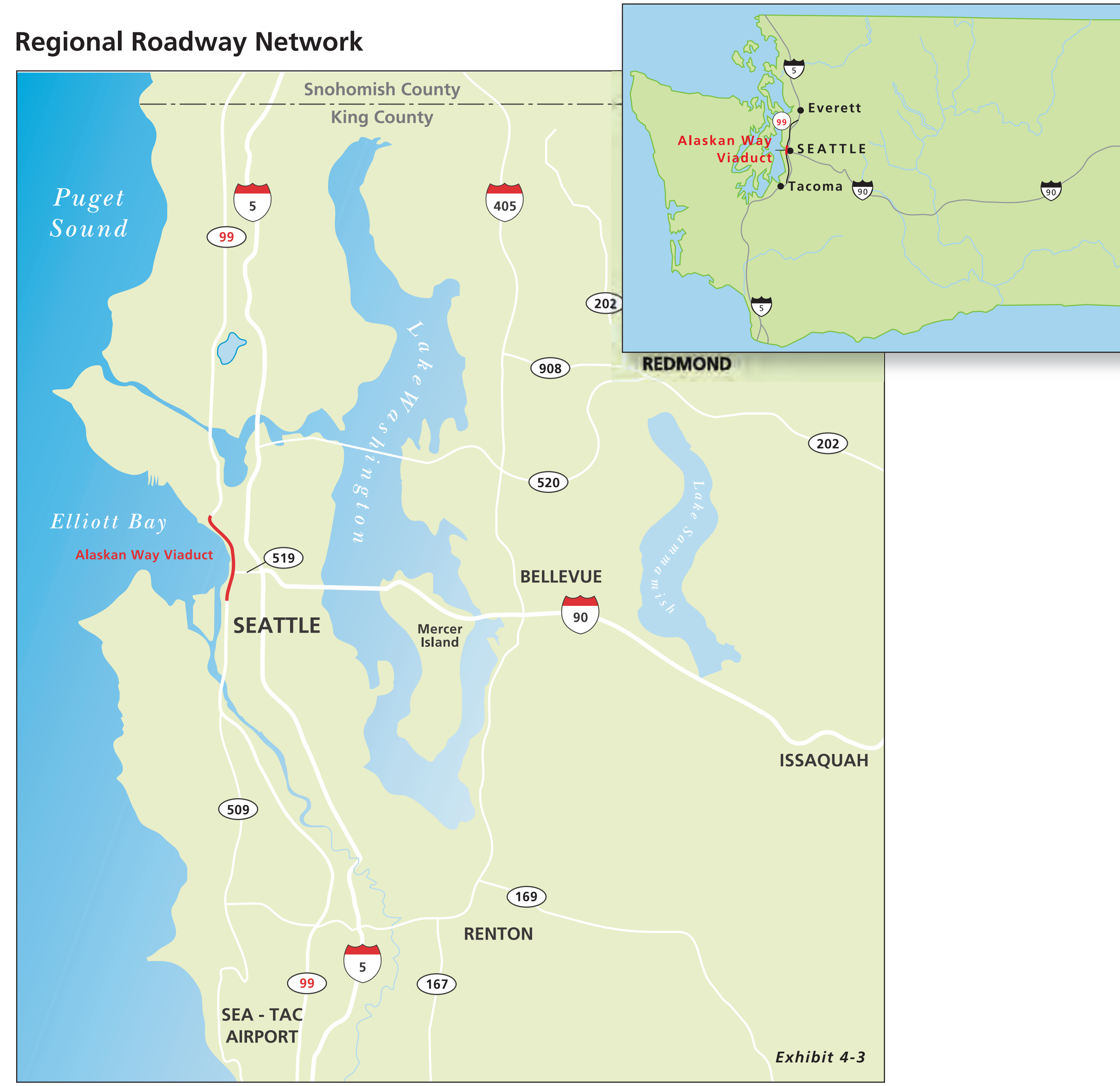


Exhibit 4-3

downtown, and the Seattle Center/South Lake Union area, as shown in Exhibit 4-4.

I-5

I-5 is a major interstate freeway that runs the length of the west coast from the Mexican border south of San Diego, California, to the Canadian border north of Bellingham, Washington. I-5 is the most used and most important highway corridor in the region. Within the transportation study area, I-5 runs north-south just east of downtown. The corridor serves a number of roles, including freight transport, commuting, and longer-distance regional trips.

I-5 varies from two to five travel lanes in each direction with additional collector-distributor lanes providing access to downtown ramps and accommodating merging traffic from I-90 and SR 520. Two continuous lanes are provided through downtown in each direction, as other lanes are added or dropped to provide access in downtown. In addition to the mainline, a reversible set of express lanes provides HOV access to and from downtown and additional capacity for general-purpose through traffic.

SR 519

SR 519 is a short segment of state highway that provides connections to and from I-90 and I-5 near S. Royal Brougham Way and S. Atlantic Street/Edgar Martinez Way. These connections provide freight traffic to and from Port of Seattle facilities with access to major freeways. It also provides general traffic with access to the stadiums, Colman Dock ferry terminal, the central waterfront, and SODO area. Finally, it provides reliable and safe connections for the high volume of vehicles and pedestrians that use this area to be separated for nearby rail activities.

Local Streets

Seattle city streets provide critical connections and additional through-traffic capacity for vehicles and transit; Exhibit 4-4 shows the downtown street network. Approximately 42 percent of all daily users (vehicle and transit) on the viaduct have one trip end in downtown Seattle. Therefore, connections to the downtown street network are important.

5 How are existing conditions evaluated in this EIS?

This chapter describes many study area conditions as they now exist, but transportation conditions are described as they may exist in 2015. Transportation conditions in 2015 are described because notable changes to the regional transportation network are currently being implemented. Including these imminent changes in the description of the affected environment more clearly shows conditions that will exist in the area and the effects of this project on the transportation network.

Specific transportation network changes that have recently been completed or are underway include:

- Construction of the S. Holgate Street to S. King Street Viaduct Replacement Project
- Implementation of RapidRide transit service between downtown and West Seattle, Ballard, and along Aurora Avenue/SR 99
- Completion of the SR 519 – South Seattle Intermodal Access Project

Construction of the S. Holgate Street to S. King Street Viaduct Replacement Project, which began in August of 2010, is expected to be completed in 2014. This section of SR 99 is being replaced with a new side-by-side roadway that will have three lanes in each direction. A northbound off-ramp and southbound on-ramp is provided to Alaskan Way S. just south of S. King Street.

The S. Holgate Street to S. King Street Viaduct Replacement Project will create two new multi-purpose bicycle/pedestrian facilities between S. Royal Brougham Way and S. King Street. The Port Side Pedestrian/Bicycle Facility will run along the western edge of the Alaskan Way Surface Street, while the City Side Trail will run between SR 99 and First Avenue S.

SR 99 Existing Lane Configuration

Exhibit 4-4

Why are 2015 transportation data used to reflect existing conditions?

Previous EISs for this project used year 2005 conditions to describe the affected environment for the project area. The affected environment describes the context, or setting, of the project. However, for the Final EIS, the year 2015 was chosen to reflect the affected environment based on projects recently completed or currently underway. The S. Holgate Street to S. King Street Viaduct Replacement Project affects access to the Alaskan Way Viaduct. The project is funded, under construction, and will be complete by 2015. SR 519 has also been recently modified resulting in new traffic patterns in the south area and needs to be captured as part of the affected environment. Based primarily on these two projects, it was determined that 2015 would serve as a better description of the project setting in the Final EIS than 2005 conditions.

In addition to the S. Holgate Street to S. King Street Viaduct Replacement Project, by 2015 transit riders to downtown Seattle will benefit from the implementation of RapidRide, an enhanced bus service that will have unique low-floor buses with wider aisles, three doors, and faster fare collection for shorter travel times. Service will be frequent, with trips every 10 minutes or less in the peak periods and every 15 minutes or less in the off-peak periods. The C Line, serving West Seattle, is scheduled to be completed in 2012, although some of the new service will be implemented in 2011. The D Line, serving Ballard-Uptown, is scheduled to be implemented in 2012. The E Line serving Aurora Avenue N. is scheduled to be implemented in 2013. The C, D, and E Lines will all serve downtown Seattle via Third Avenue.

The completion of the SR 519 South Seattle Intermodal Access Project in 2010 improved connections to I-90 and I-5 for traffic heading to the Port of Seattle terminals, Colman Dock ferry terminal, central waterfront area, sports stadiums, and destinations in Seattle's SODO neighborhood. The project constructed the S. Atlantic Street on-ramp to I-5 and I-90, which separates road and railway traffic and improves access from the Port of Seattle and Seattle Ferry Terminal to I-5 and I-90. The project also constructed the Royal Brougham Way Bridge and the I-90/I-5 off-ramp to S. Atlantic Street, which eliminated the remaining safety concerns related to surface-level rail crossings on S. Royal Brougham Way, and provides safe and efficient waterfront and stadium access for drivers and freight haulers.

6 How much traffic is estimated to travel on SR 99, in Seattle, and in the region each day?

Though daily traffic volumes on SR 99 are estimated to vary considerably depending on location, the viaduct is estimated to carry about 20 percent of downtown traffic traveling north-south each day near Seneca Street. I-5 is estimated to carry about 54 percent, and the local streets collectively are estimated to carry approximately 26 percent. Because traffic volumes on SR 99 vary from location to location, these proportions would be different depending on location. For example, SR 99 volumes near Yesler Way are estimated at about 116,000 vehicles per day; volumes north of Seneca are estimated at about 98,500 vehicles per day, and volumes through the Battery Street Tunnel are estimated at around 70,000 vehicles per day.

Exhibit 4-5 provides data showing the estimated vehicle miles of travel (VMT) and vehicle hours of delay (VHD) for all modeled roadways located in the Seattle Center City and within the broader four-county region (King, Pierce, Snohomish, and Kitsap counties). VMT indicates how many miles vehicles travel on the roadway network. VHT (vehicle hours of travel) measures how long travelers spend on the roadway system, and VHD measures the number of hours lost by travelers due to traveling at a speed less than the posted speed limit.

Exhibit 4-5
2015 VMT, VHT, and VHD for Seattle Center City and Region

Measure	AM Peak	PM Peak	Daily
SEATTLE CENTER CITY			
Vehicle miles of travel (VMT)	431,900	536,600	2,425,200
Vehicle hours of travel (VHT)	16,900	26,800	87,200
Vehicle hours of delay (VHD)	5,300	9,100	23,000
FOUR-COUNTY REGION			
VMT	18,003,800	21,210,200	97,141,400
VHT	746,800	857,400	3,310,100
VHD	253,600	271,400	678,300

Vehicle volumes are estimated at selected locations (called screenlines) to gauge the effects such volumes may have on nearby parallel facilities. Exhibit 4-6 summarizes the estimated combined daily vehicle volumes expected to travel on SR 99, I-5, and city streets in 2015 at selected locations in the transportation study area.

Exhibit 4-6
2015 Estimated Daily Vehicle Volumes
on SR 99, I-5, and City Streets at Selected Locations

Location	Daily Vehicle Volumes
South – south of S. King Street	535,200
Central – north of Seneca Street	474,900
North – north of Thomas Street	548,800

Analysis uses person-trips to measure the number of people that use the transportation system, rather than vehicles. Exhibit 4-7 summarizes the estimated combined daily person-trips that are expected to travel on SR 99, I-5, and city streets in 2015 at selected locations in the transportation study area.

Exhibit 4-7
2015 Estimated Daily Person Throughput
on SR 99, I-5, and City Streets at Selected Locations

Location	Total Person Throughput	Transit Riders
South – south of S. King Street	787,900	101,100
Central – north of Seneca Street	728,700	126,700
North – north of Thomas Street	791,200	118,400

7 Where are the people using the viaduct coming from and going to?

SR 99 is an important route to, from, and through downtown Seattle. SR 99 primarily serves short regional trips and trips within Seattle. Regional trips served by SR 99 include trips from northwest Seattle neighborhoods to the Seattle-Tacoma International (Sea-Tac) Airport or trips from downtown to Shoreline or Burien. Examples of Seattle trips include those to or from West Seattle, South Park, Downtown, Belltown, South Lake Union, Queen Anne, Magnolia, Ballard, and Fremont.

SR 99 serves as a major freight corridor providing access for businesses in the SODO and Duwamish industrial areas to northwest Seattle neighborhoods. SR 99 is an important route for freight to and from the Ballard and Interbay manufacturing and industrial area. WSDOT classifies the viaduct section of SR 99 as a freight corridor carrying more than 10 million tons per year—the highest classification made. Also, SR 99 is an important link to Safeco Field, Qwest Field, and Seattle Center.

Modeling indicates that 44 percent of travelers using the viaduct would be heading to or coming from Seattle's downtown central business district by 2015. The remaining 56 percent of travelers would use SR 99 to travel through downtown. Specifically, 23 percent of travelers would pass through downtown to nearby locations just north or south of downtown, such as SODO, Capitol Hill, Queen Anne, or South Lake Union. The remaining 33 percent of travelers on SR 99 are making longer-distance through trips, such as trips from Ballard to Burien.

Appendix C, Transportation Discipline Report

Regional traffic demand and traffic distributions for SR 99, I-5, and city streets are further discussed in *Appendix C*, Section 4.1.4.

Travel speeds on SR 99 are discussed in *Appendix C*, Section 4.2.3.

What area does Seattle Center City refer to?

The area defined as Seattle Center City is roughly bounded by S. Royal Brougham Way in the south, just north of Mercer Street to the north, Broadway to the east, and Elliott Bay to the west.

What are VMT, VHT, and VHD?

- Vehicle miles of travel (VMT) is a measure of how many miles vehicles travel on the roadway network.
- Vehicle hours of travel (VHT) indicates how long travelers spend on the roadway network.
- Vehicle hours of delay (VHD) measures the number of hours lost by travelers due to traveling at a speed less than the posted speed limit. VHD is often used as an indicator of congestion.

Where are SR 99 travelers coming from and going to?

To understand who uses this section of SR 99, the project team studied where SR 99 travelers are coming from and going to (origin and destination study). Additional information about this study is provided in *Appendix C, Transportation Discipline Report*, Section 4.1.4.6.1.

Where are access points provided to and from SR 99?
Between S. Spokane Street and the Battery Street Tunnel, all access to SR 99 is provided via ramps. North of the Battery Street Tunnel, access is mostly provided by surface street connections. Exhibit 4-8 shows SR 99 access and ramp locations and the number of vehicles estimated to be using those connections in 2015. As shown in Exhibit 4-8, daily traffic volumes on SR 99 are fairly balanced for northbound and southbound traffic. Exhibit 4-9 describes the connections.

Exhibit 4-9
Existing Connections Provided To and From SR 99

Connections	Access Descriptions
To/From Stadium Area	Access at First Avenue S. is provided by: • a northbound on-ramp along Railroad Way S. • a southbound off-ramp along Railroad Way S.
To/From Downtown Seattle	Access is provided by: • a northbound off-ramp at Seneca Street • a southbound on-ramp Columbia Street By 2015, access as part of the S. Holgate Street to S. King Street Viaduct Replacement Project will include: • a northbound off-ramp to Alaskan Way near S. King Street • a southbound on-ramp to SR 99 near S. King Street
To/From Elliott and Western Corridor	SR 99 connections are provided by: • a northbound off-ramp at Western Avenue • a southbound on-ramp at Elliott Avenue • a northbound on-ramp near Battery Street • a southbound off-ramp at Battery Street
To/From South Lake Union	Access is provided by: • a northbound on-ramp and southbound off-ramp at Denny Way • a southbound off-ramp at Broad Street • a northbound off-ramp at Mercer Street/Dexter Avenue N. • several side-street connections

8 What are typical travel conditions on SR 99?

What are typical traffic patterns on SR 99?
Daily SR 99 traffic volumes are fairly balanced between north- and southbound traffic, and that trend is expected to continue in 2015. However, during the morning and evening commutes traffic volumes are directional, with heavier volumes headed toward downtown during the AM peak hour (8:00 a.m. to 9:00 a.m.) and heavier volumes leaving downtown during the PM peak hour (5:00 p.m. to 6:00 p.m.).

How does traffic flow on SR 99?
During non-peak hours, there is less congestion on SR 99 so travelers typically find faster operating speeds. During the morning and evening commutes, drivers on SR 99 experience reduced speeds in some locations. Exhibit 4-10 shows estimated speeds on SR 99 in 2015.

Exhibit 4-10
Estimated Average Traffic Speeds on SR 99 during Peak Hours in 2015
in miles per hour

		SOUTHBOUND		NORTHBOUND	
SR 99 Segment	Speed Limit	AM Peak	PM Peak	AM Peak	PM Peak
S. Spokane Street to Stadium Ramps	50 40 trucks	48	32	37	46
Stadium Ramps to First Avenue S. Ramps	50 40 trucks	49	42	27	35
First Avenue S. Ramps to Seneca/Columbia Ramps	50 40 trucks	24	31	22	21
Seneca/Columbia Ramps to Elliott/Western Ramps	50 40 trucks	36	43	17	14
Battery Street Tunnel	40 35 advisory	33	33	33	33
North of the Battery Street Tunnel	40	25	33	35	33

SR 99 travelers are expected to experience delay and substantially reduced travel speeds between First Avenue S. and the Columbia and Seneca ramps during the morning and evening commutes in 2015. As noted previously, by 2015 about 44 percent of travelers on SR 99 are expected to be heading to or from downtown. Reduced speeds in this section confirm that a high volume of trips are heading to or leaving downtown using the Columbia and Seneca ramps. The Columbia on-ramp offers very little room for drivers to accelerate as they enter the highway. This design deficiency, coupled with slowdowns caused by traffic weaving to access the First Avenue S. off ramp, leads to decreased travel speeds for southbound traffic during the evening commute. During the morning commute, traffic in this area backs up due to weaving movements associated with the northbound on-ramp at First Avenue S. and traffic queues at Seneca Street that can back up onto SR 99.

Traffic in both directions is expected to slow during peak commute hours through the Battery Street Tunnel. This is due to a combination of high traffic volumes and roadway constraints such as narrow lanes and limited shoulders.

2015 SR 99 Existing Daily Ramp and Traffic Volumes

Exhibit 4-8

What is the AM peak hour and the PM peak hour?

The AM and PM peak hours occur when traffic is heaviest during the morning and evening commutes. For SR 99, the AM peak hour is from 8:00 a.m. to 9:00 a.m. The PM peak hour is from 5:00 p.m. to 6:00 p.m. Traffic conditions during these peak travel times were modeled to understand traffic conditions and effects when traffic is heaviest on a typical day.

North of Denny Way, travelers would experience slightly reduced speeds due to increased traffic volumes during the daily commute.

9 How well do local streets and intersections operate?

Traffic delay at key intersections was studied to understand how local streets and intersections operate throughout the downtown street grid. In 2015, most intersections located in the project area are expected to operate within acceptable levels of service, which means that, on average, drivers can expect to wait at a traffic signal for less than a minute. There are a few intersections that are expected to operate with a minute or more of delay. These intersections are described as congested and highly congested intersections. For the traffic analysis conducted for this project, congested intersections are defined as intersections that may cause drivers considerable delay during the AM and PM peak hours. A driver might wait about 1 or 2 minutes to travel through a traffic signal at a congested intersection. At a highly congested intersection, a driver might wait 2 minutes or more to travel through the traffic signal. Intersections located in the project area that are defined as congested or highly congested are discussed in detail below:

South – South of S. King Street

By 2015, the intersections shown in Exhibit 4-11 and listed below are expected to be congested.

- Alaskan Way S./just south of S. King Street –
  This intersection is expected to operate with just over 1.5 minutes of delay during the morning commute. In the evening commute, delay at this intersection is projected to be about 1 minute. Increased delay at this location is not expected to affect drivers traveling on Alaskan Way S., since the delay is largely a result of the operational approach to hold ferry traffic for a period of time and release it in groups.

- East Marginal Way S. and S. Atlantic Street –
  During the morning commute, this intersection is expected to operate with just over 1.5 minutes of delay (102 seconds). During the evening commute, this intersection is expected to operate with about 1 minute of delay.

- Colorado Avenue and S. Atlantic Street –
  During the morning commute, this intersection is expected to operate with about 1 minute of delay.

During the evening commute, these three intersections are expected to operate with about 1 minute of delay:

- First Avenue and Yesler Way
- First Avenue S. and S. Atlantic Street
- Fourth Avenue S. and S. Royal Brougham Way

Central – S. King Street up to Denny Way

In the central section, one intersection is expected to experience congestion:

- First Avenue and Columbia Street –
  During the evening commute, this intersection is expected to be highly congested, with just over 2 minutes of delay (146 seconds). Congestion at this intersection is due primarily to traffic traveling to the Columbia Street on-ramp to SR 99.

North – From Denny Way North

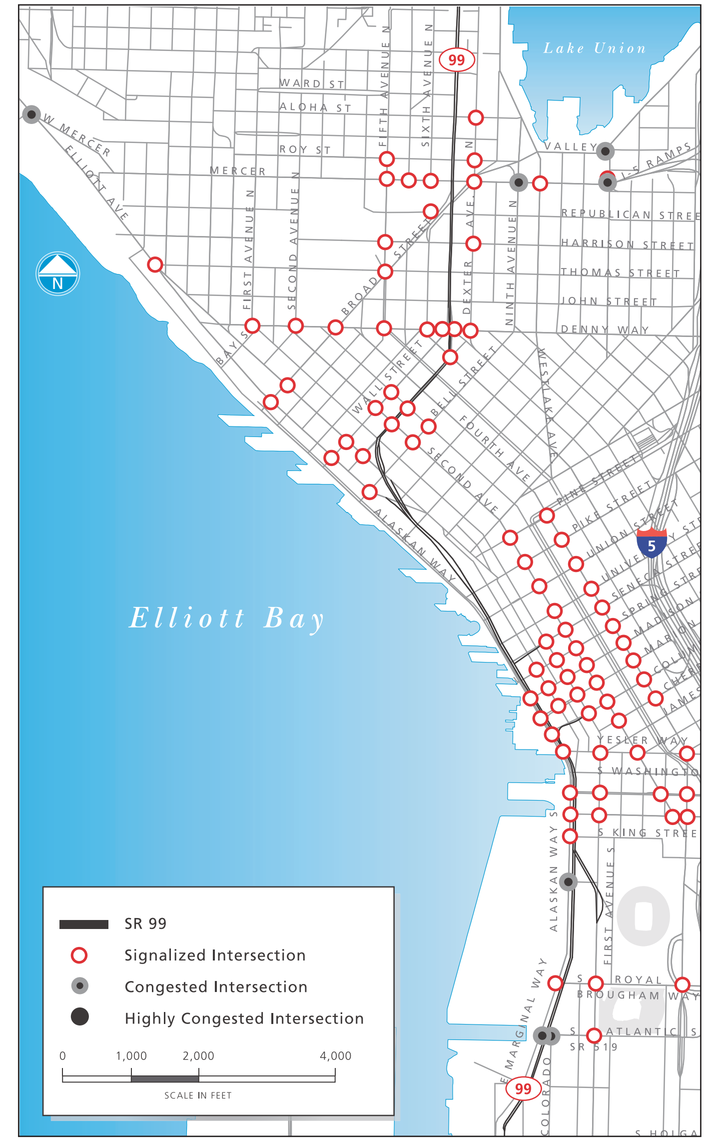
There are several intersections north of Denny Way that are expected to experience congestion during the morning and evening commute. These intersections include:

- W. Mercer Place and Elliott Avenue W. –
  In the morning commute, this intersection is expected to operate with about 1 minute of delay. During the evening commute, this intersection is expected to operate with just over 2 minutes of delay (130 seconds).

- Ninth Avenue N. and Mercer Street –
  During peak commute hours, this intersection is expected to operate with about 1 minute of delay.

Congested Intersections in 2015

AM Peak



PM Peak

Exhibit 4-11

- I-5 ramp and Mercer Street –
  During the morning commute, this intersection is expected to operate with about 1 minute of delay. During the evening commute, this intersection is expected to operate with about 3 minutes of delay.

During the morning commute, about 1 minute of delay is expected at the following intersection:

- Valley Street near South Lake Union

What are congested and highly congested intersections?

For the traffic analysis conducted for this project, congested intersections are intersections that may cause drivers considerable delay. On average, a driver might wait about 1 or 2 minutes to travel through a traffic signal at a congested intersection. At a highly congested intersection a driver might wait 2 minutes or more to get through the traffic signal. Traffic analysts use the phrase Level of Service (LOS) to describe intersection delay. The information presented on congested intersections in this text captures intersections expected to operate at LOS E and F in 2015. Detailed information about LOS at individual intersections is discussed in *Appendix C*, Section 4.3.

During the evening commute, delay is expected at the following intersections:

- Aurora Avenue Northbound and Denny Way – This intersection is expected to operate with about 1.5 minutes of delay.
- Dexter Avenue N. and Denny Way – This intersection is expected to operate with about 1 minute of delay.
- Dexter Avenue N. and Mercer Street – This intersection is expected to operate with just over 1 minute of delay (78 seconds).
- Westlake Avenue N. and Mercer Street – This intersection is expected to operate with about 2 minutes of delay.

10 What are the existing conditions for specific types of users?

How does transit use the viaduct?
Downtown Seattle is served by a well-developed system of bus transit, supplemented by a large, regionally implemented vanpool program, Link light rail between Westlake Center and Sea-Tac Airport, the new South Lake Union streetcar, and Sound Transit commuter rail.

Buses use SR 99 for routes serving Burien and West Seattle via the Seneca and Columbia ramps. Buses serving north Seattle using Aurora Avenue enter and exit SR 99 using the Denny Way ramps. Exhibit 4-12 shows the bus routes using SR 99 in the project area. In addition to buses, vanpools from several areas use SR 99 in the project area.

By 2015, travelers to downtown Seattle will benefit from the implementation of RapidRide, an enhanced bus service that will improve travel times. The C Line will serve West Seattle, the D Line will serve Ballard-Uptown, and the E Line will serve Aurora Avenue N.

What are existing conditions for freight and rail?
SR 99 connects areas that generate substantial freight and truck traffic. These include the Ballard/Interbay and Duwamish manufacturing and industrial areas shown in Exhibit 4-13. In addition, light industrial and warehouse areas farther north and south of the project area and in the South Lake Union neighborhood also generate truck traffic.

The Ballard Interbay Northend Manufacturing and Industrial Center (BINMIC) includes approximately 650 businesses and workplaces employing 14,500 people in 2008.[3] Many of these businesses are located there because of the area's marine and railroad access. The BINMIC is not directly served by SR 99 or I-5, though SR 99 provides primary access since it is the closest and most reliable route through Seattle. Drivers from the BINMIC reach SR 99 via 15th Avenue W., which turns into Elliott Avenue and connects to the viaduct. Alternative routes also lead to Mercer Street and I-5. However, Mercer Street and I-5 is a less direct and typically more congested route than SR 99.

The Duwamish Manufacturing and Industrial Center (MIC) is another significant generator of freight traffic. In 2008, approximately 1,900 businesses and workplaces employing 65,300 people were located in the Duwamish MIC. This area includes Boeing's Plant 2 and most of the Port of Seattle. The Port of Seattle owns several container terminals in the Duwamish MIC, and it is one of the largest West Coast cargo centers, serving as the entry and exit point for marine cargo to and from the Pacific Rim and Alaska. Most of the freight shipped through the port is in containers that are transferred to or from railcars or trucks on the dock. Some of the containers are shuttled by truck to or from the railyards within the Duwamish MIC. These trucks use several possible routes in the project area, including SR 99, SR 519, S. Atlantic Street/Edgar Martinez Drive S., S. Spokane Street, S. Spokane Street Viaduct to I-5 or I-90, E. Marginal Way S., and Alaskan Way. Truck travel to and from Port facilities is fairly constant throughout the workday. Terminal 46, leased to Hanjin, borders East Marginal Way S. in the south segment of the

SR 99 Existing Bus Routes

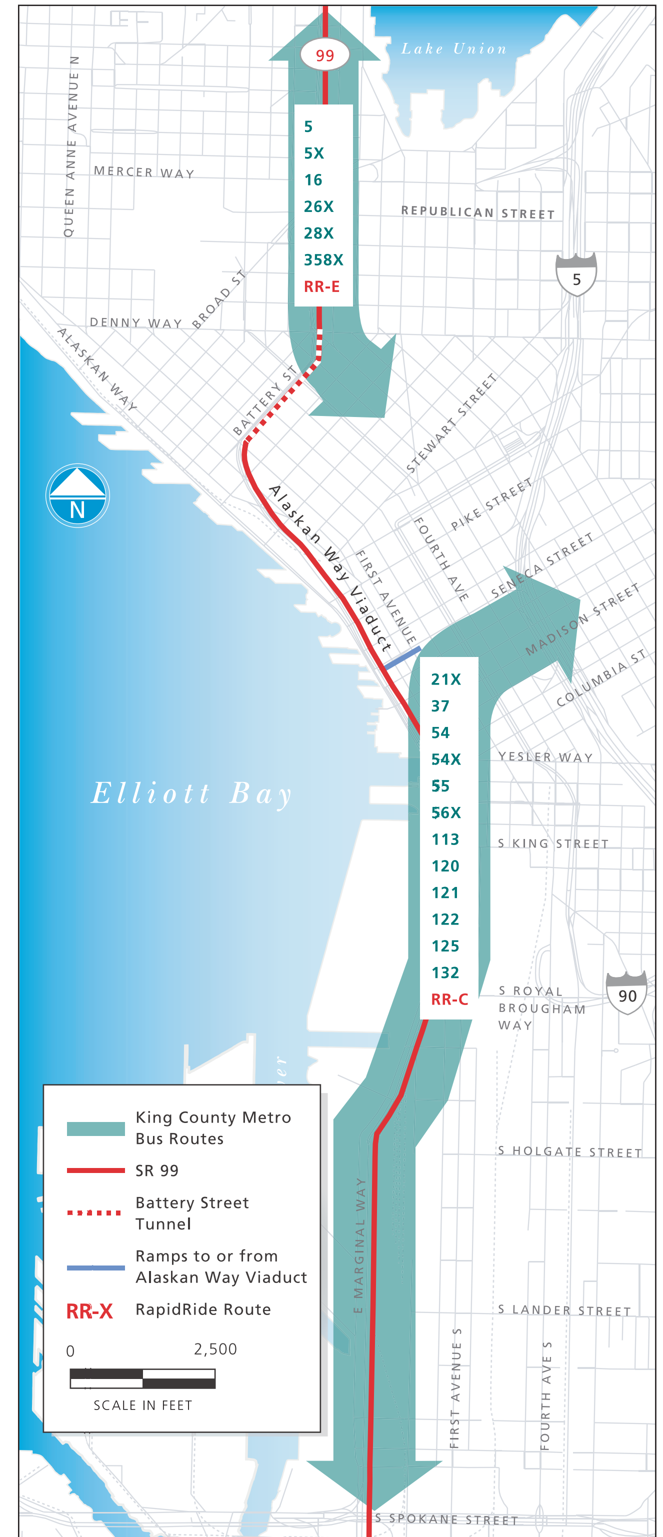


Exhibit 4-12

Appendix C, Transportation Disipline Report

Detailed information about the individual intersections that were evaluated is discussed in *Appendix C*, Section 4.3.

Transit operating in the project area is discussed in *Appendix C*, Section 4.6.

Freight conditions and connections are discussed in *Appendix C*, Section 4.7.

Duwamish and BINMIC Industrial Areas

Exhibit 4-13

3 City of Seattle 2009a.

project area and is the largest container terminal in the project area.

Two railyards located near SR 99 are integral links for moving freight. The BNSF North Seattle International Gateway (SIG) Railyard is east of SR 99 south of S. Atlantic Street. The Whatcom Railyard is west of East Marginal Way S. and has tracks owned by Union Pacific and BNSF. Both railyards have tail tracks that extend well north of the main yard. The tail track is needed to assemble and sort railcars for both the Whatcom and BNSF SIG Railyards.

SR 99 is designated as a high-use freight route by WSDOT, and the City of Seattle (the City) has designated it as a Major Truck Street. SR 99 provides access for businesses in the Duwamish and SODO areas and is a key route for freight to and from the BINMIC. Freight trips in the North Duwamish area, including port-related trips, must share the street system with other uses, including stadium event and ferry access traffic, both of which can overwhelm the street network at times. Rail lines intersect roadways at many locations, and rail traffic preempts use of the roadway when trains are passing.

Alaskan Way and Western and Elliott Avenues are Major Truck Streets and are used as routes for over-legal (over-sized or overweight) trucks that are not allowed on the viaduct. Vertical clearance is limited at the Marion Street pedestrian bridge.

Based on truck volume counts collected in June 2006, an estimated 3,720 trucks use the Alaskan Way Viaduct through central Seattle on a typical weekday; trucks represent about 3 percent of daily traffic volumes on SR 99. As shown in Exhibit 4-14, daily truck volumes are directionally balanced, though slightly more trucks use southbound SR 99 south of the Railroad Way ramps than northbound SR 99. SR 99 daily truck volumes for the SR 99 mainline and ramps are shown in Exhibit 4-14. Unlike overall traffic volumes, which peak during the morning and evening commutes, truck volumes peak during the midday and afternoon. Northbound truck volumes peak between 2:00 p.m. and 3:00 p.m. and southbound truck volumes peak between 3:00 p.m. and 4:00 p.m.

Trucks hauling combustible or flammable materials are prohibited in the Battery Street Tunnel at all times and are prohibited on the viaduct during peak travel periods (7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. on weekdays). Between 80 and 100 tanker trucks are estimated to use the viaduct each day; the exact share of these trucks hauling combustible or flammable materials is unknown. However, based on observation, it is estimated that 55 to 70 tankers per day may be carrying flammable or hazardous loads on the viaduct and exit prior to entering the Battery Street Tunnel.

What are existing conditions for ferry traffic?
Washington State Ferries operates the largest ferry fleet in the United States. In downtown Seattle, Washington State Ferries operates from the Seattle Ferry Terminal at Colman Dock, located on the waterfront near Yesler Way. From the Seattle Ferry Terminal, Washington State Ferries provides daily ferry service to Bainbridge Island and Bremerton. Two ferries that carry both vehicles and passengers serve each of these routes. Service is provided between 4:45 a.m. and 1:35 a.m. daily.

Vehicle access to Colman Dock is provided from Alaskan Way at Yesler Way and exits are provided to Alaskan Way at Yesler Way and Marion Street. Drivers heading south on SR 99 after leaving the ferry exit on Marion Street to reach First Avenue and then access the southbound on-ramp at Columbia Street. Drivers who want to travel northbound on SR 99 can choose to exit the ferry terminal on south- or northbound Alaskan Way:

- From southbound Alaskan Way, drivers could take S. Royal Brougham Way to reach First Avenue S., and then access the First Avenue S. northbound on-ramp near Railroad Way S.
- From northbound Alaskan Way, drivers could continue on Alaskan Way up to Broad Street, and then rejoin SR 99 north of the Battery Street Tunnel.

Daily Truck Volumes

SR 99 Volumes *Ramp Volumes*

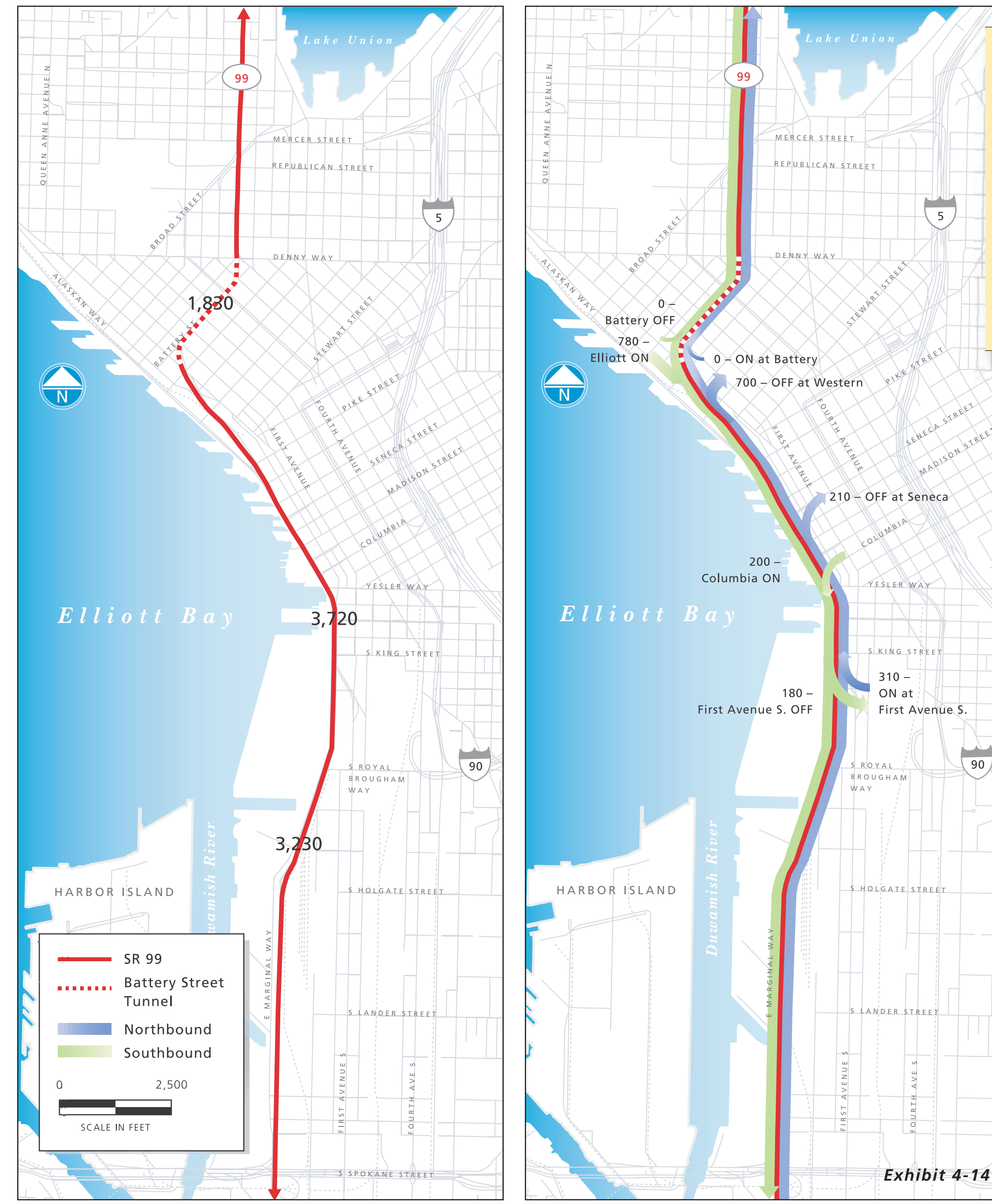


Exhibit 4-14

What is an over-legal truck?

An over-legal truck is one that is oversized or overweight. These trucks are limited to the designated over-legal route along Alaskan Way and Broad Street, or I-5.

Appendix C, Transportation Disipline Report

Ferry services operating in the project area are discussed in *Appendix C*, Section 4.11.

Both Colman Dock access points operate well, even during the AM and PM peak hours. When a ferry is offloading, traffic exiting Colman Dock at Marion Street or Yesler Way has signal priority, which restricts movement of north-south traffic on Alaskan Way. This causes a temporary delay for Alaskan Way drivers, but normal traffic operations typically resume quickly once ferry unloading is complete. During the AM peak hour, approximately 545 vehicles currently exit and 240 vehicles arrive at Colman Dock. During the PM peak hour, approximately 435 vehicles currently exit and 530 vehicles arrive at Colman Dock.

Every day, several thousand people walk to and from the Seattle Ferry Terminal at Colman Dock. People get to Colman Dock via Alaskan Way or from the Marion Street pedestrian bridge, a pedestrian overpass that connects First Avenue to Colman Dock. In addition, many people get to the ferry on bicycle from various locations in downtown and elsewhere.

King County also provides two passenger-only ferry (Water Taxi) routes to downtown Seattle from West Seattle and Vashon Island. The Port of Kingston also provides passenger-only service. These ferries dock just south of Colman Dock at Pier 50. Service to West Seattle is provided in April through October with a boat that has capacity for 250 people. Weekday service begins at 6:50 a.m. and ends most days at approximately 7:00 p.m. Weekend service begins at 8:30 a.m. and continues to 11:00 p.m. on Saturdays and 6:30 p.m. on Sundays. Service to Vashon Island is provided with a boat that has capacity for 150 people. The ferry to and from Vashon Island runs year-round on weekdays during peak commute times in the morning and evening. The Kingston ferry runs on weekdays and select holidays and has two ferries that can accommodate up to 150 people.

What are existing conditions for event traffic?

South

By 2015, completion of the S. Holgate Street to S. King Street Viaduct Replacement Project will improve roadway connections near the stadiums to and from regional facilities such as SR 99, I-90, and I-5.

Regional access from the stadium area to northbound SR 99 and from southbound SR 99 is provided via the on- and off-ramps at First Avenue S. The S. Holgate Street to S. King Street Viaduct Replacement Project will provide new ramps to southbound SR 99 and from northbound SR 99 to Alaskan Way S. near S. King Street.

Similar to conditions today, during events at Safeco Field or Qwest Field, traffic levels in the general vicinity will intensify within a relatively short amount of time, travel patterns change as patrons search for parking, and pedestrian activity increases. As a result, local traffic conditions will typically be much more congested prior to and following events compared to typical, non-event conditions. For example, for a typical Seahawks game, estimates indicate that between 15,000 and 20,000 additional vehicles, beyond background traffic levels, enter and exit the stadium area.

Explicit detour routing and comprehensive traffic control measures are typically in place on First Avenue S. and critical east-west arterials (e.g., S. Royal Brougham Way and S. Atlantic Street) for large events at Safeco Field and Qwest Field such as Seahawks, Sounders, and Mariners games. These measures commonly include police-based traffic management commissioned by the City. During events, many patrons shift to alternative means of travel (bus, light rail, commuter rail, walking, etc.), particularly public transit.

North

Seattle Center is the major event facility in the north end. It is home to many events including Bumbershoot, the Northwest Folklife Festival, and the Seattle Storm women's basketball team. Other large-scale events related to holidays and the theatre district also occur throughout the year.

For larger events at Seattle Center, traffic control measures and minor detours are occasionally used to manage access to parking and general circulation. However, due to the smaller scale of events and the capacity of the Seattle Center facility, such measures are not in place as consistently, nor are they required as frequently compared to the larger sporting venues in the south. Local bus and monorail service is provided to and from the downtown core (and some neighborhoods on the periphery).

What are existing conditions for pedestrians?

Popular destinations for pedestrians in the project area include Safeco and Qwest Fields; waterfront attractions; Pioneer Square; Pike Place Market; Seattle Center; numerous shops, restaurants, and cafes; office buildings; and residences.

In the south near the stadiums, pedestrian activity is highly variable due to special events. First Avenue S. and Occidental Avenue S. provide the main north-south pedestrian facilities, in addition to east-west streets such as S. Royal Brougham Way.

North of S. Royal Brougham Way, people can walk on the west side of Alaskan Way north along the waterfront. The Waterfront Bicycle/Pedestrian Facility runs on the east side of Alaskan Way from approximately S. Royal Brougham Way to approximately Bell Street, where the separated facility turns into a sidewalk. By 2015, the new Port Side Pedestrian/Bicycle Facility and the City Side Trail will replace the Waterfront Bicycle/Pedestrian Facility south of S. King Street. Pedestrians can use sidewalks on both sides of the roadway, and crossing signals are located at intersections to help people make their way between the east and west sides of Alaskan Way. People on foot can also reach the waterfront via the Marion Street pedestrian bridge, which connects over Alaskan Way to Colman Dock; the Lenora Street pedestrian bridge, which connects Elliott Avenue to the east side of Alaskan Way; and the Bell Street Skybridge, which connects over Alaskan Way to the Bell Street International Conference Center. Because of the steep hill, the pedestrian bridges at Lenora and Bell Streets also help to connect the waterfront to the Belltown neighborhood. Pedestrian activity along the waterfront varies substantially,

Appendix C, Transportation Disipline Report

Ferry services operating in the project area are discussed in *Appendix C*, Section 4.11.

Event traffic is discussed in *Appendix C*, Section 4.13.

Pedestrian connections are discussed in *Appendix C*, Section 4.9.

Bicycle connections are discussed in *Appendix C*, Section 4.10.

What is on-street parking?

There are two types of on-street parking, short-term and long-term. On-street short-term parking includes metered spaces with a time limit of up to 2 hours, time-restricted public parking spaces (such as 1-hour parking and loading zones), bus/taxi zones, and spaces reserved for police parking. On-street long-term parking includes unmetered, unrestricted on-street public parking spaces and 10-hour metered spaces.

What is off-street parking?

Off-street parking includes public parking garages and lots where people pay to park. Most off-street parking is privately owned and operated.

both day-to-day and seasonally due to ferry, tourist, and cruise ship activities. Overall pedestrian volumes are typically higher during the summer months and tend to peak on weekends.

Colman Dock is an important destination for pedestrians heading to and from the ferry. On an average workday, several thousand people walk between Colman Dock and downtown workplaces. This is one of the biggest concentrations of pedestrian commuters in the region. Most of them cross on the Marion Street pedestrian bridge that passes just underneath the lower level of the viaduct.

North of the Battery Street Tunnel, there are several north-south pedestrian routes; however, east-west routes are limited. The only pedestrian crossings in the area are along Broad and Mercer Streets. Denny Way is the primary pedestrian corridor in this area. Pedestrian volumes are highly variable in this area as well, due to event foot traffic going to and from Seattle Center.

What are the existing conditions for bicyclists?
The project area has several local and regional connections for bicycle travel, as shown in Exhibit 4-15. However, bicycles are not allowed on SR 99. Cyclists use dedicated lanes and trails in the area for commuting to work, to access the Seattle Ferry Terminal at Colman Dock, for recreation, and to get to many activities along the waterfront and in adjacent neighborhoods. Bicycle routes in the area link to a regional trail system that connects with local communities to the south and north. The regional trail system connects from Seattle's waterfront through the Cascade Mountains to Eastern Washington.

From the south or West Seattle, cyclists can connect via the Duwamish and Alki Trails to the bicycle route located along East Marginal Way S. A bicycle lane is located between S. Spokane Street and S. Royal Brougham Way. From S. Royal Brougham Way to Bell Street, bicycle and pedestrians travel along Alaskan Way on the Waterfront Bicycle/Pedestrian Facility, a multi-use pathway separated from the roadway. By 2015, the new Port Side Pedestrian/Bicycle Facility and the City Side Trail will replace the Waterfront Bicycle/Pedestrian Facility south of S. King Street. The separated pathway ends at Bell Street. Either cyclists can share the road with other vehicles along the waterfront up to Broad Street and Myrtle Edwards Park, or they can use the 20-foot-wide sidewalk up to Clay Street. From there, the Elliott Bay pedestrian and bicycle trail continues to the Interbay and Magnolia neighborhoods. Other major bicycle routes within or near the area include Second, Fourth, and Dexter Avenues, which all feature bicycle lanes.

Near the stadiums, S. Dearborn Street connects to the I-90 Trail, which provides access to I-90 and the Mountains to Sound Greenway Trail. The Mountains to Sound Greenway Trail currently runs along S. Atlantic Street and by 2015 will connect to the new City Side Trail along the east side of the new Alaskan Way surface street.

11 How many parking spaces exist in the project area?
Parking spaces within the project's footprint are a mix of short-term spaces, long-term spaces, and other privately owned spaces. Existing on- and off-street public parking spaces in the south and north portal areas are shown in Exhibit 4-16.

Exhibit 4-16
Existing Public Parking Spaces in the Project Area

	ON-STREET		OFF-STREET	Total
	Short-Term	Long-Term		
Stadium Area	170	20	250	440
Pioneer Square Area	220	10	130	360
Central Area	560	0	110	670
Belltown Area	120	0	200	320
North Area	170	300	140	610
Total	**1,240**	**330**	**830**	**2,400**

Note: Private business parking is not included.

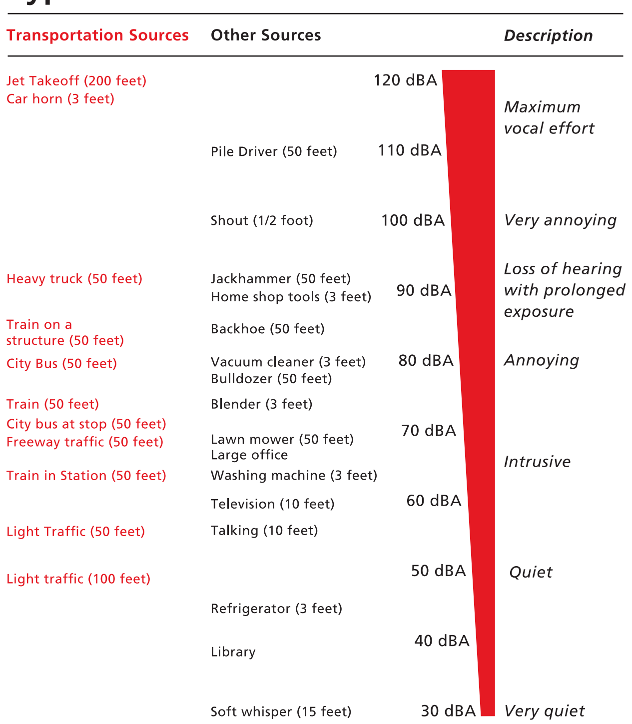
12 How noisy is it in the project area?
Noise from traffic, construction, and the diverse activities of city dwellers is a normal part of life in the project area. Environmental noise is composed of many frequencies, each occurring simultaneously at its own sound pressure level. The equivalent sound level (L_{eq}) is an averaged sound level reported in A weighted decibels (dBA) to account for how the human ear responds to sound

Exhibit 4-15

frequencies. To the human ear, a 5-dBA change in noise is readily noticeable. A 10-dBA decrease would sound like the noise level has been cut in half. Typical noise levels are presented in Exhibit 4-17.

Exhibit 4-17

Typical Sound Levels



Source: FTA 1995, EPA 1971, EPA 1974

Existing outdoor noise levels in the project area range from 61 to 80 dBA (both for short durations and over a 24-hour period), which is typical for major downtown metropolitan areas. Noise levels tend to be about 10 dBA quieter during the nighttime and early morning hours (midnight to 6:00 a.m.).

High noise levels can interfere with conversation, disturb sleep, and detract from the overall quality of life. Traffic noise levels that approach or exceed the Federal Highway Administration (FHWA) noise abatement criterion, which is 67 dBA for noise-sensitive outdoor uses such as parks, hotels, and residences, can cause a negative impact. Noise measured at the Washington Street Boat Landing, the Seattle Aquarium, and along much of the waterfront exceeds FHWA's criterion for traffic noise abatement.

Noise levels for the loudest hour of the day were modeled throughout the study area to understand expected noise conditions in 2015. By 2015, existing traffic noise levels approach or exceed the FHWA noise abatement criteria at 53 of the 70 modeled sites, which represent approximately 4,578 residential units, 1,612 hotel rooms, 120 shelter beds, 1 church, 1 school, 12 parks or public spaces, and 8 commercial use areas. The noise levels at these sites are shown in Exhibit 4-18. WSDOT has also determined that traffic noise above 80 dBA generates a severe impact at outdoor areas frequented by people. Noise at one site, an apartment building adjacent to the Elliott Avenue on-ramp, is modeled to exceed the severe noise impact criterion.

13 How is the project area affected by vibration from traffic traveling on the viaduct?

The human body responds to an average vibration decibel level (VdB), which is typically calculated over a 1-second period. The abbreviation "VdB" is used to reduce the potential for confusion with sound decibels. The threshold for most people to feel vibration is around 65 VdB, and our response to vibration is not usually significant unless the vibration exceeds 70 VdB.

Normally, people do not feel vibration when an average passenger vehicle is passing by on an at-grade roadway. However, a person standing next to one of the vertical piers supporting the Alaskan Way Viaduct would sense that the ground was rumbling beneath them. This is because vibration levels measured on the ground 3 to 5 feet from the vertical piers range from 66 to 89 VdB. These existing vibration levels represent the sum of vibrations from trucks of a range of weights, and irregular roadway conditions. In addition, the mass and span of the viaduct concentrates vibrations from heavy vehicles to the piers of the viaduct.

Vibration levels were measured at 17 locations in the project area. Of the 17 locations, 10 are in the south, 1 is along the central waterfront, and 6 are in the north portion of the project area. The levels are below the existing vibration criterion of 90 VdB that the lead agencies have adopted for this project to protect extremely

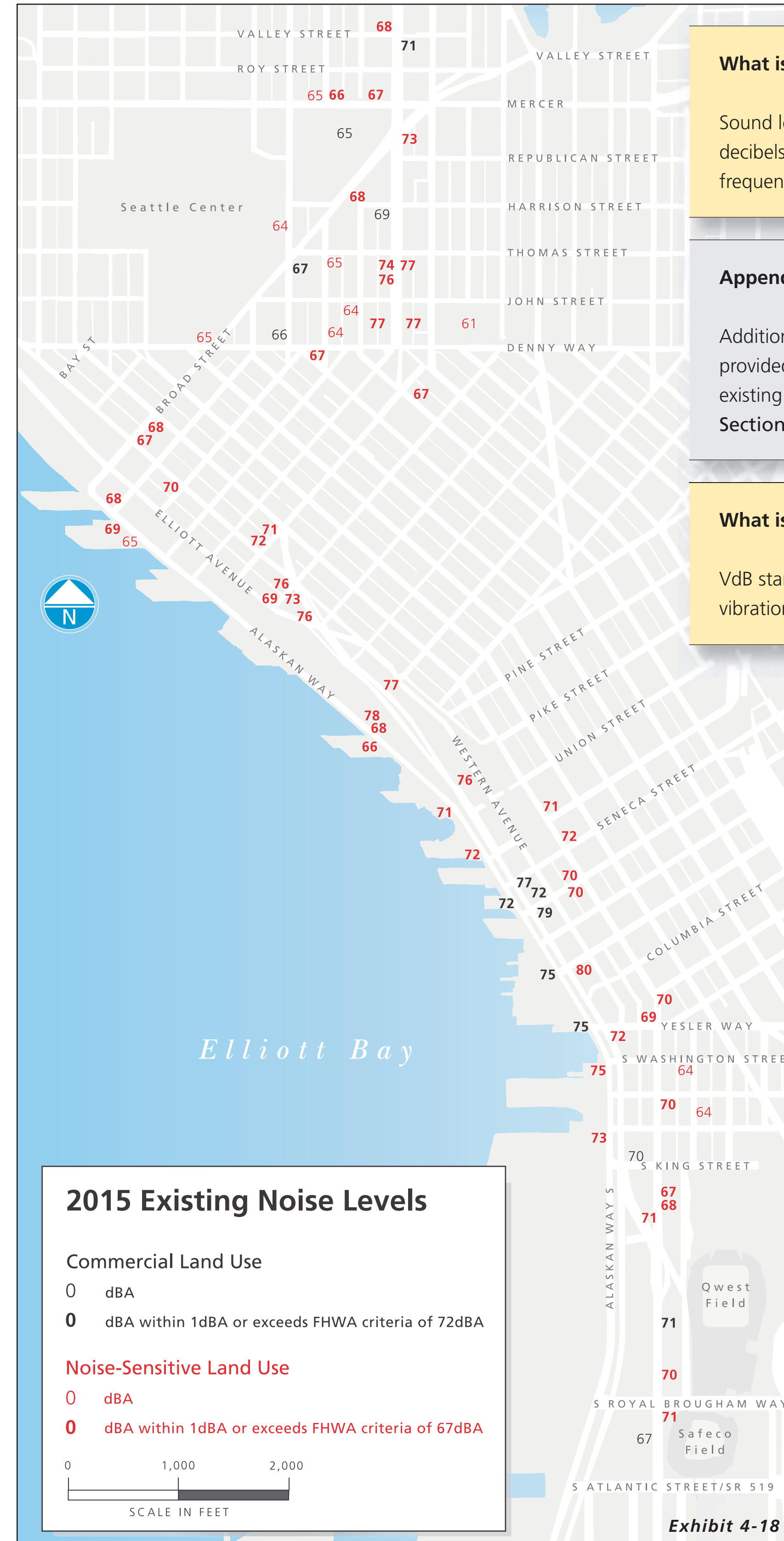


Exhibit 4-18

What is a dBA?

Sound levels are expressed on a logarithmic scale in units called decibels (dB). A-weighted decibels (dBA) are a commonly used frequency that measures sound at levels that people can hear.

Appendix F, Noise Discipline Report

Additional information on the existing noise environment is provided in *Appendix F*, Section 4.2, and information on the existing vibration environment is provided in *Appendix F*, Section 4.3.

What is a VdB?

VdB stands for vibration decibels. It is a measure of the average vibration level, typically calculated over a 1-second period.

fragile buildings (this criterion is consistent with the Federal Transit Administration's vibration criteria). These vibrations can be felt but do not generally damage buildings.

Ground vibration levels decrease substantially over distance. At distances of 25 feet or more from the vertical piers, the vibration levels are below 65 VdB. Most perceptible indoor vibration is caused by sources within buildings, such as operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible vibration are construction equipment, steel-wheeled trains, and traffic on rough roads.

14 What visual features are located in the project area?

Attractive scenic views, historic buildings, trees, and the waterfront are all positive elements of the visual experience for drivers on the Alaskan Way Viaduct. However, there are also things that present lower visual qualities, such as parking lots, some parts of industrial areas, buildings that need maintenance, and to many, the viaduct itself.

The south end of the project area is located near Safeco Field and Qwest Field, which dominate the view in much of this area. Closer to the waterfront, cranes and shipping containers at the Port of Seattle's facilities are a major component of views. Today SR 99 is elevated in this area. The double-level viaduct structure is an obvious part of the view, and its scale is compatible with the many large-scale buildings also found along the working waterfront. The side-by-side aerial roadway structure being constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project will have effects upon the visual environment that are similar to the existing viaduct.

The existing viaduct in this area offers views of Puget Sound and Elliott Bay, the Olympic Mountains, and the distant outlines of Bainbridge Island and the Kitsap Peninsula.

At the south end of the central section, the Pioneer Square Historic District's brick buildings and tree-lined streets are reminders that this neighborhood was central to Seattle's boomtown beginnings. Characteristic of 19th-century architecture, the front doors of many buildings are right up to the sidewalk. Telephone and electric lines in this neighborhood generally run underground, reducing visual clutter. The viaduct runs along the west side of the Pioneer Square Historic District, partially obstructing views to the west.

The downtown commercial core is located from just north of Yesler Way to approximately Stewart Street and from the waterfront to just west of I-5. This part of the project area includes many of Seattle's high-rise office buildings, as well as several notable historic buildings from the early decades of the 20th century. The steep hills of downtown slope toward the waterfront, providing good westward views from streets and sidewalks, open spaces, and buildings. Cars, buses, and trucks crowd the streets and largely contribute to the look in the commercial core.

The City's Green Streets program has included three east-west streets in the downtown commercial core (Marion, Spring, and University Streets). The Green Streets program promotes broad sidewalks, landscaping, and other features. The City has also designated some east-west streets as view corridors, in which views are to be protected. The existing viaduct runs along the west side of the commercial core.

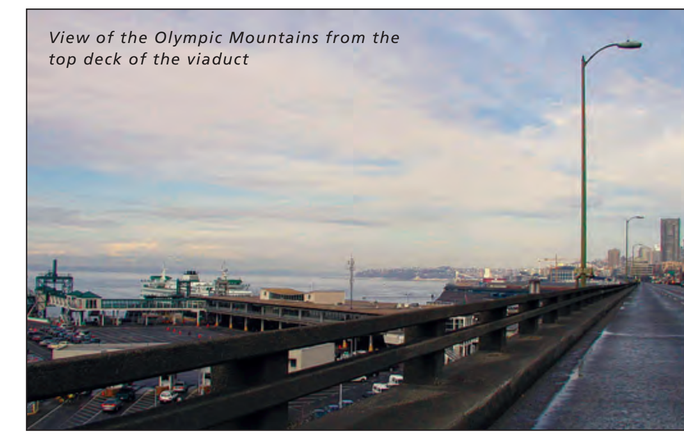
The downtown waterfront area follows along Alaskan Way from Yesler Way to Denny Way. Waterfront views, diverse attractions, and the maritime ambience make this one of Seattle's most popular areas. In this area, pier buildings that once held goods unloaded from cargo ships and trains now house shops, restaurants, and businesses. A narrow pedestrian promenade and mixed-use trail run the length of Alaskan Way along the waterfront. The viaduct runs along the east border of the central waterfront area and is a dominant feature in views toward downtown Seattle.

Walkways along the waterfront allow pedestrians to go out onto piers for a close-up view of waterfront activities and a view back at the downtown skyline rising over the top of the viaduct. Looking back toward the city from Elliott Bay or from the ends of waterfront piers, the view east is dominated by the high-rise office buildings of downtown. To the south, one can see cranes and container cargo ships at the Port of Seattle facilities. To the north, the Space Needle and grain elevators are prominent features. Because of the very large scale of all of these structures, the buildings along Alaskan Way seem like a minor part of the view. The viaduct blends in, appearing as a gray band crossing the bottom of the view.

Although Pike Place Market has sweeping outward views, the colorful views from within the market are what make it unique. The market's traditional produce and goods stalls are mixed with a wide variety of shops, restaurants, offices, and apartments. Narrow brick-paved streets, modest market buildings, and the bustle of street-oriented activities make this a pedestrian-friendly environment. Victor Steinbrueck Park is a prominent green space in this area. The viaduct is adjacent to the park, its top deck located just below the viewing area on the park's west side. Although the viaduct does not obstruct scenic views in this area, it is a prominent part of the view to both the west and southwest.

The Belltown area is bounded by Pike Place Market and Stewart Street on the south, Fifth Avenue on the east, Denny Way on the north, and the waterfront on the west. East-west streets offer good westward views of the water, Bainbridge Island and the Kitsap Peninsula, and the Olympic Mountains. As in other parts of the project area, scenic views are highly valued, and the City has passed ordinances that discourage new development from blocking them. The viaduct runs along the west side of part of this area before turning northeast to enter the Battery Street Tunnel. Views to the west are partly obstructed by the viaduct, where the elevated structure crosses Elliott Avenue.


View of downtown Seattle from Steinbrueck Park


View of the Olympic Mountains from the top deck of the viaduct


Park area along the waterfront with view of downtown Seattle

Appendix D, Visual Quality Discipline Report and Appendix E, Visual Simulations

Appendices D and *E* contain additional information and pictures of the project area.

North of the Battery Street Tunnel, views along the Aurora Avenue portion of SR 99 are dominated by traffic, the roadway, on- and off-ramps, and ends of east-west streets. The downtown skyline, Capitol Hill, and the greenbelt on the east slope of Queen Anne Hill are visible from SR 99 in this area. There are a few motels along and near Aurora Avenue, as well as businesses housed in a variety of different building styles and sizes that are between one and five stories tall. The different features in this area do not seem to merge visually as a neighborhood, partially because Aurora Avenue acts as a barrier throughout the section.

15 What are some of the positive and negative visual conditions created by the viaduct?

The Alaskan Way Viaduct is a dominant visual feature in much of the project area. Motorists traveling north on the top level of the viaduct have broad westward views across the waterfront to the Olympic Mountains and east views of the downtown skyline, sports stadiums, and the Space Needle. From the southbound lanes on the lower level of SR 99, the view is limited by the northbound lanes above, support columns, and buildings along the east side of the viaduct. However, many southbound motorists value the good view to the southwest between the Battery Street Tunnel and Pine Street.

From the ground, the existing viaduct affects the overall look of the area in several ways. It partially blocks some westward views from the east side of the structure and looms above both the pedestrians and motorists passing beneath it. In some places along the waterfront, the viaduct all but blocks views back toward the downtown area. Because on- and off-ramps obstruct views from the street level all the way to the top of the viaduct, they are especially noticeable to people in adjacent neighborhoods. The viaduct's size, bulk, and industrial concrete design conflict with the historic character of the Pioneer Square Historic District, the pedestrian-oriented environment along the central part of the waterfront, and the shops and offices on the west side of Belltown. The areas below and next to the viaduct are often in the shade, and much of the land beneath the viaduct has been given over to parking and alley-like side streets—places that people pass through to get somewhere else. Because of these various effects, many people see the viaduct as a barrier that cuts off the central part of the waterfront from Seattle's downtown core and neighborhoods located to the east.

16 What is the character of and land use in the project area?

The project area passes through seven of the City's neighborhood planning areas. The project area begins in the Duwamish neighborhood, with its industrial buildings, Port of Seattle cargo container facilities, Qwest Field, and Safeco Field and few residences. The many 19^{th}-century buildings in the Pioneer Square neighborhood make it Seattle's most historic neighborhood and one of its most distinctive.

The downtown commercial core is characterized by mostly high-rise office buildings with tens of thousands of workers who commute to the neighborhood each day. The commercial core includes the city's financial district, retail core, and a few condominiums and apartment buildings. It also includes the central waterfront.

Belltown, north of the downtown commercial core, is characterized by a mix of mid- and high rise offices, neighborhood shops, and residences. The neighborhood has undergone substantial redevelopment over the past 15 years, and many condominiums and apartment buildings have been built overlooking the waterfront. This mixed neighborhood also has many old hotels and apartment buildings, some of which have been converted into subsidized housing.

In addition, the project area passes through small sections of the Uptown neighborhood and the Denny Triangle area. Seattle Center, site of the 1962 World's Fair, is a regional civic center hosting theatre, ballet, opera, exhibitions, festivals, and basketball. The South Lake Union area at the northeast end of the project area has also been undergoing substantial redevelopment with several mid- and high-rise buildings and residences. Many of these buildings are occupied by medical and biotechnology research organizations or businesses.

17 What is the regional and local economy like now?

The greater Seattle area and King County host a large and diverse economy. King County is the largest business center in both the state of Washington and the Pacific Northwest, and it is a leading global center for several industries, including aerospace, biotechnology, clean technology, information technology, and international trade and logistics.[4]

International commerce plays a large role in the local economy. The Port of Seattle is one of the largest West Coast cargo centers, serving as a gateway for cargo shipped to and from Alaska and countries along the Pacific Rim. More than 33,000 regional jobs (direct, indirect, and induced) were generated in 2007, translating to a payroll of $2.8 billion.[5]

Tourism is also an important part of Seattle's economy, particularly in the project area. According to the City, "The Seattle-King County area attracts more than 9.4 million overnight visitors annually who spend $4.75 billion and contribute more than $419 million in state and local tax revenues. Direct visitor spending supports 62,000 jobs in the Seattle region."[6]

In 2008, the work force in King County was about 1,088,440 people (not including military personnel). Approximately 47,000 people (4.3 percent) were unemployed. The economy entered a recession in September 2008, and conditions continue to change quickly. The unemployment rate in King County rose to 8.4 percent in 2010.[7] While current conditions may vary, Seattle lost about 68,800 jobs between July 2008 and July 2009.[8]

Within one block of the project area there are approximately 1,040 businesses, including the following types:

- Commercial office businesses – 59.3 percent

Appendix G, Land Use Discipline Report

Additional information about land use in the project area is provided in *Appendix G*, Chapter 4.

Appendix L, Economics Discipline Report

Additional information about the economy in the project area is provided in *Appendix L*, Chapter 4.

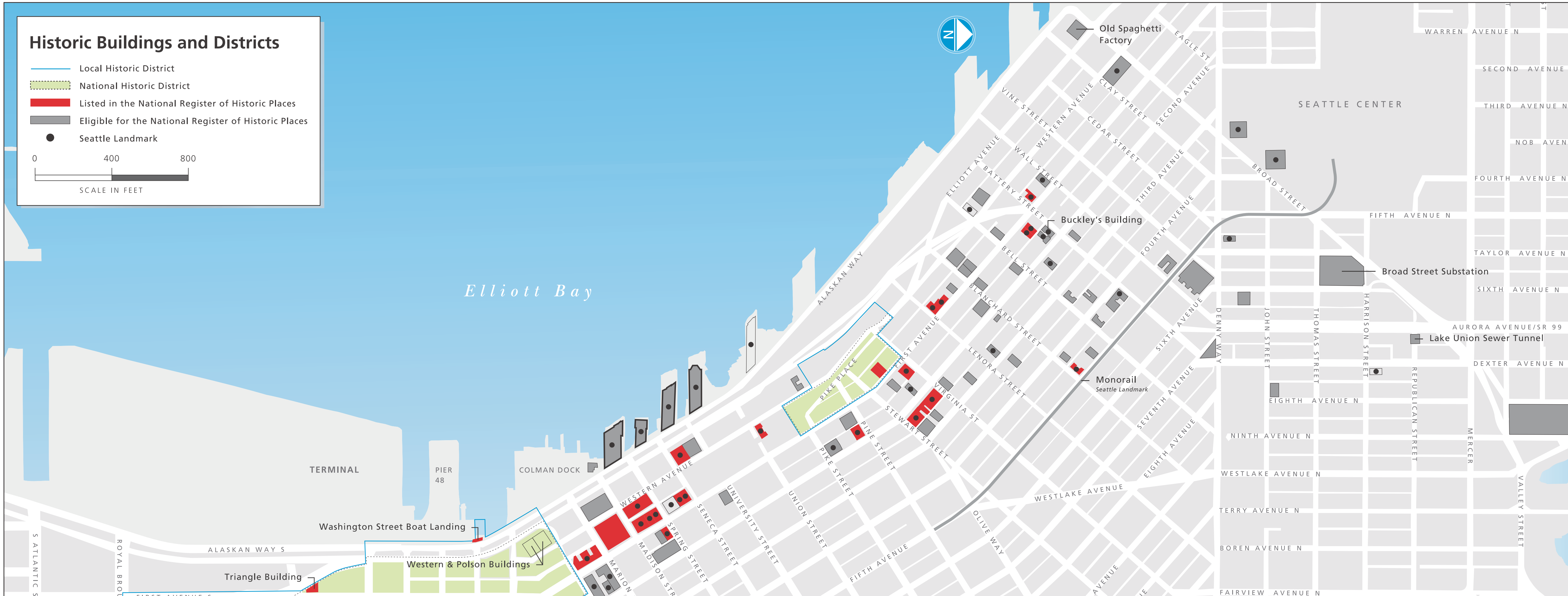
4 CTED 2009.

5 Port of Seattle 2009a.

6 City of Seattle 2008.

7 LMEA 2010b.

8 Thomas 2009.



Steinbrueck Park and the viaduct ramps

Steinbrueck Park looking towards West Seattle and Elliott Bay

Exhibit 4-19

- Commercial retail businesses – 13.5 percent
- “Other service” businesses – 8.7 percent
- “Other” businesses – 8.3 percent[9]
- Residential multi-family management – 8.2 percent[10]
- Government service – 2 percent[11]

Almost half of the “other service” businesses were involved in food services such as restaurants and coffee shops. About 15 percent of “other” businesses identified were pay parking areas. Businesses in the area depend on parking spaces, freight delivery spaces, and transit to accommodate employees, customers, and freight transport.

18 What historic and archaeological resources are located in the project area?

The Alaskan Way Viaduct and Battery Street Tunnel are recorded as one historic property and have been determined eligible for the National Register of Historic Places (NRHP). Many historic properties are located within the two national historic districts, the Pioneer Square Historic District and the Pike Place Market Historic District, shown in Exhibit 4-19. Each of these areas have a locally designated boundary that is slightly larger than the nationally designated boundary. There is one National Historic Landmark (inclusive of the Pioneer Building, Pioneer Place, and Pergola), which is located at First Avenue and Yesler Way. Including the districts themselves, there are 30 properties listed in the NRHP (including several buildings that are within historic district boundaries) within the study area. Many City-designated landmarks and NRHP-eligible properties are in the study area as well, as shown on Exhibit 4-19.

One identified archaeological site in the project area has been determined eligible for listing in the NRHP. The Dearborn South Tideland Site (45KI924) is a late 19th- and early 20th century historic archaeological site consisting of building foundations and associated refuse. Another archaeological site, 45KI958, has been identified near the north portal area. Although this archaeological site has not been formally determined eligible for the NRHP, WSDOT will treat it as an eligible site for this analysis. This site is an early- to mid-20th century historic archaeological site also consisting of building foundations and associated refuse. Given the constraints imposed by the urban environment and deep historic fill, evaluation and, if necessary, data recovery of this archaeological site would be undertaken in concert with construction. This process is described in a Memorandum of Agreement created in consultation with the State Historic Preservation Officer, the tribes, and consulting parties.

19 What parks and recreational facilities are located in the project area?

Publicly owned parks and recreation spaces in the project area include Occidental Park, Pioneer Square Park, the Washington Street Boat Landing, Waterfront Park, Victor Steinbrueck Park, Pier 62/63 Park, Pier 66, Belltown Cottage Park, Olympic Sculpture Park, Myrtle Edwards Park, Elliott Bay Park, Tilikum Place, Denny Park, Lake Union Park, and Seattle Center, as shown in Exhibit 4-20. Private or semi-public open spaces include several of the waterfront piers and the plazas and terraces around the Seattle Art Museum and Benaroya Hall. From Pier 55 a boat service provides access to Tillicum Village and Blake Island State Park, which are located across Puget Sound. Cultural, environmental, and educational facilities include the Seattle Aquarium and the interpretive center at the Klondike Gold Rush National Historic Park. Thousands of local residents and tourists also attend events at Qwest Field and Safeco Field in the north end of the Duwamish neighborhood.

Recreational facilities in the project area include several types of land uses, such as open spaces around buildings (both public and private), viewpoints, shoreline access points, and the trails, promenades, and walkways that allow people to make their way through the area without relying on cars. There are several viewpoints along the waterfront, including Waterfront Park and Victor Steinbrueck Park. Trails include the Waterfront Bicycle/Pedestrian Facility, which connects to several adjacent trail systems such as the Mountains to Sound Greenway Trail; bike and pedestrian trails are shown in Exhibit 4-15. By 2015, the S. Holgate Street to S. King Street Viaduct Replacement Project will replace this connection with two new trails, the Port Side Pedestrian/Bicycle Facility and the City Side Trail, in the vicinity of the stadiums.

Recreational facilities also include streets that are part of Seattle’s Green Streets program, which promotes creation of pedestrian-oriented features such as wide sidewalks and landscaping. Outdoor art is also located throughout the project area, including sculptures, fountains, and murals. Most of these attractions are located at a distance from proposed construction activities.

20 Who lives in the neighborhoods located in the project area?

The residents of the project area represent a diverse mix of individuals. Like the rest of the city, approximately a quarter of the residents are minorities. The proportion of minorities (non-white) is a bit lower in the project area compared to the rest of the city, but a higher percentage of Latino persons live in the project area. Nearly three-quarters of all residents live alone, and only a small number of families with children live in the area.

Residents in the project area reside in new luxury downtown condominiums and apartment buildings, older apartments and converted old hotels, subsidized housing, and homeless shelters. Some people live on the city streets and even sleep under the viaduct itself.

The Seattle/King County Coalition on Homelessness reports that approximately 8,900 people lacked permanent housing in King County in 2009,[12] and preliminary data for 2010 show similar conditions. The vast majority of these people obtained shelter in the county’s homeless shelters, most of which are located in downtown Seattle. However, more than 1,900 individuals reportedly lived on the streets in Seattle in 2009[13] and in 2010.[14]

Compared to the rest of Seattle’s population, the project area has a much higher proportion of people who live at or below the poverty level and a slightly higher percentage of people with disabilities and mobility limitations, as shown in Exhibit 4-21. About 45 percent of the residents

Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report

Maps and a table showing the properties that are listed in or eligible for the National Register of Historic Places, as well as City-designated landmarks, are included in *Appendix I*, Chapter 4. *Appendix I* also provides more detail on how the area around Seattle was settled and developed.

Attachment A includes an inventory of buildings in the area that are more than 40 years old.

Appendix H, Social Discipline Report

Community and neighborhood resources and social services in the area are identified in *Appendix H*.

Appendix H also contains additional background information about minority, low-income, and homeless populations living in the project area.

9 Other businesses include private non-profit social service organizations.

10 Residential multi-family use does not include individual residential units, but refers to an apartment or condo building with a front desk for a property manager who works in the building.

11 Government service, while not a for-profit business, still operates in a business like manner and is included in this inventory. Government service includes municipal government offices and social service agencies.

12 Eisinger 2009.

13 Seattle/King County Coalition on Homelessness 2009.

14 Seattle/King County Coalition on Homelessness 2010.

in the project area do not own a private automobile and rely on walking or public transit for transportation. Low-income residents, minorities, the elderly, and those with disabilities are protected by a combination of laws, policies, and an executive order called Environmental Justice (Executive Order [EO] 12898, issued in 1994).

Exhibit 4-21
Population Characteristics in 2000

	Census Tracts in the Project Area	City of Seattle
Population	17,336	563,374
Percent Minority[1]	28	32
Percent Latino[2]	7	5
Percent at or Below Poverty Level	23	12
Percent Disabled with Mobility Limitations	9	6
Percent Transit Reliant	45	16

Source: U.S. Census Bureau 2000
1 Minority includes persons of all races except white.
2 Latino persons may be white or minority race.

The 2010 census data was not available at the time the analysis for this Final EIS was prepared. However, updated demographic data at the city level are available for 2008 through the U.S. Census Bureau's American Community Survey.

The American Community Survey estimated the city's total 2008 population to be 582,490, which reflects an increase of 3 percent since 2000.[15] The Hispanic/Latino population

What is environmental justice?

Environmental justice acknowledges that the quality of our environment affects the quality of our lives, and that minority and low-income populations should not bear an unequal environmental burden. Environmental justice seeks to lessen unequal distributions of environmental burdens (e.g., pollution, industrial facilities, crime) and equalize benefits and access to clean air and water, parks, transportation, etc.

Environmental Justice Statutes and Regulations

- Presidential Executive Order 12898 (Environmental Justice)
- Title VI of the Civil Rights Act of 1964
- Civil Rights Restoration Act of 1987
- USDOT Environmental Justice Order (DOT Order 5610.2)
- Presidential Executive Order 13166 (Limited English Proficiency)
- NEPA

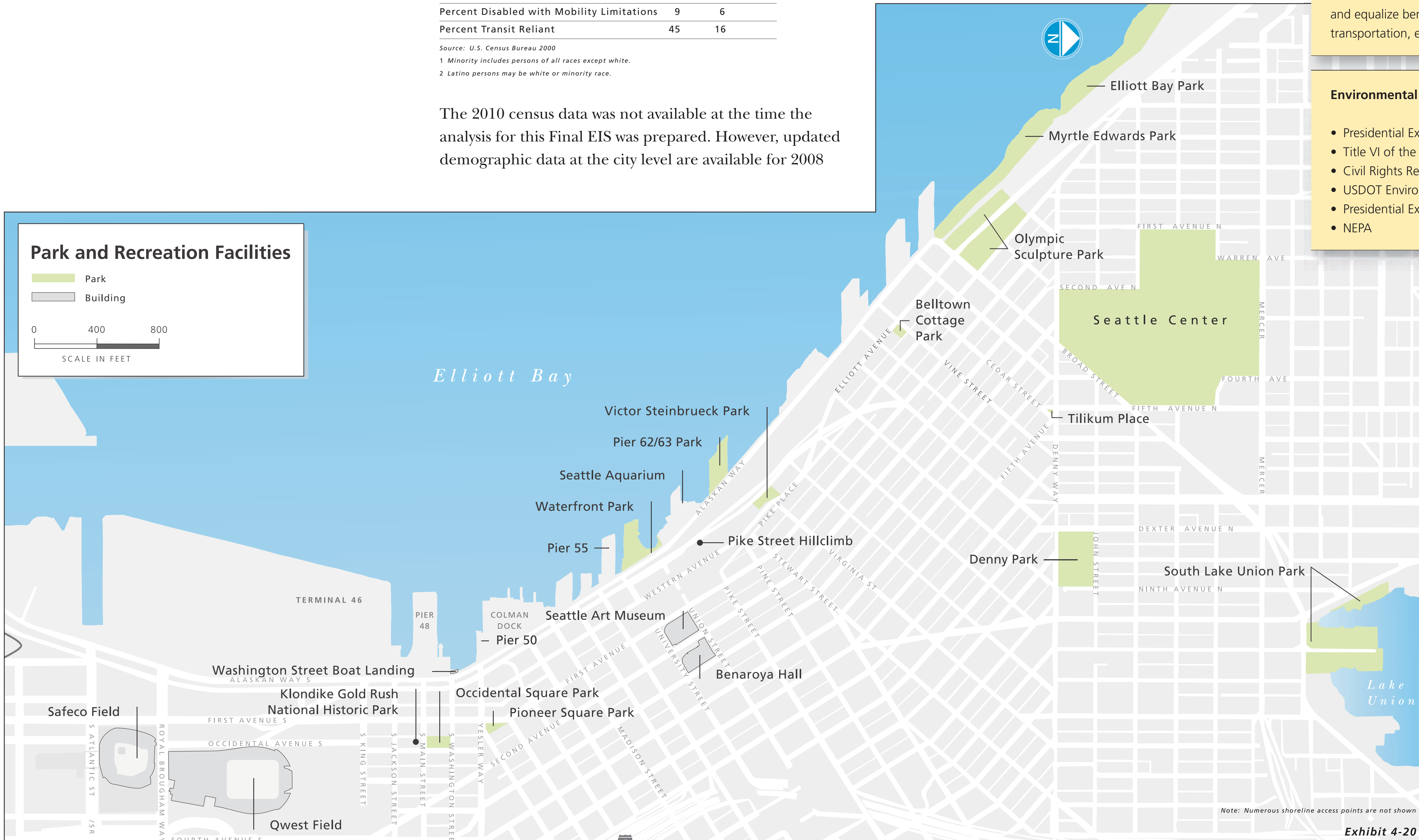


Exhibit 4-20

15 U.S. Census Bureau 2008.

was reported to comprise 5 percent of the total population in 2000 and has not changed based on the 2008 American Community Survey. The total minority population in 2000 was reported to be about 32 percent and has decreased slightly to 30 percent in 2008. Based on this analysis, the racial, Hispanic/Latino ethnicity, and total minority composition of the project area population is likely to be similar to the demographic characteristics reported in the 2000 census (i.e., 25 percent non-white, 7 percent Hispanic/Latino, and 28 percent total minority).

Similarly, the percentage of persons living at or below the poverty level in the city of Seattle has remained the same between 2000 and 2008. Based on this analysis, the proportion of the population living at or below the poverty level and residing in the project area has not changed substantially and remains approximately 23 percent.

21 What community and social services serve these neighborhoods?

The project area is home to many people who have low incomes and/or disabilities. The Pioneer Square and Belltown neighborhoods include much of Seattle's subsidized, special needs, and emergency housing. Nearly 4,000 subsidized housing units are located within five blocks of the project area.

A variety of community-based organizations and government agencies in the area offer help and support to people in need. These organizations provide meals, hygiene facilities, donated clothing, and emergency housing (shelters). Many also offer counseling to help people manage problems such as substance abuse, domestic violence, or mental health issues. Others provide employment training, referrals for day labor, job placement, and structured daytime activities.

Most of the government agencies and organizations providing these services depend heavily upon volunteers from church groups or the community and operate on very limited budgets.

22 What public services and utilities are located in the project area?

Public Services

Public services and facilities located in the project area include emergency medical services, fire stations, police, medical clinics, public schools, postal services, disaster preparedness, solid waste pick-up, and recycling. Harborview Medical Center, a major regional trauma center and Medic One headquarters, is located just east of the project area on Ninth Avenue.

Several fire stations are located within or adjacent to the project area. Fire Station No. 10 is located adjacent to the south end of the project area on Fourth Avenue S. and S. Washington Street; it houses an engine company, a ladder unit, and an aid unit. The Fire Alarm Center and the City's Emergency Operations Center are co-located with Fire Station No. 10. Fire Station No. 5 is located on the waterfront, near the Seattle Ferry Terminal at Colman Dock; it is the base for both an engine and a fireboat. Fire Station No. 2 is located near the north end of the Battery Street Tunnel and houses one engine company, a ladder unit, a medic unit, and a reserve medic unit. In addition, Fire Stations No. 8, 14, and 25 are a short distance outside of the project area and may respond to an emergency in the project area if additional support is needed. The Fire Department Headquarters is also located near the project area on Second Avenue S. and S. Main Street.

Although no police stations are located within the project area, the West Precinct of the Seattle Police Department is located nearby at Eighth Avenue and Virginia Street. The operations center for Washington State Ferries is also located nearby at Third Avenue and Broad Street. Farther south along Alaskan Way, the Coast Guard has a facility where its rescue vessels and ocean-going vessels are docked.

Utilities

The area near the existing viaduct serves as a major utility corridor critical to providing services in Seattle. Potentially affected utilities within the study area are summarized in the following list:

- Wet vaults or regulators, which are underground structures used for water quality treatment, flow control, containment of discharges during fire suppression events, or control of diversions to the combined sewer outfalls.
- Water distribution mains (8- to 12-inch-diameter lines), large water feeder mains (16- to 48-inch-diameter lines), water services, and hydrants.
- Sanitary sewer mains (8- to 12-inch-diameter lines), large conveyances (16- to 48 inch-diameter, 60-inch-diameter, and larger), and manholes.
- Storm drainage and combined sewer facilities.
- Natural gas facilities including low-pressure, intermediate-pressure, and high-pressure mains, metering equipment, and valves.
- Low-pressure and high-pressure steam lines, valves, and vaults.
- Telephone service and fiber-optic cable lines.
- Electrical distribution and transmission lines. The electrical distribution network includes overhead and underground primary lines, secondary lines, individual lines, manholes, vaults, transformers, switches, and ducts. The transmission facilities include ducts, vaults, and high-voltage, pressurized dielectric underground cable.
- Electrical systems (underground and overhead wire) serving transit systems.

23 Is air quality a concern in the project area?

Air quality in the immediate project area is a concern due to the dense urban environment and high volume of traffic that emit pollutants such as ozone, nitrogen dioxide, particulate matter ($PM_{2.5}$ and PM_{10}), and carbon monoxide. Air quality in the area is regulated by the U.S. Environmental Protection Agency (EPA), Washington

Appendix K, Public Services and Utilities Discipline Report

Additional information about public services and utilities in the project area are provided in *Appendix K*, Chapter 4.

Appendix M, Air Discipline Report

Additional information about air quality in the project area is provided in *Appendix M*, Chapter 4.

What is a maintenance area?

In a maintenance area, the air quality standard for a specific pollutant such as carbon monoxide or PM_{10} was not met previously, but the standard has since been met.

State Department of Ecology (Ecology), and the Puget Sound Clean Air Agency. Air quality data were compiled using Ecology and EPA AirData databases for 2008, the latest calendar year for which these data are available.

The project area is located entirely in a carbon monoxide maintenance area. Just south of the project area is a PM_{10} maintenance area. These maintenance areas were previously not in compliance with the National Ambient Air Quality Standards, established by EPA under the Clean Air Act, but since then they have met the standards (demonstrated attainment) and are classified as maintenance areas. Monitored levels for carbon monoxide do not exceed national and state ambient air quality standards in the project area. The project area is designated in attainment for all other EPA-regulated pollutants, including $PM_{2.5}$.

Regional trends show that carbon monoxide concentrations have decreased considerably over the last 20 years. Technological advances in control of motor vehicle emissions have caused pollutant levels to drop, even though the numbers of vehicles and VMT have increased.

24 Are greenhouse gas emissions a concern in the region?
Human-caused greenhouse gas emissions are a concern in the region because they contribute to global warming and climate change. In Washington State, transportation-related emissions from cars, trucks, planes, and ships account for nearly half of the state's total greenhouse gas emissions.[16] Vehicles are the most common source of greenhouse gas emissions in the area.

To help reduce greenhouse gas emissions in Washington State, Governor Gregoire issued EO 07-02 in February 2007, which established the following goals:

- By 2020, reduce greenhouse gas emissions to 1990 levels
- By 2035, reduce greenhouse gas emissions to 25 percent below 1990 levels
- By 2050, reduce emissions to 50 percent below 1990 levels or 70 percent below our expected emissions that year

In 2008, Washington State set greenhouse gas reduction goals (Revised Code of Washington [RCW] 70.235.020) and VMT benchmarks (RCW 47.01.440) in law:

- Reduce statewide greenhouse gas emissions to 1990 levels by 2020, 25 percent below 1990 levels by 2035, and 50 percent below 1990 levels by 2050 (from a baseline of 94.6 million metric tons of carbon dioxide equivalent).
- Reduce per capita VMT from a business-as-usual projection by 18 percent by 2020, 30 percent by 2035, and 50 percent by 2050.

In 2009, the Washington State Legislature passed laws to encourage electric vehicles, create a sustainable energy trust, set performance standards for greenhouse gas emissions, improve energy efficiency, establish a climate change/land use work group, and support commute trip reduction for state agencies. Governor Gregoire issued an executive order (EO 09-05)[17] that directs the state to do additional work to reduce greenhouse gas emissions and VMT and to work with larger metropolitan transportation organizations to adopt regional transportation plans that would achieve statutory benchmarks. WSDOT is working closely with Puget Sound Regional Council and other government jurisdictions in the region to address these important issues. In 2009, WSDOT developed Guidance for Project-Level Greenhouse Gas and Climate Change Evaluations.[18] WSDOT's current guidance is compatible with the proposed national approach from the White House Council on Environmental Quality.[19] In addition, WSDOT serves on the advisory team reviewing Ecology's draft guidance on addressing climate change and greenhouse gas emissions for the State Environmental Policy Act (SEPA).

How did the project consider future conditions related to climate change?
WSDOT acknowledges that effects of climate change may alter the function, sizing, and operations of our facilities. Therefore, in addition to mitigating greenhouse gas emissions, WSDOT must also ensure that its transportation facilities can adapt to the changing climate.

Pacific Northwest climate projections are available from the Climate Impacts Group at the University of Washington:
http://cses.washington.edu/cig/fpt/ccscenarios.shtml.

Washington State is likely to experience over the next 50 years:

- Increased temperature (extreme heat events, changes in air quality, glacial melting)
- Changes in volume and timing of precipitation (reduced snow pack, increased erosion, flooding)
- Ecological effects of a changing climate (spread of disease, altered plant and animal habitats, negative impacts on human health and well-being)
- Sea-level rise, coastal erosion, salt water intrusion

The project team considered the information on climate change with regard to preliminary design as well as the potential for changes in the surrounding natural environment.

To ensure that our facilities can function as intended for their planned 50-, 70-, or 100-year lifespan, they should be designed to perform under the variable conditions expected as a result of climate change. The standard design for this project has incorporated features that will provide greater resilience and function with the potential effects brought on by climate change. For example, drainage culverts may need to be resized to accommodate more intense rainfall events or increased flows due to more rapid glacial thawing.

What are greenhouse gases?

Climate-changing greenhouse gases generally include carbon dioxide (CO_2), methane, nitrous oxide, and fluorinated gases.

The greenhouse gases often associated with transportation sources are CO_2, methane, and nitrous oxide (found in dentists' offices as the anesthetic laughing gas). CO_2 makes up the bulk of vehicle emissions. Any process that burns fossil fuel releases CO_2 into the air. Vehicles
are a significant source of greenhouse gas emissions and contribute to climate change primarily through the burning of gasoline and diesel fuels.

What is climate change?

Climate change is the term used to describe the changes to weather patterns that are currently being seen on a global level. These patterns are measured by temperature, rainfall, wind patterns, ocean currents, and many other indicators.

The project's design takes into account current research on projected sea level rise over the 100-year design life of the facility.

16 CTED 2008.

17 Ecology 2009a.

18 WSDOT 2009.

19 CEQ 2010.

WSDOT is working with other state agencies to develop the state's climate response strategy (see details on line at http://www.ecy.wa.gov/climatechange/adaptation.htm).

25 How much energy does transportation in the region use?

Transportation currently accounts for approximately 30 percent of the energy consumed in Washington. (By comparison, the residential sector consumes 25 percent, commercial 19 percent, and industrial 26 percent.) Washington's transportation energy consumption is approximately 322 million British thermal units (BTU) per person, which is below the national average of 333 million BTU.[20] Petroleum (i.e., gasoline, diesel fuel, and jet fuel) is the predominant source of energy for transportation in Washington State.

Seattle's carbon footprint was about 8 percent smaller in 2005 than it was in 1990, in part due to energy conservation efforts and use of cleaner-burning fuels by households and businesses.[21] The emissions from transportation sources (road, rail, marine, and air), which make up roughly 60 percent of Seattle's carbon footprint, have increased about 3 percent compared to 1990. Emissions from on-road transportation (trucks, buses, vans, cars, and light-duty trucks), which make up roughly 40 percent of Seattle's carbon footprint, were up roughly 5 percent from 1990 levels.

26 What are water quality conditions in the Duwamish River, Elliott Bay, and Lake Union?

Water bodies near the project area include the Duwamish River, Elliott Bay, and Lake Union. Development and urban activities in Seattle have degraded the quality of water in nearby water bodies for more than 100 years. Buildings and impervious surfaces, such as concrete and asphalt, cover nearly 100 percent of the project area, preventing infiltration into the soils and contributing to non-point source pollution contained in runoff. Pollutant sources include discharges from industrial facilities, combined sewer overflows, spills, contaminated groundwater, and urban storm drains.[22] Highway runoff in the Seattle area is also a measurable source of suspended solids, metals (zinc and copper), and other pollutants.[23]

Most of the stormwater runoff from the project area discharges either directly to Elliott Bay or to the combined sewer system, which discharges to Puget Sound after being treated at the West Point Treatment Plant located in northwest Seattle. A smaller portion of the project area discharges to Lake Union.

Duwamish River

The Duwamish River originates where the Green and Black Rivers merge in Tukwila, and it flows approximately 13 miles to Elliott Bay. The Duwamish River is the primary freshwater source to Elliott Bay. The mouth of the Duwamish River is divided by Harbor Island into two channels, the East and West Waterways. The Duwamish River's East Waterway is located adjacent to the southern portion of the project area and carries between 20 and 30 percent of the river's flow, depending on the tidal conditions.

Ecology has designated the following uses for protection in the Duwamish River: salmon and trout rearing, supply for industrial water, agricultural water, livestock watering, wildlife habitat, fishing, commerce and navigation, boating, and aesthetics (Washington Administrative Code [WAC] 173-201A).

The Duwamish Waterway is included on the 303(d) list for exceeding the criteria for fecal coliform bacteria and dissolved oxygen.[24] The Duwamish Waterway contains high concentrations of various metals and chemical compounds that are considered pollutants. A portion of the Duwamish Waterway near the proposed construction staging areas is also undergoing cleanup as a Superfund site under the Comprehensive Environmental Response, Compensation, and Liability Act.

Elliott Bay

Elliott Bay is an estuary adjacent to the project area. Its primary fresh water source is the Duwamish River. Along the downtown Seattle waterfront, the Elliott Bay shoreline is relatively shallow.

Ecology has designated Elliott Bay for protection to support aquatic life such as salmon migration, rearing, and spawning and shellfish habitat. Additionally, Ecology has required protection for swimming and in-water recreation, wildlife habitat, fishing, boating, aesthetic enjoyment, commerce, and navigation. Elliott Bay is included on the Ecology 303(d) list for exceeding fecal coliform criteria.[24]

Puget Sound

Puget Sound is a large marine water body that covers approximately 900 square miles. Elliott Bay is the portion of Puget Sound within the project area and is on Ecology's 303(d) list. Ecology has designated the same uses for protection in Puget Sound as for Elliott Bay. The water quality of Puget Sound in the vicinity of the project is influenced by a deep-water outfall from the West Point Treatment Plant. The West Point Treatment Plant treats water from the combined drainage system that is a mixture of sewage and stormwater runoff.

Lake Union

Lake Union is located north of the project area. Only a small portion of the project area drains to the Lake Union watershed. The lake represents a transitional area between the fresh waters of Lake Washington and marine waters of Puget Sound. The water quality of Lake Union is influenced by freshwater flows coming from Lake Washington and from storm drains and combined sewer outfalls.

Ecology has designated Lake Union to be protected for core summer fish habitat, swimming and in-water recreational uses, water supply (domestic, industrial, agricultural, and stock), wildlife habitat, harvesting, commerce, navigation, boating, and aesthetic enjoyment (WAC 173-201A). Lake Union has been included on Ecology's 303(d) list for exceeding aldrin (a pesticide), fecal coliform, lead, and total phosphorus criteria.[24]

Appendix R, Energy Discipline Report

Additional information about energy use in the project area is provided in *Appendix R*, Chapter 4.

Appendix O, Surface Water Discipline Report

Additional information about surface water in the project area is provided in *Appendix O*, Chapter 4.

What is the 303(d) list?

The EPA requires Ecology to prepare the 303(d) list to periodically assess the quality of water in the state by collecting data. Based on this data, Ecology prepares a list of all waters in which beneficial uses, such as salmon habitat and recreational uses, have been impaired due to poor water quality. Ecology then uses this list to develop plans to improve water quality. The 303(d) list is a requirement of the federal Clean Water Act (33 U.S.C. § 1313(d)).

20 EIA 2008.

21 City of Seattle 2008.

22 Ecology 1995.

23 Driscoll et al. 1990.

24 Ecology 2009b.

27 How is stormwater currently managed in the project area?

Stormwater runoff for over 58,000 acres in central Seattle is collected in a complex system of pipes that make up a combined sewer system for storm drainage and sanitary sewage. The combined sewer system normally operates by conveying flows to the West Point Treatment Plant for treatment and eventual discharge to Puget Sound. However, in heavy rain events, flows can exceed the treatment plant's capacity, leading to the direct discharge of a portion of the combined stormwater and sanitary sewage to nearby water bodies at designated combined sewer outfalls. This is one of the ways in which contaminants in stormwater runoff from the project area can discharge to local water bodies. Combined sewer outfalls and stormwater outfalls in the project area are shown in Exhibit 4-22.

In other parts of the project area, separate storm drains directly discharge stormwater (possibly containing runoff contaminants but presumably free of sanitary sewage) with only minimal treatment to local water bodies, including Elliott Bay, the Duwamish River, and Lake Union.

In the remaining project area, stormwater is collected in separate storm drains that divert water from smaller storms to the combined sewer while discharging other runoff directly to local water bodies. These storm drains also divert the first flush from larger storms to treatment facilities; this first flush tends to carry the most pollutants.

There are seven separate sub-basins that collect stormwater runoff along the viaduct. The configuration of systems is so localized and complicated that in some areas, the runoff from the viaduct itself and the surface street below are not managed in the same way. For example, runoff from the viaduct may discharge directly to Elliott Bay or to the combined sewer, while runoff from the surface street may by conveyed to the West Point Treatment Plant before being discharged.

When stormwater runoff from the project area discharges to local water bodies, it does so from 11 major and many smaller outfalls. Most of the discharge from the existing viaduct in the project area either drains to Puget Sound through the West Point Treatment Plant, or enters Elliott Bay via direct discharge to outfalls. Runoff from most of the northern portion of the project area is directed to the West Point Treatment Plant, though some of it discharges directly to Lake Union. In comparison to the overall watershed discharging to these water bodies, the project area is only about 0.01 percent of the total watershed area. For that reason, the quantity of pollutants from the runoff is very small when compared to the total quantities of pollutants discharged to local water bodies. However, the overall problem of polluted runoff entering local waters is an important issue.

To add to the complexity of the stormwater runoff and wastewater issues, drainage and sewerage ownership and operation responsibilities are split between King County and the City. Both jurisdictions have long-term plans for reducing direct discharges from combined sewer overflows, which would improve water quality.

28 What fish and wildlife species live in or near the project area?

Elliott Bay is adjacent to the project area. The shoreline adjacent to Elliott Bay and the project area has undergone substantial development, including the original construction of the existing seawall at a location seaward of the natural shoreline. No natural shoreline remains along the waterfront, from the Duwamish River mouth up the western side of Elliott Bay in downtown Seattle.

Despite these modifications, Elliott Bay supports a rich community of resident and transient fish species. Resident fish species commonly observed along the Seattle shoreline include surfperch, bay pipefish, shiner perch, sculpin, greenling, various flatfishes, and a limited number of lingcod.

Salmonid species listed under the federal Endangered Species Act (ESA) that occur in the project vicinity include Puget Sound Chinook salmon, steelhead, and bull trout. At times, the Seattle waterfront is a migration corridor and

Combined Sewer and Stormwater Outfalls

Exhibit 4-22

Appendix N, Wildlife, Fish, and Vegetation Discipline Report

Additional information about species in the project area is provided in *Appendix N*, Chapter 4.

ESA Species Potentially Occurring in the Project Vicinity

Threatened and endangered ESA species that may live in the project area include:

Fish
- Chinook salmon
- Steelhead
- Bull trout
- Pacific eulachon
- Canary rockfish
- Yelloweye rockfish
- Bocaccio

Birds
- Marbled murrelet

Mammals
- Killer whale
- Humpback whale
- Steller sea lion

Washington State Species of Concern Potentially Occurring in the Project Vicinity

Washington State species of concern that may live in the area include:

Fish
- Black rockfish
- Brown rockfish
- Canary rockfish
- China rockfish
- Copper rockfish
- Greenstripe rockfish
- Quillback rockfish
- Redstripe rockfish
- Tiger rockfish
- Widow rockfish
- Yellowtail rockfish
- Pacific cod
- Pacific hake
- Pacific herring
- River lamprey
- Walleye pollock

Birds
- Common loon
- Common murre
- Peregrine falcon
- Purple martin
- Western grebe
- Bald eagle
- Brandt's cormorant

Mammals
- Dall's porpoise
- Gray whale
- Harbor seal
- Pacific harbor porpoise
- California sea lion
- Townsend's beg-eared bat

rearing area for these species and other juvenile anadromous salmonids. Elliott Bay is also expected to support the three Georgia Basin rockfish species recently listed under the ESA (bocaccio, canary rockfish, and yelloweye rockfish).[25] While there are some references to the Pacific eulachon, which was also recently listed, occurring in Puget Sound, there are no known spawning populations, and individual fish have rarely been observed.[26]

The other ESA-listed species potentially occurring in the project vicinity are Steller sea lions, southern resident killer whales, humpback whales (unlikely to occur in Elliott Bay), and marbled murrelets. Steller sea lions have only occasionally been sighted in southern Puget Sound.[27] Killer whales commonly occur in Puget Sound but infrequently occur in Elliott Bay.[28] Marbled murrelets may occasionally occur in the general area;[29] however, it is unlikely that the marbled murrelets commonly forage along the Seattle shoreline in the vicinity of the project area because of the high levels of human activity. The closest known nesting area is in the Cascade Mountains, some 30 miles from the project area.[30] Species that have essential fish habitat in the Elliott Bay are Chinook salmon, English sole, starry flounder, rock sole, sand sole, Pacific sanddab, lingcod, rockfish, and spotted ratfish.

In addition to the ESA-listed species, a number of Washington State Species of Concern that are documented in King County could occur in the project vicinity (see sidebar).[31] While most of the project area currently drains to Elliott Bay, the northern portion of the area drains to Lake Union, which is part of the Lake Washington basin. More than 50 freshwater and anadromous fish species are found within the Lake Washington basin, including more than 20 nonnative freshwater species.[32, 33] In addition to the freshwater and anadromous species, some estuarine and marine species occur in Lake Union due to the saltwater intrusion through the Ballard Locks. Native freshwater species include northern pikeminnow, three-spine stickleback, peamouth chub, and sculpin; anadromous species include longfin smelt, river and Pacific lamprey, and various trout and salmon species; marine species include starry flounder, shiner perch, striped seaperch, and Pacific staghorn sculpin.[33] Nonnative species include yellow perch, black crappie, bluegill, and smallmouth and largemouth bass.[32] Priority Habitats and Species maps from the Washington Department of Fish and Wildlife (WDFW) indicate that the closest forage fish spawning is much more than 2 miles from the project area.[34] On land, there is no natural vegetation in the project area. The highly urban waterfront and downtown areas include a few trees and shrubs planted along the surface streets. The small amount of wildlife present in the area has adapted to human activity and a modified environment.

Birds that are commonly found in this urban environment, including robins, sparrows, and crows, generally feed on the ground and along the streets. Raptors such as osprey, peregrine falcon, and bald eagles have been observed along the project area, but they do not nest in the project area, other than one peregrine falcon nest on top of a building. Bald eagles were recently delisted as a threatened species under the ESA but are protected under the Bald and Golden Eagle Act. Bald eagles sometimes forage along the Seattle waterfront as well as other shorelines within the city, where they prey upon fish, waterfowl, and seabirds. The Seattle shoreline is not known as a wintering area for bald eagles. Waterfowl species that can be found along the Seattle waterfront include several types of gulls, loons, grebe, cormorant, and blue heron.

29 What are the groundwater conditions in the project area?

The flow of groundwater in the project area is affected by the soils it flows through, Puget Sound, and to a lesser extent by Lake Union on the north edge of the project area. Groundwater moves more easily through sand and gravels, while soils that contain silt and clay slow down groundwater movement. The line below which all of the space between soil particles is filled with groundwater is called the water table.

Groundwater Movement
in the Project Area

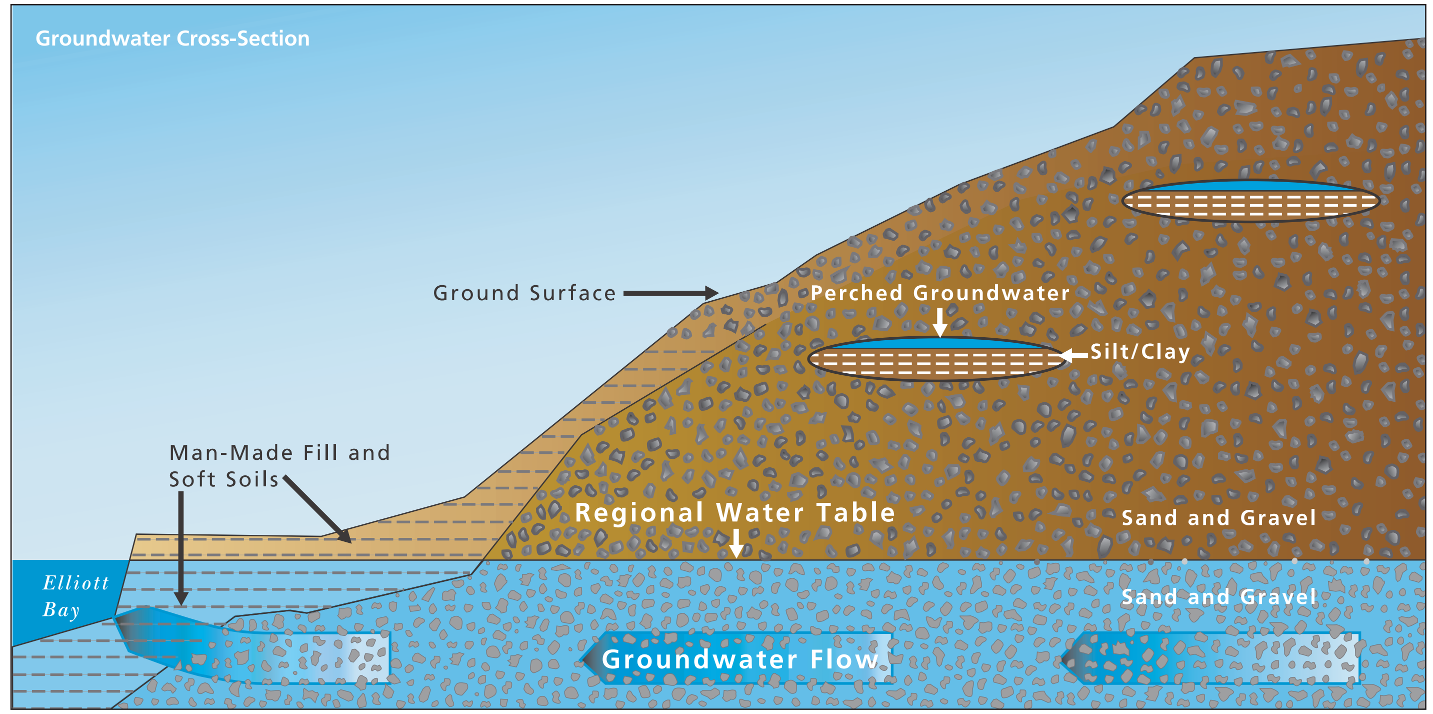


Exhibit 4-23

Appendix Q, Hazardous Materials Discipline Report

Additional information about hazardous materials in the project area and exhibits showing sites with documented and potential contaminant releases are provided in *Appendix Q*, Chapter 4. The discipline report also contains more information on each of the contaminants and their effects.

25 NMFS 2010a.

26 NMFS 2010b.

27 Jeffries, et al. 2000.

28 City of Seattle 2009b.

29 Li 2009.

30 USFWS 2009.

31 WDFW 2009b.

32 Warner and Fresh 1999.

33 Kerwin 2001.

34 WDFW 2009a.

The water table is generally flat, and the depth varies depending on the elevation of the ground surface. The water table near the south part of the project area and along the waterfront ranges between 8 to 12 feet below the ground surface within the fill soils. The depth to the water table increases to the north to about 170 feet near Lenora Street. North of Lenora Street, the depth of the water table decreases as the ground surface elevation decreases. The water table is about 90 to 100 feet below the ground surface near the Battery Street Tunnel and the north part of the project area. The water table becomes shallower as the ground surface dips downward toward Lake Union.

Groundwater conditions in the project area are highly variable due to the layering within the fine- and coarse-grained soils. In general, coarse-grained sands and gravels are the primary water-bearing soils in this area. Fine-grained sediments (silt and clay) overlie these deposits. In some areas, small zones of shallow groundwater perch on top of the fine-grained soils, as shown in Exhibit 4-23. Between and beneath these perched water-bearing zones, the fine-grained soils are generally unsaturated down to the underlying water table.

30 Are there any potentially contaminated sites in the project area?

Past industrial and commercial activities, railroad operations, and hazardous materials in the fill may have contaminated soil and/or groundwater within the project area. Contaminated sites pose a potential risk for project costs and complications, both in real estate acquisition and construction.

There are six general types of contaminants found in the project area:

- **Oil –** mid- to heavy-range petroleum hydrocarbons
- **Gasoline**
- **Metals –** such as arsenic, chromium, lead, and mercury
- **Solvents –** such as trichloroethylene and tetrachloroethylene
- **Polychlorinated biphenyls (PCBs)**
- **Polycyclic aromatic hydrocarbon (PAHs) –** may be present in fill and treated timbers

The area between S. Royal Brougham Way and S. King Street has primarily been industrial. Industries in this area have included metal works, foundries and plating operations, machine shops, warehouses, fueling facilities, and railroad operations. In the late 1800s, S. King Street terminated at a coal wharf, which also housed machine shops and a roundhouse for railcars. Metal works, metal plating shops, machine shops, and foundries were located on wharves both north and south of the S. King Street Wharf throughout the early 1900s. The most likely contaminants from industrial operations include metals, solvents, and petroleum products. Also, the area is underlain by fill that was placed in the early 1900s, which covered and incorporated timber and debris that previously had been used in the construction of piers, wharves, and trestles and wood waste from Yesler's large sawmill. Based on historical information, the northern part of the south portal area is located near the former site of the large sawmill. It is likely that there were large deposits of floating wood, piles for pier structures, and wood debris present in this area before fill was placed in the area around 1900. This wood waste is likely to be encountered in the south portal area. Other common contaminants in this fill include petroleum constituents and metals. In addition, some of the buried piles and timbers were probably treated with creosote, which likely has leached into adjoining soil and groundwater. Lubricating oil associated with railroad operations may also be encountered in the fill soils.

The project area is characterized by commercial activity that includes dry cleaners, printers, lithographers, automobile repair, gas stations, and commercial residential properties such as hotels and apartments. In the last 20 years, condominiums have been constructed at the north end of the project area, mostly displacing commercial uses. The area north of Denny Way is also a commercial area; primary businesses in this area are automobile repair shops, gas stations, and motels.

The north portion of the project area (Battery Street Tunnel to Roy Street) was shaped by the leveling of Denny Hill. Commercial and light industrial businesses developed rapidly after the regrading. In the 1930s through the 1950s, there were approximately 80 gas stations/repair shops and several automobile dealerships in this area, most of which have since been converted to other uses. Several former dry cleaners and metal work operations were also identified in the historical records for this area. These businesses are no longer in operation, and property uses have changed. Consequently, there is a high potential to encounter petroleum in soil and groundwater. Dry cleaning solvents may also be encountered.

Because there has been only limited redevelopment along the proposed alignments, many of the buildings were constructed prior to recent laws restricting the use of hazardous building materials. Therefore, asbestos-containing material and lead-based paint should be anticipated in many of the buildings in the area. Asbestos-containing material may also be present and lead-based paint is known to be present on some of the components of the existing viaduct, which would be demolished as part of the project.


SAFECO FIELD

CHAPTER 5 - PERMANENT EFFECTS

What is in Chapter 5?

This chapter describes the long-term project effects of the No Build Alternative, Bored Tunnel Alternative (Preferred), Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative, with and without tolls.

1 What happens if the viaduct isn't replaced?

The hills and water around Seattle and the Puget Sound are beautiful to look at, but they have a constraining effect on where people can live and work. They also constrain our transportation facilities. There are only two north-south highway routes through downtown Seattle: Interstate 5 (I-5) and State Route 99 (SR 99) on the existing viaduct. With I-5 already at capacity during peak periods and throughout much of the day, SR 99 plays a critical role in the regional transportation system. From the perspective of Seattle and surrounding communities, the proposed build alternatives to replace the viaduct are similar, so this question focuses on what would happen in the long run (by 2030) if the viaduct is closed and isn't replaced. This is also the "No Action" alternative required by the National Environmental Policy Act (NEPA).

The viaduct serves traffic headed into and out of downtown Seattle and traffic traveling through the downtown area. A large portion of travelers using the viaduct, 44 percent, are heading to or coming from Seattle's downtown central business district. Approximately 23 percent of travelers travel through downtown and are destined for nearby locations just north or south of downtown, such as south of downtown (SODO), Capitol Hill, Queen Anne, or South Lake Union. The remaining 33 percent of travelers are making longer-distance through trips, such as trips from Ballard to Burien. This means that the majority of trips, 56 percent, are through trips. The people and businesses in all these areas depend on SR 99 directly for their daily travel, or indirectly, as SR 99 takes trips that otherwise would crowd other regional roadways such as I-5.

Seattle and surrounding areas have had the viaduct to depend on for more than half a century, and it is reflected in the land use patterns we see today. Land use and transportation planning in the Puget Sound area are coordinated by the Puget Sound Regional Council (PSRC) in accordance with state and federal requirements. The Council recently adopted "VISION 2040," a long-range strategy to guide growth and development in the four-county area (King, Pierce, Snohomish, and Kitsap counties).[1] This plan is supported by "Transportation 2040," the region's long-range transportation plan.[2] These plans were developed jointly over 4 years through a public process involving local governments and agencies in the four-county area. Transportation 2040's highest priority is to maintain, preserve, and operate the region's transportation system and specifically includes replacing the Alaskan Way Viaduct.

If the viaduct is closed and the central waterfront portion of SR 99 not replaced, trips that would have used the roadway would need to find other routes. Because alternative routes are longer and already congested, we expect that some travelers would change their travel patterns or avoid the trip entirely. In addition, land use and development patterns would adapt to different degrees of accessibility. Without the viaduct, the trips to and from the downtown core would not change much because of the wide range of alternative routes, but through trips (i.e., trips between districts north and south of downtown in the primary travelshed) would change to a greater degree because the only other highway route through downtown Seattle, I-5, is already congested. Hence, land use in downtown is not likely to change (mostly because it is already built out), but some jobs and households would be redistributed between areas north and south of downtown. These areas include the Seattle neighborhoods of South Lake Union, Uptown, Queen Anne, Magnolia, Ballard, and Fremont. To the south, areas affected include SODO, West Seattle, Duwamish, and Burien.

Without a replacement for the viaduct, initial estimates show nearly 2,000 jobs moving between the areas north and south of the viaduct, with a net increase of jobs in the south. Population would also be redistributed with an increase of nearly 1,000 households in the southern area. This is a small percentage of the total population and employment in these areas, but if it is triggered by the closure of SR 99, redistribution of this nature would be burdensome for those affected and would have what can be considered severe economic consequences. In addition, many transit routes to and from downtown Seattle are on SR 99 or nearby parallel streets such as First Avenue S., Dexter Avenue, and Elliott and Western Avenues. Without the viaduct, this transit access would be greatly impeded. Further, the loss of the viaduct would also eliminate one of only three truck routes through downtown, and increased vehicle volumes on downtown streets would degrade conditions for vehicles, bicycles, and pedestrians.

Additional information on 2030 Viaduct Closed (No Build Alternative)

The *Transportation Discipline Report, Appendix C*, explains how the 2030 Viaduct Closed (No Build Alternative) was modeled and how transportation and land use could be affected. Traffic data for modeled conditions for the 2030 Viaduct Closed are provided for most of the traffic conditions that were measured, such as vehicle miles traveled, vehicle hours of delay, and traffic volumes. These measures allow for relative comparisons between the No Build and build alternatives. However, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions, which would be reflected in the traffic model output. As a result, predictions of detailed congestion measures such as travel speeds, travel times, and delays would not be useful.

In this chapter, information for the 2030 Viaduct Closed shows what would happen if the lead agencies did not replace the existing viaduct and it was closed with little or no warning. To understand what would happen if the viaduct is replaced, the effects are compared among the build alternatives to explain tradeoffs.

1 PSRC 2009.

2 PSRC 2010.

From an analytical perspective, it is accurate and easy to write "some travelers would change their travel patterns" and "some jobs and households would be redistributed." This means some people, families, and businesses would find their situation so untenable that they would move away and their lives would be changed. While the net change in land use may be small, the disruption to some individuals and communities would be substantial.

These outcomes assume that the viaduct is closed and simply not replaced. However, rather than forcing people to tolerate or adapt to this condition, it is likely the transportation agencies serving the Seattle area would develop other alterations or improvements to transportation facilities and systems. These improvements would be responding to a new set of transportation needs and likely evaluated under additional environmental review. Transportation and land use plans might also be revised. In summary, not replacing the Alaskan Way Viaduct would have a significant adverse effect, and it would require many years for the area businesses and residents to adjust.

TRANSPORTATION

2 What conditions were modeled for the traffic analysis?

Several conditions were modeled to understand the effects of the alternatives.

- **2030 Viaduct Closed –** This represents the No Build Alternative. The 2030 Viaduct Closed assesses 2030 traffic conditions if the viaduct were closed in 2030 between the First Avenue S. ramps and the Battery Street Tunnel ramps. However, for reasons discussed in Question 1 of this chapter, certain aspects of the transportation network such as travel times, travel speeds, and congested intersections were not evaluated.
- **2030 build alternatives with and without tolls –** Traffic conditions were evaluated for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives with and without tolls.

3 How do the SR 99 lane configuration and access points compare among the alternatives?

Exhibit 5-1 compares proposed access points between the existing SR 99 roadway and the proposed build alternatives.

Proposed access points are the same for each of the build alternatives with or without tolls.

The Elevated Structure Alternative provides access that most closely resembles connections provided by the existing viaduct. Compared to the existing facility, the Elevated Structure Alternative would remove the northbound on-ramp and southbound off-ramp at Battery Street and change access points north of Denny Way. The Cut-and-Cover Tunnel Alternative provides similar connections as the Elevated Structure, only it would remove the Columbia and Seneca ramps. Access to and from downtown from the south would be provided by the northbound off-ramp and southbound on-ramp to Alaskan Way S. just south of S. King Street, provided as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. In addition to the access changes described above, the Bored Tunnel Alternative would remove the northbound Elliott Avenue off-ramp and southbound Western Avenue on-ramp. Drivers that currently use these ramps could either use Alaskan Way or the bored tunnel and Mercer Street to access SR 99 as shown in Exhibit 5-2.

The build alternatives all propose two through lanes in each direction for traffic between S. King Street and Denny Way. The Elevated Structure and Cut-and-Cover Tunnel Alternatives would provide an additional lane in each direction on SR 99 between S. King Street and the ramps connecting to Elliott and Western Avenues.

4 How would regional travel patterns compare?

Several metrics were used to understand and compare the effects the alternatives would have to the regional transportation network. The information presented below compares the following for the Viaduct Closed and build alternatives:

- Vehicle miles of travel
- Vehicle hours of travel
- Vehicle hours of delay

Exhibit 5-1
Alternatives Comparison – SR 99 Ramp Connections

CONNECTIONS	RAMP CONNECTIONS FOR ALTERNATIVES			
To/From	Existing	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Stadium Area	A northbound on-ramp and southbound off-ramp currently provide access to First Avenue S. near Railroad Way S.	The existing ramps to First Avenue S. would be replaced with a northbound on-ramp and southbound off-ramp near S. Royal Brougham Way. In addition, a northbound off-ramp and southbound on-ramp would be provided to Alaskan Way S. just south of S. King Street as part of the S. Holgate Street to S. King Street Viaduct Replacement Project.	Same connections as the Bored Tunnel Alternative	Same connections as the Bored Tunnel Alternative
Downtown Seattle	A northbound off-ramp is located at Seneca Street and a southbound on-ramp is located at Columbia Street.	The Columbia and Seneca Street ramps would be removed. Access to and from downtown from the south would be provided by the northbound off-ramp and southbound on-ramp to Alaskan Way S. just south of S. King Street.	Same connections as the Bored Tunnel Alternative	The Columbia and Seneca ramps would be rebuilt in addition to the ramps provided near the stadium area.
Elliott & Western Corridor	SR 99 connections are provided by a northbound off-ramp at Western Avenue, a southbound on-ramp at Elliott Avenue, a northbound on-ramp near Battery Street, and a southbound off-ramp at Battery Street.	The existing ramps would not be replaced. Instead, drivers heading to or from SR 99 and northwest Seattle (including Ballard, Interbay, and Magnolia) could access SR 99 via Mercer Street and new ramps at Republican Street, or drivers could connect to SR 99 by traveling on Alaskan Way.	The Battery Street ramps would be removed. The Western Avenue northbound off-ramp and the Elliott Avenue southbound on-ramp would be replaced with new ramps in a similar location as the existing ramps.	Same as the Cut-&-Cover Tunnel Alternative
South Lake Union	Access is provided by a northbound on-ramp and southbound off-ramp at Denny Way, a northbound off-ramp at Mercer Street, a southbound off-ramp at Broad Street, and several side street connections.	Existing ramps to Denny Way and the southbound off-ramp to Broad Street would be replaced with ramps that provide access to Aurora Avenue near Harrison Street. A southbound on-ramp and northbound off-ramp at Republican Street would replace street connections between John and Mercer Streets and the northbound off-ramp to Mercer Street.	The Denny Way ramps would be rebuilt in their current location. Side street connections between John and Aloha Streets would be replaced by a northbound off-ramp to Republican Street and improved right turn on and off connections at Roy Street.	Same as the Cut-&-Cover Tunnel Alternative

What is the project study area for transportation effects?

The traffic study area for this project is roughly bordered by I-5 to the east, Elliott Bay to the west, S. Spokane Street to the south, and Valley Street to the north. This area includes I-5, SR 99, the Spokane Street Viaduct, SR 519, and many city streets.

What area does Seattle Center City refer to?

The area defined as Seattle Center City is roughly bounded by S. Royal Brougham Way in the south, just north of Mercer Street to the north, Broadway to the east, and Elliott Bay to the west.

Vehicle Miles Traveled

Vehicle miles of travel (VMT) measures how many total miles all vehicles travel on a roadway network on an average weekday. Exhibit 5-3 shows VMT for the downtown Seattle Center City area, as well as for the broader four-county region.

Exhibit 5-3
2030 Daily Vehicle Miles of Travel
in Daily Miles Traveled

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Seattle Center City						
2,371,400	2,521,600	2,534,400	2,545,400	2,540,000	2,556,600	2,551,200
Four-County Region						
110,820,300	109,471,700	109,541,400	109,497,900	109,506,800	109,668,400	109,696,600

Among the alternatives, the Viaduct Closed would have the lowest VMT in the Seattle Center City. VMT is lowest with the Viaduct Closed because there would be less roadway capacity in Seattle. This would increase congestion on adjacent routes including I-5 and city streets, which would cause drivers to eliminate trips or avoid the area. Of all the alternatives, VMT for the Viaduct Closed is highest in the four-county region. In this case, VMT is highest for Viaduct Closed because drivers would redistribute to other less direct routes, increasing VMT in the four-county region.

Among the build alternatives, VMT across the four-county region is about equal with and without tolls. These results suggest that various SR 99 build alternatives have little effect on the number of vehicle miles traveled in the region.

Differences among the build alternatives at the local, Seattle Center City level are minor and vary by just over 1 percent. VMT is expected to be highest for the Non-Tolled Elevated Structure Alternative and lowest for the Non-Tolled Bored Tunnel Alternative. VMT would be highest for the Non-Tolled Elevated Structure because it provides more access to and from SR 99 of any of the build alternatives evaluated. Conversely, the Non-Tolled Bored Tunnel Alternative is expected to have the lowest VMT because it provides less access than the other build alternatives. Within the Seattle Center City, differences between the tolled build alternatives and the non-tolled build alternatives are less than one half of 1 percent, which suggests that tolling has very little if any effect on the number of vehicle miles traveled in the local area. The reason why tolling has a very small effect on VMT is that routes drivers might choose to take to avoid the tolls would require traveling a similar distance as SR 99.

Vehicle Hours Traveled

Vehicle hours of travel (VHT) indicates the total number of hours traveled on the roadway network on an average weekday. Exhibit 5-4 shows daily VHT for the downtown Seattle Center City area as well as the broader four-county region.

SR 99 Access To and From Northwest Seattle

With the Bored Tunnel *With the Cut-&-Cover Tunnel and Elevated Structure*

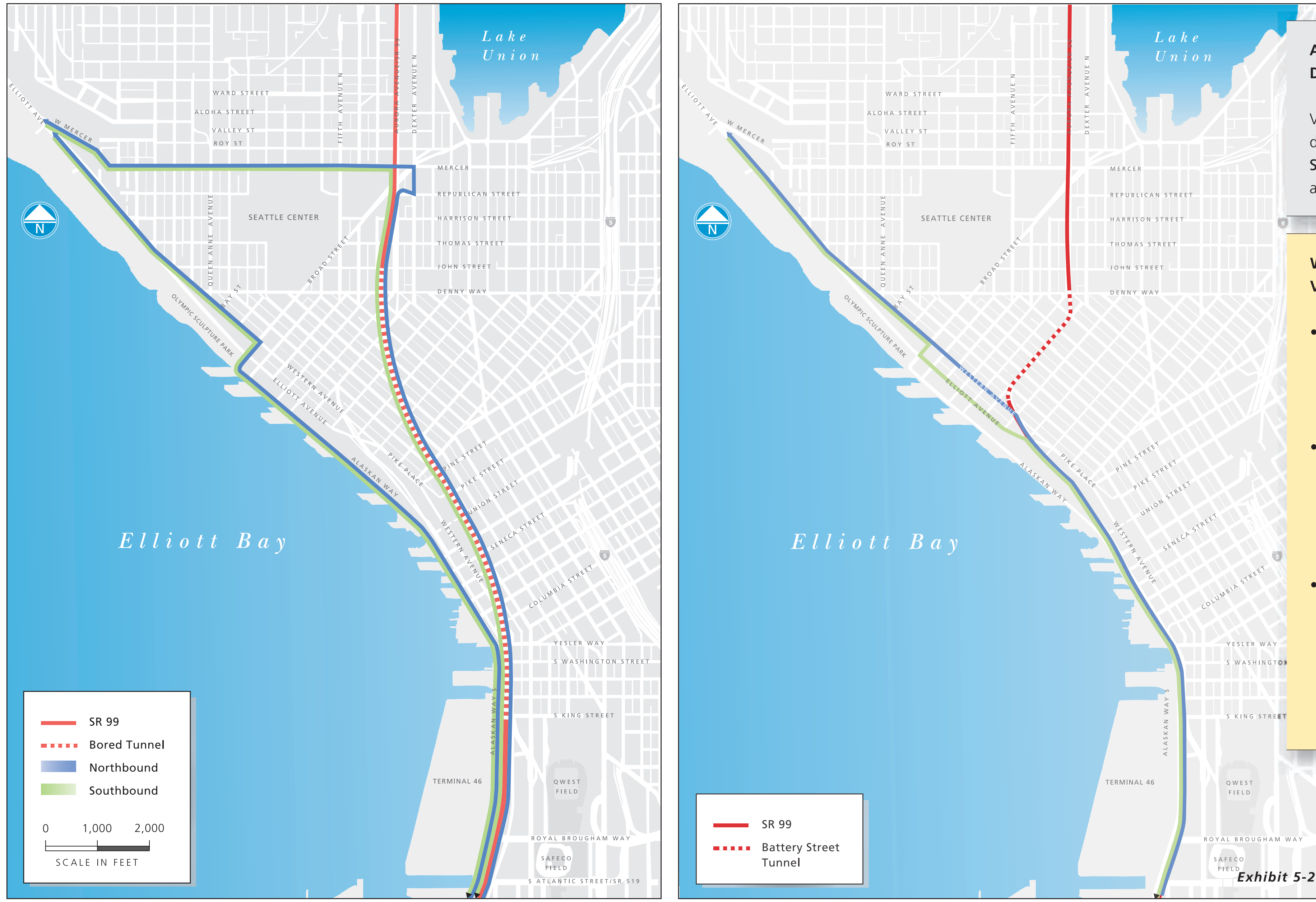


Exhibit 5-2

Appendix C, Transportation Discipline Report

Vehicle miles traveled are discussed in *Appendix C*, Sections 5.1.1, 7.2.1.1, 7.2.2.1, and 7.2.3.1.

What are VMT, VHT, and VHD?

- Vehicle miles of travel (VMT) measures how many miles vehicles travel on the roadway network.
- Vehicle hours of travel (VHT) indicates the total number of hours that travelers spend on the roadway network.
- Vehicle hours delay (VHD) measures the number of hours lost by travelers due to traveling at less than the posted speed limit. VHD is often used as an indicator of congestion.

Exhibit 5-4
2030 Daily Vehicle Hours of Travel
in Daily Hours Traveled

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Seattle Center City						
107,400	101,000	107,900	99,500	107,500	99,700	109,100
Four-County Region						
4,436,100	4,402,800	4,415,500	4,402,300	4,409,500	4,427,900	4,440,500

In the four-county region and the Seattle Center City, VHT is highest with the Viaduct Closed and tolled build alternatives. Differences among the alternatives in VHT at the regional four-county level are less than 1 percent, which suggests that SR 99 has very little effect on VHT in the four-county region. Within the Seattle Center City, differences are more pronounced. VHT is highest with the tolled build alternatives and the Viaduct Closed. For Viaduct Closed and the tolled build alternatives, VHT would increase because adjacent roadways would be more congested, which would increase delay for many trips in Seattle area. VHT is expected to increase by about 7 percent for the Tolled Bored Tunnel compared to the Non-Tolled Bored Tunnel. VHT for the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure is expected to increase by 8 and 9 percent, respectively.

Vehicle Hours of Delay

Vehicle hours of delay (VHD) measures the number of hours lost by travelers due to traveling at less than the posted speed limit during an average weekday. VHD is often used as an indicator of congestion. Exhibit 5-5 shows daily VHD for the Seattle Center City area as well as for the broader four-county region.

Exhibit 5-5
2030 Daily Vehicle Hours of Delay
in Daily Hours Delay

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Seattle Center City						
41,300	33,300	38,700	31,000	37,600	31,100	38,900
Four-County Region						
1,385,800	1,355,000	1,364,400	1,353,700	1,358,700	1,374,900	1,384,900

Note: The four-county region comprises King, Pierce, Snohomish, and Kitsap counties.

VHD is highest for Viaduct Closed for the four-county region and Seattle Center City. VHD is highest with the Viaduct Closed because drivers would redistribute to other less direct routes that would become more congested if the viaduct were closed, which would increase total delay in the transportation system. The increase in vehicle delay is much more pronounced at the local, Seattle Center City level than within the broader four-county region. VHD would be lowest with the Non-Tolled Cut-and-Cover Tunnel because this alternative maintains direct access to the Elliott and Western transportation corridor, but it eliminates access at Columbia and Seneca Streets. This combination of access elements improves travel speeds and reduces delay compared to the Non-Tolled Elevated Structure and Bored Tunnel Alternatives.

In all cases, tolling the build alternatives increases delay both locally and regionally. Tolling is expected to increase delay because drivers would divert to other routes that are more congested. The total number of hours of delay is expected to be similar among the tolled build alternatives in the local Seattle Center City area.

5 How would vehicle volumes and person throughput compare?

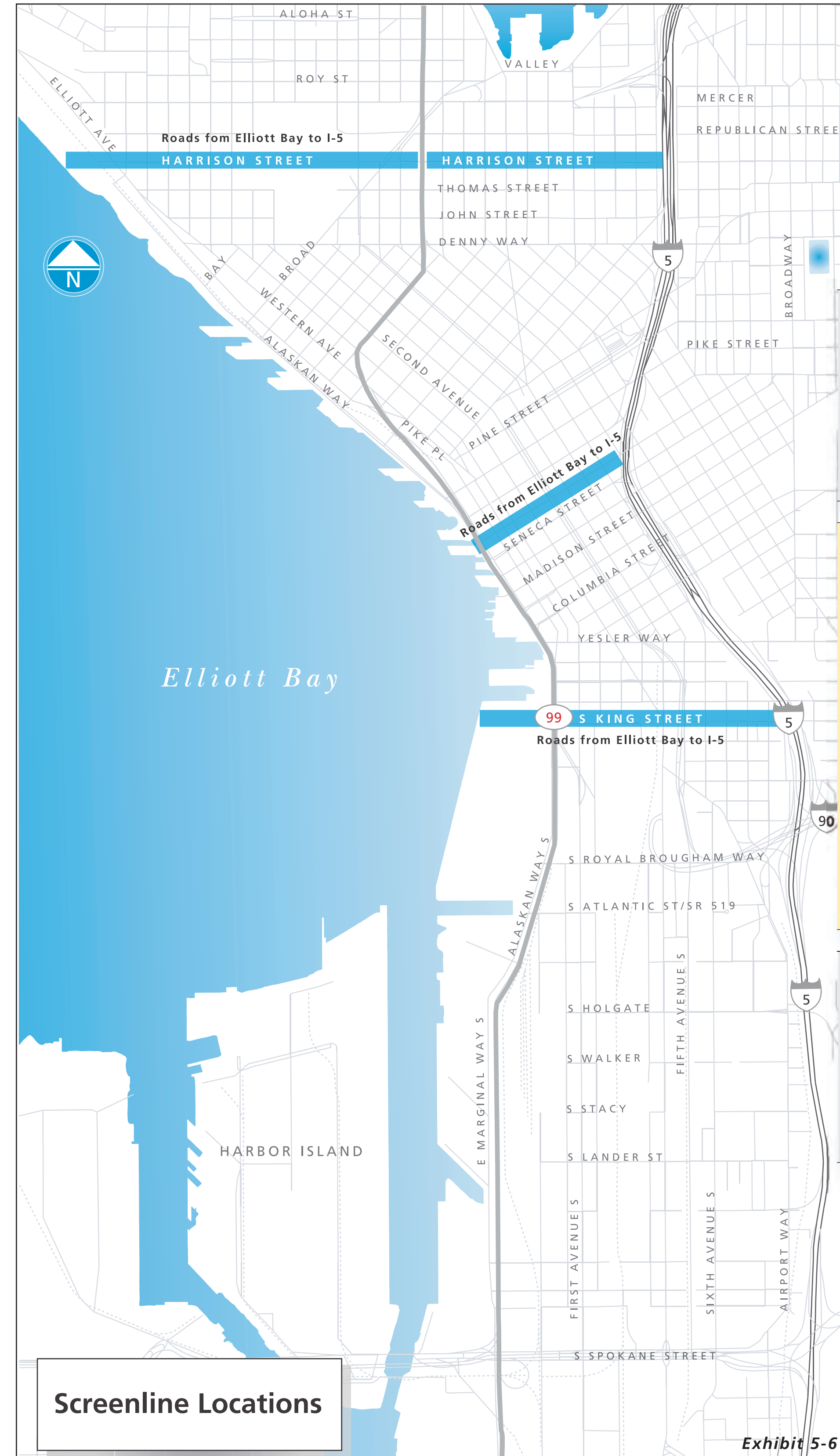
Vehicle Volumes at Screenlines

Traffic volumes were analyzed throughout the transportation system located in the study area. The analysis captured combined traffic volumes on I-5, SR 99, and local streets at specific locations called screenlines, shown in Exhibit 5-6. The results of the screenline analysis at three locations in the study area are provided in Exhibit 5-7.

Exhibit 5-7
2030 Daily Vehicle Volumes at Screenlines
Daily Volume

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
South Screenline – South of S. King Street						
515,800	559,000	561,500	565,500	565,100	572,800	566,800
Central Screenline – North of Seneca Street						
447,500	491,100	490,800	498,600	492,800	502,200	487,900
North Screenline – North of Thomas Street						
538,000	578,000	572,200	569,200	559,200	569,600	556,300

Exhibit 5-7 shows that vehicle volumes would be substantially lower across all three screenlines with the Viaduct Closed. Vehicle volumes would decrease with the Viaduct Closed because SR 99 would not be replaced through downtown, which would substantially reduce roadway capacity.



Screenline Locations
Exhibit 5-6

Appendix C, Transportation Discipline Report

Vehicle Hours of Travel is discussed in *Appendix C*, Sections 5.1.2, 7.2.1.2, 7.2.2.2, and 7.2.3.2.

What is the AM peak hour (morning commute) and the PM peak hour (evening commute)?

The AM and PM peak hours occur when traffic is heaviest during the morning and evening commutes. For SR 99, the AM peak hour is from 8:00 a.m. to 9:00 a.m. The PM peak hour is from 5:00 p.m. to 6:00 p.m. Traffic conditions during these peak travel times were modeled to understand traffic conditions and effects when traffic is heaviest on a typical day.

Appendix C, Transportation Discipline Report

Vehicle Hours of Delay is discussed in *Appendix C*, Sections 5.1.3, 7.2.1.3, 7.2.2.3, and 7.2.3.3.

Across the south and central screenlines, differences in vehicle volumes among the tolled and non-tolled build alternatives vary by up to 2 percent. Vehicle volumes are expected to be highest with the Non-Tolled Elevated Structure across the south and central screenlines. Vehicle volumes would be highest with this alternative because it is the only alternative that provides ramps at Columbia and Seneca Streets that get travelers closer to desired destinations in central downtown.

Across the north screenline, differences in vehicle volumes among the tolled and non-tolled build alternatives vary by up to 4 percent. The Non-Tolled Bored Tunnel Alternative is expected to carry the highest vehicle volumes across the north screenline because the Battery Street Tunnel, just south of this location would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions for drivers, and vehicle volumes in this area would increase.

For the build alternatives, in nearly all cases, vehicle volumes for the non-tolled alternatives are expected to be higher than the tolled alternatives. These reductions in vehicle volumes across the transportation network for the tolled alternatives are likely attributed to people who choose to eliminate trips or change their destination to avoid proposed tolls.

Vehicle Volumes for the Tolled and Non-Tolled Bored Tunnel
In most cases, the Tolled Bored Tunnel is expected to carry fewer vehicles than the Non-Tolled Bored Tunnel. Small differences of 1 percent or less in vehicle volumes between the tolled and non tolled Bored Tunnel are likely attributed to people who choose to eliminate trips or change their destination to avoid tolls.

Across the south screenline, the Tolled Bored Tunnel is expected to carry slightly more vehicles than the Non-Tolled Bored Tunnel. Across the central screenline, the Tolled Bored Tunnel is expected to carry slightly fewer vehicles than the Non Tolled Bored Tunnel. However, in both cases differences are less than one half of 1 percent. North of Denny Way, the Non Tolled Bored Tunnel is expected to carry about 1 percent more vehicles than the Tolled Bored Tunnel. These results indicate that tolling has very little effect on the total number of vehicles expected to travel in the project area; however, the distribution of traffic across SR 99, I-5 and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. The number of vehicles that would divert from SR 99 and the effects to other routes are discussed in Questions 6 through 11 in this chapter.

Vehicle Volumes for the Tolled and Non-Tolled Cut-and-Cover Tunnel
The Tolled Cut-and-Cover Tunnel is expected to carry fewer vehicles than the Non-Tolled Cut-and-Cover Tunnel. Small differences of up to 2 percent in vehicle volumes between the tolled and non tolled Cut-and-Cover Tunnel are likely attributed to people who choose to eliminate trips or change their destination to avoid tolls.

Across the south screenline, the Non-Tolled Cut-and-Cover Tunnel is expected to carry slightly more vehicles than the Tolled Cut-and-Cover Tunnel; however, differences are less than one half of 1 percent. Across the central screenline, the Non-Tolled Cut-and-Cover Tunnel is expected to carry about 1 percent more vehicles than the Tolled Cut-and-Cover Tunnel. North of Denny Way, the Non-Tolled Cut-and-Cover Tunnel is expected to carry about 2 percent more vehicles than the Tolled Cut-and-Cover Tunnel. These results indicate that tolling has very little effect on the total number of vehicles expected to travel in the project area; however, the distribution of traffic across SR 99, I-5 and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. The number of vehicles that would divert from SR 99 and the effects to other routes are discussed in Questions 6 through 11 in this chapter.

Vehicle Volumes for the Tolled and Non-Tolled Elevated Structure
The Tolled Elevated Structure is expected to carry fewer vehicles than the Non-Tolled Elevated Structure. Small differences in vehicle volumes of 2 percent or less between the tolled and non tolled Elevated Structure are likely attributed to people who choose to eliminate trips or change their destination to avoid tolls.

Across the south screenline, the Non-Tolled Elevated Structure is expected to carry about 1 percent more vehicles than the Tolled Elevated Structure. Across the central screenline, the Non-Tolled Elevated Structure is expected to carry about 3 percent more vehicles than the Tolled Elevated Structure. North of Denny Way, the Non-Tolled Elevated Structure is expected to carry about 2 percent more vehicles than the Tolled Elevated Structure. These results indicate that tolling has very little effect on the total number of vehicles expected to travel in the project area; however, the distribution of traffic across SR 99, I-5 and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. The number of vehicles that would divert from SR 99 and the effects to other routes are discussed in Questions 6 through 11 in this chapter.

Person Throughput at Screenlines
Person throughput is similar to assessing vehicle volumes, though the output focuses on the number of people traveling through the transportation network at specific screenlines rather than the vehicle volumes. Person throughput was evaluated for the alternatives at the same locations as vehicle volumes, and the results of the analysis are shown in Exhibit 5-8.

Exhibit 5-8
2030 Person Throughput at Screenlines
Daily Volume

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
South Screenline – South of S. King Street						
821,800	880,600	885,300	890,900	893,700	899,800	895,700
Central Screenline – North of Seneca Street						
727,600	795,800	798,100	808,200	803,800	814,900	798,700
North Screenline – North of Thomas Street						
839,900	894,700	887,200	880,700	867,800	882,400	865,500

Appendix C, Transportation Discipline Report

Screenline vehicle volumes and analysis are discussed in *Appendix C*, Sections 5.1.5, 7.2.1.5, 7.2.2.5 and 7.2.3.5.

Person throughput at screenlines is discussed in *Appendix C*, Sections 5.1.4, 7.2.1.4, 7.2.2.4, and 7.2.3.4.

The results for the person throughput analysis show similar trends as those discussed earlier in Question 5 for vehicle volumes. Because these trends were discussed in the previous section, this text provides an overview of the results with less detail.

Exhibit 5-8 shows that person throughput would be substantially lower across all three screenlines with the Viaduct Closed. Person throughput would decrease with the Viaduct Closed because SR 99 would be closed for safety reasons, which would reduce total person throughput through Seattle's transportation network.

Across the south and central screenlines, differences in person throughput among the tolled and non-tolled build alternatives vary by as much as to 2 percent. Person throughput is expected to be highest with the Non-Tolled Elevated Structure across the south and central screenlines. Person throughput would be highest with this alternative because it provides more access to and from SR 99 than any of the build alternatives evaluated.

Across the north screenline, differences in vehicle volumes among the tolled and non-tolled build alternatives vary by up to 3 percent. The Non-Tolled Bored Tunnel Alternative is expected to carry the highest number of people across the north screenline because the Battery Street Tunnel, just south of this location would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions, and person throughput in this area would increase.

For the build alternatives, in nearly all cases, person throughput for the non-tolled alternatives is expected to be higher than for the tolled alternatives. However, person throughput varies between the tolled and non-tolled build alternatives by a small amount (3 percent or less), which suggests that tolling has very little effect on the total number of people expected to use the transportation network in the project area; however, the distribution of traffic across SR 99, I-5, and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. Reductions in person throughput across the transportation network for the tolled alternatives are likely attributed to people who choose to eliminate trips or change their destination to avoid proposed tolls.

6 How would SR 99 mainline and ramp volumes compare?

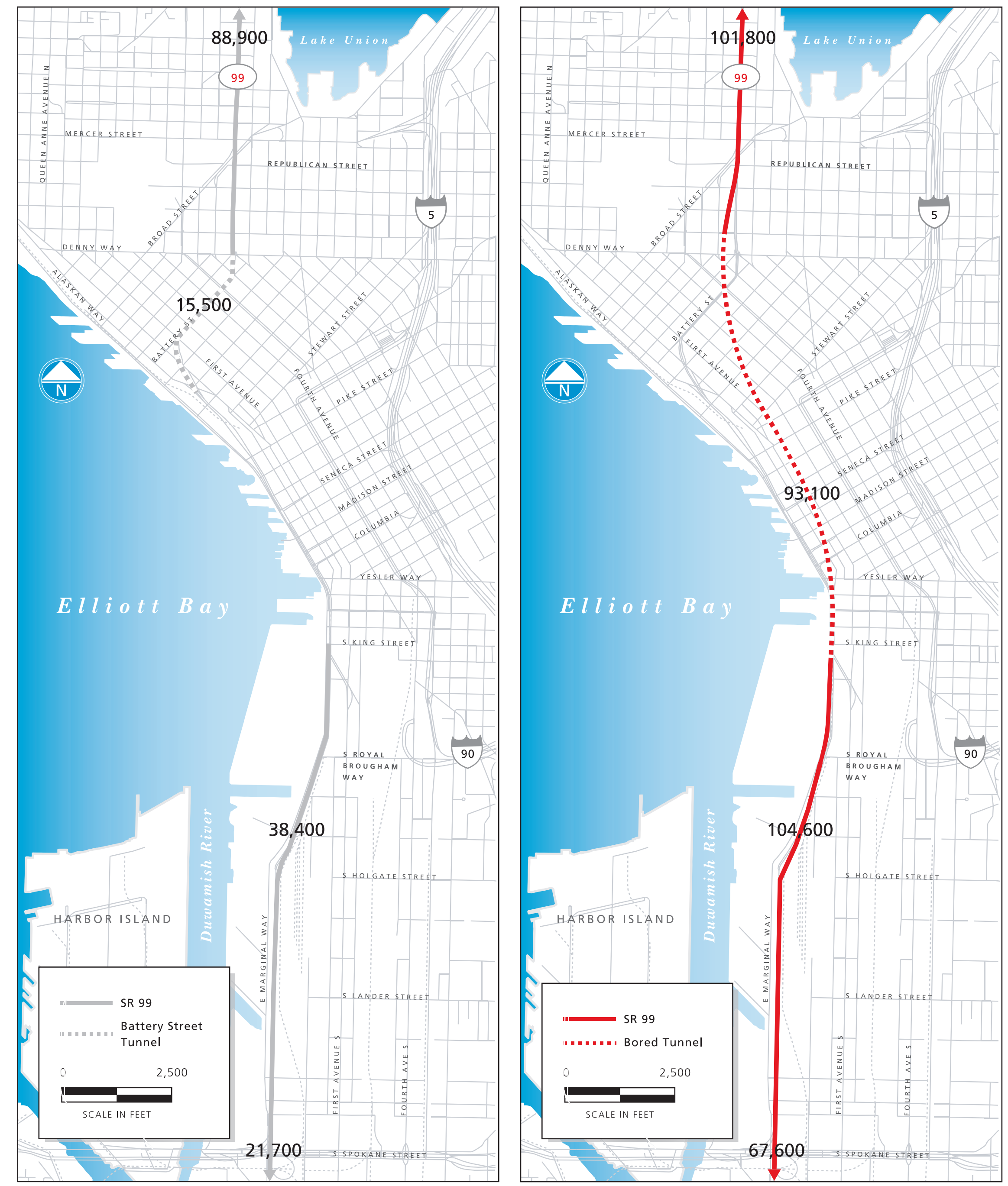
Exhibits 5-9 and 5-10 compare average daily traffic volumes on the SR 99 mainline and ramps. If SR 99 is not tolled, daily traffic volumes on SR 99 through the south and central sections are projected to be lower for the Bored Tunnel than for the other alternatives, because the Columbia and Seneca ramps and the Elliott and Western ramps would be removed and access would be provided at different locations. North of Virginia Street, near the Battery Street Tunnel, SR 99 daily volumes with the Non-Tolled Bored Tunnel are expected to be higher than with the other alternatives. Traffic volumes would increase near the current location of the Battery Street Tunnel, because the Battery Street Tunnel would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions for drivers, and additional traffic would be expected to use the tunnel.

Even though SR 99 volumes are expected to decrease in the southern and central sections with the Non-Tolled Bored Tunnel Alternative, vehicle volumes across the transportation system are expected be similar among all of the build alternatives. As discussed previously in Question 5 and shown in Exhibit 5-7, the Non-Tolled Bored Tunnel is expected to carry fewer vehicles each day (about 2 to 2.5 percent) than the Non Tolled Cut-and-Cover Tunnel and Elevated Structure.

If SR 99 is tolled, SR 99 mainline and ramp volumes would change substantially, since many drivers are expected to divert from SR 99 to other routes such as I-5 and city streets to avoid the toll. For each of the tolled alternatives, tolls would only be charged for through trips, so many northbound drivers are expected to divert from SR 99 near the stadiums or avoid SR 99 by getting on north of

2030 SR 99 Mainline Volumes

Viaduct Closed *Non-Tolled Bored Tunnel*



Appendix C, Transportation Discipline Report

SR 99 vehicle and ramp volumes are discussed in *Appendix C*, Sections 5.2.1, 7.3.1.1, 7.3.2.1, and 7.3.3.1.

2030 SR 99 Mainline Volumes

Tolled Bored Tunnel — *Non-Tolled Cut-&-Cover Tunnel* — *Tolled Cut-&-Cover Tunnel* — *Non-Tolled Elevated Structure* — *Tolled Elevated Structure*

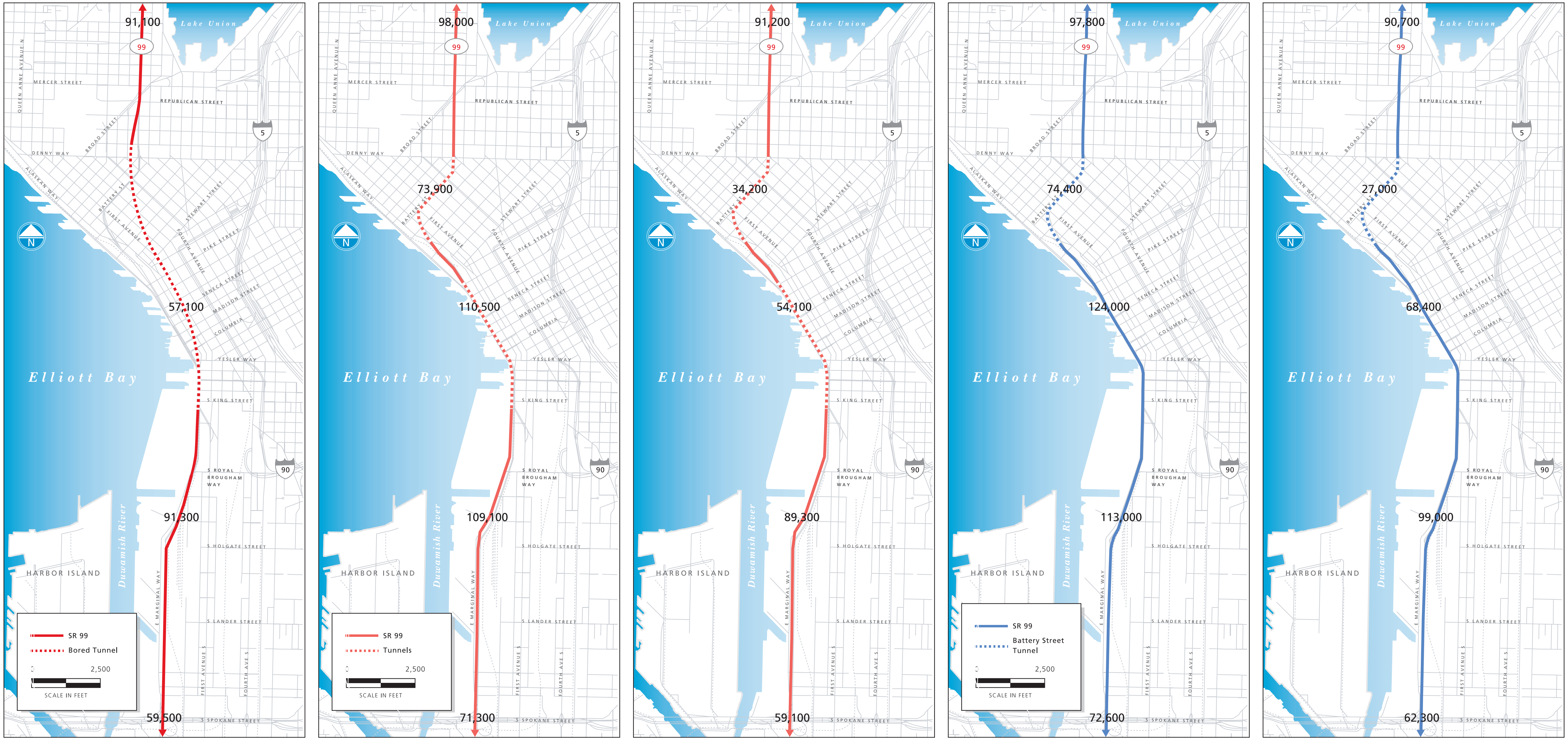


Exhibit 5-9

Denny Way. Similarly, many southbound drivers are expected to divert from SR 99 north of Denny Way or avoid SR 99 by getting on near or south of the stadiums. Tens of thousands of drivers are expected to divert, and much of this diversion is expected to occur during off-peak travel times when other routes, such as city streets and I-5, are able to accommodate additional vehicles. These added vehicles could increase the number of hours that city streets and I-5 are congested each day. In order to avoid major disruption of traffic patterns and to protect the integrity and viability of adjacent activities on the waterfront and in downtown Seattle, WSDOT and the City will implement a long-term tolling solution to minimize the amount of diverted traffic to optimize operation of the transportation network as described in Chapter 8, Question 1. For the tolled alternatives, the Elevated Structure is expected to carry the highest vehicle volumes in the south and central areas, followed by the Bored Tunnel and Cut-and-Cover Tunnel. North of Virginia Street, the Tolled Bored Tunnel is expected to carry the most vehicles, because the Battery Street Tunnel would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less abrupt curves.

7 How would traffic conditions on I-5 compare?

I-5 vehicle volumes south of SR 520 show less than a 1 percent difference among the alternatives, as shown in Exhibit 5-11. I-5 vehicle volumes for the Viaduct Closed show up to a 5 percent increase over the proposed build alternatives near Seneca Street and south of I-90. This increase is to be expected, since SR 99 would be closed. For the non-tolled alternatives, I-5 vehicle volumes show very little variation among the build alternatives (less than one half of 1 percent) near Seneca Street and south of I-90. If the build alternatives are tolled, additional vehicles are expected to divert to I-5 near Seneca and south of I-90. Near Seneca Street, traffic volumes on I-5 would increase by about 4 percent for the tolled build alternatives compared to the non-tolled build alternatives. I-5 volumes south of I-90 are expected to increase by 2 or 3 percent with the tolled build alternatives. Trips that divert to I-5 because of tolls on SR 99 are expected to divert primarily during off-peak travel times when I-5 can accommodate additional vehicles. Additional traffic on I-5 during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route.

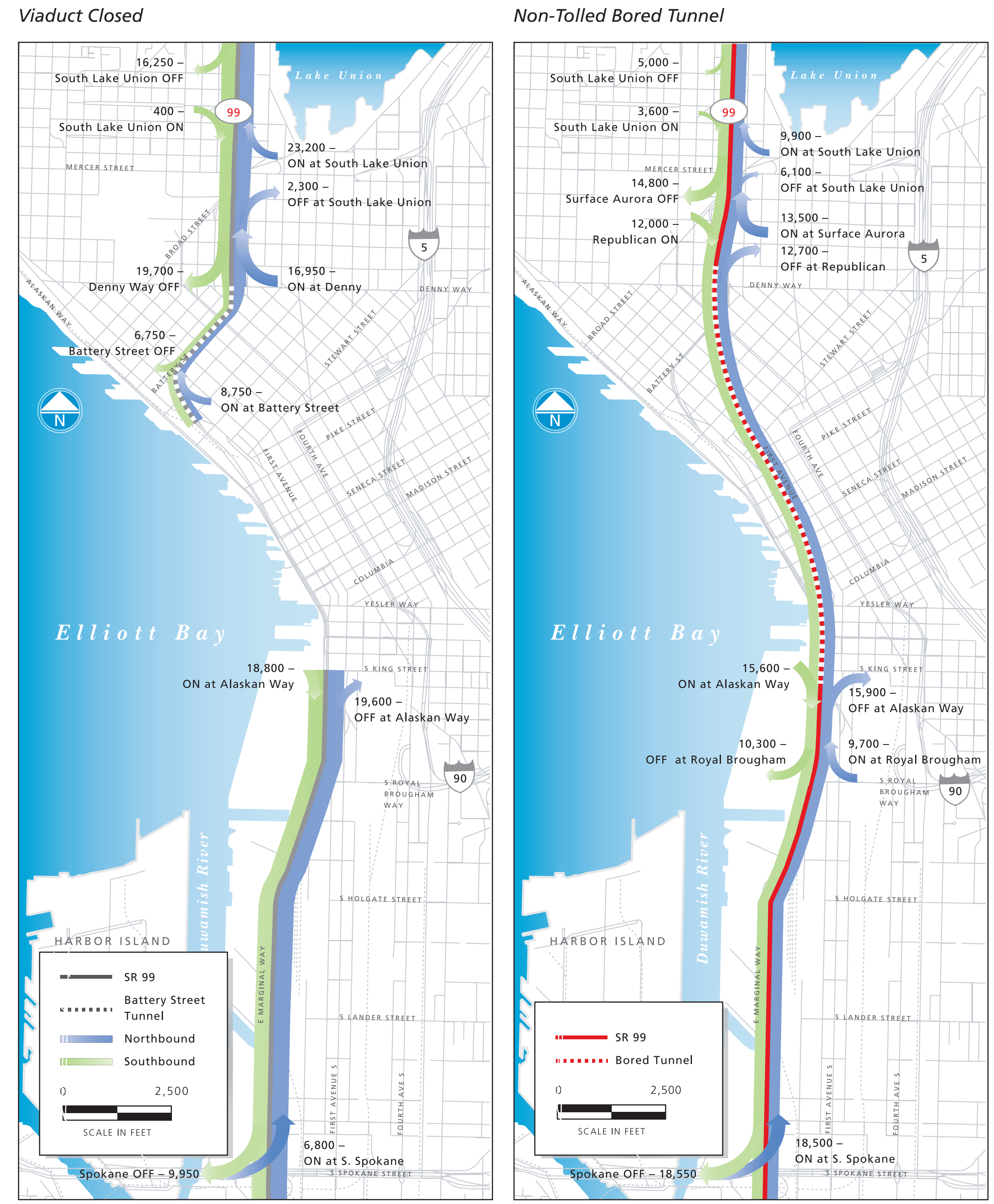
Exhibit 5-11
I-5 Daily Vehicle Volumes in 2030

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
I-5 Just South of I-90						
281,900	268,200	276,700	268,200	277,100	266,700	273,000
I-5 Just North of Seneca Street						
283,200	269,200	281,000	268,600	280,700	268,800	281,200
Just I-5 South of SR 520						
324,900	324,200	326,100	324,700	325,200	325,700	326,300

8 How would traffic conditions on area streets compare?

Exhibits 5-12 and 5-13 show the intersections that would operate with congested conditions for the tolled and non-tolled build alternatives. Exhibits 5-14 and 5-15 indicate the number of congested intersections for the tolled and non-tolled build alternatives. If the build alternatives are tolled, increased congestion and delay is expected at many intersections in the project area. This congestion and delay would be caused by higher volumes of vehicles expected on city streets as drivers choose to divert from SR 99 to avoid tolls. The text in Questions 9, 10, and 11 explains how daily vehicle volumes would increase on city streets in the south, central, and north project areas if the build alternatives were tolled, and the effects of these increases. The effects of vehicle volume increases due to tolling would be most pronounced in the central (or downtown) area. If the build alternatives are tolled, effects to surface streets would be mitigated as discussed in Chapter 8, Question 1.

2030 SR 99 Ramp Volumes



Appendix C, Transportation Discipline Report

Vehicle volumes on I-5 are presented in *Appendix C*, Sections 5.1.6, 7.2.1.6, 7.2.2.6, and 7.2.3.6.

2030 SR 99 Ramp Volumes

Tolled Bored Tunnel | *Non-Tolled Cut-&-Cover Tunnel* | *Tolled Cut-&-Cover Tunnel* | *Non-Tolled Elevated Structure* | *Tolled Elevated Structure*

Exhibit 5-10

Exhibit 5-14
Congested Intersections during the AM Peak Hour[1]

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
South Area – South of S. King Street						
	3	1	6	4	4	3
Central Area – North of S. King Street						
	3	8	0	7	0	12
North Area – North of Denny Way						
	8	10	5	10	5	10
Total	14	19	11	21	9	25

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate*

Exhibit 5-15
Congested Intersections during the PM Peak Hour[1]

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
South Area – South of S. King Street						
	4	5	2	6	2	7
Central Area – North of S. King Street						
	6	13	3	9	5	19
North Area – North of Denny Way						
	9	17	9	14	9	13
Total	19	35	14	29	16	39

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate*

9 How would conditions compare on city streets south of S. King Street?

Exhibit 5-16 shows the location of screenlines and Exhibit 5-17 shows expected daily vehicle volumes on city streets south of S. King Street for the alternatives.

Exhibit 5-17
2030 Daily Vehicle Volumes for Screenlines South of S. King Street
Daily Volume

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Streets just north of S. Spokane Stree between the Duwamish River & I-5						
139,300	117,000	128,100	115,900	129,300	115,000	122,600
Streets just south of S. King Street between SR 99 & I-5						
124,100	109,400	124,100	98,200	119,900	94,600	116,800

Expected Conditions for the Non-Tolled Build Alternatives

For the non-tolled build alternatives, vehicle volumes on city streets in the south are expected to be slightly higher for the Bored Tunnel than the other two build alternatives as shown in Exhibit 5-17. The reason for this is that the Bored Tunnel does not provide ramps to Elliott and Western Avenue, which would cause more drivers to travel on city streets. Despite increased traffic volumes on city streets with the Non-Tolled Bored Tunnel, a similar number of intersections are expected to be congested as the other build alternatives, as shown in Exhibit 5-18.

Exhibit 5-18
Congested Intersections in the South Area[1]
South of S. King Street

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
AM Peak Hour	3	1	6	4	4	3
PM Peak Hour	4	5	2	6	2	7

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

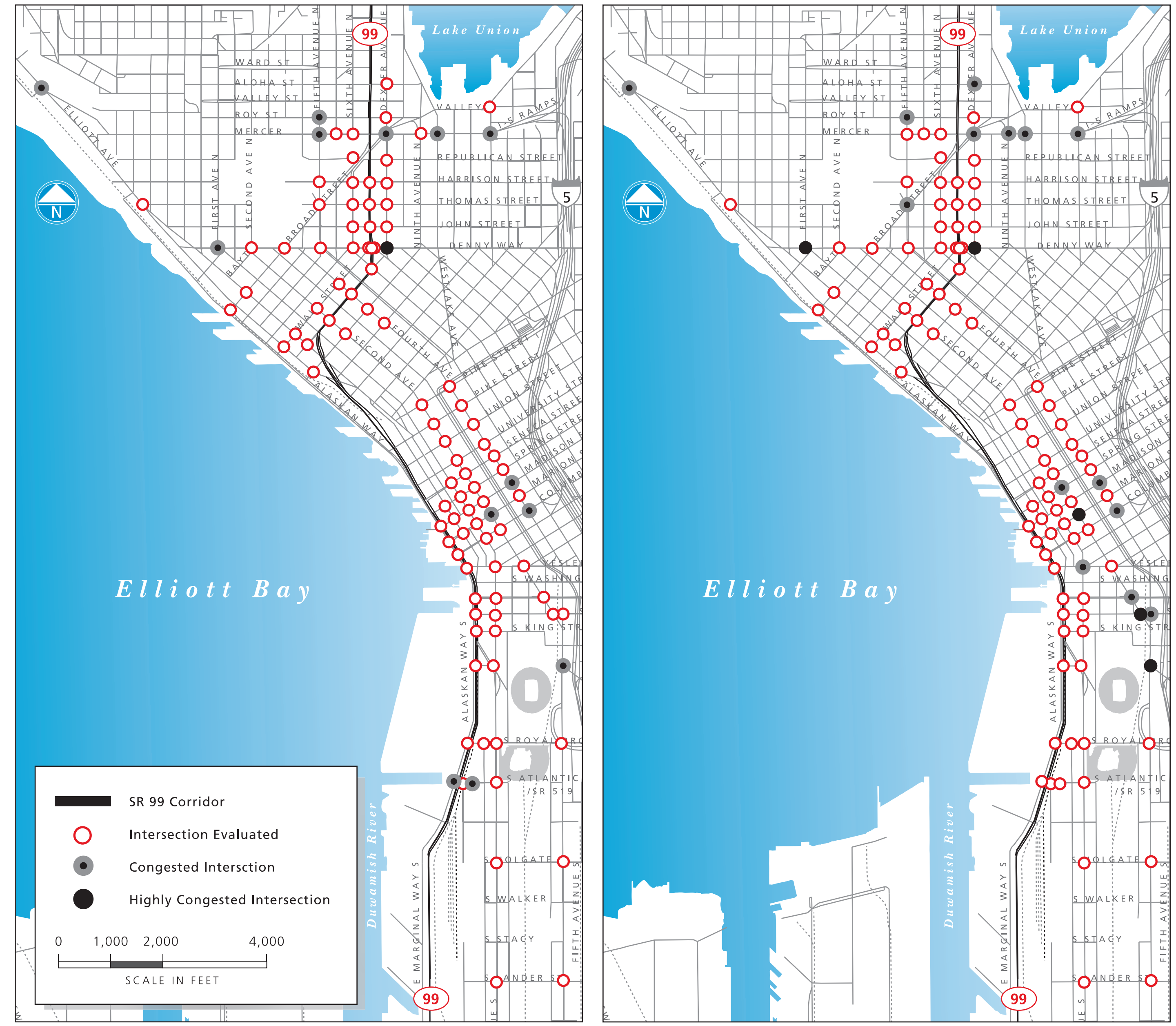
Expected Conditions for the Tolled Build Alternatives

Exhibit 5-17 shows that vehicle volumes on city streets in the south are expected to increase by several thousand vehicles per day if the build alternatives are tolled. However, the total number of congested intersections is expected to decrease during the morning commute by one or two intersections if SR 99 is tolled. Intersections along S. Atlantic Street are expected to be less congested if SR 99 is tolled because fewer vehicles would use the on-ramp in this area to get onto SR 99. Instead, many drivers would avoid this on-ramp and use non-tolled routes to reach their destinations.

During the evening commute, a similar number of intersections are expected to be congested with Tolled Bored Tunnel as compared to the Non-Tolled Bored Tunnel. For the other build alternatives, four or five additional intersections are expected to be congested if the build alternatives were tolled. For all of the tolled build alternatives, the location of the congestion would shift from the streets located near the SR 99 ramps to the intersection of Fourth Avenue S. and Airport Way and intersections on First Avenue if the build alternatives were tolled. Congestion would shift due to fewer vehicles using the SR 99 ramps to avoid paying tolls on SR 99.

2030 Congested Intersections – AM Peak Hour[1]

Non-Tolled Bored Tunnel | *Tolled Bored Tunnel*



1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

Congested Intersections for Viaduct Closed

As discussed in **Question 1** of this chapter, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of intersection conditions are not appropriate and are not shown in exhibits.

2030 Congested Intersections – AM Peak Hour[1]

Non-Tolled Cut-&-Cover Tunnel | *Tolled Cut-&-Cover Tunnel* | *Non-Tolled Elevated Structure* | *Tolled Elevated Structure*

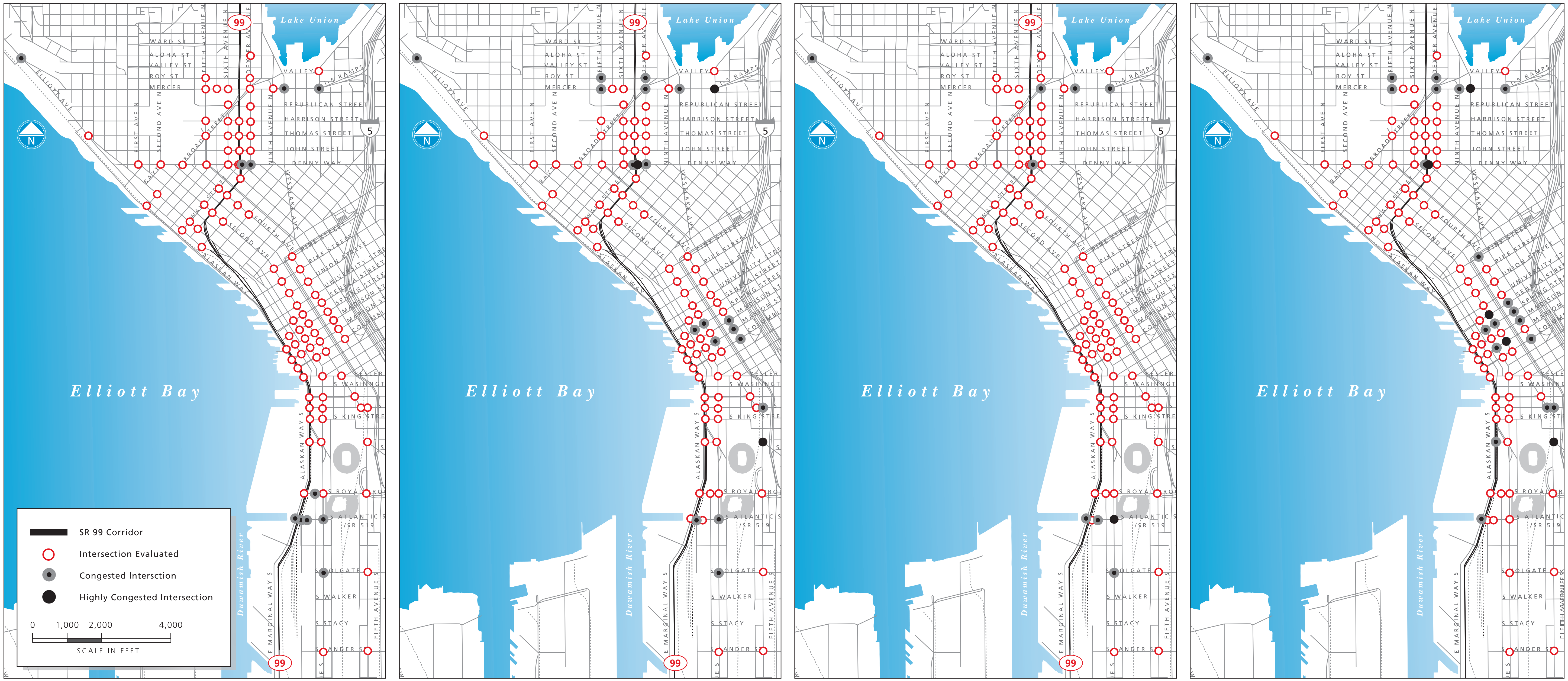


Exhibit 5-12

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

Appendix C, Transportation Discipline Report

Congested intersections are discussed in *Appendix C*, Sections 5.3 and 7.4.

10 How would conditions compare for Alaskan Way and streets north of S. King Street?

Conditions on Alaskan Way

Exhibit 5-19 shows expected daily vehicle volumes on Alaskan Way.

Exhibit 5-19
Daily Vehicle Volumes on Alaskan Way in 2030

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Just South of S. King Street						
47,300	33,300	38,200	33,700	47,000	22,500	34,300
Just North of Seneca Street						
25,300	19,800	25,700	16,800	30,100	16,300	30,500
Just North of Pine Street						
24,800	18,800	24,900	15,600	27,600	15,400	28,200

Expected Conditions for the Non-Tolled Build Alternatives

For the non-tolled build alternatives, daily vehicle volumes on Alaskan Way are expected to be highest with the Bored Tunnel. Increased vehicle volumes are expected on Alaskan Way with this alternative, because SR 99 would no longer provide ramps to Elliott and Western Avenues. Because of this, Alaskan Way would become one of two possible travel routes for trips heading to and from northwest Seattle, which would increase traffic volumes on Alaskan Way.

Expected Conditions for the Tolled Build Alternatives

If the build alternatives were tolled, daily vehicle volumes on Alaskan Way are expected to increase by several thousand vehicles per day compared to the non-tolled build alternatives as drivers divert from SR 99 to avoid paying tolls. The Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure are expected to have higher vehicle volumes on Alaskan Way north of S. King Street than the Tolled Bored Tunnel, because these two build alternatives would rebuild and improve Alaskan Way, which would increase demand if SR 99 were tolled. In addition, more drivers are expected to divert to city streets with the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure because drivers would need to pay a toll to use the Elliott and Western ramps. There are other routes, such as Alaskan Way and Mercer Street that drivers could use to avoid paying these tolls.

Even though daily vehicle volumes on Alaskan Way would substantially increase if SR 99 is tolled, these increases are not expected to substantially increase intersection congestion on Alaskan Way during peak travel hours as indicated previously in Exhibits 5-12 and 5-13.

Conditions on Streets North of Seneca Street

Exhibit 5-20 shows expected daily vehicle volumes on city streets just north of Seneca Street for the alternatives.

Exhibit 5-20
Daily Vehicle Volumes in 2030 for Screenlines North of Seneca Street
Daily Volume

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Streets between Alaskan Way & I-5, north of Seneca Street						
143,000	114,300	129,100	108,200	130,300	111,600	138,400
Streets between I-5 & Lake Washington, north of Seneca Street						
167,400	153,700	167,100	151,700	167,400	152,100	170,400

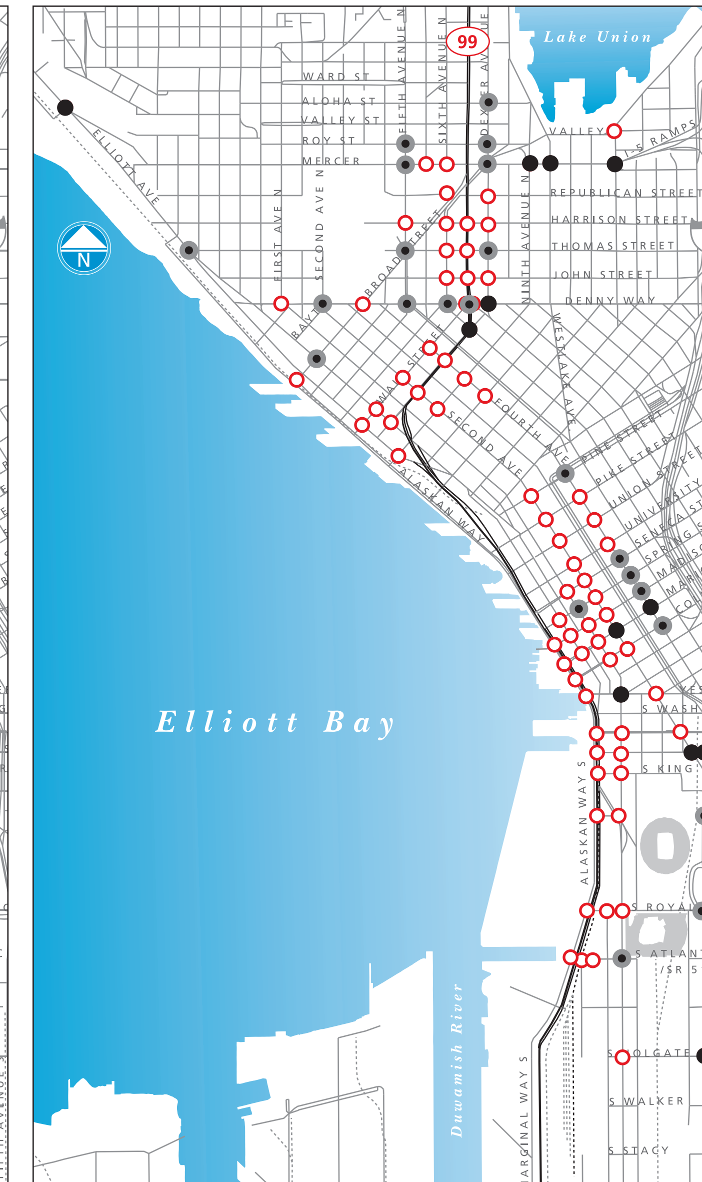
Expected Conditions for the Non-Tolled Build Alternatives

For the non-tolled build alternatives, the Bored Tunnel is expected to have higher daily vehicle volumes on city streets north of Seneca Street. Increased vehicle volumes are expected on city streets north of Seneca Street due to access changes proposed with the Non-Tolled Bored Tunnel Alternative that would eliminate the Elliott and Western ramps. Increased vehicle volumes on city streets through downtown are expected to result in a few additional congested intersections for the Non-Tolled Bored Tunnel, as compared to the other two build alternatives. During the morning commute, three additional congested intersections are expected through downtown and one to three additional intersections are expected to be congested during the evening commute as indicated in Exhibits 5-12, 5-13, and 5-21. Travel times in the general purpose travel lanes on Second and Fourth Avenues are expected to be up to 2 minutes longer with the Non-Tolled Bored Tunnel Alternative as compared to the other build alternatives, as shown in Exhibits 5-22 and 5-23.

2030 Congested Intersections – PM Peak Hour[1]

Non-Tolled Bored Tunnel

Tolled Bored Tunnel



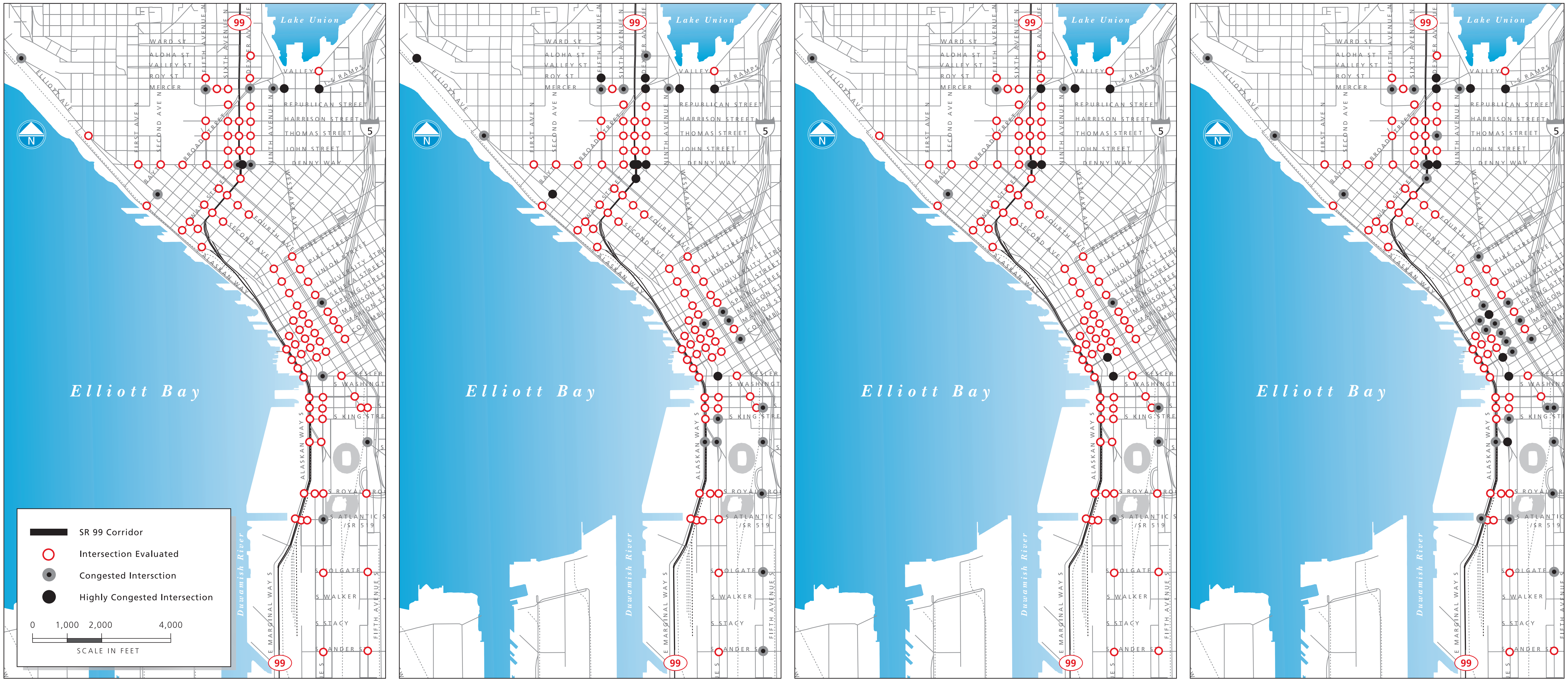
1 Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.

What are congested and highly congested intersections?

For the traffic analysis conducted for this project, congested intersections are intersections that may cause drivers considerable delay. A driver might wait about 1 or 2 minutes to travel through a traffic signal at a congested intersection. At a highly congested intersection, a driver might wait 2 minutes or more to get through the traffic signal. Traffic analysts use the phrase Level of Service (LOS) to describe intersection delay. The information presented on congested intersections in this text captures intersections expected to operate at LOS E and F in 2030.

2030 Congested Intersections – PM Peak Hour[1]

Non-Tolled Cut-&-Cover Tunnel | *Tolled Cut-&-Cover Tunnel* | *Non-Tolled Elevated Structure* | *Tolled Elevated Structure*



1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

Exhibit 5-13

Exhibit 5-21
Congested Intersections in the Central Area
S. King Street to Denny Way[1]

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
AM Peak Hour	3	8	0	7	0	12
PM Peak Hour	6	13	3	9	5	19

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

Exhibit 5-22
AM Peak Hour Travel Times for the General Purpose Lanes on Second & Fourth Avenues[1]
in Minutes

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Second Avenue – Wall Street to S. Royal Brougham Way						
Southbound	15	20	14	20	14	21
Fourth Avenue – S. Royal Brougham Way to Battery Street						
Northbound	12	21	12	21	12	21

Exhibit 5-23
PM Peak Hour Travel Times for the General Purpose Lanes on Second & Fourth Avenues[1]
in Minutes

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED-	TOLLED
Second Avenue – Wall Street to S. Royal Brougham Way						
Southbound	16	24	14	21	14	23
Fourth Avenue – S. Royal Brougham Way to Battery Street						
Northbound	14	21	13	21	13	21

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of travel times are not appropriate.*

Expected Conditions for the Tolled Build Alternatives

If the build alternatives are tolled, daily vehicle volumes on city streets north of Seneca Street are expected to increase by several thousand vehicles per day as drivers divert from SR 99 to avoid paying tolls. The Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure are expected to have higher vehicle volumes on city streets north of Seneca Street than the Tolled Bored Tunnel because more vehicles are expected to divert from SR 99 to other routes if the Cut-and-Cover Tunnel and Elevated Structure were tolled because these two build alternatives would rebuild and improve Alaskan Way, which would increase demand if SR 99 were tolled. In addition, more drivers are expected to divert to city streets with the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure because drivers would need to pay a toll to use the Elliott and Western ramps. There are other routes, such as Alaskan Way and Mercer Street that drivers would likely use to avoid paying these tolls.

Among the tolled build alternatives, congestion is expected to increase and cause drivers considerable delay during the morning and evening commutes at multiple intersections as indicated in Exhibits 5-12, 5-13, and 5-21. Most of these intersections are located on Second and Fourth Avenues. As a result, travel times in the general purpose travel lanes on Second and Fourth Avenues are expected to increase by 5 to 9 minutes during peak commute hours. Travel times for the tolled build alternatives are expected to be similar among the tolled build alternatives, as indicated in Exhibits 5-22 and 5-23.

11 How would conditions compare for streets from Denny Way north?

Exhibit 5-24 shows expected daily vehicle volumes on city streets north of Thomas Street for the alternatives.

Exhibit 5-24
Daily Vehicle Volume in 2030 for Screenlines North of Thomas Street
Daily Volume

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Streets between Elliott & Aurora Avenue, north of Thomas Street						
113,700	92,200	107,300	95,000	106,600	95,700	107,800
Streets between Aurora Avenue & I-5, north of Thomas Street						
79,500	89,800	93,500	87,800	93,500	87,300	95,200

Expected Conditions for the Non-Tolled Build Alternatives

For the non-tolled build alternatives, daily vehicle volumes on streets north of Thomas Street are expected to be similar, as shown in Exhibit 5-24. The Non-Tolled Bored Tunnel is expected to have a similar number of congested intersections as the other build alternatives during the evening commute, and three additional congested intersections during the morning commute, as shown in Exhibits 5-12 and 5-13 and listed in Exhibit 5-25. During the morning commute, additional congestion and congested intersections are expected on Mercer Street with the Non-Tolled Bored Tunnel because more vehicles are expected to travel on this route to travel to and from

Screenline Locations
on city streets

Exhibit 5-16

northwest Seattle due to the loss of the Elliott and Western ramp connections to SR 99.

Travel times on Mercer Street vary somewhat among the non-tolled build alternatives during the morning and evening commute, as shown in Exhibits 5-26 and 5-27. These variations are due to the different roadway configurations proposed for the Non-Tolled Bored Tunnel Alternative as compared to the proposed design for the Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives. The different roadway designs lead to different traffic patterns, which may vary travel times and routing.

Exhibit 5-25
Congested Intersections from Denny Way North[1]

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
AM Peak Hour	8	10	5	10	5	10
PM Peak Hour	9	17	9	14	9	13

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

Exhibit 5-26
AM Peak Hour Travel Times on Mercer Street[1]
in Minutes

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Mercer Street – I-5 to Elliott Avenue						
Westbound	12	12	8	8	9	10
Eastbound	8	9	9	9	10	11

Exhibit 5-27
PM Peak Hour Travel Times on Mercer Street[1]
in Minutes

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED-	TOLLED
Mercer Street – I-5 to Elliott Avenue						
Westbound	14	13	11	12	11	12
Eastbound	13	15	16	18	15	15

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel times are not appropriate*

Expected Conditions for the Tolled Build Alternatives
If the build alternatives are tolled, daily vehicle volumes on city streets north of Denny Way are expected to increase by several thousand vehicles per day as drivers divert from SR 99 to avoid paying tolls. Vehicle volumes at screenlines are expected to be similar among the tolled build alternatives.

Increased vehicle volumes on streets north of Denny Way will increase congestion and cause drivers considerable delay at multiple intersections, as indicated in Exhibits 5-12, 5-13, and 5-25. The effects of increased congestion would be most pronounced during the evening commute as drivers leave downtown and avoid paying tolls on SR 99 by connecting to it north of Denny Way. As shown in Exhibits 5-26 and 5-27, travel times on Mercer would stay the same or increase by a minute or two if the build alternatives were tolled.

12 How would SR 99 travel speeds compare?

Travel Speeds Overview
Exhibit 5-28 compares average SR 99 travel speeds for the build alternatives.

Exhibit 5-28
Average SR 99 Travel Speeds During Peak Hours in 2030[1]

	Southbound		Northbound	
	PEAK HOURS			
Alternative	AM	PM	AM	PM
Non-Tolled Bored Tunnel	41	38	41	38
Tolled Bored Tunnel	37	40	36	40
Non-Tolled Cut-&-Cover Tunnel	32	39	40	34
Tolled Cut-&-Cover Tunnel	34	36	33	38
Non-Tolled Elevated Structure	36	38	39	39
Tolled Elevated Structure	35	36	30	31

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel speeds are not appropriate.*

Among the non-tolled build alternatives, the Bored Tunnel is expected to operate with average SR 99 travel speeds that are equal to or faster than speeds for the Cut-and-Cover Tunnel and the Elevated Structure Alternatives. Because the Non-Tolled Bored Tunnel would have fewer access points, SR 99 volumes are expected to be lower than for the other build alternatives, which would increase speeds. Fewer access points also result in fewer weaving motions than other build alternatives, which would improve traffic flow and increase traffic speeds. Finally, the Non-Tolled Bored Tunnel replaces the Battery Street Tunnel with a new tunnel that has wider lanes and shoulders and less-abrupt curves, which will increase speeds on this section of SR 99.

For the same reasons discussed above, the Tolled Bored Tunnel is expected to operate with average SR 99 travel speeds that are equal to or faster than speeds for the Tolled Cut-and-Cover Tunnel and the Tolled Elevated Structure Alternatives.

Travel speeds for the build alternatives for specific sections of SR 99 are shown in Exhibits 5-29 and 5-30 and explained in the text below. For all of the build alternatives, drivers will experience slowing in the stadium area and north of the Battery Street Tunnel if SR 99 is tolled. Congestion is expected to increase in these areas and slow travel speeds as drivers exit SR 99 to avoid paying a toll to travel through downtown.

Travel Speeds for the Tolled and Non-Tolled Bored Tunnel
Drivers will experience slowing at the tunnel portals during peak travel hours if the Bored Tunnel is tolled because many drivers are projected to exit SR 99 to avoid paying the toll. Because of this, traffic queues are expected to increase at the on and off-ramps near the tunnel portals during peak commute hours, which will increase congestion and reduce speeds. Once drivers are in the tunnel, they will be able to travel slightly faster through the Tolled Bored Tunnel, because it would carry fewer vehicles than the Non-Tolled Bored Tunnel.

During the morning commute, drivers would experience slower travel speeds with a Tolled Bored Tunnel than with the Non Tolled Bored Tunnel for northbound trips heading into downtown from the south. For this direction of traffic, travel speeds are projected to be 26 miles per hour for the Tolled Bored Tunnel and 45 miles per hour for the Non-Tolled Bored Tunnel. Slower travel speeds are also expected for the Tolled Bored Tunnel than the Non-Tolled Bored Tunnel for southbound trips heading into downtown from north of Denny Way. For this direction of traffic, travel speeds are expected to be

Travel Speeds for Viaduct Closed

As discussed in **Question 1** of this chapter, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore predictions of travel speeds are not appropriate and are not shown in exhibits.

Appendix C, Transportation Discipline Report

Travel speeds are discussed in *Appendix C*, Sections 5.2.3, 7.3.1.3, 7.3.2.3, and 7.3.3.3.

18 miles per hour for the Tolled Bored Tunnel and 30 miles per hour for the Non-Tolled Bored Tunnel. During the evening commute, travel speeds are expected to be similar for the Bored Tunnel with or without tolls.

Travel Speeds for the Tolled and Non-Tolled Cut-and-Cover Tunnel

Drivers will experience slowing at the tunnel portals if the Cut-and-Cover Tunnel is tolled, because many drivers are projected to exit SR 99 to avoid paying the toll. Because of this, traffic queues are expected to increase at the on- and off-ramps near the tunnel portals, which will increase congestion and reduce speeds. Once drivers are in the tunnel, they will be able to travel slightly faster through a Tolled Cut-and-Cover Tunnel, because some traffic is expected to divert from the tunnel and use other routes to avoid the toll.

During the morning commute, slower travel speeds are expected for the Tolled Cut-and-Cover Tunnel than the Non-tolled Cut-and-Cover Tunnel for northbound trips heading into downtown from the south. For this direction of traffic, travel speeds are projected to be 17 miles per hour for the Tolled Cut-and-Cover Tunnel and 46 miles per hour for the Non-Tolled Cut-and-Cover Tunnel. During the evening commute, this same northbound trip is expected to be 35 miles per hour for the Tolled Cut-and-Cover Tunnel and 42 miles per hour for the Non-Tolled Cut-and-Cover Tunnel.

Slightly slower travel speeds are also expected for southbound traffic north of Denny Way. For this direction of traffic during the morning commute, speeds for the Tolled Cut-and-Cover Tunnel are expected to be 10 miles per hour and 16 miles per hour for the Non-Tolled Cut-and-Cover Tunnel. During the evening commute southbound travel speeds are expected to be 21 miles per hour for the Tolled Cut-and-Cover Tunnel and 33 miles per hour for the Non-Tolled Cut-and-Cover Tunnel.

Travel Speeds for the Tolled and Non-Tolled Elevated Structure

Like the other alternatives, drivers will experience slowing near the stadiums and north of Denny Way if the Elevated Structure is tolled, because many drivers are projected to exit SR 99 to avoid paying the toll. Because of this, traffic queues are expected to increase at the on- and off-ramps near the stadiums and north of Denny Way, which will increase congestion and reduce speeds. However, once drivers are on the elevated structure, they will be able to travel slightly faster if SR 99 is tolled, because some traffic is expected to divert from SR 99 to avoid the toll.

During the morning commute, slower travel speeds are expected for the Tolled Elevated Structure than the Non-Tolled Elevated Structure for northbound trips heading into downtown from the south. For this direction of traffic, travel speeds are projected to be 9 miles per hour for the Tolled Elevated Structure and 47 miles per hour if it is not tolled. During the evening commute, this same northbound trip is expected to be 10 miles per hour for the Tolled Elevated Structure and 47 miles per hour if it is not tolled. Substantially decreased travel speeds for the Tolled Elevated Structure in this location is due to long queues of vehicles that are expected to increase congestion near the south end ramps, which will back traffic up onto the SR 99 mainline, substantially reducing speeds in this area.

Slightly slower travel speeds are also expected for southbound traffic north of Denny Way. For this direction of traffic during the morning commute, speeds are expected to be 10 miles per hour for the Tolled Elevated Structure and 16 miles per hour for the Non-Tolled Elevated Structure. During the evening commute, southbound travel speeds are expected to be 20 miles per hour for the Tolled Elevated Structure and 34 miles per hour if it is not tolled.

2030 SR 99 Travel Speeds – AM Peak Hour[1]

Non-Tolled Bored Tunnel *Tolled Bored Tunnel*

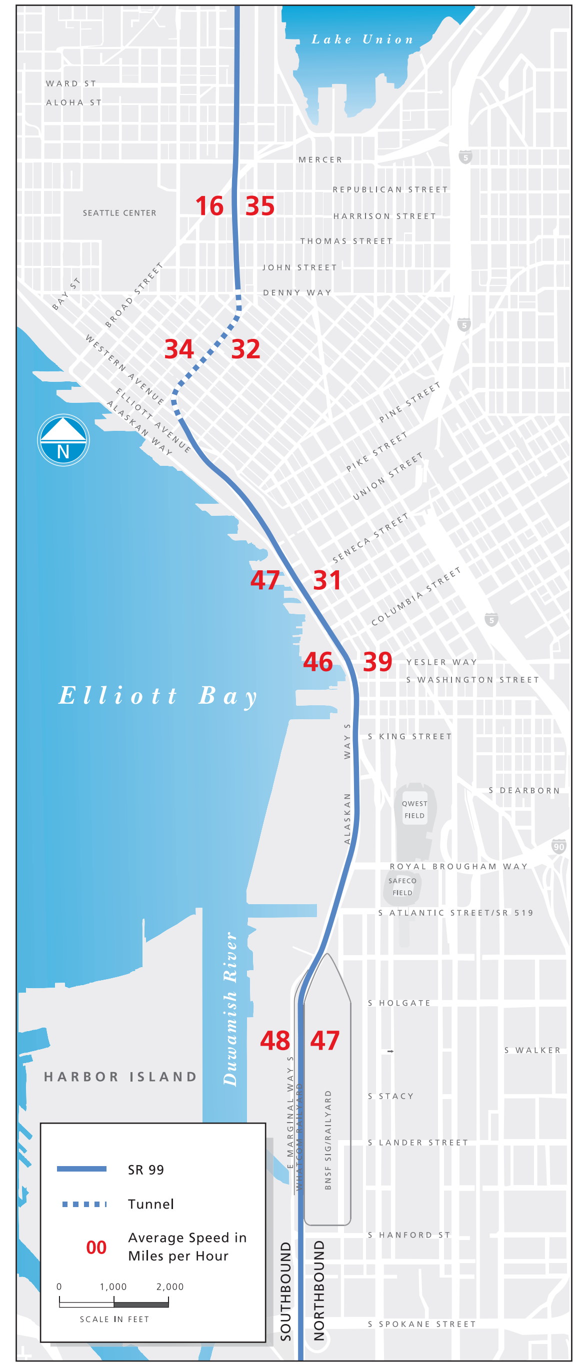
1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel speeds are not appropriate.*

2030 SR 99 Travel Speeds – AM Peak Hour[1]

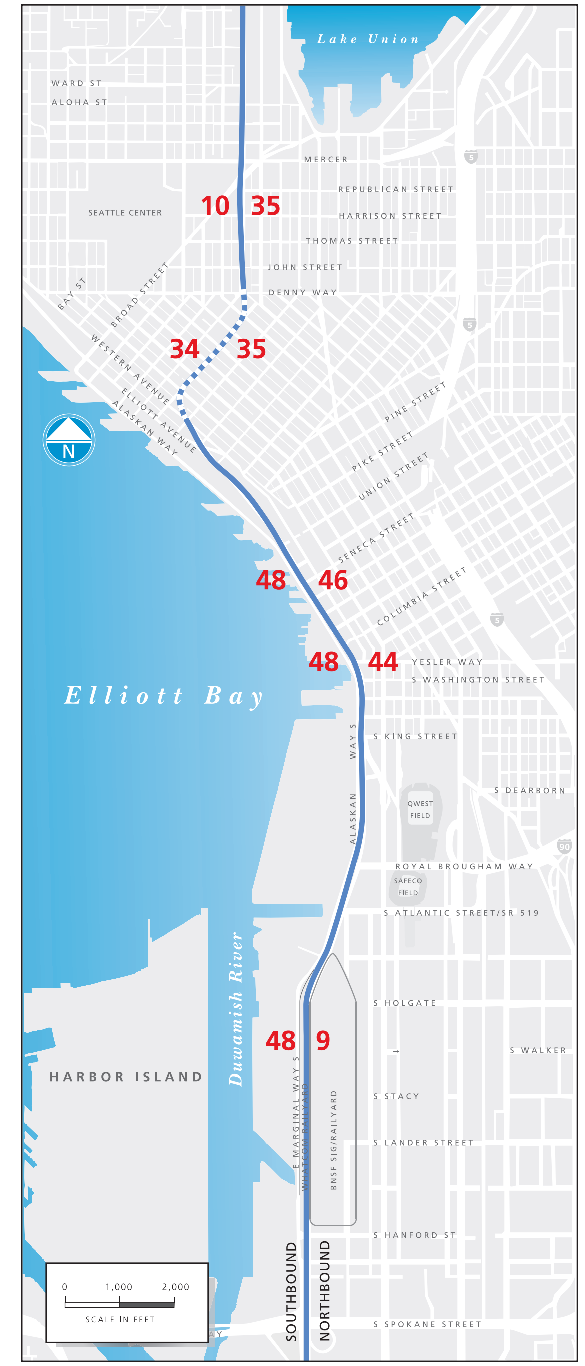
Non-Tolled Cut-&-Cover Tunnel

Tolled Cut-&-Cover Tunnel

Non-Tolled Elevated Structure



Tolled Elevated Structure



1 Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel speeds are not appropriate.

Exhibit 5-29

13 How would SR 99 travel times compare?

SR 99 Travel Times Overview

Travel times for key routes during the AM and PM peak hours are shown in Exhibit 5-31. In most cases, travel times are expected to be longer with the tolled alternatives than the non-tolled alternatives. Tolling is expected to increase travel times because many vehicles are expected to divert to surface streets using SR 99 ramps near the stadiums and north of Denny Way to avoid the toll. This diversion will increase congestion in these sections of SR 99, which will increase travel times.

West Seattle Trips to and from Downtown

During the morning commute, drivers heading in to downtown Seattle are expected to have similar travel times of 32 or 33 minutes with any of the tolled alternatives. During the evening commute, it is expected to take drivers using the Tolled Bored Tunnel 31 minutes to travel from downtown to West Seattle, compared to 29 and 25 minutes, respectively, for the Tolled Cut-and-Cover Tunnel and the Tolled Elevated Structure. Travel time differences among the alternatives are due largely to variations in downtown access between the alternatives. The Tolled Elevated Structure is expected to be the fastest trip because this alternative includes ramps at Columbia and Seneca, which is a more direct route to central downtown than the other two build alternatives.

For the non-tolled build alternatives, travel times from West Seattle to downtown during the morning commute are expected to be 26 minutes for the Non-Tolled Bored Tunnel compared to 23 and 20 minutes, respectively, for the Non-Tolled Cut-and-Cover Tunnel and Non-Tolled Elevated Structure. During the evening commute, travel times leaving downtown are expected to be 27 minutes for the Non-Tolled Bored Tunnel, compared to 24 minutes for the Non-Tolled Cut-and-Cover Tunnel and 22 minutes for the Non-Tolled Elevated Structure. Again, differences in travel times are mostly related to variations in access among the alternatives. Travel times are expected to be fastest for the Non-Tolled Elevated Structure because of the more direct access provided to central downtown by the Columbia and Seneca ramps.

North Seattle Trips to and from Downtown

For the tolled alternatives, during the morning commute drivers heading from north Seattle into downtown are expected to have a travel time of 27 minutes with the Tolled Bored Tunnel, compared to a travel time of 32 and 35 minutes, respectively, with the Tolled Elevated Structure and Cut-and-Cover Tunnel. The Bored Tunnel is expected to have faster travel times due to additional street connections provided north of Denny Way, as compared to the other two build alternatives.

During the evening commute, drivers leaving downtown and heading to north Seattle are expected to have travel times of 23 minutes with the Tolled Bored Tunnel, as compared to 20 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure. The Tolled Bored Tunnel is expected to have increased travel times compared to the other two alternatives because of additional intersections located on Aurora Avenue from Denny Way to the northbound on-ramp to SR 99.

For the non-tolled alternatives, drivers heading from north Seattle into downtown during the morning commute are expected to have a travel time of 22 minutes with the Non Tolled Bored Tunnel, as compared to a travel time of 24 minutes with the Non-Tolled Cut-and-Cover Tunnel or Elevated Structure. As discussed previously, the Bored Tunnel is expected to be slightly faster due to additional street connections provided north of Denny Way as compared to the other two alternatives.

For the evening commute, drivers leaving downtown are expected to have similar travel times of 17 to 18 minutes with the non-tolled alternatives.

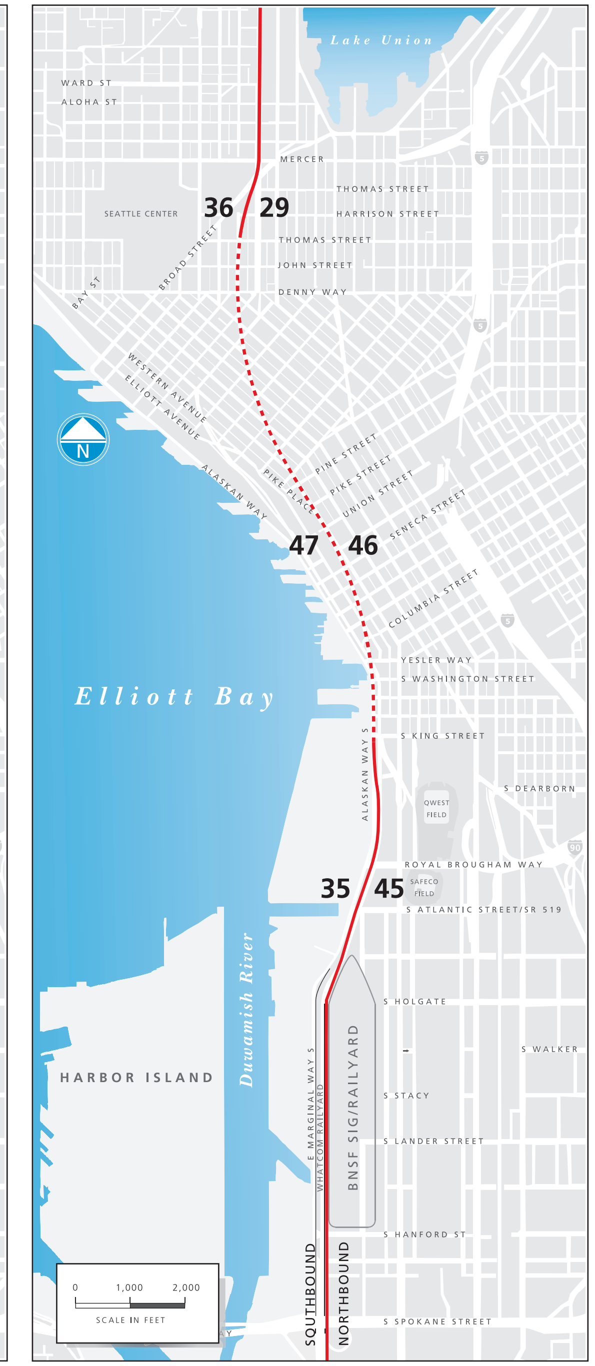
SR 99 Through Trips

In most cases, SR 99 through trips are expected to be fastest for the Tolled or Non-Tolled Bored Tunnel Alternative as compared to the other tolled or non-tolled build alternatives. The Bored Tunnel is expected to have

2030 SR 99 Travel Speeds – PM Peak Hour[1]

Non-Tolled Bored Tunnel

Tolled Bored Tunnel



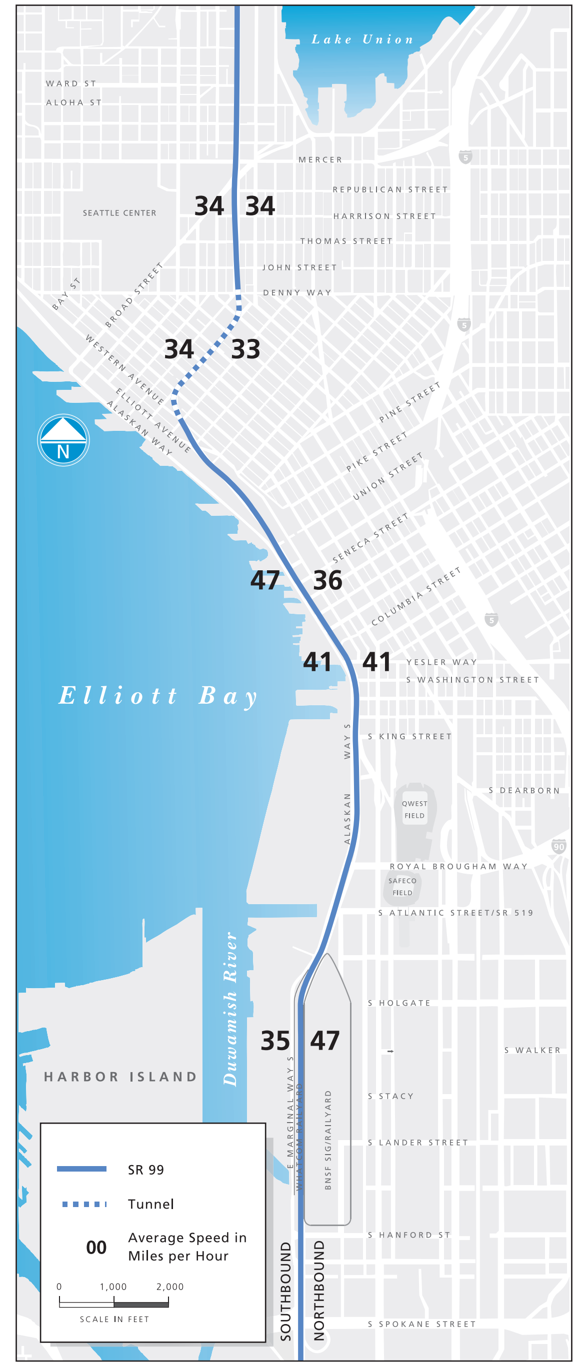
1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel speeds are not appropriate.*

2030 SR 99 Travel Speeds – PM Peak Hour[1]

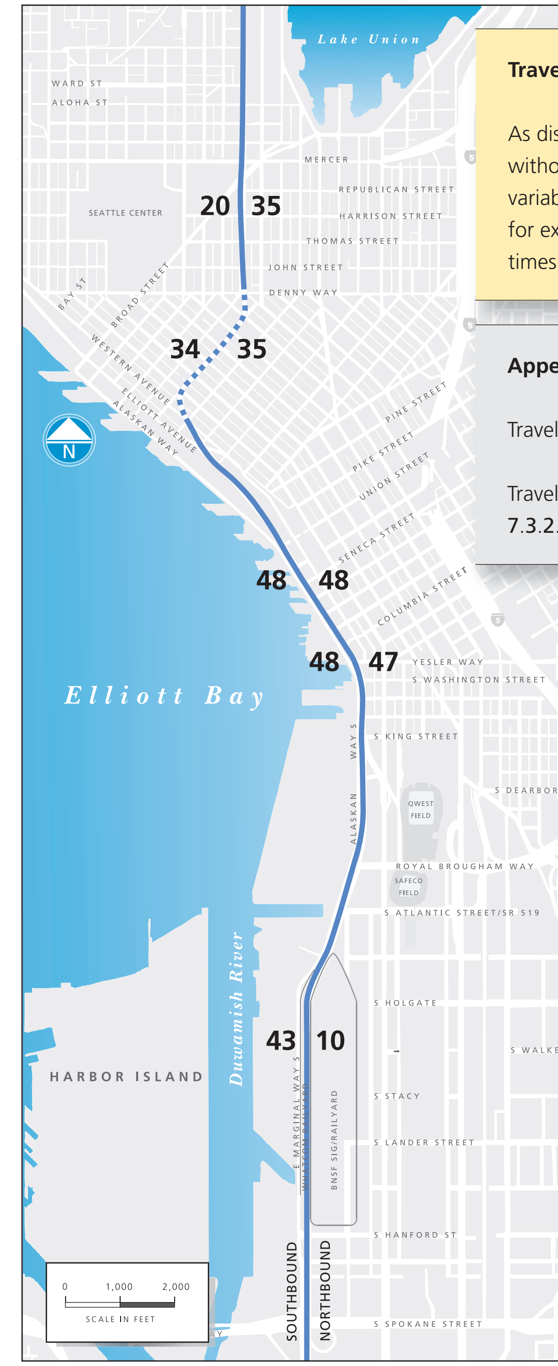
Non-Tolled Cut-&-Cover Tunnel

Tolled Cut-&-Cover Tunnel

Non-Tolled Elevated Structure



Tolled Elevated Structure



Travel Times for Viaduct Closed

As discussed in **Question 1** of this chapter, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore predictions of travel times are not appropriate and are not shown in exhibits.

Appendix C, Transportation Discipline Report

Travel times are discussed in *Appendix C*, Section 5.4 and 7.5.

Travel speeds are discussed in *Appendix C*, Sections 5.2.3, 7.3.1.3, 7.3.2.3, and 7.3.3.3.

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel speeds are not appropriate.*

Exhibit 5-30

2030 Travel Times Comparison

NON-TOLLED/TOLLED

West Seattle Trips to and from Downtown

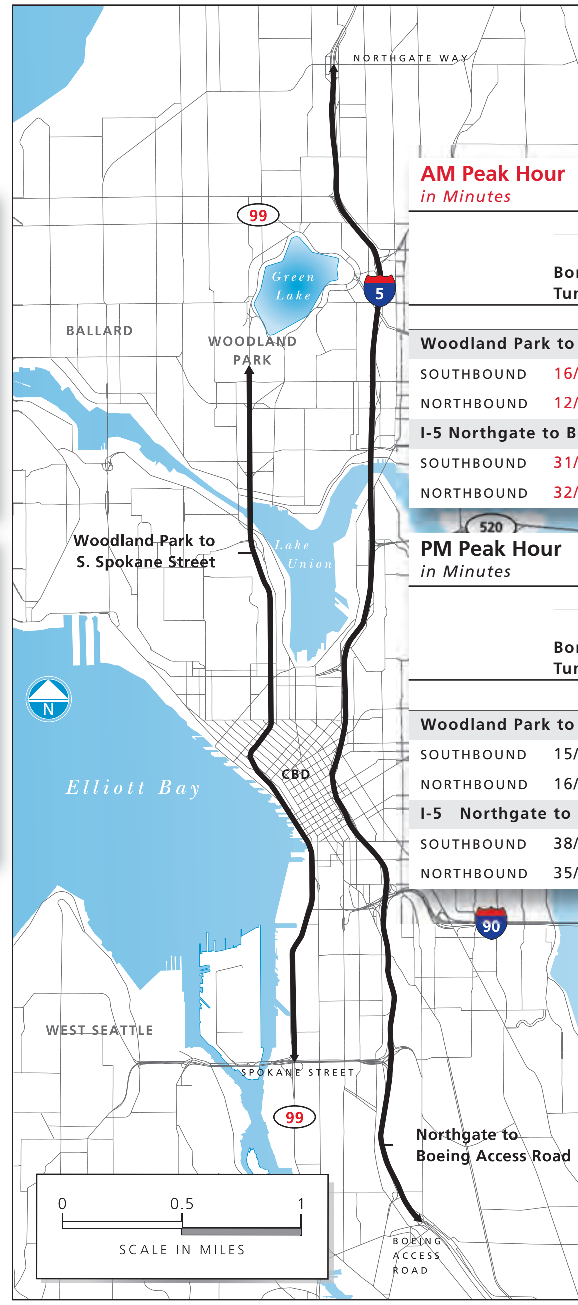
AM Peak Hour
in Minutes

	YEAR 2030 Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
West Seattle to Downtown Central Business District			
NORTHBOUND	26/32	23/32	20/33
Woodland Park to Downtown Central Business District			
SOUTHBOUND	22/27	24/35	24/32

PM Peak Hour
in Minutes

	YEAR 2030 Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Downtown Central Business District to West Seattle			
SOUTHBOUND	27/31	24/29	22/25
Downtown Central Business District to Woodland Park			
NORTHBOUND	18/23	17/20	17/20

North Seattle Trips to and from Downtown



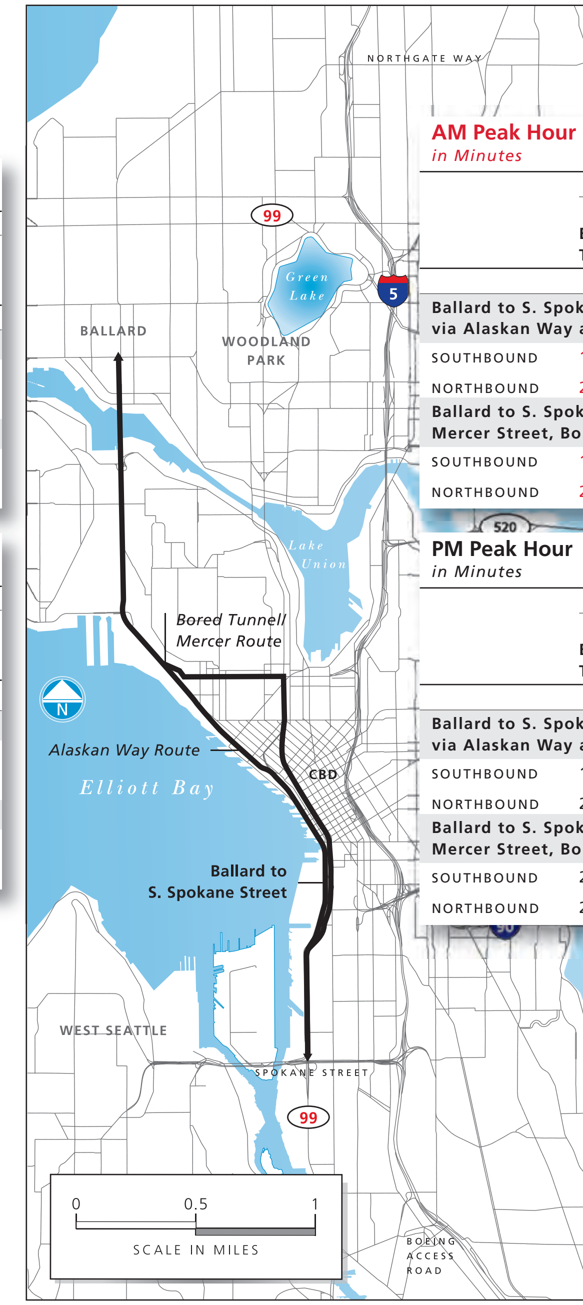
AM Peak Hour
in Minutes

	YEAR 2030 Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Woodland Park to S. Spokane Street			
SOUTHBOUND	16/16	20/22	19/21
NORTHBOUND	12/12	12/14	13/22
I-5 Northgate to Boeing Access Road			
SOUTHBOUND	31/32	31/32	31/32
NORTHBOUND	32/33	32/33	32/33

PM Peak Hour
in Minutes

	YEAR 2030 Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Woodland Park to S. Spokane Street			
SOUTHBOUND	15/14	14/16	15/16
NORTHBOUND	16/15	17/15	16/19
I-5 Northgate to Boeing Access Road			
SOUTHBOUND	38/40	38/39	38/40
NORTHBOUND	35/36	35/36	34/36

SR 99 Through Trips



AM Peak Hour
in Minutes

	YEAR 2030 Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Ballard to S. Spokane Street – via Alaskan Way and Alaskan Way Viaduct			
SOUTHBOUND	17/20	16/16	15/15
NORTHBOUND	21/27	15/17	16/26
Ballard to S. Spokane Street – Mercer Street, Bored Tunnel			
SOUTHBOUND	17/18	NA	NA
NORTHBOUND	25/24	NA	NA

PM Peak Hour
in Minutes

	YEAR 2030 Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Ballard to S. Spokane Street – via Alaskan Way and Alaskan Way Viaduct			
SOUTHBOUND	19/23	21/16	20/17
NORTHBOUND	24/27	23/23	25/25
Ballard to S. Spokane Street – Mercer Street, Bored Tunnel			
SOUTHBOUND	22/24	NA	NA
NORTHBOUND	27/27	NA	NA

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of travel times are not appropriate.*

Exhibit 5-31

faster travel times for through trips because it would have fewer access points, which would reduce traffic volumes on SR 99. Fewer access points would also result in fewer weaving motions than other build alternatives, which reduce travel times. In addition, the Bored Tunnel replaces the Battery Street Tunnel with a new tunnel that has wider lanes and shoulders and less-abrupt curves, which will increase speeds on this section of SR 99.

For the tolled alternatives, SR 99 through trips are expected to be the fastest with the Tolled Bored Tunnel Alternative. During the morning commute, travel times for southbound trips are expected to be 16 minutes for the Tolled Bored Tunnel compared to 22 minutes and 21 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively. Travel times for northbound trips are expected to be 12 minutes for the Tolled Bored Tunnel compared with 14 and 22 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively.

During the evening commute, travel times for southbound traffic are expected to be 14 minutes for the Tolled Bored Tunnel compared with 16 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure. Northbound travel times are expected to be 15 minutes for the Tolled Bored Tunnel and Cut-and-Cover Tunnel and 19 minutes for the Tolled Elevated Structure. Travel times are expected to be slower with the Tolled Cut-and-Cover Tunnel and Elevated Structure because slower speeds are expected for these alternatives through downtown and near the stadiums and north of Denny Way, as compared to the Tolled Bored Tunnel.

For the non-tolled build alternatives, travel times for SR 99 through trips are expected to be fastest with the Non-Tolled Bored Tunnel, although differences among the non-tolled build alternatives are less pronounced than they are for the tolled alternatives. During the morning commute, travel times are expected to be 16 minutes for the Non-Tolled Bored Tunnel compared to 19 and 20 minutes for the Non-Tolled Elevated Structure and Cut-and-Cover Tunnel, respectively. Travel times for northbound trips are expected to be similar among the non tolled alternatives at 12 minutes for the Non-Tolled Bored Tunnel and Cut-and-Cover Tunnel and 13 minutes for the Non Tolled Elevated Structure.

During the evening commute, travel times for southbound traffic are expected to be 14 minutes for the Non-Tolled Cut and-Cover Tunnel compared with 15 minutes for the Non Tolled Bored Tunnel and Elevated Structure. Northbound travel times are expected to be 16 minutes for the Non-Tolled Bored Tunnel and Elevated Structure and 17 minutes for the Cut-and-Cover Tunnel.

Northwest Seattle Trips through Downtown

The Bored Tunnel Alternative with or without tolls does not replace the Elliott and Western ramps, which results in longer travel times for this alternative as compared to the Cut-and-Cover Tunnel and Elevated Structure Alternatives with or without tolls. With the Bored Tunnel, drivers could choose to get to northwest Seattle either by exiting SR 99 near the stadiums and continuing north on Alaskan Way, or they could choose to travel through the bored tunnel and exit SR 99 using ramps at Republican Street to connect with Mercer Street.

For the tolled alternatives, southbound travel times during the morning commute are expected to be 18 to 20 minutes for the Tolled Bored Tunnel compared to 15 and 16 minutes for the Tolled Elevated Structure and Cut-and-Cover Tunnel, respectively. Northbound trips are expected to take 24 to 27 minutes with the Tolled Bored Tunnel, compared to 17 and 26 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively. The Tolled Elevated Structure is expected to have longer travel times for this trip compared to the Tolled Cut-and-Cover Tunnel because of traffic back-ups expected due to the ramps at Columbia and Seneca Streets.

During the evening commute, southbound travel times ranging from 23 or 24 minutes are expected for the Tolled Bored Tunnel compared to 16 or 17 minutes for the Tolled Cut-and-Cover Tunnel or Elevated Structure, respectively. Northbound travel times of 27 minutes are expected for the Tolled Bored Tunnel compared to 23 and 25 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively.

In most cases, travel times are expected to be faster for the non-tolled build alternatives than the tolled build alternatives, as shown in Exhibit 5-31. For the non-tolled build alternatives, southbound travel times during the morning commute are expected to be 17 minutes for the Non-Tolled Bored Tunnel compared to 16 and 15 minutes for the Non-Tolled Cut-and-Cover Tunnel and Non-Tolled Elevated Structure, respectively. Northbound trips are expected to take 21 to 25 minutes with the Non-Tolled Bored Tunnel, compared to 15 and 16 minutes for the Non-Tolled Cut-and-Cover Tunnel and Non-Tolled Elevated Structure, respectively.

During the evening commute, southbound travel times ranging from 19 to 22 minutes are expected for the Non-Tolled Bored Tunnel compared to 21 or 20 minutes for the Non-Tolled Cut-and-Cover Tunnel or Non-Tolled Elevated Structure, respectively. Northbound travel times of 24 to 27 minutes are expected for the Non-Tolled Bored Tunnel compared to 23 and 25 minutes for the Non-Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively.

I-5 Trips

In all but one instance, travel times on I-5 are expected to be the same for all of the tolled alternatives. The same is true when comparing I-5 travel times for the non-tolled alternatives. For the one instance when travel times are different, the difference is 1 minute as described in the text below. For the tolled build alternatives in 2030, southbound trips on I-5 during the PM peak hour are expected to take 40 minutes for the Bored Tunnel and Elevated Structure Alternatives as compared to 39 minutes for the Cut-and-Cover Tunnel Alternative. For the non-tolled build alternatives in 2030, northbound trips on I-5 during the PM peak hour are expected to take 35 minutes for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives as compared to 34 minutes for the Elevated Structure Alternative.

Travel times on I-5 are expected to vary between 1 and 2 minutes between the tolled and non tolled alternatives, which suggests that the build alternatives have similar effects to I-5 and that tolling the build alternatives results in a negligible effect to I-5 operations. Noticeable effects to I-5 are not expected because the additional trips that divert to I-5 because of tolls are expected to divert during off-peak travel times when I-5 can accommodate additional vehicles. Diversion during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route.

14 How would conditions for transit compare?

Downtown transit access to and from the south would likely be similar to existing conditions for the Elevated Structure Alternative with and without tolls, since the Columbia and Seneca ramps would be rebuilt and transit could continue to use these ramps as they do today to access downtown and SR 99 (although transit would have the option to use the ramps to Alaskan Way S. as well). For the tolled and non-tolled tunnel alternatives, downtown transit access to and from the south would change, since the Columbia and Seneca ramps would be relocated and buses would likely access downtown via the new ramps on Alaskan Way S., and then use S. Main Street and/or S. Washington Street to access the north-south Third Avenue bus "spine." The new ramps would extend transit service coverage to a larger portion of the downtown area, particularly the Pioneer Square area. Because transit access would be provided a few blocks south of where it is today, transit travel times to areas near the southern portion of downtown could decrease, while transit travel times to areas toward the central or north areas of downtown could increase. Travel times for selected trips are provided in Exhibit 5-32.

For transit vehicles serving downtown Seattle from the north, transit access is expected to be comparable for the build alternatives. For the Tolled and Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives, transit would access downtown via ramps to Denny Way, similar to existing conditions. For the Tolled and Non-Tolled Bored Tunnel Alternative, access would be provided via the ramps to Aurora Avenue at Harrison Street. Here, transit would be required to merge from the left-lane on- or off-ramp to the right transit-only lane that would be provided in both directions to Third Avenue. The transit-only lane would allow transit to bypass potential queues forming at intersections; however, transit would be required to travel through three additional traffic signals on Aurora Avenue between Harrison Street and Denny Way.

In the central waterfront area, the Tolled and Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives include replacing the waterfront streetcar, which would benefit transit along the waterfront.

Transit Travel Times

Transit travel times are compared in Exhibit 5-32. If the build alternatives were tolled, slower transit travel times would be expected for transit traveling on Second Avenue, Fourth Avenue, and to and from West Seattle. For the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure, slower transit travel times also would be expected for southbound trips coming into downtown from north Seattle via Aurora Avenue because unlike the Bored Tunnel, these alternatives would not provide a transit-only lane beginning at Harrison Street. Transit travel times would slow with tolling due to increased congestion on city surface streets caused by drivers avoiding the tolled portion of SR 99. If the build alternatives were tolled, travel time increases on Second and Fourth Avenues would not be as pronounced for transit as they would be for other traffic, because transit-only lanes are provided on Second and Fourth Avenues. On Second Avenue, transit travel times would increase by 1 or 2 minutes compared to the non-tolled build alternatives. Transit travel times on Fourth Avenue would be expected to increase by up to 5 minutes compared to the non-tolled build alternatives. There are two explanations for these travel time increases:

2030 Transit Travel Times Comparison

NON-TOLLED/TOLLED

AM Peak Hour
in Minutes

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Elliott Avenue – *South of Ballard Bridge to Denny Way*			
SOUTHBOUND	8/8	8/8	8/8
NORTHBOUND	7/7	7/8	7/8
Aurora Avenue – *South of Ballard Bridge to Central Business District*			
SOUTHBOUND	6/8	9/15	9/14
NORTHBOUND	7/8	6/6	6/6
Second Avenue – *Wall Street to S. Royal Brougham Way*			
SOUTHBOUND	14/13	14/15	14/16
Fourth Avenue – *S. Royal Brougham Way to Battery Street*			
NORTHBOUND	14/17	13/18	14/17
West Seattle to Downtown Central Business District			
NORTHBOUND	26/32	23/32	20/33
SOUTHBOUND	16/16	14/16	12/14

PM Peak Hour
in Minutes

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
	NON-TOLLED/TOLLED		
Elliott Avenue – *South of Ballard Bridge to Denny Way*			
SOUTHBOUND	8/8	8/8	8/8
NORTHBOUND	8/8	10/12	9/9
Aurora Avenue – *South of Ballard Bridge to Central Business District*			
SOUTHBOUND	5/5	5/9	5/9
NORTHBOUND	7/8	5/5	5/5
Second Avenue – *Wall Street to S. Royal Brougham Way*			
SOUTHBOUND	15/17	15/16	14/15
Fourth Avenue – *S. Royal Brougham Way to Battery Street*			
NORTHBOUND	14/15	13/17	13/18
West Seattle to Downtown Central Business District			
NORTHBOUND	18/23	19/26	16/23
SOUTHBOUND	27/31	24/29	22/25

1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of travel times are not appropriate.*

Exhibit 5-32

Appendix C, Transportation Discipline Report

Transit information is discussed in *Appendix C*, Section 5.6 and 7.7.

1 Speeds for transit on Fourth Avenue would be reduced because bus drivers must weave between the transit-only and congested general-purpose travel lane due to skip stop operations, and

2 Speeds for transit in the transit-only lane on Fourth Avenue would be reduced by a higher number of non-transit vehicles making right turns, as permitted, using the transit-only lane.

If the build alternatives were tolled, effects to transit would be mitigated as discussed in Chapter 8, Question 1.

For the non-tolled build alternatives, most travel times would be within 1 or 2 minutes of each other. The primary exception is for trips heading to and from downtown and West Seattle. These trips are expected to be fastest with the Non-Tolled Elevated Structure and slowest with the Non-Tolled Bored Tunnel. The Non-Tolled Elevated Structure is expected to provide a faster trip because the Columbia and Seneca ramps included in this alternative provide more direct access into downtown than the tunnel alternatives that provide access near S. King Street.

Transit Ridership

The Viaduct Closed is expected to carry the fewest number of transit riders of any of the alternatives considered, as shown in Exhibit 5-33. Of the three screenlines evaluated, the Viaduct Closed would affect transit ridership most across the central screenline where the number of transit riders would be 9 to 12 percent less than the build alternatives. Transit ridership is expected to be lower with the Viaduct Closed because operating conditions in the corridor for all vehicles traveling on highways and arterials, including buses, would be worse than for any of the tolled or non-tolled build alternatives.

Exhibit 5-33
2030 Daily Transit Riders at Screenlines
in Number of Riders

Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
South Screenline – South of S. KIng Street						
160,800	164,900	164,400	166,500	166,900	165,400	166,400
Central Screenline – North of Seneca Street						
162,400	178,000	177,300	180,400	179,300	182,100	180,300
North Screenline – North of Thomas Street						
165,400	168,400	168,000	166,700	165,700	167,600	166,800

Tolling the alternatives is expected to change transit ridership by up to 1 percent. This suggests that based on our modeling assumptions, tolling does not have much effect on people's decision to take transit.

Transit Mode Share

Exhibit 5-34 compares expected transit mode share among the alternatives.

Exhibit 5-34
2030 Daily Transit Mode Share To & From Seattle's City Center
in Percentages

	Viaduct Closed	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
		NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Work Trips	39.6	41.0	41.0	40.9	41.0	40.6	40.6
Non-Work-Related Trips	9.8	10.1	9.9	10.0	9.8	10.0	9.8

Results for daily transit mode share are similar among the alternatives. This suggests that the overall demand for transit is similar among the alternatives and they have very little effect on transit mode share.

15 How would access change for drivers, bicyclists, and pedestrians?

Access provided for drivers, bicyclists, and pedestrians would be the same for each of the build alternatives regardless of whether or not they are tolled.

How would access compare for drivers headed into or out of downtown from the south?

Downtown access to and from the south would be enhanced for the Tolled or Non-Tolled Elevated Structure Alternative as compared to the Tolled or Non-Tolled Bored Tunnel or Cut-and-Cover Tunnel Alternatives, since drivers would be able to continue to use rebuilt ramps at Columbia or Seneca Streets, or drivers could choose to use ramps to Alaskan Way S.

For the tunnel alternatives, downtown access to and from the south would change and would be provided via Alaskan Way just south of S. King Street. An advantage of this configuration is that Alaskan Way is able to better accommodate and distribute SR 99 traffic flows than the downtown streets adjacent to the Columbia and Seneca ramps. With this configuration, drivers would be able to travel from Alaskan Way to the downtown street grid using any of several cross streets, including S. Jackson Street, S. Main Street, Yesler Way, and Columbia, Marion, Madison, and Spring Streets, rather than being concentrated to single locations at Columbia and Seneca Streets.

Because access would be less centrally located to downtown than the existing ramps, trips destined to the central and northern portions of downtown would have to travel a few additional blocks on city streets rather than on SR 99, which may increase their travel times, as discussed in Question 13 of this chapter. Conversely, drivers heading to and from the southern areas of downtown would find that the new ramps provide more direct access, since these drivers would no longer need to backtrack from the Seneca off-ramp to their destination.

How would access compare for drivers heading into or out of downtown from the north?

Conditions for drivers heading into or out of downtown from the north would change only slightly compared to existing conditions for any of the build alternatives evaluated. For any of the build alternatives, similar access is provided. With the Tolled or Non-Tolled Cut-and-Cover Tunnel or Elevated Structure, access to and from downtown would be provided via rebuilt ramps at Denny Way, which would be similar to access provided today. For the Tolled or Non-Tolled Bored Tunnel, access to Denny Way would be provided via ramps near Harrison Street. Between Harrison Street and Denny Way, drivers would

What is transit mode share?

Transit mode share indicates the percentage of trips made using transit for trips that originate in or are destined for Seattle's Center City area.

Transit ridership and mode share are based on relative availability and convenience of transit compared to other means of travel.

travel through three new signalized intersections at John, Thomas, and Harrison Streets that would provide a connected street grid.

How would access compare for drivers heading to or from northwest Seattle (Ballard, Interbay, and Magnolia)?
The Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure would rebuild the existing on- and off-ramps at Elliott and Western Avenues, so access would be similar to what is provided today. The Tolled or Non-Tolled Bored Tunnel would remove the on- and off-ramps at Elliott and Western Avenues. Drivers coming from northwest Seattle could access SR 99 either by traveling on Mercer Street and connecting to a new ramp at Republican Street, or by traveling on Alaskan Way to a new on ramp near S. King Street. In some cases, these access changes may increase travel times, as discussed previously in Question 13 and shown in Exhibit 5-31.

How would access for freight compare?
Conditions for freight with the Tolled or Non-Tolled Elevated Structure and Cut-and-Cover Tunnel would be similar but slightly improved as compared to existing conditions, because the lanes and ramps on SR 99 would be wider than they are today. With the Tolled or Non-Tolled Bored Tunnel Alternative, lane and ramp widths would also increase; and for many freight trips, conditions would be similar to existing conditions. An exception is that for freight traveling to or from northwest Seattle, the route would change. Drivers could travel on Mercer Street to access the ramps at Republican Street, or they could access the southern portion of SR 99 via Alaskan Way. Proposed access changes and tolling could affect travel times for freight, similar to general traffic, as described in Question 13 and shown in Exhibit 5-31.

Hazardous and flammable cargo would be restricted from using either the Bored Tunnel or the Cut-and-Cover Tunnel. This type of cargo is not permitted in the Battery Street Tunnel today. Instead of traveling on SR 99 through downtown, freight carrying hazardous or flammable cargo would be required to use another route, such as the Alaskan Way surface street or I-5 potentially affecting 55 to 70 tanker trucks per day. For the Tolled or Non-Tolled Elevated Structure Alternative, hazardous and flammable cargo would continue to be restricted from using the Battery Street Tunnel, similar to existing conditions.

How would access compare for ferry traffic?
Access to the Seattle Ferry Terminal would be similar for all of the build alternatives. As with existing ferry operations, service disruptions due to issues with vessels, terminals, or demand spikes associated with peak summer holiday traffic would likely still cause some disruption to traffic operations along Alaskan Way near Marion Street and Yesler Way. Fewer vehicles are expected to travel on Alaskan Way with the non tolled build alternatives as compared to the tolled build alternatives. A discussion of conditions on Alaskan Way for the tolled and non-tolled build alternatives is provided in Question 10.

How would access compare for event traffic?
During special events at the stadiums (Qwest and Safeco Fields), conditions are expected to be similar for the build alternatives, since similar improvements are proposed. If the build alternatives are tolled, congestion on streets near event areas would likely be higher than if the build alternatives are not tolled, since drivers are expected to divert from SR 99 to surface streets near the stadiums and Seattle Center area if SR 99 is tolled. A discussion of effects to area surface streets due to tolling is provided in Questions 8, 9, 10, and 11.

For events at Seattle Center, the Tolled or Non-Tolled Bored Tunnel Alternative is expected to provide the best package of improvements to accommodate event traffic. The Bored Tunnel Alternative provides an additional surface street connection in the north at John Street compared to the other build alternatives. The surface street offers drivers and pedestrians more travel options when large volumes of event traffic increase congestion on area streets.

How would access compare for pedestrians?
All of the build alternatives provide improved pedestrian conditions in the south and north areas by providing improvements between S. Royal Brougham Way and S. King Street and connecting the street grid north of Denny Way. In the north section, the Tolled or Non-Tolled Bored Tunnel Alternative offers somewhat better pedestrian connections compared to the other build alternatives, because it connects an additional east-west street at John Street.

In the central waterfront area, the Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative offers substantially improved conditions for pedestrians due to the combination of removing the existing viaduct, substantially widening the existing pedestrian promenade along the waterfront, and building a connection to and from Victor Steinbrueck Park near the Pike Place Market. The Tolled or Non-Tolled Bored Tunnel Alternative would also remove the viaduct, which would provide opportunities to improve pedestrian conditions in the future, although improvements to Alaskan Way along the waterfront are not proposed as part of the Tolled or Non-Tolled Bored Tunnel Alternative. The Tolled or Non-Tolled Bored Tunnel Alternative provides the most available space along the waterfront to provide pedestrian amenities; unlike the other alternatives, it does not propose to locate a streetcar along the waterfront. In the central waterfront area, the Tolled or Non-Tolled Elevated Structure Alternative would continue to provide limited opportunities to improve pedestrian conditions.

How would access compare for bicyclists?
All of the build alternatives provide improved bicycle conditions in the south and north areas due to proposed improvements associated with replacing the viaduct between S. Royal Brougham Way and S. King Street and connecting the street grid north of Denny Way. North of Denny Way, the Tolled or Non-Tolled Bored Tunnel Alternative would provide an additional east-west connection at John Street compared to the other two build alternatives.

In the central waterfront area, the Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative offers the most improved conditions for bicyclists due to the combination

Appendix C, Transportation Discipline Report

Truck traffic and freight are discussed in *Appendix C*, Sections 5.7 and 7.8.

Ferry conditions are discussed in *Appendix C*, Sections 5.11 and 7.12.

Event traffic discussed in *Appendix C*, Sections 5.13 and 7.14.

Effects to pedestrians are discussed in *Appendix C*, Sections 5.9 and 7.10.

Effects to bicyclists are discussed in *Appendix C*, Sections 5.10 and 7.11.

of removing the existing viaduct, adding dedicated bicycle lanes on the surface street, and providing a wider pedestrian/bicycle path than currently exists along the waterfront. The Tolled or Non-Tolled Bored Tunnel Alternative would also remove the viaduct, which would provide opportunities for improved bicycle conditions in the future; however, improvements to Alaskan Way along the central waterfront are not proposed as part of the Tolled or Non-Tolled Bored Tunnel Alternative and will be designed and implemented by the City as part of the broader Alaskan Way Viaduct and Seawall Replacement Program. In the central waterfront area, the Tolled or Non-Tolled Elevated Structure Alternative offers limited opportunities to improve conditions for bicyclists, although dedicated bicycle lanes would be provided along Alaskan Way.

OTHER PERMANENT EFFECTS

16 How would noise levels compare?

Noise Effects Overview

The analysis of noise effects compares the modeled year 2030 noise levels with the year 2015, which is used to represent existing conditions. Noise from traffic and the diverse activities of city dwellers is a normal part of life in the project area. Existing outdoor noise levels in 2015 are expected to range from 61 to 80 A-weighted decibels (dBA) in the project area (both for short durations and over a 24-hour period). These noise levels are typical for major downtown metropolitan areas. Noise levels tend to be about 10 dBA quieter during the nighttime and early morning hours (midnight to 6:00 a.m.).

To compare how noise levels would change, and in accordance with FHWA guidance, traffic noise levels were modeled at 70 sites for both existing conditions expected in 2015 and the year 2030 for each of the build alternatives, with and without tolls. This comparison is shown in Exhibits 5-35 and 5-36. For the Bored Tunnel and Elevated Structure Alternatives, the difference between the tolled and non-tolled modeling results is within 2 dBA. For the Cut-and-Cover Tunnel Alternative, there is one location where the non-tolled noise level would be 3 dBA higher, but all other locations are within 2 dBA. A change of 2 dBA or less is not noticeable to most listeners, so noise levels between the tolled and non-tolled conditions for each alternative would be very similar. None of the build alternatives would have vibration impacts during operation.

Traffic noise levels currently approach or exceed FHWA noise abatement criteria[3] at 53 of the 70 sites, which represent approximately 4,578 residential units, 1,612 hotel rooms, 120 shelter beds, 1 church, 1 school, 12 parks or public spaces, and 8 commercial use areas. Exhibit 5-37 compares noise effects among the tolled and non tolled build alternatives. The tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives are expected to reduce the number of sites that would approach or exceed FHWA noise abatement criteria and the tolled and non-tolled Elevated Structure Alternatives would increase the number of affected sites. The FHWA noise criterion is 67 dBA for residences, parks, schools, churches, and similar areas and 72 dBA for developed land such as commercial buildings. One site, an apartment building adjacent to the Elliott Avenue on-ramp, currently exceeds the severe noise impact criterion of 80 dBA at sensitive land uses.

Exhibit 5-37
Range of Noise Effects Compared to 2015 Existing Viaduct

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED
Sites that are within 1 dBA or exceed FHWA noise criteria	40 of 70 sites	41 of 70 sites	40 of 70 sites	43 of 70 sites	57 of 70 sites	57 of 70 sites
Range in noise levels on the central waterfront	-1 to -16 dBA	-1 to -16 dBA	-1 to -17 dBA	0 to -15 dBA	-2 to +3 dBA	-3 to +2 dBA
Range in noise levels from Lenora Street to the Battery Street Tunnel	-6 to -13 dBA	-6 to -13 dBA	-5 to -12 dBA	-6 to -12 dBA	-1 to +1 dBA	0 to -1 dBA
Range in noise levels north of Denny Way	-6 to +4 dBA	-6 to +6 dBA	-3 to +6 dBA	-3 to +4 dBA	-3 to +6 dBA	-3 to +5 dBA

Measures for noise abatement as required by federal regulations (23 CFR 772) were evaluated for each alternative to determine what measures are feasible and reasonable. These measures include the following:

- **Traffic management –** measures include time restrictions, traffic control devices, signing for prohibition of certain vehicle types (e.g., motorcycles and heavy trucks), modified speed limits, and exclusive lane designations. For example, speed limits could be reduced, but a reduction of 10 to 15 miles per hour would be required to decrease traffic noise by 5 dBA. Implementation of these measures for the sole purpose of noise mitigation would not be reasonable.

- **Land acquisition for noise buffers or barriers –** in an urban area such as the study area, this would require relocating numerous residents and businesses and would not be reasonable for the purpose of noise mitigation.

- **Realigning the roadway –** the alignment is defined by available right-of-way and the design features of the project. The cost of realigning the roadway would not be reasonable exclusively as an operational noise mitigation consideration.

- **Noise insulation of buildings –** this measure does not apply to commercial and residential structures and is not eligible for federal funding.

- **Noise barriers –** to be effective, noise barriers would have to block access to the surface streets. There are no feasible mitigation measures to reduce traffic noise levels because the surface streets provide local access to downtown and the waterfront throughout the central waterfront.

None of these measures were identified to be feasible and reasonable for any of the build alternatives. Non-traditional measures, such as using noise-absorbing materials, were considered during design and rejected as ineffective and prohibitively expensive.

Appendix F, Noise Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in Chapter 2 of *Appendix F*. This report also contains details on the noise measurement locations, modeling results, and information about mitigation. The feasibility and reasonableness of noise abatement measures is discussed in *Appendix F*, Section 5.5.

What is dBA?

Sound levels are expressed on a logarithmic scale in units called decibels (dB). A-weighted decibels (dBA) are a commonly used frequency that measures sound at levels that people can hear.

A 2-dBA change in noise levels is the smallest change that can be heard by sensitive listeners.

How does WSDOT evaluate what measures are feasible and reasonable?

WSDOT evaluates many factors to determine whether measures would be feasible and reasonable. Determination of engineering feasibility includes evaluating whether measures could be constructed in a location to achieve a noise reduction of at least 7 dBA at the closest receptors and a reduction of 5 dBA or more at most of the first row of receptors. Determination of reasonableness includes determining the number of sensitive receptors benefited by at least 3 dBA; the cost-effectiveness of the measure; and concerns such as aesthetics, safety, and the desires of nearby residents. This approach is consistent with FHWA noise abatement requirements; WSDOT noise policy adopts the FHWA criteria.

3 USDOT 1982.

Change in Noise Levels – Tolled Alternatives

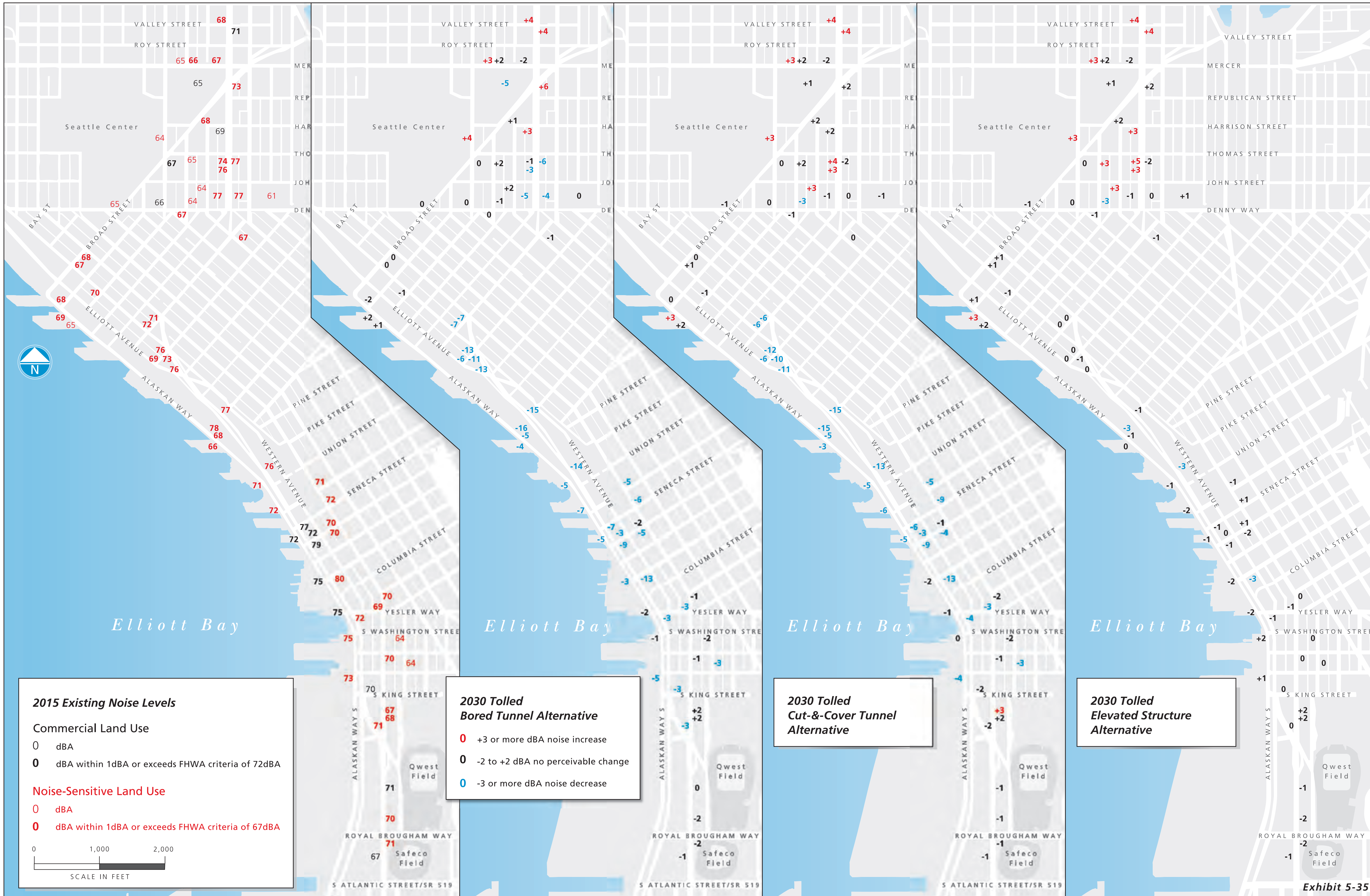


Exhibit 5-35

Change in Noise Levels – Non-Tolled Alternatives

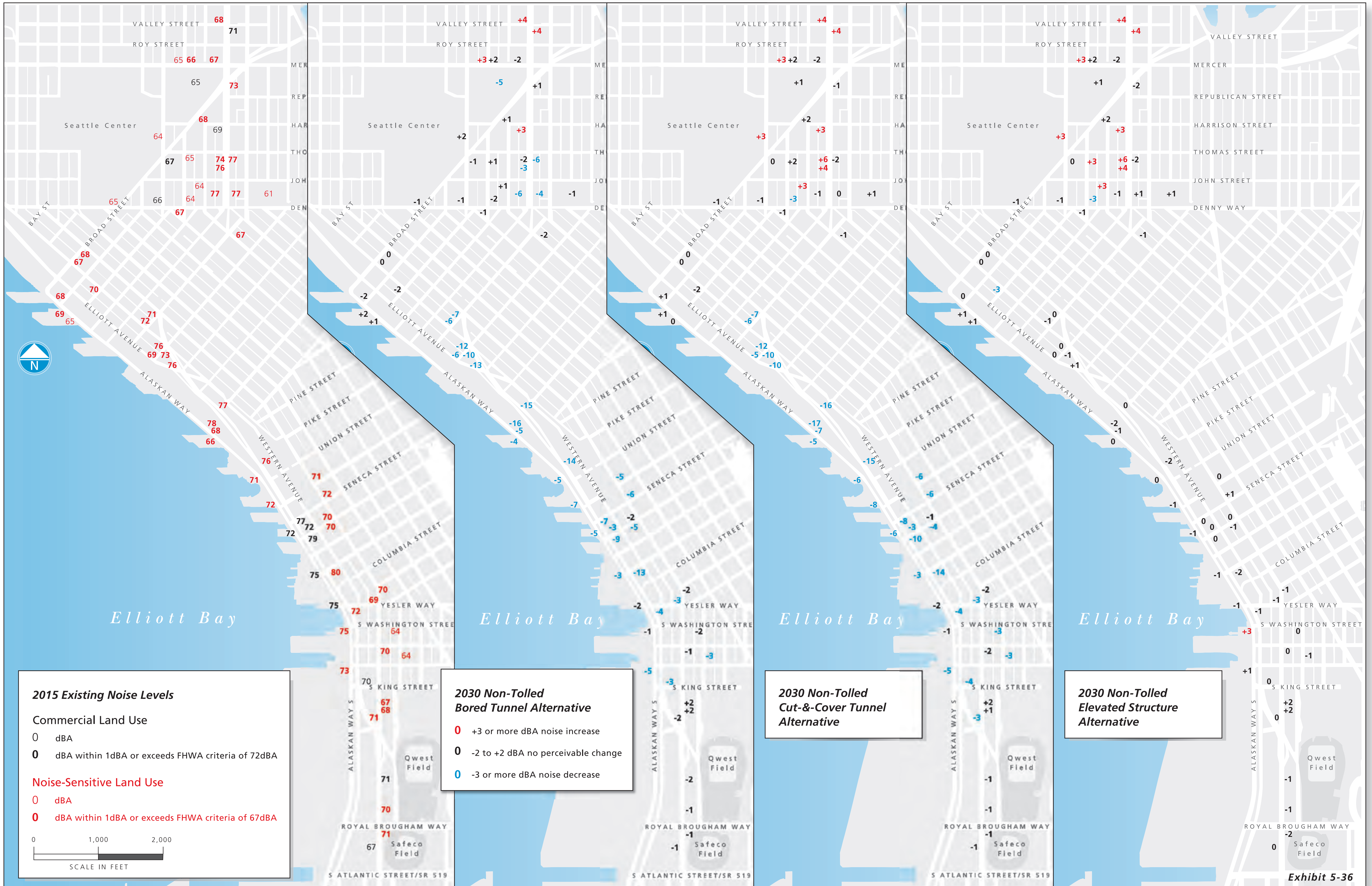


Exhibit 5-36

Noise Effects for the Tolled and Non-Tolled Bored Tunnel
The loudest hour traffic noise levels with the Bored Tunnel Alternative would range between 60 and 75 dBA at the modeled locations. Out of the 70 sites modeled, the 2030 Tolled Bored Tunnel has one additional site where traffic noise levels would approach or exceed FHWA noise abatement criteria, compared to the non-tolled conditions. With the Tolled Bored Tunnel, the 41 sites that were found to approach or exceed FHWA noise abatement criteria represent approximately 3,453 residential units, 1,286 hotel rooms, 120 shelter beds, 1 church, 1 school, 11 parks or public use spaces, and 5 commercial use areas. With the Non-Tolled Bored Tunnel, the 40 sites represent approximately 3,705 residential units, 1,286 hotel rooms, 120 shelter beds, 1 church, 1 school, 11 parks or public spaces, and 3 commercial use areas. None of these sites would exceed the severe noise impact criterion of 80 dBA at sensitive land uses. The number of modeled sites that exceed the noise abatement criteria would be reduced by 12 sites with the Tolled Bored Tunnel and 13 sites with the Non-Tolled Bored Tunnel compared to existing conditions.

South Area
Noise levels were studied at 9 locations near the south portal of the Bored Tunnel Alternative. The noise levels would remain the same or decrease by up to 5 dBA in 2030 at 7 locations and would increase by 2 dBA at 2 locations. Noise levels would exceed FHWA noise abatement criteria at 6 of the 9 sites for the Non-Tolled Bored Tunnel, which represent approximately 135 residential units, 220 hotel rooms, and 2 parks or public spaces. In addition to these 6 sites, 1 additional site, a commercial use area, would exceed FHWA noise abatement criteria with the Tolled Bored Tunnel Alternative. Noise levels with the Bored Tunnel Alternative would range from 66 to 71 dBA at modeled locations in the south portal area.

Central Waterfront
With the either the Tolled or Non-Tolled Bored Tunnel, noise levels along Seattle's central waterfront, would decrease at all 31 locations studied between S. Jackson Street and the Battery Street Tunnel. In the vicinity of Alaskan Way and Broad Street, noise levels at 2 sites would increase by 1 to 2 dBA and noise levels at 4 sites would remain the same or decrease by 1 to 2 dBA. Traffic noise levels would continue to be typical of an urban area.

Noise levels were modeled and found to approach or exceed the FHWA noise abatement criteria at 19 of the 37 modeled sites for both the Tolled and Non-Tolled Bored Tunnel, as compared to 29 of 37 sites that would approach or exceed FHWA criteria today. For the Tolled Bored Tunnel, the 19 sites represent approximately 2,977 residential units, 353 hotel rooms, 120 shelter beds, 5 parks or public open space uses, and 2 commercial use areas. The 19 sites for the Non-Tolled Bored Tunnel represent approximately 3,289 residential units, 353 hotel rooms, 120 shelter beds, 4 parks or public open space uses, and 2 commercial use areas. Noise levels with the either the Tolled or Non-Tolled Bored Tunnel would range from 61 to 74 dBA at modeled locations in the central waterfront area.

North Area
At the north tunnel portal, future noise levels are expected to vary depending on location. At some sites, noise levels would decrease by up to 6 dBA, and at other sites noise levels are predicted to stay the same or increase by 1 to 6 dBA. With the Tolled Bored Tunnel, traffic noise levels were found to approach or exceed the FHWA noise abatement criteria at 16 of the 24 modeled sites, which is an increase of 4 sites compared to existing conditions. The 16 sites represent approximately 341 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. With the Non-Tolled Bored Tunnel, traffic noise levels modeled were found to approach or exceed the FHWA noise abatement criteria at 15 of the 24 modeled sites, which represent approximately 281 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. Noise levels with either the Tolled or Non-Tolled Bored Tunnel would range from 60 to 75 dBA at modeled locations in the north area.

Ventilation System Noise
The Tolled or Non-Tolled Bored Tunnel would require a ventilation system with several ventilation stacks, which would be included as part of the tunnel operations buildings proposed at the tunnel portals. At the south portal, the tunnel operations building would be located on the block bounded by S. Dearborn Street, Alaskan Way S., and the new Railroad Way S. access road. At the north portal, the tunnel operations building would be located between Thomas and Harrison Streets on the eastside on Sixth Avenue N. The ventilation fans would be designed not to exceed either 60 dBA at the nearest commercial uses or 57 dBA at the property line of the nearest residential use during normal operations. Ventilation fans must be routinely tested in emergency mode operation, which is subject to the property line noise limits. Testing of ventilation fans would likely occur during normal daytime hours, and these periodic tests are not expected to have a noticeable effect to ambient noise levels in the area. Fans that are normally operated during nighttime hours would be designed not to exceed 47 dBA at the property line of the nearest residential use.

Noise Effects for the Tolled and Non-Tolled Cut-and-Cover Tunnel
The loudest hour traffic noise levels were found to range from 61 and 79 dBA at the modeled locations with the Tolled Cut-and-Cover Tunnel and 61 and 80 dBA with the Non Tolled Cut-and-Cover Tunnel. Out of the 70 modeled sites, the number of sites approaching or exceeding FHWA noise abatement criteria would be 43 with the Tolled Cut-and-Cover Tunnel and 40 with the Non-Tolled Cut-and-Cover Tunnel. With the Tolled Cut and-Cover Tunnel, the 43 sites represent approximately 3,596 residential units, 1,395 hotel rooms, 120 shelter beds, 1 church, 1 school, 12 parks or public use spaces, and 5 commercial use areas. None of these sites would exceed the severe noise impact criterion of 80 dBA at sensitive land uses. With the Non-Tolled Cut-and-Cover Tunnel, the 40 sites represent approximately 3,541 residential units, 1,257 hotel rooms, 120 shelter beds, 1 church, 1 school, 10 parks or public spaces, and 4 commercial use areas. Two of these sites located just north of John Street are

Noise Effects to Low-Income and Minority Populations

Question 26 in this chapter discusses possible noise effects to low-income and minority populations.

predicted to have noise levels of 80 dBA, which is the severe noise impact criterion at sensitive land uses. These locations have a lot of traffic noise from vehicles entering and exiting SR 99 just north of the Battery Street Tunnel as well as surface street traffic. The number of modeled sites that would exceed the noise abatement criteria would be reduced by 10 sites with the Tolled Cut-and-Cover Tunnel and 13 sites with the Non-Tolled Cut-and-Cover Tunnel compared to existing conditions.

South Area

Noise levels were studied at 9 locations near the south portal of the Cut-and-Cover Tunnel Alternative. The noise levels would decrease by 1 to 4 dBA in 2030 at 7 locations and would increase by 2 or 3 dBA at 2 locations with the Tolled Cut-and-Cover Tunnel. With the Non-Tolled Cut-and-Cover Tunnel, noise levels would decrease by 1 to 5 dBA in 2030 at 7 locations and would increase by 1 or 2 dBA at two locations. Noise levels would exceed FHWA noise abatement criteria at 6 of the 9 sites with both the Tolled and Non-Tolled Cut-and-Cover Tunnel, which represent approximately 135 residential units, 220 hotel rooms, and 2 parks or public spaces. Noise levels with the Cut-and-Cover Tunnel would range from 66 to 70 dBA at modeled locations in the south portal area.

Central Waterfront

With the Tolled Cut-and-Cover Tunnel, noise levels along Seattle's central waterfront would decrease at 30 of the 31 locations studied between S. Jackson Street and the Battery Street Tunnel, and one location near S. Washington Street would remain the same. With the Non-Tolled Cut-and-Cover Tunnel, noise levels would decrease at all 31 locations studied. For both the Tolled and Non-Tolled Cut-and-Cover Tunnel, noise levels in the vicinity of Alaskan Way and Broad Street would increase by 1 to 3 dBA at three sites, and noise levels at three other sites would remain the same or decrease by 1 to 2 dBA. Traffic noise levels would continue to be typical of an urban area.

Noise levels were modeled and found to approach or exceed the FHWA noise abatement criteria at 21 of the 37 modeled sites for the Tolled Cut-and-Cover Tunnel and 18 of the 37 modeled sites for Non-Tolled Cut-and-Cover Tunnel, as compared to 29 of 37 sites that approach of exceed FHWA criteria today. For the Tolled Cut-and-Cover Tunnel, the 21 sites represent approximately 3,120 residential units, 462 hotel rooms, 120 shelter beds, 6 parks or public open space uses, and 3 commercial use areas. The 18 sites for the Non-Tolled Cut-and-Cover Tunnel represent approximately 3,065 residential units, 324 hotel rooms, 120 shelter beds, 3 parks or public open space uses, and 2 commercial use areas. Noise levels with the Tolled Cut-and-Cover Tunnel would range from 61 to 75 dBA at modeled locations in the central waterfront area, and from 61 to 74 dBA with the Non-Tolled Cut-and-Cover Tunnel.

North Area

At the north tunnel portal, changes in future noise levels vary depending on location. At some sites, noise levels would decrease by as much as 3 dBA, and at other sites noise levels are predicted to stay the same or increase up to 4 dBA with tolls or up to 6 dBA without tolls. With both the Tolled and Non-Tolled Cut-and-Cover Tunnel, traffic noise levels were found to approach or exceed the FHWA noise abatement criteria at 16 of the 24 modeled sites, which is an increase of four sites compared to existing conditions. The 16 sites represent approximately 341 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. Noise levels with the Tolled Cut-and-Cover Tunnel would range from 61 to 79 dBA at modeled locations in the north area or 61 to 80 dBA for the Non-Tolled Cut-and-Cover Tunnel.

Ventilation System Noise

The Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative would require a ventilation system, which would be included as part of the tunnel operations buildings proposed at the portals of the cut-and-cover tunnel along the waterfront. At the south portal, the tunnel operations building would be located on the block bounded by S. Dearborn Street, Alaskan Way S., and the new Railroad Way S. access road. At the north portal, the tunnel operations building would have ventilation stacks and be located between Alaskan Way and SR 99 just north of Pike Street. There would also be a ventilation and maintenance building at each end of the Battery Street Tunnel.

The ventilation fans would be designed and operated as described for the Tolled or Non-Tolled Bored Tunnel Alternative.

Noise Effects for the Tolled and Non-Tolled Elevated Structure

The loudest hour traffic noise levels would range between 61 and 79 dBA at the modeled locations with the Tolled Elevated Structure and 61 and 80 dBA with the Non-Tolled Elevated Structure. Out of the 70 sites modeled, both the 2030 Tolled and Non-Tolled Elevated Structure were found to approach or exceed FHWA noise abatement criteria at 57 sites. These sites represent approximately 4,730 residential units, 1,715 hotel rooms, 120 shelter beds, 1 church, 1 school, 14 parks or public use spaces, and 8 commercial use areas. None of these sites would exceed the severe noise impact criterion of 80 dBA at sensitive land uses with the Tolled Elevated Structure. However, two sites are predicted to have noise levels of 80 dBA with the Non-Tolled Elevated Structure. The number of modeled sites that would exceed the noise abatement criteria would increase by 4 sites with either the Tolled or Non-Tolled Elevated Structure compared to existing conditions.

South Area

Noise levels were studied at 9 locations near the south end of the Elevated Structure Alternative. The noise levels would remain the same or decrease by up to 2 dBA in 2030 at 6 locations and would increase by 1 or 2 dBA at 3 locations. Noise levels would exceed FHWA noise abatement criteria at 6 of the 9 sites under both the Tolled and Non-Tolled Elevated Structure, which represent approximately 135 residential units, 220 hotel rooms, and 2 parks or public spaces. Noise levels would range from 66 to 74 dBA at modeled locations in the south area with the Tolled Elevated Structure, or from 67 to 74 dBA without tolls.

Central Waterfront

Noise levels along Seattle's central waterfront with both the Tolled and Non-Tolled Elevated Structure would be within 3 dBA of the existing conditions. Traffic noise levels would continue to be typical of an urban city.

Noise levels were modeled and found to approach or exceed the FHWA noise abatement criteria at 35 of the 37 modeled sites for the Elevated Structure Alternative with or without tolls. These sites represent approximately 4,254 residential units, 782 hotel rooms, 120 shelter beds, 8 parks or public open space uses, and 6 commercial use areas. Noise levels with the Tolled Elevated Structure would range from 64 to 78 dBA at modeled locations in the central waterfront area, and from 63 to 79 dBA with the Non-Tolled Elevated Structure.

North Area

At the north end of the project area, changes in future noise levels vary depending on location. At some sites, noise levels would decrease by up to 3 dBA and at other sites noise levels are predicted to stay the same or increase up to 5 dBA with tolls or up to 6 dBA without tolls. With both the Tolled and Non-Tolled Elevated Structure, traffic noise levels modeled were found to approach or exceed the FHWA noise abatement criteria at 16 of the 24 sites, which is an increase of four sites compared to existing conditions. The 16 sites represent approximately 341 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. Noise levels with the Tolled Elevated Structure would range from 61 to 79 dBA at modeled locations in the north area or 61 to 80 dBA with the Non-Tolled Elevated Structure.

Ventilation System Noise

The Tolled or Non-Tolled Elevated Structure Alternative would have a ventilation and maintenance building at each end of the Battery Street Tunnel. As described for the other alternatives, the ventilation fans would be designed not to exceed either 60 dBA at the nearest commercial uses or 57 dBA at the property line of the nearest residential use during normal operations. Fans that are normally operated during nighttime hours would be designed not to exceed 47 dBA at the property line of the nearest residential use.

17 How would views change for the alternatives?

The build alternatives would change views in the project area, particularly along the central waterfront where the Bored Tunnel and Cut-and-Cover Tunnel Alternatives would remove the existing viaduct. Once the viaduct is removed by these alternatives, views to and from the waterfront that are currently obstructed by the structure would be substantially improved. Changes to views along the central waterfront for the Elevated Structure Alternative and changes to views at the south and north ends of the project area for all alternatives would not be as dramatic. The tolled build alternatives would have the same effects to views as the non-tolled build alternatives.

There would be few indirect effects to views because the area is already a densely developed urban environment and few if any changes to the urban context of the project are expected. With the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, to the extent that the existing viaduct has been perceived as a barrier to waterfront uses, new development on vacant or under-used property or redevelopment may take place around the new Alaskan Way surface street. These changes could slightly change views toward Seattle.

Appendix D, Visual Quality Discipline Report and Appendix E, Visual Simulations

The methodology used for visual assessment is described in *Appendix D*, Chapter 2. Chapter 5 provides additional information on visual effects. *Appendix E* contains the visual simulations.

Existing Alaskan Way Viaduct

BORED TUNNEL

CUT-&-COVER TUNNEL

ELEVATED STRUCTURE

Visual Simulations Looking Northwest on First Avenue S. *Exhibit 5-38*

Bored Tunnel Alternative

The Bored Tunnel Alternative would remove the existing viaduct, improving views at the surface throughout downtown. Drivers using the bored tunnel would not experience the panoramic views provided by the existing viaduct.

South Area

The Bored Tunnel Alternative would connect to the newly replaced SR 99 structure at S. Royal Brougham Way. At this point, occupants of northbound vehicles would have similar views of the downtown skyline as they do today, as shown in Exhibit 5-38. As northbound vehicles begin descending into the tunnel, views of downtown and Elliott Bay would become blocked. Occupants of southbound vehicles exiting at the south portal would see the Port of Seattle (Terminal 46) and industrial facilities as they emerge from the tunnel.

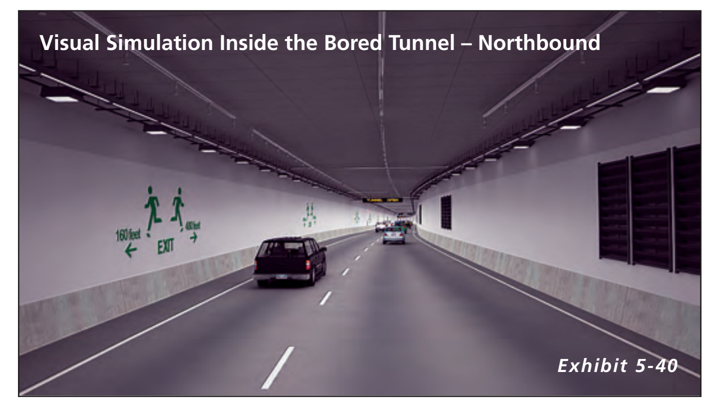
Views for people on the surface streets in the south portion of the project area would improve by removing the existing viaduct, as shown in Exhibit 5-39. Views to the west would include Terminal 46 and surface streets more prominently. Near the south portal, the existing elevated ramps along Railroad Way S. at First Avenue S. would be removed. This change would likely cause people to feel that the Pioneer Square and stadium areas are more connected visually. The proposed tunnel operations building is expected to be approximately 65 feet tall with vent stacks extending up to 30 feet above the roof. Zoning in this area now allows building heights of up to 65 feet, and the height of stacks is exempt from zoning restrictions.

Many of the people traveling to the south portal area would be attending events at Qwest or Safeco Fields. For fans congregating around Safeco Field, views would not change much. Inside the stadium, the 300 level would continue to have unobstructed views to the west. Viewers looking northwest and north would see the transition of SR 99 to the tunnel portal, although this view could be obstructed in the future by private development. The downtown skyline would continue to be the main feature for views to the north. For attendees at Qwest Field events, views toward Elliott Bay and down Railroad Way S. from the upper level of the west side of the stadium would be improved by removing the existing viaduct and the ramps to First Avenue S.

Central Waterfront

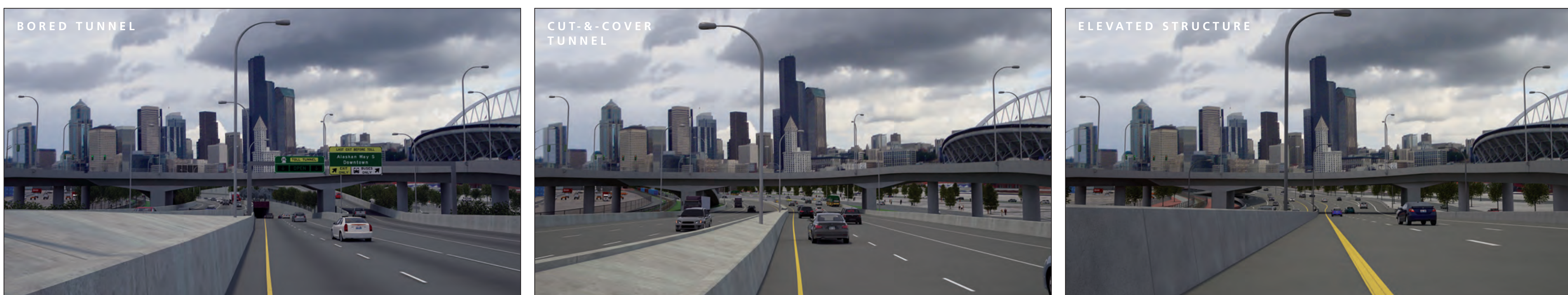
Once inside the tunnel, both northbound and southbound vehicle occupants would no longer have the scenic views of the central waterfront and downtown that they do today, as shown in Exhibit 5-40.

Removing the existing viaduct would transform the relationship that the neighborhoods east of the viaduct have to the central waterfront. Views of the Pioneer Square Historic District from the waterfront would be unobstructed for the first time since the early 1950s. Historic brick buildings, high-rise buildings, and other features (such as parking lots) would face viewers along the waterfront. Views down streets that are perpendicular to the existing viaduct would no longer be obstructed by the viaduct. These views would be framed by buildings primarily of the same period with similar materials and architectural style, together with complementary elements



Visual Simulation Inside the Bored Tunnel – Northbound

Exhibit 5-40



Visual Simulations Looking North at S. Royal Brougham Way *Exhibit 5-39* of the streetscape, including sidewalks, street trees, and the roadway itself. The Pioneer Square Historic District has a large number of visitors, and people likely would find the area more appealing after the existing viaduct is removed. Viaduct removal supports policies in the Pioneer Square Neighborhood Plan to improve the connection of east-west streets to the waterfront, by improving views and pedestrian connections.

Views from buildings that face the existing viaduct would no longer be obstructed by the viaduct, as shown in Exhibit 5-41. Views from buildings east of the viaduct would have more open foreground views of the waterfront; middle ground views of Elliott Bay, Puget Sound, West Seattle, Alki Point, and Magnolia; and distant views of the Kitsap Peninsula Hills and the Olympic Mountains. Buildings on perpendicular streets to the east would have improved views down the streets.

At the north end of the central waterfront is the Pike Place Market Historic District. Views from the market and Victor Steinbrueck Park toward the waterfront would no longer be obstructed by the viaduct.

Views for pedestrians on the waterfront and piers along Alaskan Way toward downtown Seattle would no longer have the visual barrier of the viaduct between the waterfront and downtown. From a distance near the ends of the piers and from ferries and other vessels in Elliott Bay, downtown towers loom above the existing viaduct, and the views would not change dramatically.

North Area

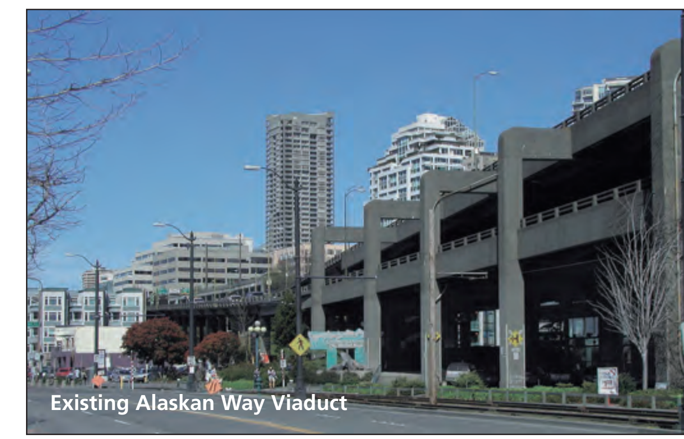
Views exiting the bored tunnel for vehicle occupants traveling northbound on SR 99 would be nearly identical to what people experience today when exiting the Battery Street Tunnel, as shown in Exhibit 5-42. Views from southbound SR 99 would also be similar to existing conditions. Vehicle occupants traveling southbound would see the downtown access off-ramp in the center lane connecting at Harrison Street. SR 99 would continue to have semi-restricted access north of the portals with a barrier in the center. Views from perpendicular streets would continue to be of a standard urban roadway with large volumes of fast-moving traffic, much like today.

Between Harrison Street and Denny Way, the rebuilt Aurora Avenue surface street would be integrated with the surrounding neighborhood. John, Thomas, and Harrison Streets would connect across Aurora Avenue. The neighborhood would no longer be divided by SR 99, and vehicle, bicycle, and pedestrian circulation would be enhanced. This would not change the visual quality of the street, which would continue to be a six-lane urban arterial. The major difference would be the slower speed of traffic and the periodic queuing of cars at intersections.

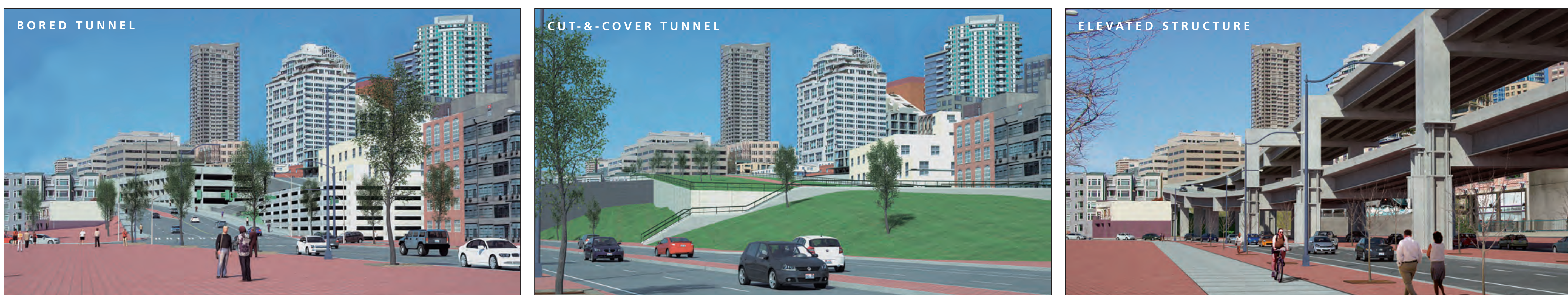
The tunnel operations building located on Sixth Avenue N. between Thomas and Harrison Streets would be similar in size to existing buildings in the vicinity. The tunnel operations building is expected to be approximately 60 feet tall with vent stacks extending up to 35 feet above the roof. This could be somewhat shorter than other buildings that may be developed in the future, since zoning in this area now allows building heights of up to 85 feet.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative has visual effects almost identical to those of the Bored Tunnel Alternative at the south portal and along the central waterfront. It differs in the connection between Alaskan Way and Pike Street and the Battery Street Tunnel, and on Aurora Avenue. As with the Bored Tunnel, the major changes are beneficial and result from removal of the existing elevated structure along the waterfront with associated visual impacts, providing opportunities for a variety of visual amenities on the Alaskan Way surface street. The



Existing Alaskan Way Viaduct



Visual Simulations Looking North on Alaskan Way at Union Street

Exhibit 5-41

Cut-and-Cover Tunnel includes additional visual amenities provided by the proposed lid connecting to Steinbrueck Park.

South Area

Visual effects with the Cut-and-Cover Tunnel are almost identical to the Bored Tunnel; the one exception is the tunnel operations and maintenance building (see Exhibit 5-39). For the Cut-and-Cover Tunnel, this building would contain an operations room, offices, equipment and vehicle storage, and facilities for minor repairs. It would not contain ventilation equipment and would be two stories tall (as compared to the Bored Tunnel Alternative operations building height of approximately 65 feet, with ventilation stacks extending up to 30 feet above the roof).

Central Waterfront

As with the bored tunnel, once inside the cut-and-cover tunnel, both northbound and southbound vehicle occupants would no longer have the scenic views of the central waterfront and downtown as they do today. On the surface, with the removal of the viaduct, views to and from downtown areas, as well as views to and from the improved central waterfront streetscape would improve, as with the Bored Tunnel Alternative.

Along the central waterfront, the Cut-and-Cover Tunnel includes a tunnel operations building near Pine Street and a lid above the tunnel from near Pike Street to Steinbrueck Park, as shown in Exhibit 5-41, but otherwise would appear similar to the Bored Tunnel Alternative. The lid would extend over the roof of the operations building between Pike and Pine Streets. North of Pine Street, the lid would be about 100 feet wide and extend over the northbound lanes and a portion of the southbound lanes. The pedestrian lid would provide more opportunities for observing the Olympic Mountains, Puget Sound, Elliott Bay, and the downtown skyline. South of Pine Street, the two-story high wall of the tunnel operations building would be visible along the east side of the Alaskan Way surface street. This wall would be somewhat obscured by street trees in spring, summer, and early autumn. If it is treated as a building frontage with windows and other openings, it is more likely to be perceived as part of the building frontage of a typical urban street. If it is a blank concrete wall, it would be more likely to detract from the urban streetscape. The building also would include vent stacks that would protrude above the public open space area on top of the building.

As SR 99 enters the Battery Street Tunnel, a new south portal and vent structure would extend to the south over the approach roadway. The building roof would be at the approximate level of First Avenue and may include a public open space or viewing area. The portal and the vent building would be about 50 feet high, including the 15-foot-high vent enclosure. It would be a relatively minor element in the continuous arterial framed by urban buildings.

North Area

Views for occupants of vehicles on SR 99 north of the Battery Street Tunnel would be of a lowered roadway framed by retaining walls on either side. This would be a change from the existing frontage of street trees and buildings but would not be substantially different from expectations of a high-speed corridor through an urban setting.

With the SR 99 lowered below grade, Thomas and Harrison Streets are proposed to connect over SR 99. The neighborhood would no longer be divided by the existing high-speed highway, and vehicle and pedestrian circulation would be enhanced. However, these improvements would not substantially change the visual quality of the street, either for views from the road or views toward the road.

The tunnel operations building at the north Battery Street Tunnel portal would be located over the portal on the north side of Denny Way, and it would block pedestrian views of SR 99 to the north. Loss of this view of a high-

Visual Simulation Looking North Toward Aurora Avenue at Denny Way *Exhibit 5-42* speed highway in an urban environment is not considered adverse. The building would be one story high, with about 70 feet of street frontage.

Elevated Structure Alternative

With the Elevated Structure Alternative, drivers on SR 99 would experience portions of the views currently seen from the viaduct today. Because the new structure would be wider and taller than the existing viaduct, this alternative would continue to dominate near views and be a visual barrier to and from the waterfront and downtown Seattle and the Pioneer Square Historic District.

South Area

The Elevated Structure Alternative would remove the elevated Railroad Way S. ramps in the south area, but it would construct new elevated structures in the same vicinity, maintaining the visual barrier between Pioneer Square and the waterfront, as shown in Exhibit 5-39. Because of the additional width of the elevated structure, views would be restricted along Alaskan Way.

Central Waterfront

With the Elevated Structure Alternative, effects to views in the project area would be similar to existing views. For motorists traveling on the new elevated structure, scenic views of the Seattle skyline would still be a part of their driving experience. But views toward the waterfront would be different than today, because roadside barriers would be solid (like concrete jersey barriers) instead of being topped by railings, and the barriers would be taller than they are now. From an average car, Puget Sound, Bainbridge Island, and the Olympic Mountains would probably still be part of the view, but it is likely that views of much of the waterfront would be hidden by the barriers.

Like the existing viaduct, the new elevated structure would continue to obstruct views; cast shade over an extensive area; limit future development of parks, trails, and sidewalks; generate overhead traffic noise; and give the impression that the city is separated from its waterfront, as shown in Exhibit 5-41. The additional width of the elevated structure would restrict views along Alaskan Way.

However, the Elevated Structure Alternative would make some improvements over existing conditions. The new structure would have fewer support columns and they would be spaced farther apart, reducing visual clutter beneath the structure. The streetscape—things like sidewalks, streetcar stops, landscaping, and lighting—would be part of an integrated design that would create continuity along the waterfront compared to today's conditions.

With the Elevated Structure Alternative, SR 99 would continue to be routed over Elliott and Western Avenues. The effects to views from the new elevated structure near Pike Place Market and Victor Steinbrueck Park would be similar to views today, and the views and overall character of the surrounding neighborhood would be about the same.

As with the Cut-and-Cover Tunnel Alternative, new tunnel operations structures (maintenance and ventilation buildings) would be constructed at the Battery Street Tunnel's south and north portals, but they would not adversely affect the urbanized visual environment.

North Area

As with the Cut-and-Cover Tunnel Alternative, views for motorists north of the Battery Street Tunnel would be of a depressed roadway framed by retaining walls on either side. The connections of John, Thomas, and Harrison Streets over SR 99 would not substantially change the visual quality of the street, for views either from or toward the road.

18 What properties would need to be acquired?

The Bored Tunnel Alternative would have fewer acquisitions on the surface than the other alternatives, as shown in Exhibit 5-43. The Bored Tunnel Alternative would also require subsurface acquisitions. The Cut-and-Cover Tunnel Alternative would acquire a few more parcels than the Elevated Structure Alternative. The specific parcels needed for the alternatives are shown in Exhibit 5-43 and the totals are listed in Exhibits 5-44 and 5-45. Tolling would not affect which parcels are needed for each of the alternatives. WSDOT is currently advancing acquisitions where there are willing parties.

Exhibit 5-44
Summary of Surface Parcels Acquired for the Alternatives

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Partial Acquisitions	6	24	19
Full Acquisitions	6	16	16
Total Properties Affected	**12**	**40**	**35**

Note: Effects for the non-tolled and tolled build alternatives are the same. This does not include subsurface property acquisitions.

When acquiring properties, Washington State Department of Transportation (WSDOT) would follow the amended provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. This act implements federal and state constitutional guarantees that private property will not be taken or damaged for public use without just compensation.

There are warehouse and office/commercial properties available for sale or lease south of downtown, in central downtown, and in the South Lake Union area that could provide comparable space for businesses located on acquired properties. The sizes of available properties vary greatly, as do prices and lease rates. The current market has slowed due to difficult economic conditions. This has resulted in higher vacancy rates than were experienced at the end of the 1990s and early 2000s when the economy was stronger. It is difficult to predict how long the current economic environment will last; however, as the economy improves, the demand for all property types downtown is expected to be relatively high, based on activity during the recent past.

Bored Tunnel Alternative

For the Bored Tunnel Alternative, 12 parcels (approximately 7.8 acres) would be acquired for right-of-way. In addition to the 6 partial and 6 full acquisitions, the Bored Tunnel Alternative would have approximately 55 subsurface acquisitions.[4] The subsurface property acquisitions would not affect land uses on the surface because the area acquired would be outside of the practical building requirements for typical building

Exhibit 5-45
Parcel Areas Needed for the Alternatives

	Bored Tunnel		Cut-&-Cover Tunnel		Elevated Structure	
	PARTIAL	FULL	PARTIAL	FULL	PARTIAL	FULL
SOUTH – South of S. King Street						
Parcels	3	2	3	0	3	0
Square Feet	17,900	173,900	17,900	0	17,900	0
Acres	about 0.4	about 4.0	about 0.4	0	about 0.4	0
CENTRAL – S. King Street to Denny Way						
Parcels	55 subsurface easements	0	12	5	7	5
Square Feet		0	8,300	30,200	2,500	62,200
Acres		0	about 0.2	about 0.7	about 0.06	about 1.4
NORTH – Denny Way North						
Parcels	3	4	9	11	9	11
Square Feet	15,850	15,850	93,050	248,900	93,050	248,900
Acres	about 0.4	about 3.0	about 2.1	about 5.7	about 2.1	about 5.7
Total						
Parcels	**6**	**6**	**24**	**16**	**19**	**16**
Square Feet	**33,750**	**304,500**	**119,250**	**279,100**	**113,450**	**311,100**
Acres	about **0.8**	about **7.0**	about **2.7**	about **6.4**	about **2.6**	about **7.1**

Note: Effects for the non-tolled and tolled build alternatives are the same.

Appendix G, Land Use Discipline Report

Additional details about acquired properties can be found in Chapter 5 of *Appendix G*.

Attachment A of *Appendix G* lists subsurface property acquisitions required for the Bored Tunnel Alternative.

4 Parsons Brinckerhoff 2009.

Surface Parcels Acquired for the Alternatives

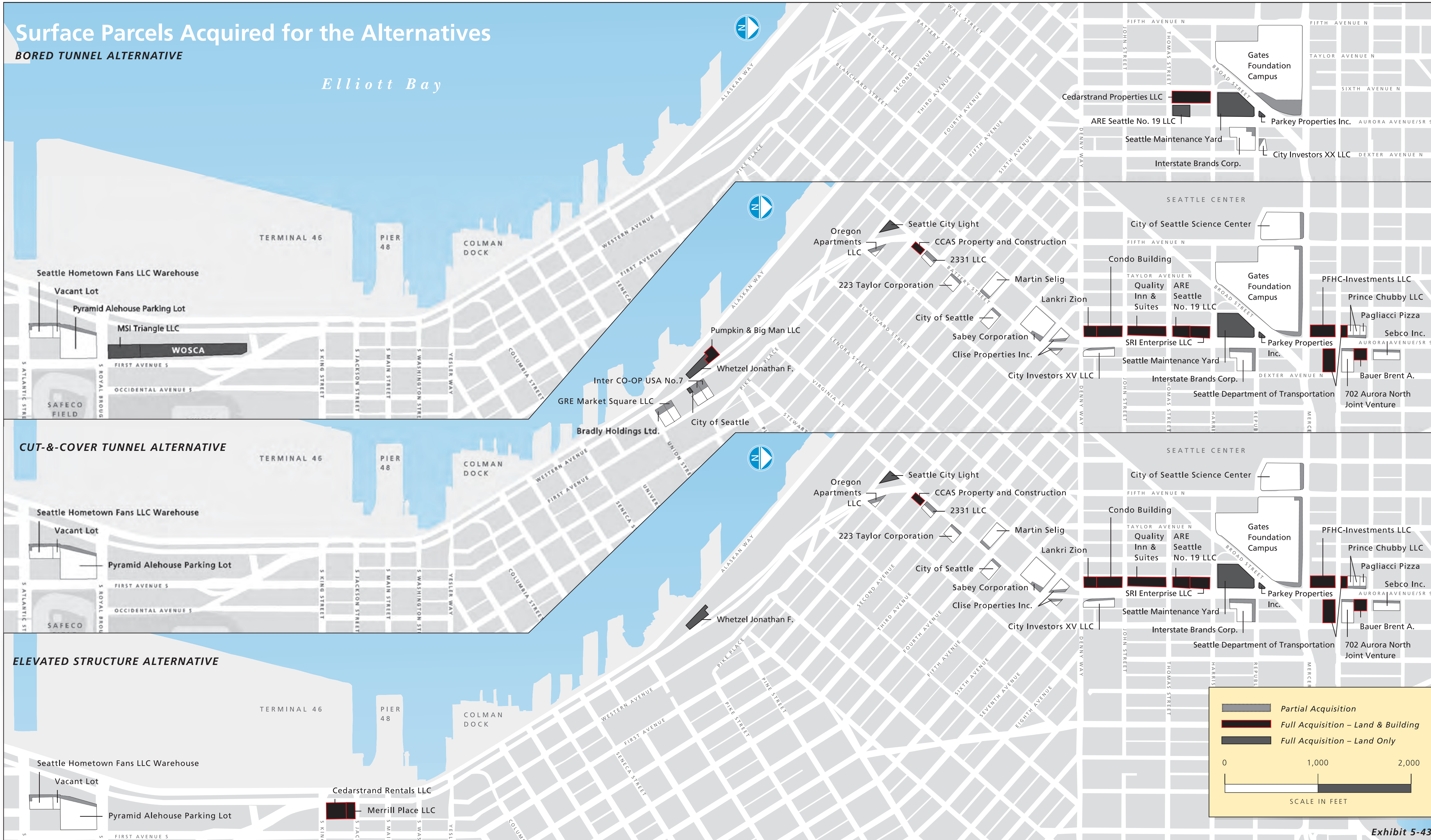


Exhibit 5-43

foundations and zoning requirements. Future development such as excavations for grouting, pilings, or installing heat pumps, would need to consider the boundaries of the subsurface property that would be acquired for the tunnel. These acquisitions are not anticipated to change the development potential of the affected properties under current zoning. For the GSA Federal Office Building, the subsurface acquisition is also outside potential development requirements. The distance between the building piles and the top of the bored tunnel would be approximately 64 feet.

In the south portal area, full acquisitions would include about 173,000 square feet (4.0 acres) of land zoned for Industrial Commercial and Pioneer Square Mixed use. One warehouse building near S. Atlantic Street could be displaced with an estimated 25 employees affected. The determination of the need for altering or demolishing this warehouse will be made during final design of the project. One building on Terminal 46 would also be permanently removed, which would relocate 8 employees. Partial acquisitions would include about 17,900 square feet (0.4 acre) of land zoned for Industrial Commercial use.

In the north portal area, full acquisitions would include about 131,500 square feet (approximately 3.0 acres) of property. Partial acquisitions would include about 15,850 square feet (approximately 0.4 acre). Two buildings, an office and a vacant building, would be displaced on the acquired parcels, and an estimated 119 employees could be affected. All of the property acquisition in the north portal area is zoned as Seattle Mixed.

Cut-and-Cover Tunnel Alternative

For the Cut-and-Cover Tunnel Alternative, up to 40 parcels (approximately 9.1 acres) would be acquired for right-of-way. This would include full acquisition of 16 parcels and partial acquisition of 24 parcels. Eleven buildings would be displaced on the acquired parcels, and an estimated 124 employees could be affected. The 11 buildings include 3 retail buildings, 2 office buildings, 1 church, 2 hotel/motel buildings, 1 condominium, and 2 vacant buildings.

Some of the acquired parcels would be used for tunnel operations buildings, which would be constructed at the south tunnel portal near Railroad Way S. and at the north portal between Pike and Pine Streets on the east side of Alaskan Way. Maintenance and ventilation buildings would also be located at each end of the Battery Street Tunnel, near where First Avenue intersects with Battery Street and near Denny Way.

In the south area, there would be no full acquisitions. Partial acquisitions would include about 17,900 square feet (approximately 0.4 acre). Along the central waterfront area, full acquisitions would include about 30,200 square feet (approximately 0.7 acre) of property. Partial acquisitions would include about 8,300 square feet (approximately 0.2 acre). In the north area, full acquisitions would include about 249,000 square feet (approximately 5.7 acres) of property. Partial acquisitions would include about 93,100 square feet (approximately 2.1 acre).

Elevated Structure Alternative

The Elevated Structure Alternative requires the acquisition of 35 parcels (approximately 9.7 acres), 16 full acquisitions and 19 partial acquisitions. Twelve buildings would be displaced on the acquired parcels. These buildings include 1 parking garage, 2 office buildings, 1 church, 2 hotels, 3 retail buildings, 1 condominium building, and 2 vacant buildings. Under this alternative, approximately 170 employees could be affected by potential displacements.

In the south area, there would be no full acquisitions. Partial acquisitions would include about 17,900 square feet (approximately 0.4 acre). Along the central waterfront area, full acquisitions would include about 62,200 square feet (approximately 1.4 acres) of property. Partial acquisitions would include about 2,500 square feet (approximately 0.06 acre). In the north area, property acquisitions would be the same as for the Cut-and-Cover Tunnel Alternative.

19 How would land use effects compare?

The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would be consistent and compatible with existing land use plans. The Elevated Structure Alternative is consistent with existing land use plans but would not support the Central Waterfront Concept Plan.[5]

The proposed project elements are allowed and consistent with the City's land use and shoreline codes as well as the Coastal Zone Management Act (CZMA). They would not affect the ecological functions of the shoreline. The viaduct is considered "upland" in Seattle's Comprehensive Plan and Shoreline Master Program, and demolition of the viaduct and its replacement with a surface street, an elevated structure, or a tunnel would be allowed.

The build alternatives would maintain local and regional mobility by replacing the existing viaduct with a facility that would provide an alternate route to I-5 and Seattle's surface streets. Tolling may directly benefit motorists through reduced congestion on SR 99, and it may also result in a shift of traffic and congestion problems to other routes and areas. Although there would be some properties that would be permanently changed due to right-of-way acquisitions, this conversion of land use is not expected to influence development activity or trends in this densely developed urban area. None of the tolled or non-tolled build alternatives would have direct effects to land uses or land use patterns in the study area.

The project represents only one of numerous ongoing improvements occurring in the city. Because the project would replace an existing facility to meet safety and mobility needs, it is consistent with land use plans and generally maintains and supports existing land use conditions. Therefore, the potential to induce growth in Seattle would be minor. The alternatives are not expected to be a major catalyst for future growth, because large-scale redevelopment is not likely and the alternatives

Appendix G, Land Use Discipline Report

Additional details about acquired properties can be found in Chapter 5 of *Appendix G*.

5 City of Seattle 2006.

would support planned future growth as identified in Seattle's Comprehensive Plan.

Several properties would be permanently converted from office, retail, and commercial land uses to transportation uses due to the acquisitions discussed in Question 18. Conversion of land to transportation use would result in a slight reduction in the overall density of potential development in the project area. However, it is not expected to influence development activity or trends in affected areas. Several private developments are planned or already under construction near the project area. Planned development in the south area includes an office and residential mixed-use project on Qwest Field's north parking lot, as well as other mixed-use residential and office developments. In the Uptown and South Lake Union neighborhoods, much of the development continues to be focused on residential and office uses and includes the Gates Foundation Campus.

Removing off-street parking spaces would not result in any land use nonconformities with respect to accessory parking requirements. Parking effects are discussed in Question 20.

For all of the build alternatives, no permanent changes in land use would occur as a result of property being used as a staging area. A potential opportunity for redevelopment would occur at the various construction staging locations after the project is completed.

Current waterfront planning activities are expected to help determine future land uses in the central section. Seattle's Central Waterfront Concept Plan[6] identifies a few existing waterfront development opportunities as well as sites near the project area that have development potential but may require partnerships between private developers and public agencies.

The City's guiding principles for central waterfront development are established by Seattle Resolution 31264. With regards to transportation, these principles include "Improve Access and Mobility," which states "The future waterfront should accommodate safe, comfortable and efficient travel by pedestrians, bicyclists, vehicles and freight. The interactions among these parties must be designed carefully for safety, comfort and efficiency for all." To the extent alternatives, especially with tolling, increase vehicle volumes on Alaskan Way they could make achieving these goals more difficult.

With the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, it is expected that small to moderate-scale future redevelopment along a new Alaskan Way would be an indirect effect of removing the existing viaduct. Development would be constrained by land use and building regulations and likely occur in the form of modest expansions of existing buildings on the east side of the roadway. In addition, changes would occur in the relationship between the waterfront and upland properties leading to the downtown core. To the extent that the existing viaduct has been perceived as a barrier to waterfront uses, new development on vacant or underused property or redevelopment may take place around the new Alaskan Way surface street.

Bored Tunnel Alternative

Only a few land uses in the south and north portal areas would be permanently changed due to right-of-way acquisitions for the Bored Tunnel Alternative. The primary changes would be from office, retail, and commercial land uses to transportation uses. This conversion of land use is not expected to influence development activity or trends in those areas. The subsurface acquisitions would not affect existing land uses and are not anticipated to change the development potential of the affected properties under current zoning, because the limits would be outside of the practical building requirements for typical building foundations and zoning requirements.

A tunnel operations building would be built at each of the portals to house ventilation equipment and maintenance and control facilities. Each building would likely be about 60 to 65 feet tall, with ventilation stacks extending 30 to 35 feet beyond the roof, which meets existing zoning and land use code requirements. The tunnel operations buildings would be designed to fit in with their surrounding neighborhoods.

The new east-west surface street at S. Dearborn Street in the south portal area would improve east-west connections between existing land uses such as the sports stadiums, Seattle Ferry Terminal, and waterfront businesses. The south portal area would also have new blocks of property that would be available for future development under the City's existing Industrial Commercial land use zone. Some of the properties that had been used for staging and other construction activities may be sold at a future date. The availability of this land for development is not expected to influence development activity or trends in the Pioneer Square or Greater Duwamish Manufacturing and Industrial Center neighborhoods.

In the north portal area, new connections across Aurora Avenue at John, Thomas, and Harrison Streets and the extension of Sixth Avenue N. to Mercer Street would improve vehicle, bicycle, and pedestrian mobility between the Uptown, Belltown, and South Lake Union neighborhoods. Broad Street would be closed between Ninth Avenue N. and Taylor Avenue N. Although the removal of Broad Street would change pedestrian, bicycle, and vehicle circulation patterns, it would not decrease accessibility to adjacent land uses, and overall mobility in the area would be improved compared to existing conditions.

Cut-and-Cover Tunnel Alternative

With the Cut-and-Cover Tunnel Alternative, conversion of land to transportation use would result in a reduction in the overall amount of developable industrial and commercial property. However, it is not expected to greatly influence development activity in the project area. The existing viaduct structure would be removed, and new open space would be created between S. King Street and the Battery Street Tunnel. In addition to the construction staging areas, the right-of-way above the proposed tunnel could also have some redevelopment potential for public use.

6 City of Seattle 2006.

Tunnel operations buildings would be located near each portal of the cut-and-cover tunnel. At the south portal near Railroad Way S., the approximately 40-foot-tall building does not include ventilation stacks and would meet existing zoning and land use code requirements. At the north portal near Pine Street, the building would be 15 feet above the proposed roadway, with ventilation stacks extending about 30 feet beyond the roof. The tunnel operations buildings would follow Seattle's design review process and be designed to fit in with their surrounding neighborhoods.

Maintenance and ventilation buildings would also be located at each end of Battery Street Tunnel, near where First Avenue intersects with Battery Street and near Denny Way. These buildings would likely vary in height from approximately 15 to 40 feet, with ventilation stacks 15 feet tall, and they are not expected to exceed the zoning height limitations. It is expected that if potential conflicts with zoning regulations occur, they would be addressed by conditional use permit requirements.

Most of the land to be acquired is located in the central and north sections of the project area. After the removal of the existing viaduct, a portion of the public land area that currently contains its support columns may become available for other public uses.

Where enhanced pedestrian access could be provided by this alternative from the lid structure above the cut-and-cover tunnel between Union Street and just north of Virginia Street, the connection among business, retail, and service uses downtown and waterfront land uses would improve.

Elevated Structure Alternative
Conversion of acquired parcels to transportation use would result in a minor reduction in the overall amount of developable industrial and commercial property, which may have some localized effect on uses. However, it is not expected to greatly influence development activity in the project area. Most of the land to be acquired is located in the central and north sections.

The Elevated Structure Alternative would not result in opportunities for redevelopment in the project area, because it would be in the same location as the existing viaduct. Because the new elevated structure would be wider than the existing structure, the "barrier effect" between the waterfront and downtown would be reinforced. This barrier has been considered a hindrance to improving the connection between the downtown core and the land uses along the waterfront. This alternative would not influence land use patterns and is less likely than the other build alternatives to result in a noticeable change in the connection between the waterfront and downtown.

20 How would local and regional economic effects compare?

Effects to Businesses and Employees
As discussed previously, 12 properties would be acquired for the Bored Tunnel Alternative, 40 for the Cut-and-Cover Tunnel Alternative, and 35 for the Elevated Structure Alternative. The number of property acquisitions would be the same for tolled and non-tolled build alternatives. The economic effects of acquiring these properties are summarized in Exhibit 5-46.

Partially acquired properties would retain their existing buildings, maintain their current function, and continue to pay property taxes at a reassessed value.

For the Bored Tunnel Alternative, 4 buildings on fully acquired parcels would be removed. The loss of parcels with buildings would relocate or displace an estimated 152 workers, which represents about 0.08 percent of the total 2010 forecasted workforce in the Seattle Central Business District.

For the Cut-and-Cover Tunnel Alternative, 11 buildings on fully acquired parcels would be removed. The loss of parcels with buildings would relocate or displace an estimated 124 workers, which represents about 0.06 percent of the total 2010 forecasted workforce in the Seattle Central Business District.

Exhibit 5-46
Acquired Parcel Effects

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
SOUTH AREA			
Number of Parcels Subject to Acquisition – *full and partial*	5	3	3
Number of Parcels Subject to Full Acquisition	2	0	0
Number of Buildings Acquired	2	0	0
Approximate Area of Work Space Relocated or Displaced – *in square feet*	14,925	0	0
Estimated Number of Permanent Jobs Affected by Relocation or Displacement[1]	33	0	0
Approximate Property Tax Paid by Fully Acquired Parcels[2] – *in dollars*	0	0	0
Area of Fully Acquired Parcels – *in square feet*	173,900	0	0
CENTRAL WATERFRONT AREA			
Number of Parcels Subject to Acquisition – *full and partial*	0[4]	17	12
Number of Parcels Subject to Full Acquisition	0	5	5
Number of Buildings Acquired	0	2	3
Approximate Area of Work Space Relocated or Displaced – *in square feet*	0	18,900	94,100
Estimated Number of Permanent Jobs Affected by Relocation or Displacement[1]	0	24	70
Approximate Property Tax Paid by Fully Acquired Parcels[2] – *in dollars*	0	32,000	91,200
Area of Fully Acquired Tax-Paying Parcels[3] – *in square feet*	0	30,200	49,850
NORTH AREA			
Number of Parcels Subject to Acquisition – *full and partial*	7	20	20
Number of Parcels Subject to Full Acquisition	4	11	11
Number of Buildings Acquired	2	9	9
Approximate Area of Work Space Relocated or Displaced – *in square feet*	51,500	291,600	291,600
Estimated Number of Permanent Jobs Affected by Relocation or Displacement[1]	119	100	100
Approximate Property Tax Paid by Fully Acquired Parcels[2] – *in dollars*	105,600	478,900	478,900
Area of Fully Acquired Tax-Paying Parcels[3] – *in square feet*	131,500	249,000	249,000

Note Effects for the non-tolled and tolled build alternatives are the same.

1 *This estimate was based on the total square footage of each individual building, the use of the building (e.g. car wash, educational, and office), and the average square feet required per worker based on the use of the building (U.S. Department of Energy 2006).*

2 *This estimate was based on actual amounts collected in 2009 by the King County Finance and Business Operations for all of the parcels to be acquired. This estimate is for 1 year and represents less than 0.01 percent of all property tax revenue collected by King County in 2009 (King County GIS Center 2010).*

3 *The area of tax-paying parcels is less than the total area of property acquired because City and State-owned property does not pay tax.*

4 *The subsurface easements are not included here because this section is discussing the economic impacts of surface properties acquired.*

For the Elevated Structure Alternative, 12 buildings on fully acquired parcels would be removed. The loss of parcels with buildings would relocate or displace an estimated 170 workers, which represents about 0.08 percent of the total 2010 forecasted workforce in the Seattle Central Business District.

Appendix L, Economics Discipline Report

Additional information on economic effects are provided in Chapter 5 of *Appendix L, Economics Discipline Report*.

Appendix C, Transportation Discipline Report

Additional information on parking is provided in *Appendix C*, Section 5.8.

Any of the build alternatives could result in indirect regional economic benefits. Pedestrians and vehicles would benefit from increased connectivity of the surface streets in the north project area, linking South Lake Union and the Uptown neighborhoods. Other improvements that would increase connectivity include the extension of Sixth Avenue N., closure of the existing Broad Street right-of-way, and reconstruction of the Mercer Street corridor, which would facilitate freight movement between the BINMIC and I-5. Where improved connections to the downtown core and the central waterfront may facilitate commute trips from surrounding neighborhoods, some development activity and/or increased shopping visits may be stimulated by the desirability of this connection.

Either of the tunnel alternatives would have substantially fewer effects on visual quality and noise effects along the central waterfront than the structure associated with the Elevated Structure Alternative or the existing viaduct. These improved conditions would have the indirect effect of enhancing the viability and desirability of the central waterfront, which, in turn, would increase the economic vitality of the area.

Effects to Parking

Exhibit 5-47 summarizes the total on- and off-street parking losses for each build alternative. All of the build alternatives are expected to reduce parking compared to existing conditions. There would be approximately twice as many parking spaces removed for the Cut-and-Cover Tunnel and Elevated Structure Alternatives as for the Bored Tunnel Alternative. The number of parking spaces affected by each of the alternative would be the same under both tolled and non-tolled conditions. If any ADA parking spaces are affected, they would be accommodated in accordance with City guidelines and Federal requirements.

Exhibit 5-47
Public Parking Spaces Removed

	SPACES REMOVED		
Alternative	On-Street	Off-Street	Total
Bored Tunnel	390	250	640
Cut-&-Cover Tunnel	690	500	1,190
Elevated Structure	750	630	1,380

Note: Effects for the non-tolled and tolled build alternatives are the same.

In the stadium area, the parking effects are the same for all of the build alternatives, as shown in Exhibit 5-48. About 110 on-street spaces and 250 off-street spaces would be removed near the stadiums.

Along the central waterfront, the Cut-and-Cover Tunnel and Elevated Structure Alternatives would remove about half of the on-street parking spaces under the viaduct and along Alaskan Way. The affected parking spaces are shown in Exhibit 5-49. There would be no long-term effects to existing parking under the viaduct from the Bored Tunnel Alternative; however, future planned projects along the central waterfront may reduce available parking. The Bored Tunnel Alternative would not change the parking supply in the Pioneer Square, central, or Belltown areas.

The parking effects north of the Battery Street Tunnel are the same for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. The Bored Tunnel Alternative would remove about 40 more on-street parking spaces in the north area than the other two alternatives. Affected parking spaces in the north area are shown in Exhibit 5-50.

The parking removals are consistent with Seattle's Comprehensive Plan.[7] Goal TG18 indicates that in making decisions about on-street parking, transportation is the primary purpose of the street system. In addition, it is the City's general policy, as described in policy T-42, to replace short-term parking only when the project results in a concentrated and substantial amount of on-street parking loss. The Seattle Department of Transportation will ultimately determine how on-street parking spaces are managed and will likely encourage short-term instead of long-term parking.

Stadium Area Affected Parking Spaces

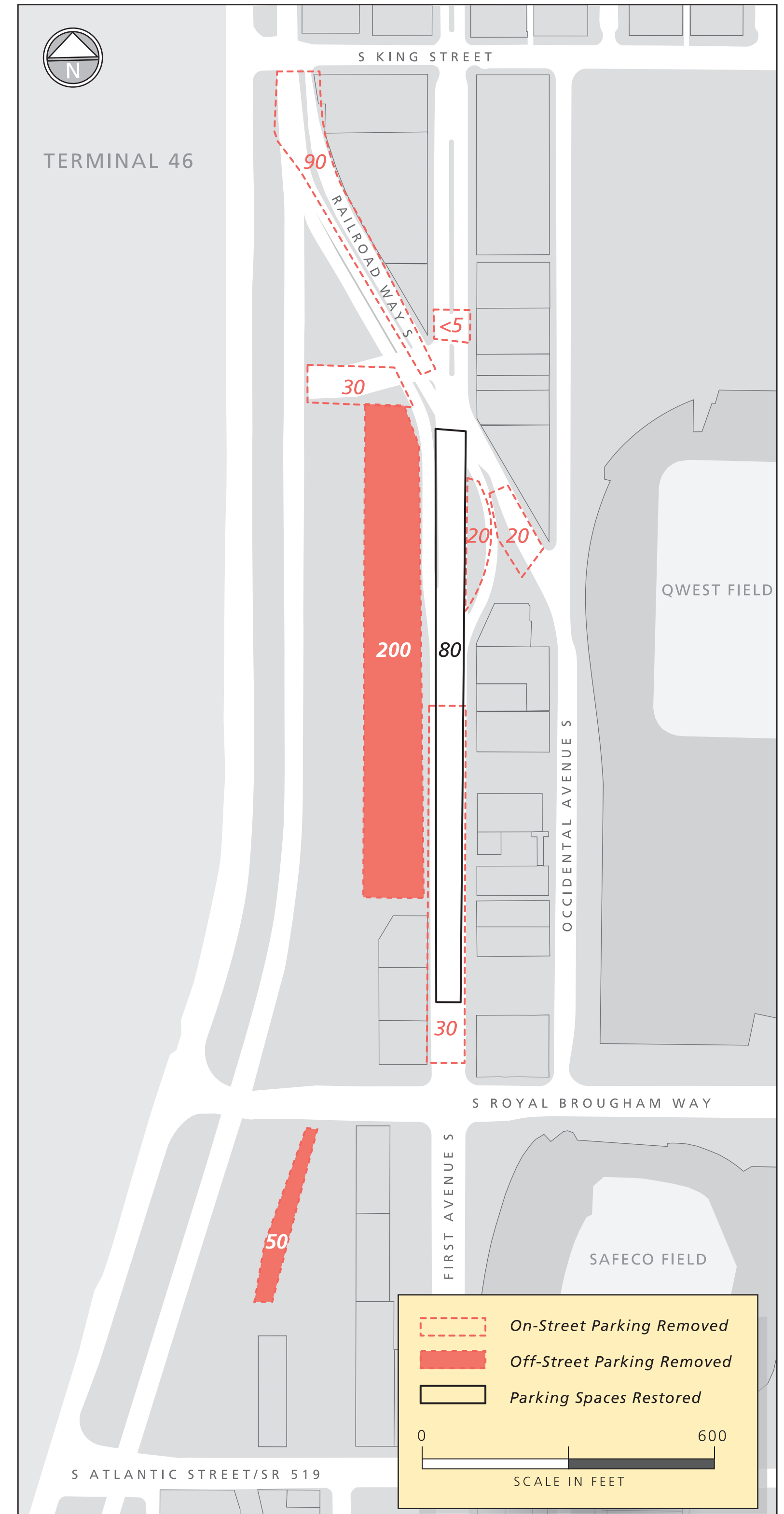


Exhibit 5-48

7 City of Seattle 2005.

Bored Tunnel Alternative

The Bored Tunnel Alternative would remove approximately 640 parking spaces, as shown in Exhibit 5-51.

Exhibit 5-51
Parking Effects of the Bored Tunnel Alternative

Area	Spaces Removed: On-Street	Off-Street	Total
Stadium	110	250	360
North	280	0	280
Total	**390**	**250**	**640**

Note: Effects for the Non-Tolled and Tolled Bored Tunnel Alternative are the same.

In the stadium area, there are approximately 440 existing parking spaces. Any of the build alternatives would remove about 360 of these spaces. Approximately 80 on-street spaces would be replaced and about 110 on-street spaces would be removed. If 110 on-street spaces were removed, approximately $278,000 would be lost each year from the City's General Fund. On-street parking is available within several blocks of the spaces that would be removed. Most of the on-street spaces that would be permanently removed are 2-hour metered parking spaces along Railroad Way S. Drivers who would have otherwise used these spaces may have to travel several blocks farther to find available on-street spaces on surrounding streets, or they could use a pay lot.

Approximately 250 off-street parking spaces would be permanently affected by the Bored Tunnel Alternative. Of these spaces, about 200 are on the Washington-Oregon Shippers Cooperative Association (WOSCA) property and are currently unavailable due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project. However, the S. Holgate Street to S. King Street Viaduct Replacement Project assumed that these 200 spaces could be replaced. With this project, there may be space on the WOSCA site to replace some of the off-street parking; however, the conservative assumption is that these spaces would not be replaced. As a result, the 200 spaces on the WOSCA site are included as an effect of the Bored Tunnel Alternative. Future use of the space will be determined by WSDOT or potential future property owners. Off street parking lots generally are underutilized

Central Waterfront Area Affected Parking Spaces

Cut-&-Cover Tunnel

Exhibit 5-49

during an average non-event weekday within walking distance of the stadium area, so parking spaces are not expected to be difficult to find.

During events at the stadiums, finding available parking may be more challenging or more expensive than it is today. However, a number of major parking facilities are located within walking distance of the stadiums, including the Safeco Field Garage, Qwest Event Center Garage, Union Station Garage, North Lot (Qwest Field), Impark Parking, and Home Plate Parking. These six parking facilities provide about 6,900 parking spaces. Many smaller parking lots and garages are also within walking distance of the stadiums. Event-goers will continue to be encouraged to use bus and rail service and to carpool to the stadiums. The Safeco Field Transportation Management Plan and the Qwest Field Transportation Management Program both include parking reduction and transit-related goals and mitigation measures that aim to reduce the number of event attendees who require parking near the stadiums.

In the north area, there are approximately 90 on-street, short term parking spaces and approximately 230 on-street, long-term spaces within the north portal area, for a total of 320 on street spaces. The on-street, long-term spaces mainly consist of metered spaces with a 10-hour limit. For the Bored Tunnel Alternative, approximately 40 spaces would be replaced, resulting in a loss of 280 on street spaces, compared with existing conditions. Most of these spaces would be removed to accommodate bicycle lanes or vehicle lanes. The Seattle Department of Transportation will manage the on-street parking spaces, so no assumptions are made about whether the new and replaced on street parking spaces would be long- or short-term. However, if 280 on-street spaces are removed in the north area, approximately $244,000 would be lost each year from the City's General Fund.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would remove approximately 1,190 spaces, as shown in Exhibit 5-52.

North Area Affected Parking Spaces

Bored Tunnel

Exhibit 5-50

Exhibit 5-52
Parking Effects of the Cut-&-Cover Tunnel Alternative

	SPACES REMOVED		
Area	On-Street	Off-Street	Total
Stadium	110	250	**360**
Pioneer Square	110	0	**110**
Central	240	70	**310**
Belltown	+10	150	**140**
North	240	30	**270**
Total	**690**	**500**	**1,190**

Note: Effects for the Non-Tolled and Tolled Cut-&-Cover Tunnel Alternative are the same.

In the stadium area, the Cut-and-Cover Tunnel Alternative would have the same effects as described for the Bored Tunnel Alternative.

In the Pioneer Square area, about 110 on-street parking spaces would be removed. Almost all of the affected spaces are short-term spaces, with the exception of about 10 unrestricted unmetered spaces along Alaskan Way. The loss of 110 on-street spaces could make it more difficult for shoppers and restaurant patrons to find parking in this area, and would result in approximately $278,000 lost each year from the City's General Fund.

In the central waterfront area along Alaskan Way and under the viaduct, approximately 240 of the existing 510 on-street spaces would be removed by the Cut-and-Cover Tunnel Alternative. These 240 spaces represent about half of the on-street spaces under the viaduct and along Alaskan Way. On-street parking along the waterfront is highly utilized under existing conditions, so removing many of the spaces would make it even more difficult to find parking. Many drivers would likely need to seek short-term parking in surrounding parking garages, which could be more expensive and farther away from their destinations on the waterfront. The loss of these 240 paid on-street spaces would reduce the City's General Fund by approximately $1.6 million each year.

In addition to the on-street parking effects along the central waterfront, there also would be an off-street public parking lot located across from the Seattle Aquarium that would be removed. This lot holds approximately 70 pay spaces.

In Belltown, which includes parking along Alaskan Way north of Wall Street, Battery Street, and Elliott and Western Avenues, about 10 on-street spaces would be gained. These spaces would generate approximately $9,000 annually, which would be added to the City's General Fund each year. Two private public pay lots under the viaduct in the Elliott/Western vicinity and one on Battery Street would be removed by the Cut-and-Cover Tunnel Alternative. These lots total about 150 off-street spaces.

In the north area, about 240 on-street spaces would be removed, as shown on Exhibit 5-52. This includes about 70 short-term spaces and 170 long-term spaces. The number of on-street parking spaces removed is similar to the 280 on-street spaces removed by the Bored Tunnel Alternative, but the spaces are in different locations. The loss of these 240 paid on street spaces would reduce the City's General Fund by approximately $209,000 each year.

Elevated Structure Alternative

The Elevated Structure Alternative would remove approximately 1,380 spaces, as shown in Exhibit 5-53.

Exhibit 5-53
Parking Effects of the Elevated Structure Alternative

	SPACES REMOVED		
Area	On-Street	Off-Street	Total
Stadium	110	250	**360**
Pioneer Square	130	130	**260**
Central	250	70	**320**
Belltown	20	150	**170**
North	240	30	**270**
Total	**750**	**630**	**1,380**

Note: Effects for the Non-Tolled and Tolled Elevated Structure Alternative are the same.

In the stadium area, the Elevated Structure Alternative would have the same affects as described for the Bored Tunnel Alternative.

In the Pioneer Square area, about 130 on-street parking spaces would be removed. Almost all of the affected spaces are short term spaces, with the exception of about 10 unrestricted unmetered spaces along Alaskan Way. The loss of 130 on-street spaces could make it slightly more difficult for shoppers and restaurant patrons to find parking in this area, and would result in approximately $329,000 lost each year from the City's General Fund.

The Elevated Structure Alternative would also remove a parking garage on S. King Street that has approximately 130 off-street spaces. The other two alternatives do not require demolition of this parking garage. The net effect would be a loss of about 260 parking spaces in the Pioneer Square area.

In the central waterfront area along Alaskan Way and under the viaduct, approximately 250 of the existing 510 on-street spaces would be removed by the Elevated Structure Alternative. These 250 spaces represent about half of the on-street spaces under the viaduct and along Alaskan Way. On-street parking along the waterfront is highly utilized under existing conditions, so removing many of the spaces would make it even more difficult to find parking. Many drivers would likely need to seek short-term parking in surrounding parking garages, which could be more expensive and farther away from their destinations on the waterfront. The loss of these 250 paid on street spaces would reduce the City's General Fund by approximately $1.65 million each year.

In addition to the on-street parking effects along the central waterfront, about 70 off-street spaces located in a surface parking lot on the east side of Alaskan Way near the Seattle Aquarium would be removed to accommodate the realigned Alaskan Way surface street.

In Belltown, which includes parking along Alaskan Way north of Wall Street, Battery Street, and Elliott and Western Avenues, about 20 on-street spaces would be removed. If these spaces are removed, approximately $17,000 would be lost each year from the City's General Fund. In addition, two pay lots under the viaduct in the Elliott/Western vicinity and one on Battery Street would be removed by the Elevated Structure Alternative. These lots total about 150 off-street spaces.

In the north area, the Elevated Structure Alternative would have the same affects as described for the Cut-and-Cover Tunnel Alternative.

How would local and regional economic effects change if the build alternatives were not tolled?

Most of the effects to the local and regional economy are the same for the tolled and non-tolled build alternatives. However, if the SR 99 facility is not tolled, the state would not be able to recoup a portion of the capital cost from the direct users of the facility. The non-tolled alternatives would place a higher burden on the state to use gas tax and other state funds on the Alaskan Way Viaduct Replacement Project, rather than using these funds for other projects in the state.

The non-tolled build alternatives would not experience traffic diversion from motorists seeking to avoid a tolled facility. The cost of congestion for the non-tolled build alternatives would decrease compared to the tolled alternatives.

21 How would effects to historic resources compare?

Bored Tunnel Alternative

The Bored Tunnel Alternative would demolish the Alaskan Way Viaduct and decommission the Battery Street Tunnel, both of which are eligible for the National Register of Historic Places (NRHP). These structures have been documented with photos and a narrative history in accordance with Historic American Engineering Record (HAER) standards. The consultation process required by Section 106 of the National Historic Preservation Act (see Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report, for more information) determined the project will have an adverse effect on one or more structures that are listed in or eligible for the NRHP, as shown in Exhibit 5-54. These properties are the Alaskan Way Viaduct and Battery Street Tunnel, and the Lake Union Sewer Tunnel. The Western Building and Polson Building are contributing elements of the NRHP-listed Pioneer Square Historic District. Therefore, effects to these buildings during construction of the Bored Tunnel Alternative would affect the district itself; see Chapter 6, Question 19. Adverse effects to these resources are addressed in a Memorandum of Agreement developed in consultation with the State Historic Preservation Office, tribes, and the consulting parties and will meet the requirements of Section 106 and other applicable laws, regulations, and policies.

At the south portal, an approximately 65-foot-high tunnel operations building that would contain ventilation fans, exhaust stacks, emergency generators, and electrical and fire support utilities would be constructed on the block bordered by Alaskan Way S., Railroad Way S., and S. Dearborn Street. This site is across the street from the Pioneer Square Historic District and the Triangle Building, which are listed in the NRHP. It would be a noticeable new feature, but less obtrusive than the ramp adjacent to First Avenue S. along Railroad Way S. that would be demolished as part of the Bored Tunnel Alternative, and therefore would not adversely affect the adjacent NRHP-listed historic resources.

At the north portal, an approximately 60-foot-high tunnel operations building would be constructed on the east side of Sixth Avenue N. between Thomas and Harrison Streets. The NRHP-eligible Seattle City Light Broad Street Substation is located across Sixth Avenue N. from the proposed tunnel operations building, but since both are concrete industrial buildings of similar appearance, the substation would not be adversely affected by the tunnel operations building. Also near the north portal at Republican Street, a shaft connecting to the NRHP-eligible Lake Union sewer tunnel would be modified by the project, resulting in an adverse effect to the resource.

Removing the existing viaduct structure would result in beneficial effects to the Pioneer Square Historic District and Piers 54 through 62/63 on the central waterfront due to reduced noise, vibration, and air pollution and improved views to and from the historic buildings. Removing the adjacent Columbia and Seneca Street ramps would provide similar benefits to nearby historic structures. The Tolled Bored Tunnel Alternative would increase traffic in Pioneer Square compared to the Non-Tolled Bored Tunnel Alternative; however, the additional traffic would not adversely affect the contributing features of Pioneer Square that make it eligible for the NRHP.

Exhibit 5-54
Permanent Effects to Historic Properties

Property	National Register Status	Alternatives: Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Alaskan Way Viaduct[1]	NRHP eligible	Demolition – *Adverse effect*	Demolition – *Adverse effect*	Demolition – *Adverse effect*
Battery Street Tunnel[1]	NRHP eligible	Decommisioning – *Adverse effect*	Alteration	Alteration
Elliot Bay Seawall	NRHP eligible	*No operational effect*	Demolition – *Adverse effect*	Demolition – *Adverse effect*
Washington Street Boat Landing – *Foot of Washington Street*	NRHP listed	*No operational effect*	Removal[2] – *Adverse effect*	Removal[2] – *Adverse effect*
Lake Union Sewer Tunnel – *Republican Street east of Aurora Avenue*	NRHP eligible	Alter manhole shaft – *Adverse effect*	Alter manhole shaft – *Adverse effect*	Alter manhole shaft – *Adverse effect*

Note: Effects for the non-tolled and tolled build alternatives would be the same

1 *The Alaskan Way Viaduct and the Battery Street Tunnel are recorded as a single historic property.*

2 *After construction, the Washington Street Boat Landing would be replaced in approximately the same location.*

Cut-and-Cover Tunnel Alternative

As with the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would demolish the NRHP-eligible Alaskan Way Viaduct and modify the NRHP-eligible Battery Street Tunnel (adverse effect), construct a tunnel operations building adjacent to Pioneer Square (no adverse effect), modify the historic sewer tunnel shaft near Republican Street (adverse effect) and benefit historic piers and buildings along the central waterfront by removing the viaduct and the Columbia and Seneca ramps (beneficial effect). Unlike the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would not affect the Polson or Western Buildings. It would replace the NRHP-eligible Elliott Bay Seawall (adverse effect) as well as remove the NRHP-listed Washington Street Boat Landing (adverse effect) during construction. The boat landing would be replaced in approximately the same location after construction. The Cut-and-Cover Tunnel Alternative would also excavate beneath the NRHP-eligible Buckley's (MGM-Loew's) building, formerly known as the McGraw Kittenger Case Building (adverse effect during construction, discussed in Chapter 6). It would construct tunnel operations and maintenance buildings near historic resources at Pine Street and both ends of the Battery Street Tunnel. The

Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report

Methods used to assess existing conditions, environmental effects, and mitigation are described in *Appendix I*, Chapter 2. Chapter 5 of *Appendix I* provides additional information on effects to historic, cultural, and archaeological resources.

The Memorandum of Agreement can be found in **Attachment C** of *Appendix I*.

Section 4(f) and Protection of Historic Resources

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic and archaeological sites. The project is adjacent to some of Seattle's best-known historic buildings and neighborhoods. The Alaskan Way Viaduct/Battery Street Tunnel and the Lake Union sewer tunnel manhole shaft would be permanently affected by all alternatives.

Additional construction-related and alternative-specific effects to historic and cultural resources are discussed in **Chapter 6, Questions 19 and 20** and in the **Section 4(f) Evaluation** found at the end of this document on page 239. The **Section 4(f) Supplemental Materials** are provided in *Appendix J* of this *Final EIS*.

Appendix U, Final EIS Correspondence

For more information about historic and archaeological resources, please see the DAHP concurrence letter in *Appendix U*.

tunnel operations building at Pine Street would be located below the landscaped pedestrian lid and would therefore not adversely affect the historic resources in its vicinity, which are located above the lid. The tunnel operations building at the south end of the Battery Street Tunnel would be incorporated into the tunnel portal and would not protrude into the historic context of nor adversely affect the nearby resources, located above the portal on First Avenue. The tunnel operations building at the north end of the Battery Street Tunnel would be an unassuming one-story structure that would not block views of, nor interfere with the historic context of, nor adversely affect resources in its vicinity. The Tolled Cut-and-Cover Tunnel Alternative would increase traffic in Pioneer Square compared to the Non-Tolled Cut-and-Cover Tunnel Alternative; however, the additional traffic would not adversely affect the contributing features of Pioneer Square that make it eligible for the NRHP.

Elevated Structure Alternative

As with the tunnel alternatives, the Elevated Structure Alternative would demolish the NRHP-eligible Alaskan Way Viaduct and modify the Battery Street Tunnel (adverse effect), and modify the historic sewer tunnel shaft near Republican Street (adverse effect). Unlike the tunnel alternatives, the Elevated Structure Alternative would not include a tunnel operations building near Pioneer Square. The Elevated Structure Alternative would be larger than the existing structure and therefore would have greater impacts to the Pioneer Square Historic District than the existing viaduct. It would not result in benefits to historic piers and buildings along the central waterfront, due to the continued presence of an elevated highway. As with the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would not affect the Polson or Western Buildings or historic resources near the new Battery Street Tunnel ventilation and maintenance buildings (no adverse effect). Unlike the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would not affect the NRHP-eligible Buckley's (MGM-Loew's) Building (formerly known as the McGraw Kittenger Case Building). The Tolled Elevated Structure Alternative would increase traffic in Pioneer Square compared to the Non-Tolled Elevated Structure Alternative; however, the additional traffic would not adversely affect the contributing features of Pioneer Square that make it eligible for the NRHP.

How would effects to historic properties change if the build alternatives were not tolled?

If the build alternatives were not tolled, less traffic would divert into historic districts. However, the effects discussed above would occur as a result of the proposed facility designs, not as a result of vehicle volumes on surface streets. Therefore, the absence of tolls would not result in substantial changes to the expected effects of the build alternatives to historic resources.

22 How would effects to archaeological resources compare?

No effects to archaeological properties would result from the operation of any of the alternatives, because no ground disturbance is anticipated to result during operation.

All of the build alternatives would result in ground disturbance in archaeologically sensitive areas during construction, which is discussed in Chapter 6, Question 20.

23 How would effects to parks, recreation, and open space compare?

Effects to parks, recreation, and open spaces would be the same for the build alternatives with or without tolls.

Bored Tunnel Alternative

The Bored Tunnel Alternative would benefit parks and recreational resources by removing the existing viaduct, which would improve connections between elements of Seattle's park and recreation system into Seattle's downtown neighborhoods.

Near the south portal, the Bored Tunnel Alternative would change the configuration of SR 99 and nearby streets. The on- and off-ramps near the stadiums would provide more direct connections to recreational facilities such as Qwest and Safeco Fields.

In the Pioneer Square area, conditions for people visiting the Washington Street Boat Landing would be improved due to viaduct removal. Viaduct removal may encourage more pedestrian movement between the waterfront and Pioneer Square. The additional open space provided by removing the viaduct would be consistent with the Pioneer Square and Downtown Urban Center Neighborhood Plans.[8, 9]

In the central waterfront area, viaduct removal would improve the integration of existing park and recreation uses between the waterfront piers and downtown Seattle and reduce noise levels. With the viaduct gone, the Seattle Aquarium is likely to benefit from more pedestrian-friendly connections between the aquarium and downtown along east-west streets such as University Street and the Pike Street Hillclimb. The relationship between the waterfront and the Pike Place Market, which is a major tourist destination, would be strengthened. Piers 55 to 62/63 also attract many tourists and would be enhanced by reduced noise levels, improved views, and a more pedestrian-friendly environment. The boat service providing access across Puget Sound to Tillicum Village and Blake Island State Park is located at Pier 55 and also would potentially benefit from these changes.

Near the north portal, the Bored Tunnel Alternative would change the configuration of SR 99 and connect three surface streets across Aurora Avenue. Providing new connections at John, Thomas, and Harrison Streets would improve circulation near Denny Park and provide increased opportunities for park access. Along with new street connections, closing the Broad Street underpass and widening Mercer Street to accommodate two-way traffic would change the circulation of local traffic accessing Seattle Center. This would change travel routes for people destined for area park and recreational facilities but would not affect the physical configuration of these facilities.

Cut-and-Cover Tunnel Alternative

By removing the viaduct, the Cut-and-Cover Tunnel Alternative would improve connections between open spaces along the central waterfront, throughout downtown,

Section 4(f) and Protection of Public Park and Recreation Resources

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic and archaeological sites. The project is adjacent to some of Seattle's best-known historic buildings and neighborhoods. The Alaskan Way Viaduct/Battery Street Tunnel and the Lake Union sewer tunnel manhole shaft would be permanently affected by all alternatives.

Additional construction-related effects to park and recreational resources are discussed in Chapter 6, Question 24 and in the Section 4(f) Evaluation found at the end of this document on page 239. Section 4(f) Supplemental Materials are provided in *Appendix J* of this *Final EIS*.

Appendix H, Social Discipline Report

Methods used for assessing social resources are described in *Appendix H*, Chapter 2. Chapter 5 provides additional information on effects to neighborhoods, community, social services, and park and recreational resources.

Effects on low-income and minority populations (environmental justice) are also discussed in *Appendix H*.

8 City of Seattle 1998.

9 City of Seattle 1999.

and in Pioneer Square. Access to the stadiums and connections to Denny Park and Seattle Center also would improve. In contrast to the Bored Tunnel Alternative, which would require a separate project to create new recreational spaces along the central waterfront, the Cut-and-Cover Tunnel Alternative would create these spaces, along with new pedestrian and bicycle facilities and an improved Alaskan Way surface street. The Cut-and-Cover Tunnel Alternative includes the additional benefit of a new 130-foot-wide public open space between Stewart and Virginia Streets, creating a continuous park setting and pedestrian connection between Pike Place Market and the waterfront. It is envisioned as a lively urban landscape that could have features like seating, landscaping, fountains, viewpoints, public art, restaurants, and shopping.

Elevated Structure Alternative

Unlike the tunnel alternatives, the Elevated Structure Alternative would limit opportunities for open space and recreational activities on the central waterfront. However, some recreational amenities would be constructed along Alaskan Way as part of the Elevated Structure Alternative, in contrast with the Bored Tunnel Alternative, under which recreational facilities would be separate projects. The Elevated Structure Alternative would, as with the tunnel alternatives, improve connections to Denny Park and Seattle Center.

24 How would effects to neighborhoods compare?

The build alternatives would generally benefit neighborhoods by providing improved access and surface street connections near the stadiums and the Seattle Center area. The Elevated Structure Alternative would provide access to central downtown and northwest Seattle similar to the existing viaduct because it would include ramps at Columbia and Seneca Streets and Elliott and Western Avenues. The Cut-and-Cover Tunnel Alternative would include the Elliott and Western Avenue ramps, and the Bored Tunnel Alternative would not provide any of these ramps. Therefore, the tunnel alternatives would change how some drivers access downtown. Some travel routes to businesses and residences in the downtown Central Business District and Belltown may take more time, since drivers would need to exit SR 99 at the north or south portal and then travel via local streets.

All of the build alternatives would enhance roadway safety north of Denny Way, since arterial connections to and from SR 99 between John and Roy Streets would be consolidated to a fewer set of access points. Circulation for all modes of travel to, from, and within neighborhoods and community resources would improve north of Denny Way, since east-west streets would be connected across Aurora Avenue. The Bored Tunnel Alternative would connect three east-west streets across Aurora Avenue compared to the other build alternatives, which would connect two east-west streets.

As an indirect result of the new east-west street connections, some areas within the Belltown, Uptown, and South Lake Union neighborhoods may become more cohesive and connected. For the Bored Tunnel Alternative, the elimination of the Western Avenue and Battery Street SR 99 ramps, and the decommissioning of the Battery Street Tunnel would likely increase the perceived quality and desirability of surrounding Belltown properties. With the Bored Tunnel or Cut-and-Cover Tunnel Alternative, removing the viaduct along the central waterfront would also likely have an indirect effect on the adjacent neighborhoods, increasing the desirability of existing properties immediately adjacent to the existing elevated structure.

25 How would effects to community and social services compare?

For people who work or seek services at downtown area community and social service facilities, access would change only slightly. Access would not change for residents who seek services in neighborhoods directly adjacent to this section of SR 99. However, for residents traveling on SR 99 to access services from outside of the project area, access would change, as discussed previously in Exhibit 5-1. Some routes might be slightly more circuitous, and travel times may be somewhat longer, while other routes (such as those to the Pioneer Square area) may become more direct and travel times may decrease.

Of the parcels that would be acquired to build the Bored Tunnel Alternative, one non-profit employment service (the Seattle Jobs Initiative) would be displaced and relocated. This organization is a policy and research agency and has no direct contact with job seekers or members of any environmental justice population; it coordinates with other community-based organizations, such as community colleges and other training programs. The relocation would not affect the environmental justice population.

Although there would be many more full and partial acquisitions necessary for the Cut-and-Cover Tunnel and Elevated Structure Alternatives, no social resources would be acquired.

26 How would effects to low-income and minority populations compare?

Access

A primary concern for minority and low-income populations (environmental justice populations) with this project is changes in SR 99 access, pedestrian routes, and transit services. These effects are likely to be short-term as people and service providers adjust to changes. Some minority and low-income populations, including those with physical and mental disabilities, economic disadvantages, and language and cultural barriers, may have more difficulty adapting to such transitions. Continued community outreach and communication will be a crucial part of minimizing any potential effects.

For social service organization workers and patrons living outside of downtown Seattle, travel routes may be altered because of changes to SR 99 access. Travel times could increase or decrease depending on the travel route and the time of the trip, but this would not substantially affect the service providers continued operations or the ability of patrons to visit these providers.

Homeless people who currently seek shelter under the viaduct would be affected by its removal with either of the tunnel alternatives, although seeking shelter underneath

What is environmental justice?

Environmental justice acknowledges that the quality of our environment affects the quality of our lives, and that minority and low-income populations should not bear an unequal environmental burden. Environmental justice seeks to lessen unequal distributions of environmental burdens (e.g., pollution, industrial facilities, crime) and equalize benefits and access to clean air and water, parks, transportation, etc. .

the viaduct is illegal. Regardless, the lead agencies have considered ways to coordinate with social service providers to notify homeless individuals who may be using areas under the viaduct for shelter.

Acquisitions and Displacements

None of the properties acquired for any of the build alternatives would be resources specifically important to minority or low-income populations. As discussed previously in Question 18, residents and employees would be displaced by the build alternatives. However, it is unknown what proportion of these residents and employees would be low-income and minority. No comprehensive survey of downtown Seattle employees and residents was conducted for this purpose.

Bored Tunnel Alternative

None of the resources displaced by the operation of the Bored Tunnel Alternative would be resources that are specifically important to minority or low-income populations. The property acquisitions required for the Bored Tunnel Alternative would result in the displacement of the nonprofit Seattle Jobs Initiative, a policy and research agency. However, this organization has no direct contact with job seekers or members of any environmental justice population; it coordinates with other community-based organizations, such as community colleges and other training programs.

Cut-and-Cover Tunnel Alternative

Most of the alignment of the Cut-and-Cover Tunnel Alternative would be within existing right-of-way. The acquisition effects of the Cut-and-Cover Tunnel Alternative would be more substantial than those of the Bored Tunnel Alternative, because the tunnel would be cut and covered along Alaskan Way and the waterfront, rather than bored under downtown. Although there would be many more full and partial acquisitions necessary for the Cut-and-Cover Tunnel Alternative, no properties social resources are located would be acquired.

Elevated Structure Alternative

Most of the alignment for the Elevated Structure Alternative would be within existing right-of-way (similar to the Cut-and-Cover Tunnel Alternative) and the effects of property acquisition would be more substantial than for the Bored Tunnel Alternative. The acquisitions would be the same as those described for the Cut-and-Cover Tunnel Alternative in the south and north segments. However, there would be differences in the central segment due to the significant differences between the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative. With the Elevated Structure Alternative, the acquired properties do not currently house social resources; many of them are office buildings or are already publicly owned.

Noise

As discussed previously in Question 16, traffic noise levels were modeled at 70 sites for both existing conditions and the year 2030 for each of the build alternatives, with and without tolls. The modeling results indicate that 10 to 13 fewer sites would approach or exceed FHWA noise abatement criteria with the tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives, compared to projected 2015 Existing Viaduct conditions. This reduction in noise levels would benefit all people near these sites, regardless of income level or minority status. Modeling results indicate that throughout most of the study area, sites with the Elevated Structure Alternative would experience similar noise levels compared to the projected 2015 Existing Viaduct. However, four additional sites would approach or exceed FHWA noise abatement criteria.

Transit

None of the build alternatives are expected to substantially alter the ability for low-income and minority persons to access transit. The location transit vehicles access downtown to and from the south would change with the new ramps near the stadiums. Buses would likely access downtown near S. King Street, which is a few blocks further south than the existing ramps at Columbia and Seneca Streets. Expected changes to transit travel times are discussed in Question 14.

Tolling

As the Puget Sound region considers implementing tolls on its facilities, the potential effects on low-income populations are important to take into account. While toll payment, by definition, would account for a higher proportion of a low income individual's monthly income, this alone does not constitute a high and adverse disproportionate impact. The analyses of the equity of tolling concluded that the effects would not be disproportionately high and adverse because there would be viable options for avoiding the toll either through alternate routes or by switching to transit. In addition, WSDOT will employ measures to improve the accessibility of transponders to low-income and minority populations. These measures are discussed in Chapter 8.

Determination

For reasons discussed above, effects due to access changes, acquisitions and displacements, noise, transit, and tolling are not expected to result in disproportionately high, and adverse effects to low-income or minority populations.

As discussed in Chapter 6, Question 24, project construction would require many years to complete and would have effects to many elements in the project area. The most widespread effects would include increased traffic congestion, noise, dust, and light and glare in and around the construction zone. These effects would be adverse, but would not disproportionately affect low-income and minority populations. Chapter 8 discusses how these effects would be mitigated.

Therefore, the build alternatives are not expected to result in disproportionately high and adverse effects on low-income or minority populations.

How would effects to low-income populations change if the build alternatives were not tolled?

Effects due to displacement from the tolled and non-tolled build alternatives on low-income populations would not change, since the same displacements would occur under tolled and non-tolled conditions. Noise effects would not change substantially between tolled and non-tolled

Chapter 6, Question 24

Discusses expected effects to low-income and minority populations during construction.

Appendix K, Public Services and Utilities Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in *Appendix K*, Chapter 2. Chapter 5 provides additional information on effects to public services and utilities.

conditions. Transit access for low-income and minority persons are not expected to be substantially altered; however, the access to and from the south would change somewhat with the new ramps in the stadium area, as discussed in Question 14. The most notable difference between the tolled and non-tolled build alternatives would be the absence of tolls. If the build alternatives were not tolled, low-income populations would not need to decide whether to pay the toll or to use an alternate non-tolled route. However, the tolled build alternatives would not result in a disproportionate high and adverse effect upon low-income populations, so the absence of tolls would not affect the environmental justice determination.

27 How would effects to public services (such as police, fire, and delivery services) and utilities compare?

Public Services

Effects Common to All Build Alternatives

All of the build alternatives would modify the transportation network in and around downtown, but they are not expected to result in significant adverse effects to public services. Since public service providers make hundreds of trips through downtown every day, some using fixed routes and others using demand-responsive routes, determining the potential effect on each provider is not possible. Depending on the route used, some public service providers would experience increased traffic-related delay while others would experience decreased traffic-related delay. Some public service providers, such as emergency medical service providers, demand right-of-way and therefore would be less affected by increased surface street traffic volume. Many public service providers operate 24 hours a day, and would therefore be unaffected during much of the day by the increased surface street traffic volumes, which are expected to cause increased congestion primarily during peak travel periods.

Safety and Security for the Bored Tunnel and Cut-and-Cover Tunnel

A variety of measures would be employed to minimize potential risks associated with emergencies such as a tunnel fire or an accident where hazardous materials, such as oil or gasoline, are spilled. One of the measures includes prohibiting trucks that carry flammable and hazardous materials from using the tunnels. Other measures include designing the tunnels to provide emergency access, evacuation routes, ventilation, and fire suppression systems in accordance with National Fire Protection Association standards and other codes and regulations. Access to the tunnels would be maintained at all times to ensure prompt emergency response times and the safety of people traveling in the tunnels. Depending on the location and extent of an emergency, a spill incident could require a response from a number of emergency management agencies, including the Seattle Office of Emergency Management, Port of Seattle, Washington State Department of Ecology, and the City of Seattle.

Utilities

Although the majority of new utility systems (such as tunnel ventilation or drainage) would be the responsibility of WSDOT to maintain, utility providers would likely experience some increased maintenance responsibilities after the utility relocation process is completed. At numerous locations throughout the project area, utilities would be redesigned or rerouted to avoid the new SR 99 facilities. As a result, many utilities may need to increase the number of linear feet of pipe, cable, and other materials in their distribution/transmission systems, which would result in increased maintenance responsibilities. Also, access to utilities could change as a result of new SR 99 roadway structures.

How would effects to public services change if the alternatives were not tolled?

If the alternatives were not tolled, less traffic would divert from SR 99. Some routes used by public service providers would experience less traffic-related delay if the alternatives were not tolled. However, since the provision of public services is not expected to be adversely impacted under tolled conditions, non-tolled conditions would not represent a major change from the effects discussed above.

28 How would effects to air quality compare?

EPA has identified several air pollutants as pollutants of concern nationwide. These pollutants, known as criteria pollutants, are CO, particulate matter with a diameter of 10 micrometers or less (PM_{10}), particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), and nitrogen dioxide (NO_2). The sources of these pollutants, their effects on human health and the nation's welfare, and their concentration in the atmosphere vary considerably. Under the Clean Air Act, U.S. Environmental Protection Agency's (EPA) has established National Ambient Air Quality Standards (NAAQS), which specify maximum allowable concentrations for these criteria pollutants (EPA 2010).

Analysis of highway projects focus primarily on emissions from automobiles, like CO. The Washington State Intersection Screening Tool (WASIST) was used to estimate CO concentrations at sensitive receptor sites near heavily congested intersections that are expected to be affected by the Viaduct Closed (No Build Alternative) and the build alternatives. The analysis showed that the non-tolled and tolled Bored Tunnel Alternative, the non-tolled and tolled Cut-and-Cover Tunnel Alternative, and the non-tolled and tolled Elevated Structure Alternative would not cause or contribute to any new localized violations of the NAAQS for CO, increase the frequency or severity of any existing violations of the NAAQS, or delay the timely attainment of the NAAQS in the 2030 design year. The results of the WASIST model indicated that more detailed EPA modeling was not necessary.

The project is included in PSRC's long-range transportation plan, approved May 20, 2010, and referred to as *Transportation 2040*,[10] and the Statewide Transportation Improvement Program.[11] The inclusion of this project is required to show that the project conforms with the Puget Sound region's Air Quality Maintenance Plans and would not cause or contribute to exceedances of the NAAQS at the regional level. The project meets all the requirements of 40 CFR 93.123 and WAC 173-420 and demonstrates regional conformity.

How would the tunnels be evacuated in an emergency?

Evacuation procedures for the bored and cut-and-cover tunnels (including ADA considerations) are discussed in **Chapter 3**.

Appendix M, Air Quality Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix M*, Chapter 2**. For the Final EIS, the year 2015 was chosen to represent the affected environment to account for projects recently completed or currently underway. To assess the operational impacts of each alternative, the project's design year 2030 was modeled.

***Appendix M*, Chapter 5** discusses the results of the Mobile Source CO Analysis and MSAT Analysis for the non-tolled alternatives and **Chapter 7** discusses the results for the tolled alternatives. This appendix also provides additional information on compliance.

10 PSRC 2010.

11 WSDOT 2010.

Estimated CO concentrations at intersections for all of the build alternatives are all projected to be below the 1 hour and 8 hour NAAQS of 35 and 9 parts per million, respectively. Even at areas of higher pollutant concentration, such as the tunnel portals and tunnel operations buildings analysis showed that all estimated concentrations of CO and would be below the NAAQS for the tolled and non-tolled build alternatives.

In addition to the criteria pollutants for which there are NAAQS, EPA also regulates air toxics, which are pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human sources, including on road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Based on FHWA's Interim Guidance Update on Air Toxic Analysis in NEPA Documents (FHWA 2009), the project belongs in Tier 3 (i.e., projects with a high potential for MSAT effects). This category is appropriate because the project has the potential to add capacity to urban roadways and the affected roadways are located near populated areas.

In accordance with FHWA guidelines, the Easy Mobile Inventory Tool was used to calculate annual mobile source air toxics (MSAT) pollutant burdens. To assess potential project-related effects, existing MSAT pollutant emission burdens were compared to future burdens under each build alternative.

Even though the VMT in the Seattle Center City area is predicted to increase by 2030, MSATs are predicted to decrease dramatically as a result of the EPA's national control programs. These programs are projected to reduce MSATs by 72 percent nationwide by 2050, even with an estimated 145 percent growth in VMT.

The air quality analysis did not indicate a notable difference in emission levels among the alternatives, either for criteria pollutants or MSATs.

How would effects to air quality change if the alternatives were not tolled?

If the alternatives were not tolled, VMT would be expected to decrease slightly within downtown Seattle. This VMT decrease would correspondingly indicate a decrease in CO emissions. However, the total change in emissions would be minor and would not alter the discussion of air quality effects provided above.

29 How would effects to greenhouse gas emissions compare?

Regional greenhouse gas emissions from all of the build alternatives are predicted to be higher in 2030 than for the 2015 Existing Viaduct, but lower than for the Viaduct Closed (No Build Alternative). Projected increases in greenhouse gases would be due primarily to the increases in future vehicle traffic and fuel use in the region. The bulk of greenhouse gas emissions from the build alternatives would come from vehicle exhaust. Emissions from energy sources that would power SR 99 ventilation and lighting systems and provide maintenance (for example, patching, crack sealing, and landscape maintenance) would produce a tiny fraction of greenhouse gas emissions, as shown in Exhibit 5-55.

Typical greenhouse gases that are in the atmosphere include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. For this project, the greenhouse gas analysis used CO_2 as the standard and emissions are expressed in terms of CO_2 equivalents to compare different greenhouse gases. The potential direct emissions of greenhouse gases under the build alternatives were estimated using the MOVES2010a model. Emissions of greenhouse gasses from construction are discussed in Chapter 6.

The estimates are conservative because they do not take into account the expected future shift in vehicle mix (i.e., fewer light-duty trucks and more fuel-efficient vehicles, including hybrids) or the new Corporate Average Fuel Economy (CAFE) standards, which would lead to better fleet-wide fuel efficiency and result in lower CO_2 equivalent emissions generated. The new CAFE standards, which were issued in April 2010, are expected to improve vehicle emissions by approximately 21 percent by 2030, as compared to the level that would occur without the regulations.[12]

Exhibit 5-55
Daily Greenhouse Gas (CO_2 equivalent)
Roadway Emissions Estimates
in metric tons per day

Study Area	2015 Existing Viaduct	2030 Viaduct Closed	TOLLED ALTERNATIVES Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
SR 99 Ventilation and Lighting	0	0	19	14	5
SR 99 Roadway Maintenance	1	1	1	1	1
Vehicles on Roadways	46,996	47,488	47,249	47,215	47,357

Note: The regional study area includes King, Pierce, Snohomish and Kitsap counties.
For all of the build alternatives, the energy consumption for non-tolled conditions would be within 1 percent of the tolled conditions.

How would effects to greenhouse gas emissions change if the build alternatives were not tolled?

If the alternatives were not tolled, VMT would be expected to decrease slightly within downtown Seattle. This VMT decrease would correspondingly indicate a decrease in greenhouse gas emissions. However, the total change in greenhouse gas emissions would be less than 1 percent and would not alter the discussion of effects provided above.

30 How would effects to energy consumption compare?

As shown in Exhibit 5-56, regional energy consumption would be higher from all of the build alternatives in 2030 than the 2015 Existing Viaduct, but lower than the Viaduct Closed. Energy consumption for SR 99 ventilation and lighting systems and maintenance activities (for example, patching, crack sealing, and landscape maintenance) would consume a tiny fraction of overall energy.

What are CO_2 equivalents?

Greenhouse gases trap different levels of heat. To compare different greenhouse gases, scientists use a weighting factor. CO_2 is used as the standard. Other gases are converted into CO_2 equivalents using the weighting factor.

Appendix R, Energy Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix R***, **Chapter 2**. This appendix also provides additional information on CO_2 equivalents, greenhouse gases, and energy consumption.

What is the EPA MOVES2010a model?

The EPA Motor Vehicle Emission Simulator (MOVES) 2010a model estimates overall fuel usage based on characteristics such as vehicle mix, vehicle age, speed, and area-specific meteorological data.

Appendix O, Surface Water Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix O***, **Chapter 2**. **Chapter 5** provides additional information on effects to water resources. **Attachment A** of ***Appendix O*** provides the detailed pollutant-loading analysis.

Exhibit 5-56
Daily Energy Consumption
in million BTUs

Study Area	2015 Existing Viaduct	2030 Viaduct Closed	TOLLED ALTERNATIVES Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
SR 99 Ventilation and Lighting	0	0	156	118	41
SR 99 Roadway Maintenance	9	9	9	9	9
Vehicles on Roadways	615,398	621,777	618,634	618,192	620,057

Note: The regional study area includes King, Pierce, Snohomish and Kitsap counties.
For all of the build alternatives, the energy consumption for non-tolled conditions would be within 1 percent of the tolled conditions.

The EPA MOVES2010a model was used to calculate the amount of energy consumed by vehicles. The future energy consumption estimate is conservative because it does not take into account the expected future shift in vehicle mix (fewer light-duty trucks and more fuel-efficient vehicles) or the new CAFE standards, which would lead to better fleet-wide fuel efficiency and result in lower energy consumption. CAFE regulations are expected to improve vehicle emissions by approximately 21 percent by 2030, as compared to the level that would occur without the regulations.[12]

How would energy consumption change if the alternatives were not tolled?

If the alternatives were not tolled, VMT would be expected to decrease slightly within downtown Seattle. This VMT decrease would correspondingly indicate a decrease in energy consumption. However, the total change in energy consumption would be less than 1 percent and would not alter the discussion of energy effects provided above.

31 How would effects to water resources compare?

The tolled build alternatives would have the same effects to water quality as the non-tolled build alternatives. Runoff from impervious surfaces such as streets and highways, particularly in urban environments, contains pollutants that affect the water quality of receiving waters like Lake Union, Elliott Bay, and Puget Sound. Compared to existing conditions, all build alternatives would reduce the overall amount of pollutant-generating impervious surface within the area that drains to these receiving waters. This is expected to improve water quality. Also, some portions of the project area currently discharge to Elliott Bay and Lake Union without treatment. All of the build alternatives would provide water quality treatment for pollutant-generating impervious surfaces in these areas.

The project area studied for water resources included approximately 100 acres of pervious and impervious surface area. Although all build alternatives would reduce the total pollutant-generating impervious surfaces, the non-pollutant-generating impervious surfaces would increase for all of the alternatives. Most of the increase would occur because of the wider pedestrian and bicycle facility in the south portal area, new sidewalks, and the tunnel operations building at each portal. Stormwater detention would be provided in certain areas to mitigate the potential for increases in overflows from the combined sewer system that might occur because of these increases in impervious surfaces. Basic water quality treatment would be provided using best management practices (BMPs) selected from the Seattle Stormwater Manual[13] and/or the WSDOT Highway Runoff Manual.[14] Treating stormwater prior to discharge would reduce the volume of pollutants entering receiving water bodies.

32 How would effects to fish and aquatic habitat compare?

The tolled build alternatives would have the same effects to fish and aquatic habitat as the non-tolled build alternatives. All build alternatives would improve water quality compared to the Viaduct Closed (No Build Alternative) because stormwater runoff would be treated prior to being discharged. Treating stormwater runoff prior to discharge would reduce potential effects to fish and aquatic resources compared to existing conditions. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would result in additional beneficial effects to aquatic life by moving the seawall landward and creating additional nearshore habitat.

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies to consult with NMFS and the U.S. Fish and Wildlife Service (USFWS), as appropriate, to ensure that their actions are not likely to jeopardize the

Exhibit 5-57
Species and Critical Habitat Effect Determinations in the Biological Opinion

Species	Federal Status	Effect Determination	Critical Habitat	Critical Habitat Effect Determination
Puget Sound Chinook Salmon *Oncorhynchus tshawytscha*	Threatened	May affect, likely to adversely affect	Designated	May affect, not likely to adversely affect
Bocaccio *Sebastes paucispinis*	Endangered	May affect, not likely to adversely affect	None designated	N/A
Southern Resident Killer Whale *Orcinus orca*	Endangered	May affect, not likely to adversely affect	2,560 square miles of Puget Sound	May affect, not likely to adversely affect
Canary Rockfish *Sebastes pinniger*	Threatened	May affect, not likely to adversely affect	None designated	N/A
Puget Sound Steelhead *Oncorhynchus mykiss*	Threatened	May affect, not likely to adversely affect	None designated	N/A
Yelloweye Rockfish *Sebastes ruberrimus*	Threatened	May affect, not likely to adversely affect	None designated	N/A
Coastal-Puget Sound Bull Trout *Salvelinus confluentus*	Threatened	May affect, not likely to adversely affect	Designated	May affect, not likely to adversely affect
Humpback Whale *Megaptera novaeangliae*	Endangered	No effect	None designated	N/A
Green Sturgeon *Acipenser medirostris*	Threatened	No effect	Designated, but none in action area	N/A
Hood Canal Summer Chum ESU *Oncorhynchus keta*	Threatened	No effect	Designated	No effect
Marbled Murrelet *Brachyramphus marmoratus*	Threatened	No effect	Designated, but none in action area	N/A
Pacific Eulachon *Thaleichthys pacificus*	Threatened	No effect	Designated, but none in action area	N/A
Steller Sea Lion *Eumetopias jubatus*	Threatened	No effect	None designated in Washington	N/A

What is an impervious surface?

A surface is considered impervious if water cannot pass through it easily. Common impervious surfaces in the project area are pavement and concrete.

What is a pollutant-generating impervious surface?

A pollutant-generating impervious surface is an area such as a street where pollution from vehicles can build up and when it rains may runoff in the stormwater.

What is a BMP?

A best management practice (BMP) is an action or structure that reduces or prevents pollutants from entering stormwater or treats stormwater to reduce possible degradation of water quality.

Appendix N, Wildlife, Fish, and Vegetation Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in *Appendix N*, Chapter 2. Chapter 5 provides additional information on potential effects from the Bored Tunnel Alternative.

Appendix U, Final EIS Correspondence

Information about the Endangered Species Act consultations including the Biological Opinion and the USFWS concurrence letter are included in *Appendix U*.

Appendix P, Earth Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in *Appendix P*, Chapter 2. This appendix also includes information on the geologic setting and hazards in the project corridor.

12 NHTSA 2010.

13 City of Seattle 2009.

14 WSDOT 2008.

continued existence of endangered or threatened species or to adversely modify or destroy their critical habitat. In addition, Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation is defined as the use of all methods and procedures that are necessary to bring any endangered or threatened species to the point at which the measures provided pursuant to the ESA are no longer necessary.

Species listed under the ESA by NMFS and USFWS were obtained from the NMFS and USFWS websites (NMFS 2011a; USFWS 2011a). These sources also identify habitat requirements of these species and specifically designated critical habitat. This information was used to assess the potential occurrence of ESA-listed or proposed species in the study area and the potential effects of project-related activities on the species or their critical habitat. The determinations made by NMFS in the January 27, 2010 Biological Opinion and USFWS in the December 7, 2010 concurrence letter and are shown in Exhibit 5-57.

Potential beneficial indirect effects of the project may include changes to invertebrate and algal resources along the waterfront due to long-term alterations of stormwater management, which could slightly alter sediment and water quality conditions in the nearshore environment.

33 How would soil conditions and groundwater be affected?

The tolled build alternatives would have the same effects to soil conditions and groundwater as the non-tolled build alternatives. Locally contaminated groundwater may be encountered in the project area. All of the build alternatives include building retaining walls, tunnels, foundations, excavations, and fills. Groundwater flow may be altered by the presence of the walls supporting the retained cuts, cut-and-cover tunnel sections, and soil improvement areas, particularly in the south project area. Areaways and basements adjacent to the new facilities could also experience leakage or partial flooding if groundwater mounding occurs. With mitigation, no indirect effects to soils or groundwater are anticipated for any of the alternatives.

Bored Tunnel Alternative

Soil improvements would be installed beneath some of the buildings along the bored tunnel alignment to mitigate potential settlement caused by tunneling. In addition, soil improvement may be performed in several locations along the tunnel alignment between S. King Street and Seneca Street to strengthen recent soil deposits along the crown of the tunnel. No soil improvements would occur between S. Main and S. Washington Streets to avoid potential archaeological deposits. Near the north portal, soil improvement may be performed near John and Thomas Streets to stabilize areas of soft and loose soils, reduce perched groundwater flow, and mitigate potential future liquefaction.

Once construction is completed, no effects to soils are expected. Soils along the bored tunnel alignment generally consist of very dense, hard soils that have been compacted by the weight of glaciers. Since the net weight of the tunnel would likely be less than the soil that is removed, additional loads would not be placed on the soil by the tunnel structure.

Groundwater flow may be altered by the presence of the bored tunnel and potential soil improvements. The combination of these improvements could obstruct groundwater flow and cause it to mound up against the east side of the tunnel alignment, raising the groundwater table in this area. A higher water table would not cause soil settlement; however, utilities and other subsurface structures that were previously above the water table could become partially submerged if groundwater mounding occurs. Areaways and basements adjacent to the south end of the alignment could also experience leakage or partial flooding if groundwater mounding occurs. The extent of effects to areaways due to groundwater mounding cannot be accurately predicted. The potential for groundwater mounding will be addressed during final design. Design elements, such as providing a path for groundwater through the retaining walls or ground improvement zones, will be incorporated into the project to avoid this effect, if determined to be necessary during final design.
If groundwater mounding occurs, it is not expected to affect contaminant concentrations or the amount of contaminants that ultimately reach Elliott Bay.

North of Yesler Way, groundwater mounding along the bored tunnel is not anticipated. The lower aquifers that the 56-foot-diameter tunnel would intersect are widespread, interconnected, and highly pervious, allowing water to flow around the tunnel.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative could result in ground movement adjacent to retaining walls and potential mounding of groundwater adjacent to walls and the rebuilt seawall. Buildings, pavements, utilities, and other structures could be affected by the presence of new fills, walls, and foundations.

Elevated Structure Alternative

The Elevated Structure Alternative could result in ground movement adjacent to retaining walls and potential mounding of groundwater adjacent to walls and the rebuilt seawall. Although the Elevated Structure Alternative does not include a cut-and-cover structure along the waterfront, the seawall in this area would be rebuilt, which could result in groundwater mounding. Buildings, pavements, utilities, and other structures could be affected by the presence of new fills, walls, and foundations.

Earth and Groundwater Benefits

The Cut-and-Cover Tunnel and Elevated Structure Alternatives include replacement of the existing seawall along Alaskan Way from S. Jackson Street to Broad Street. The replacement of the seawall would mitigate potential lateral spreading of soil toward Elliott Bay during a seismic event. This would be a benefit to structures and facilities located east of the waterfront.

What is liquefaction?

Liquefaction is what can happen to loose soils when shaking motions from an earthquake causes the soil to turn into a quicksand-like condition. This can cause foundations to fail.

What is groundwater mounding?

Groundwater mounding occurs when water is blocked and builds up behind a barrier. A barrier could be something natural such as a dense soil layer, or something constructed such as a building foundation or subsurface retaining wall.

34 What are indirect effects, and would the build alternatives have any?

An indirect effect is a reasonably foreseeable effect caused by a project but that would occur in the future or outside of the project area. Changes inside the project area are considered direct effects and are described earlier in this chapter, and specific indirect effects are also described earlier in this chapter for each environmental resource. Indirect effects are only discussed in instances where they are anticipated (meaning that if indirect effects are not discussed for a resource, effects are not expected). Once this project is completed, any of the alternatives considered generally would result in similar indirect effects, because the project is a replacement project that would mostly maintain and not increase roadway capacity. As such, the replacement facilities would continue to support existing activities and the mobility and accessibility assumed by local and regional land use plans. North of Denny Way, the built project may support renovation and revitalization of existing urban land uses by connecting the street grid and improving local circulation. The tunnel alternatives could offer greater potential for revitalization in areas adjacent to where the viaduct is removed compared to the Elevated Structure Alternative.

The Bored Tunnel or Cut-and-Cover Tunnel Alternatives would change routes and travel times for some of those who use the existing viaduct. These types of changes can affect businesses and residents, and hence potentially have an indirect effect on future land use and development patterns. However, these patterns are largely determined by land use regulations and economic conditions. The land use changes due to either of the tunnel alternatives are so small they would be insignificant.

A risk associated with an indirect effect would be the potential for catastrophic spills of hazardous materials or wastes resulting from vehicle accidents once the roadway is operational. The environmental impacts may be less for either the Bored Tunnel or Cut-and-Cover Tunnel Alternatives compared to the Elevated Structure Alternative because the spill would be contained within the tunnel. However, the potential threat to the health and safety of responders and vehicle occupants would be greater with a tunnel alternative because the space is enclosed with limited access and egress.

The Viaduct Closed (No Build Alternative) would have substantial indirect effects on the local and regional transportation system, economy, and communities north and south of Seattle. Without the connection provided by SR 99 congestion would increase and travel through the area would become more difficult. Eventually, this would lead some people to move and businesses to relocate. They would likely be replaced by others who do not need the connection to and through Seattle, so at a regional level land use patterns are not likely to change.

35 What irreversible decisions or irretrievable resources would be committed to building the alternatives?

There are notable differences in the irreversible decisions or irretrievable resources required for the alternatives being evaluated. If the decision is made to build the Elevated Structure Alternative, views would irreversibly be affected and the opportunity to restore views would be lost, since the new elevated structure would affect views more than the existing viaduct. Another irreversible decision for any of the alternatives would be converting existing commercial, industrial, or retail properties to roadway land uses. All of the alternatives require partial and full property acquisitions, and some of the needed properties have buildings on them that would be demolished. The Bored Tunnel Alternative requires fewer full and partial property acquisitions than the Cut-and-Cover Tunnel and Elevated Structure Alternatives; therefore, that alternative would convert fewer existing properties to transportation uses.

There are a few effects to resources that would also be irretrievable regardless of the alternative constructed. If archaeological resources are located in areas where soil improvements are made, they would no longer be retrievable. However, as discussed in Chapter 8, Question 18, mitigation measures, a Memorandum of Agreement, and an Unanticipated Discovery Plan will help avoid, minimize, and mitigate these potential effects.

Other resources that would not be retrievable include the physical materials used to build the project. These include resources such as aggregate used to make concrete and asphalt, steel needed to make rebar and steel structures, oil to make asphalt, and fill material. These are finite resources, but they are not currently in short supply. Contaminated soil, spoil material, and excavated soil would be transported to appropriate facilities; thus, the space used for this project would not be available for other future disposal uses. However, there is adequate space available for this type of disposal at appropriate facilities.

The energy used to build the project or keep it operating would not be retrievable. Energy currently used to operate the viaduct includes the electricity needed to keep lights and electrical systems running. These resources will continue to be used as long as the viaduct is operational. During construction, gasoline, oil, and electricity would be used, though construction would hardly affect available energy supplies. Once the project is built, energy consumption levels would not substantially increase and are expected to be comparable among the alternatives, as shown in Exhibit 5-56. The tunnel alternatives would use more energy in the long-term to operate the tunnel's lighting and ventilation systems than the Elevated Structure Alternative; however, the vehicle energy consumption is expected to be highest for Elevated Structure Alternative, because it is expected to carry more vehicles each day than the tunnel alternatives.

36 What are the tradeoffs between short-term uses of environmental resources and long-term gains (or productivity)?

This question really is asking how the alternatives compare in terms of their long-term benefits and short-term effects. Because the project involves replacing failing infrastructure that people have depended on for several generations, it's clear that the long-term benefits of replacing the roadway with any of the proposed alternatives do outweigh the short-term effects. However, of the alternatives evaluated, the Bored Tunnel Alternative would have far fewer construction effects than the Cut-and-Cover Tunnel or the Elevated Structure Alternative.

The Bored Tunnel Alternative would require about 5.4 years of construction. SR 99 closures during construction of the Bored Tunnel Alternative would be limited to about 3 weeks, in addition to occasional night and weekend closures. The Cut-and-Cover Tunnel Alternative would require closing SR 99 for 27 months, and could require up to 2 additional years of substantial lane restrictions and closures. The Elevated Structure Alternative would require closing SR 99 for approximately 6 months, in addition to up to 6 years of substantial lane restrictions and closures. The Bored Tunnel Alternative would affect SR 99 traffic for about 4.5 years, but impacts to SR 99 traffic would be far less disruptive and cause less congestion than with the other alternatives.

In addition to effects to SR 99 traffic, the Bored Tunnel Alternative would be much less disruptive to Alaskan Way and neighboring residents and businesses during construction. The Bored Tunnel Alternative would affect Alaskan Way and adjacent areas during the 9-month period when SR 99 would be removed from S. King Street up to the Battery Street Tunnel. While viaduct removal would be noisy and disruptive, these effects would be localized in two areas covering about four city blocks that would move as demolition progresses. During the demolition, Alaskan Way would continue to be open to traffic, though cross-streets between S. King Street and Battery Street would be closed for a period of up to 4 weeks.

The Cut-and-Cover Tunnel Alternative would affect waterfront businesses and residents for almost all of the expected 8.75-year construction period. The Elevated Structure Alternative would affect waterfront businesses and residents for almost all of the expected 10-year construction period. As part of improvements proposed with the broader Alaskan Way Viaduct and Seawall Replacement Program, the seawall will be replaced, and waterfront businesses and residents will be affected; however, based on initial planning for the separate seawall replacement project, they would be affected to a much lesser degree with the Bored Tunnel Alternative and a separate seawall replacement project than they would be if seawall and viaduct replacement were to occur in the same location on the waterfront.

Clearly, the Bored Tunnel Alternative has fewer short-term effects than the Cut-and-Cover Tunnel and Elevated Structure Alternatives, so the next question is how the long-term benefits of the Bored Tunnel Alternative compare to the other alternatives. Our analysis and comparison of the build alternatives in this chapter show that there are tradeoffs between them in terms of their long-term benefits. However, for most elements of the environment, the Bored Tunnel Alternative offers long-term benefits that are as good as or better than the other build alternatives.

37 How do the build alternatives meet the project's purpose and need?

While all build alternatives would replace the existing viaduct, there are some important differences in how they meet some elements of the project's purpose and need. This section discusses how well the alternatives meet each element of the project's purpose statement.

Reduce the Risk of Catastrophic Failure in an Earthquake by Providing a Facility That Meets Current Seismic Safety Standards

All build alternatives would provide a safe transportation facility that meets current seismic design standards.

Improve Traffic Safety

All build alternatives would improve traffic safety on SR 99 compared to existing conditions. All build alternatives would replace SR 99 with a facility that would improve upon existing geometrics and meet roadway design standards where feasible. For all build alternatives, there are specific areas where deviations from current roadway design standards would be needed, but all would replace SR 99 with a facility that is far closer to meeting full current roadway design standards than the existing facility.

The Tolled or Non-Tolled Bored Tunnel Alternative is the only alternative that would replace the existing Battery Street Tunnel. The Battery Street Tunnel has narrow lanes, no shoulders, and abrupt curves. The Battery Street Tunnel would be replaced by the new bored tunnel, which would have two 11-foot lanes in each direction, a 2-foot-wide shoulder on one side and an 8-foot-wide shoulder on the other side, and the abrupt curves would be eliminated. These improvements would improve safety for drivers compared to existing conditions. These Battery Street Tunnel deficiencies would be only partially remedied with improvements proposed for the Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives.

Provide Capacity for Automobiles, Freight, and Transit to Efficiently Move People and Goods to and Through Downtown Seattle

All of the build alternatives provide sufficient capacity to efficiently move people and goods to and through downtown Seattle. They provide two through lanes in each direction on SR 99. The Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives provide an additional lane in each direction on SR 99 between S. King Street and approximately Virginia Street. The Cut-and-Cover Tunnel and Elevated Structure Alternatives provide a Western Avenue off-ramp and an Elliott Avenue on ramp, which serve trips destined to and from northwest Seattle. The Tolled or Non-Tolled Bored Tunnel Alternative does not provide these ramps, but these trips could reach their destinations via the Alaskan Way surface street or via the bored tunnel and Mercer Street.

If the build alternatives are tolled, traffic would divert from SR 99 to city streets to avoid paying the toll. This will slow traffic on SR 99 near the stadiums and north of Denny, increase congestion at intersections near the off-ramps, and increase traffic volumes on city streets. Even with this traffic diversion and related local congestion, all of the tolled alternatives provide reliable capacity to and through downtown by providing additional capacity beyond the local street system. Also, the ramps from SR 99 have queue bypass lanes that will allow transit to avoid some of the congestion.

As shown in the traffic analysis, the Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives are expected to carry higher traffic volumes through downtown on SR 99 because of the Elliott and Western Avenue ramps. However, during peak travel times, this added traffic volume would result in lower travel speeds on SR 99 between S. King Street and Denny Way than are estimated for the Tolled or Non-Tolled Bored Tunnel Alternative.

SR 99 is projected to carry fewer vehicles through the south area and downtown with the Tolled or Non-Tolled Bored Tunnel Alternative. Despite this, total vehicle volumes across the transportation network are expected to be comparable for the build alternatives. Therefore, the transportation network in downtown Seattle is expected to carry nearly the same volume of traffic for each of the alternatives, but more vehicles are projected to travel on city streets with the Bored Tunnel Alternative. As shown in the discussion presented in Questions 7 through 11, the Non-Tolled Bored Tunnel Alternative is not expected to substantially increase congestion on I-5 or local streets compared to the other non-tolled build alternatives, even though more vehicles would be traveling on these routes.

If the build alternatives are tolled, effects to I-5 are expected to be minimal, because it is already at capacity and may change travel times during peak commute times by up to 2 minutes. Effects to city streets associated with tolling would be more pronounced and are discussed in Questions 8 through 11. Effects to city streets from the tolled build alternatives are expected to be comparable.

Taken together, these results support the fact that all alternatives with or without tolls provide sufficient capacity to move people and goods, but there are tradeoffs in the way traffic is accommodated.

Provide Linkages to the Regional Transportation System and to and From Downtown Seattle and the Local Street System
All build alternatives have similar connections in the south from SR 99 to Alaskan Way S. near S. King Street. All of the build alternatives develop a new east-west cross street and provide a priority lane for northbound transit service during peak hours. The Tolled or Non-Tolled Elevated Structure Alternative rebuilds the ramps at Columbia and Seneca Streets, which are not included with either tunnel alternative. These provide good linkages to the central portion of downtown.

The Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives would replace the Elliott and Western Avenue ramps near their existing location. The Bored Tunnel Alternative would not replace these ramps. Instead, traffic coming south from the Ballard, Interbay, and Magnolia neighborhoods could reach SR 99 by following Mercer Street, or it could travel along Alaskan Way.

North of Denny Way, the Tolled or Non-Tolled Bored Tunnel Alternative would rebuild Aurora Avenue to grade and would connect three east west streets, compared to two for the other alternatives. This would improve circulation and linkages north of downtown to a greater degree than the other two alternatives.

Avoid Major Disruption of Traffic Patterns due to Loss of Capacity on SR 99
The greatest differences among the build alternatives are their construction impacts and construction duration. The Tolled or Non-Tolled Bored Tunnel Alternative could be built with limited SR 99 closures (3 weeks in addition to occasional night and weekend closures). The Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative would close SR 99 for 27 months, and the Tolled or Non-Tolled Elevated Structure Alternative would close it for approximately 6 months. While SR 99 is closed, traffic would be directed onto adjacent surface streets and I-5. This would increase congestion for travelers through downtown Seattle.

The central waterfront would be largely unaffected during the 5.4-year period while the Tolled or Non-Tolled Bored Tunnel Alternative is built. Effects to the central waterfront would be limited to about 9 months when the viaduct is being demolished. The Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative would bring substantial construction impacts to the central waterfront for 8.75 years. During this time, heavy equipment would be operating directly in front of many businesses, and vehicles and pedestrians would be rerouted frequently. Most of the parking in the area would be removed. The Tolled or Non-Tolled Elevated Structure Alternative would have similar impacts but would take about 10 years to construct. The length and severity of construction of either of these alternatives would create severe hardships on adjacent activities on the central waterfront and in downtown.

Protect the Integrity and Viability of Adjacent Activities on the Central Waterfront and in Downtown Seattle
The build alternatives vary in how they would affect activities on the central waterfront and in downtown Seattle, with or without tolls. Both tunnel alternatives would remove the noise and visual impacts caused by the existing viaduct, making the central waterfront a much more pleasant place and supporting Seattle's vision for the area. The Tolled or Non-Tolled Elevated Structure Alternative would have more visual impacts than the existing viaduct and similar noise impacts. Seattle's vision for the central waterfront does not include an elevated highway.

Construction Roadway Closures, Restrictions, and Detours

STAGE ONE | STAGE TWO | STAGE THREE | STAGE FOUR | STAGE FIVE | STAGE SIX | STAGE SEVEN | FINAL STAGE

Begin August

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

In Months

Bored Tunnel

4 | 5 | 7 | 3 | 16 | 9 | 9 | 12 — 5 years 5 months

STAGE 1 –
- SR 99 reduced to 2 lanes in each direction from Battery Street Tunnel to Roy Street, Stages 1 and 2
- Alaskan Way S. closed between S. Atlantic and S. King for all stages
- Periodic lane closures on streets near the north portal

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane Street to Battery Street Tunnel, Stages 1 & 2

STAGE 2 –
- Sixth Avenue closed between Thomas and Broad Streets – Stages 2 through 7
- Harrison Street closed from Sixth Avenue to SR 99 – Stages 2 through 7
- Broad Street eastbound lanes closed
- Periodic lane closures on streets in the north portal area

S. Holgate to S. King Street Project –
- Southbound SR 99 on WOSCA Detour

STAGE 3 –
- SR 99 reduced to 2 lanes in each direction from S. Spokane Street to Roy Street – Stages 3 through 7
- All SR 99 traffic on WOSCA detour
- Broad Street eastbound lanes closed

S. Holgate to S. King Street Project –
- Close SR 99 for one week

STAGE 4 –
- All SR 99 traffic on WOSCA detour
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues
- Broad Street 2 lanes open in each direction

STAGE 5 –
- All SR 99 traffic on WOSCA detour
- Broad Street 1 eastbound, 2 westbound landes open
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues for most of stage

STAGE 6 –
- All SR 99 traffic on WOSCA detour
- Shift southbound SR 99 traffic to revised WOSCA Detour
- Broad Street closed permanently
- Mercer Street open with 2 or 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 7 –
- All SR 99 traffic on WOSCA detour
- SR 99 closed for several weeks at end of Stage
- Bored tunnel open at end of stage

FINAL STAGE –
- Alaskan Way width reduced from S. King to Pike Streets
- Periodic street closures from S. King to Battery Street
- First Avenue S. reduced to 1 lane in each direction from S. Royal Brougham to S. King
- Periodic lane closures on streets near the north portal

Cut-&-Cover Tunnel

30 | 9 | 15 | 27 | 12 | 12 — 8 years 9 months

STAGE 1 –
- Traffic remains on SR 99
- Alaskan Way periodically reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track
- All SR 99 traffic on WOSCA Detour mid-2012
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues end of 2012

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012

STAGE 2 –
- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 2 lanes in each direction from Fifth to Ninth Avenues

STAGE 3 –
- Southbound SR 99 open from S. Spokane to Columbia, closed from Columbia to Denny
- Northbound SR 99 open from S. Spokane to Denny, Western ramp closed
- SR 99 north of Denny is reduced to 2 northbound lanes and 1 southbound lane
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 4 –
- SR 99 closed to all traffic from Royal Brougham to Denny
- SR 99 north of Denny is reduced to 1 northbound lane and 2 southbound lanes
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 5 –
- Southbound SR 99 open to traffic in new tunnel
- Northbound SR 99 closed from Royal Brougham to Denny, open north of Denny
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

FINAL STAGE –
- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

Elevated Structure

30 | 9 | 27 | 3 | 24 | 21 | 3 | 3 — 10 years

STAGE 1 –
- Traffic remains on SR 99
- Alaskan Way periodically reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track
- All SR 99 traffic on WOSCA Detour mid-2012
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues end of 2012

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012

STAGE 2 –
- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way reduced to 1 lane in each direction, Stages 2 through 6
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 2 lanes in each direction from Fifth to Ninth Avenues

STAGE 3 –
- SR 99 reduced to 2 lanes in each direction
- Southbound traffic routed to Broad Street Detour
- Elliott & Western ramps closed
- SR 99 north of Denny reduced to 3 lanes total
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 4 –
- SR 99 closed
- SR 99 north of Denny is reduced to 1 northbound land and 2 southbound lanes
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 5 –
- SR 99 reduced to 2 lanes in each direction on lower viaduct deck
- Southbound traffic routed to Broad Street Detour
- Seneca, Elliott, and Western ramps closed
- Columbia ramp converted to temporary northbound off-ramp
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 6 –
- SR 99 reduced to 2 lanes in each direction on upper viaduct deck
- Columbia & Elliott southbound on-ramps closed
- Seneca & Western northbound off-ramps open
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 7 –
- SR 99 closed
- Alaskan Way periodically reduced to 1 lane in each direction

FINAL STAGE –
- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

Exhibit 6-1

CHAPTER 6 - CONSTRUCTION EFFECTS

What is in Chapter 6?

This chapter describes the roadway closures, restrictions, and detours needed and the construction effects for the preferred Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative. Construction effects would be the same for the tolled and non-tolled build alternatives, so this chapter only discusses effects of three build alternatives. The Viaduct Closed (No Build Alternative) is not discussed in this chapter, because it would not involve any construction and would not have construction effects. The Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative are compared to the extent that their construction methods, timing, and/or effects differ from one another. To understand transportation effects during construction, traffic is compared to the 2015 existing viaduct, which represents existing conditions as discussed in Chapter 4 of this Final EIS.

Specific construction activities would affect portions of SR 99 for varying amounts of time. Areas outside the SR 99 right-of-way would be restored to their original condition as soon as possible after construction.

ROADWAY CLOSURES, RESTRICTIONS, AND DETOURS

1 How would restrictions to SR 99 compare?

SR 99 Closures and Restrictions

Construction activities, detours, and roadway restrictions are described in Exhibit 6-1 in eight stages for both the Bored Tunnel and Elevated Structure Alternatives and in six stages for the Cut-and-Cover Tunnel Alternative. In addition, periodic night or weekend closures of SR 99 would be required for all of the alternatives.

The total construction duration and length of time SR 99 would be closed completely to traffic varies between the alternatives, as shown in Exhibit 6-2. Construction of the Bored Tunnel Alternative would keep SR 99 open for all but about 3 weeks of the nearly 5.4-year construction period. The 3-week closure period would be required about 4.5 years into construction to connect SR 99 to the new bored tunnel. The Elevated Structure Alternative would close SR 99 to all traffic for a total of 5 to 7 months. SR 99 would be closed for 2 to 4 months to demolish the upper level of the existing viaduct. Near the end of the construction period, the roadway would be closed for 3 months to construct and connect the new lower level of the viaduct to existing SR 99 near S. Royal Brougham Way. The Cut-and-Cover Tunnel Alternative would close SR 99 for the longest period of time. The alternative would first close southbound SR 99 to traffic for 15 months before closing SR 99 in both directions for a period of 27 months. Then northbound SR 99 would be closed to traffic for an additional 12 months.

Exhibit 6-2
SR 99 Closures and Restrictions

	SR 99 Closed	SR 99 Restricted[1]	Total Construction Time	
Bored Tunnel	3 weeks	52 months	65 months	5.4 years
Cut-&-Cover Tunnel	**Southbound –** 42 months **Northbound –** 39 months	54 months[2]	105 months	8.75 years
Elevated Structure	5 to 7 months	120 months	120 months	10.0 years

1 *Amount of time when SR 99 would be subject to lane and ramp closures. This duration does not include time when SR 99 would be closed to all traffic.*

2 *Includes Stages 3 and 5 when SR 99 is closed in one direction and restricted in the other direction.*

SR 99 Detours

When SR 99 is open, construction would restrict traffic to two lanes in each direction in many locations for all of the build alternatives. SR 99 would be reduced to two lanes because there is only enough space for two lanes in each direction through the proposed detour in the south as well as through the area north of Denny Way. Because of these lane restrictions, the speed limit on the existing viaduct would be reduced from 50 to 40 miles per hour (mph) during construction.

When construction of this project begins in 2011, SR 99 restrictions in the south area would mostly be due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project, which will have already constructed the south end detour (Washington-Oregon Shippers Cooperative Association [WOSCA] detour). The S. Holgate Street to S. King Street Viaduct Replacement Project will reconfigure the existing SR 99 ramps to First Avenue S. and use them to route SR 99 traffic to and from the WOSCA detour. A temporary southbound off-ramp will be located near S. Atlantic Street, and a temporary northbound on-ramp will be located at S. Royal Brougham Way. The S. Holgate Street to S. King Street Viaduct Replacement Project will move mainline SR 99 traffic to the WOSCA detour in two phases: southbound traffic will be detoured beginning in December 2010, and both directions of traffic will be detoured in about May 2012, as shown on Exhibit 6-3.

Around May 2012, the traffic effects of the WOSCA detour would be considered part of the effects of this project because the detour would be needed to construct the Alaskan Way Viaduct Replacement Project between

S. Royal Brougham Way and Roy Street. The WOSCA detour would have a posted speed limit of 25 mph. The Bored Tunnel Alternative would modify the WOSCA detour for southbound traffic in Stage 6, as shown in Exhibit 6-3. The WOSCA detour would be in place for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives for a period of about 4.5 years. With the Elevated Structure Alternative, the WOSCA detour would be in place for about 5.75 years.

The Elevated Structure Alternative would construct the Broad Street detour to route southbound traffic around the Battery Street Tunnel and connect back to SR 99 near Union Street, as shown in Exhibit 6-4. Southbound SR 99 traffic would be routed onto the Broad Street detour for a period of about 4.25 years to allow improvements to be constructed from Virginia Street through the Battery Street Tunnel.

2 How would traffic be restricted on other roadways during construction?

All of the alternatives would restrict surface streets in the project area during construction. When construction for this project begins, Alaskan Way S. will be closed between S. Atlantic Street and S. King Street because of the S. Holgate Street to S. King Street Viaduct Replacement Project. This section of Alaskan Way S. would remain closed between S. King and S. Atlantic Streets to accommodate construction activities for each of the alternatives. For all of the build alternatives, surface street traffic on Alaskan Way S. through the south area would be routed as shown on Exhibit 6-5. For the Bored Tunnel Alternative, this route would stay in effect for 4.5 years until the tunnel opens. For the Cut-and-Cover Tunnel Alternative, this route would be in place during the first 30 months of construction until Alaskan Way is closed north of S. King Street. For the Elevated Structure Alternative, this route would be in place for about 9.75 years.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would require closure or lane closures on Alaskan Way north of S. King Street for a period of several

WOSCA Detour

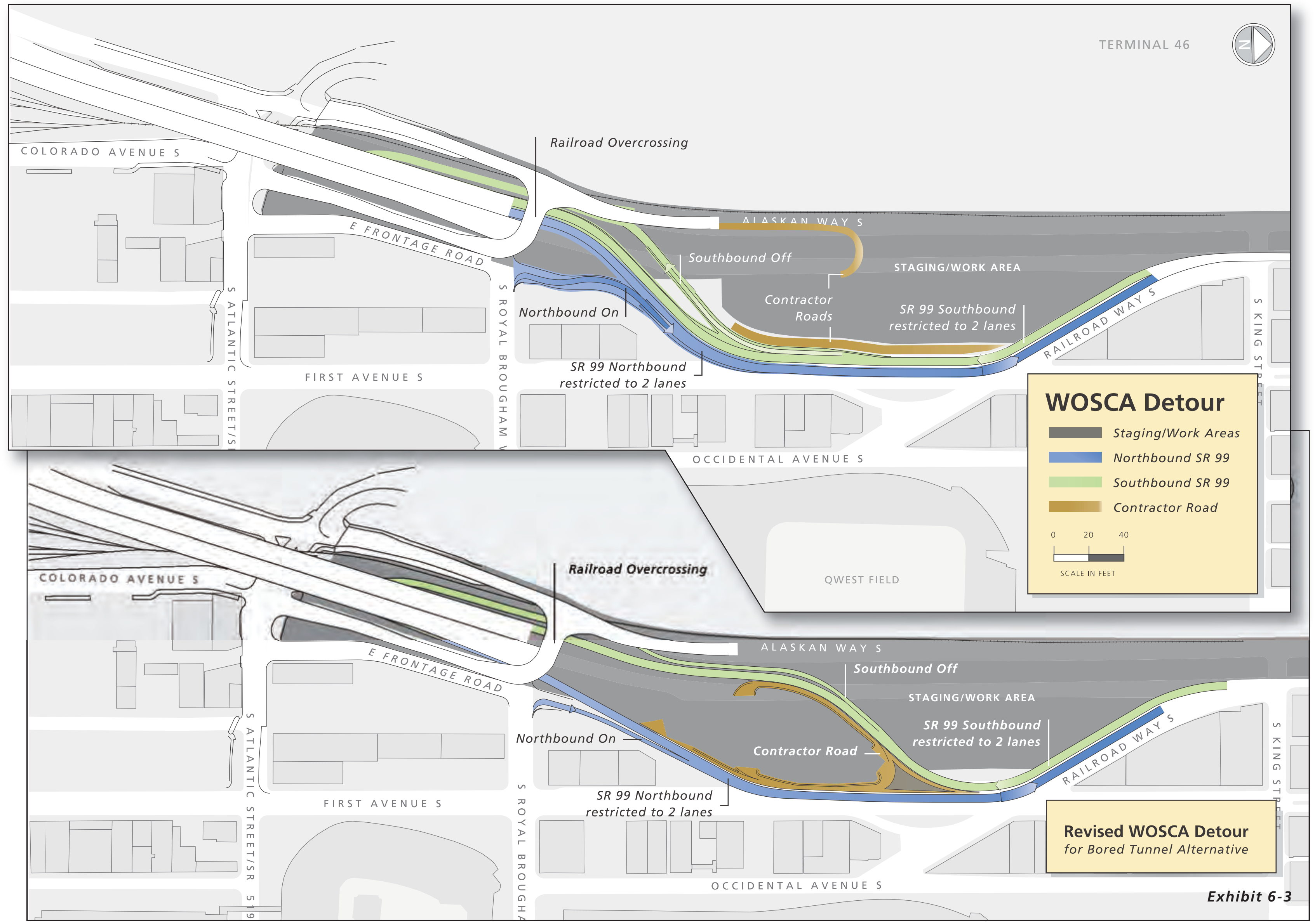


Exhibit 6-3

Broad Street Detour
Southbound Only
Viaduct
Battery Street Tunnel
Surface
Aerial
0
500
1,000
SCALE IN FEET
Elliott Bay
Pier 70
Pier 69
Pier 68
Bell Harbor Conference Center
Piers 62 - 63
Waterfront Park
Temporary Trestle
Old Spaghetti Factory
Broad Street Detour
Broad Street Detour End
Viaduct
Battery Street Tunnel
Elliott Avenue
Western Avenue
First Avenue
Second Avenue
Third Avenue
Fourth Avenue
Fifth Avenue
Sixth Avenue
Taylor Avenue
Dexter Avenue
SR 99/Aurora Avenue
Thomas Street
Thomas Street Bridge
Harrison Street
Republican
Mercer Street
Eagle Street
Clay Street
Cedar Street
Vine Street
Wall Street
Battery St
Bell Street
Union Street
Broad Street Detour Start
Visual Simulation of Broad Street Detour
Temporary Trestle at Broad Street
Broad Street Detour Traffic Signals
Surface
Aerial
Traffic Signal
Thomas St. Bridge
Broad Street Detour Start
Broad Street Detour End

Exhibit 6-4

years, as indicated in Exhibit 6-6. The Bored Tunnel Alternative does not require closing or restricting Alaskan Way north of Yesler Way during construction. However, southbound traffic would be reduced to one lane between S. King Street and Yesler Way for about 4.5 years, which would have a temporary effect on ferry queuing. To alleviate potential queuing backups on Colman Dock during peak ferry travel periods, a second northbound lane of traffic between Yesler Way and Spring Street will be added, and the signal at the intersection of Yesler Way and Alaskan Way will be modified to allow left turns out of the ferry terminal.

Exhibit 6-6
Alaskan Way Surface Street Closures and Restrictions

	Alaskan Way Closed[1]	Alaskan Way Restricted	Total Construction Time	
Bored Tunnel	0	0 month[2] – cross streets periodically closed	65 months	5.4 years
Cut-&-Cover Tunnel	63 months	42 months	105 months	8.75 years
Elevated Structure	0	120 months	120 months	10.0 years

1 *Amount of time Alaskan Way would be restricted or closed north of S. King Street.*
2 *Between S. King Street and Yesler Way, Alaskan Way would be restricted to one southbound lane for about 4.5 years. There would continue to be two northbound lanes. Alaskan Way would not be restricted north of Yesler Way.*

Alaskan Way S. Traffic Routing

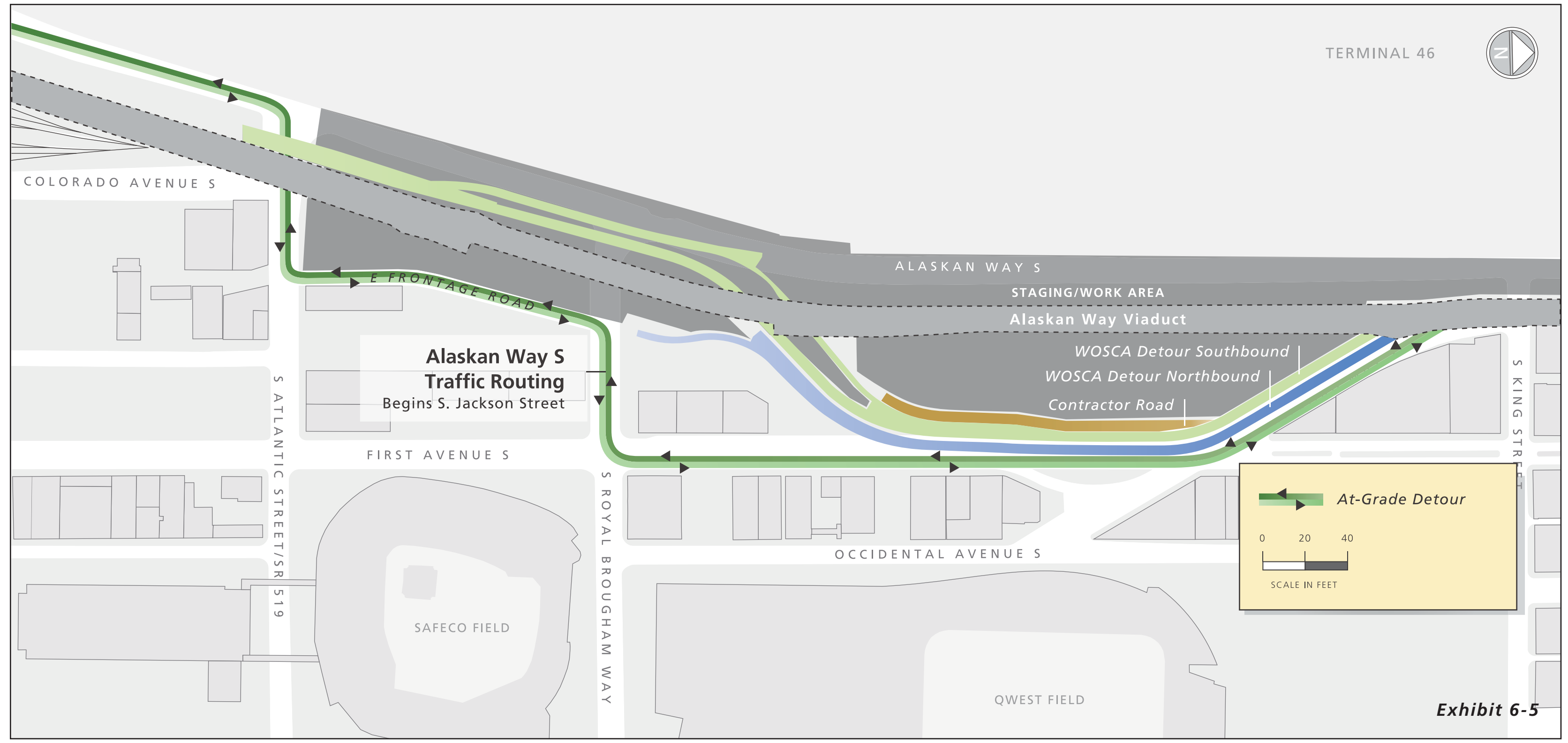


Exhibit 6-5

Throughout construction, a number of short-term traffic detours would also be needed on surface streets when activities such as relocating utilities are taking place. The text below describes likely roadway restrictions on adjacent roadways during construction for each of the alternatives. Roadway restrictions would cause some on-street parking spaces to be removed during the construction period, which are described in Question 18 of this chapter.

Bored Tunnel Alternative

South Portal Roadway Restrictions

In addition to the detour of Alaskan Way S. in this area, surface street parking on First Avenue S. would be removed between S. Royal Brougham Way and S. King Street. First Avenue S. would continue to operate with two travel lanes in each direction throughout most of the construction period; however, during the final year of construction, First Avenue S. would be closed periodically or restricted to one lane in each direction between S. Royal Brougham Way and Railroad Way S. to remove the WOSCA detour.

Central Waterfront Roadway Restrictions

Throughout most of the construction period, few long-term lane closures are expected for local streets located between the south and north portals. However, periodic lane closures would be required during viaduct demolition and to fill and close the Battery Street Tunnel. During the 9-month period when viaduct demolition occurs, Alaskan Way would be narrowed. Cross-streets that pass under the viaduct would be temporarily closed between S. King Street and the Battery Street Tunnel. It is expected that these cross-streets would be closed in two-block sections for a period of up to 4 weeks. These closures will require detours for local traffic and would cause some delays, especially during peak hours. Periodic lane closures would also be needed in specific areas along the bored tunnel alignment where soil improvements are needed.

Traffic on Battery Street and on cross streets above the Battery Street Tunnel would be maintained while it is decommissioned, although occasional short-term lane and parking restrictions may be needed.

North Portal Roadway Restrictions

There would be periodic closures on Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations. All lanes on Sixth Avenue N. from Thomas Street to Broad Street and all lanes on Harrison Street from Sixth Avenue N. to SR 99 would be closed beginning in February 2012 until about January 2016. Thomas Street would be also closed between Sixth Avenue and SR 99 for approximately 3 months when the tunnel boring machine (TBM) is removed around March 2015 to May 2015.

Near the end of 2012, Mercer Street would be reduced to two eastbound lanes between Fifth and Ninth Avenues. This restriction would last for about 1.5 years. Mercer Street would open as a two-way street, initially with two lanes in each direction around April 2014, and three lanes in each direction around September 2014.

Broad Street would be restricted to two eastbound lanes for about a year beginning in 2012. In the beginning of 2013, Broad Street would operate with two westbound lanes and one eastbound lane. In April 2014, Broad Street would operate with only one eastbound lane. Connections would be provided from Broad Street to eastbound Mercer Street and northbound Dexter Avenue only. Broad Street would be permanently closed between Taylor and Dexter Avenues around July 2014.

Cut-and-Cover Tunnel Alternative

South Area Roadway Restrictions

In addition to the detour of Alaskan Way S. in this area, surface street parking on First Avenue S. would be removed between S. Royal Brougham Way and S. King Street. First Avenue S. would continue to operate with two travel lanes in each direction throughout the construction period.

Central Waterfront Roadway Restrictions

The Alaskan Way surface street would periodically be reduced to one lane in each direction for utility relocations during the first 2.5 years (30 months) of construction. Alaskan Way would then be closed to north-south traffic for just over 5 years (63 months). During this closure, traffic would need to use Interstate 5 (I-5) or other north-south surface streets through downtown. East-west access to waterfront businesses and Colman Dock would be provided. About May 2018, Alaskan Way would reopen with one lane of traffic in each direction. Alaskan Way would then be placed in its permanent configuration with periodic lane restrictions during the last year of construction.

North Area Roadway Restrictions

There would be periodic closures on Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations.

Near the end of 2012, Mercer Street would be reduced to two eastbound lanes between Fifth and Ninth Avenues. This restriction would last for about 1.5 years. Mercer Street would open as a two-way street, initially with two lanes in each direction around April 2014, and three lanes in each direction around September 2014.

Broad Street would be closed permanently between Taylor and Dexter Avenues in May 2018. Traffic would then travel on the improved surface street grid and Mercer Street, which would be open to two-way traffic. Thomas and Harrison Streets would be connected across SR 99 and open in August 2018.

Elevated Structure Alternative

South Area Roadway Restrictions

In addition to the detour of Alaskan Way S. in this area, surface street parking on First Avenue S. would be removed between S. Royal Brougham Way and S. King Street. First Avenue S. would continue to operate with two travel lanes in each direction throughout the construction period.

Central Waterfront Roadway Restrictions

The Alaskan Way surface street would periodically be reduced to one lane in each direction for utility relocations during the first 2.5 years (30 months) of construction. After the first 2.5 years, Alaskan Way would operate with one lane in each direction until the final stage of construction when Alaskan Way would be periodically restricted to build the street in its permanent configuration.

North Area Roadway Restrictions

There would be periodic closures on Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations. When SR 99 is closed, SR 99 traffic would be diverted to streets north of Denny Way. The Elevated Structure Alternative would route traffic around the Battery Street Tunnel and connect back to SR 99 near Union Street using the Broad Street Detour, as shown in Exhibit 6-4. Southbound SR 99 traffic would use the Broad Street detour for about 4.25 years.

Near the end of 2012, Mercer Street would be reduced to two eastbound lanes between Fifth and Ninth Avenues. This restriction would last for about 1.5 years. Mercer Street would open as a two-way street, initially with two lanes in each direction around April 2014, and three lanes in each direction around September 2014.

Traffic on the Broad Street detour would operate with three southbound lanes and one northbound lane from about November 2014 to May 2019. Broad Street would be permanently closed between Taylor and Dexter Avenues when the detour is removed around May 2019. Traffic would then travel on the improved surface street grid, which would connect Thomas and Harrison Streets across SR 99 and open Mercer Street to two-way traffic.

TRAFFIC EFFECTS DURING CONSTRUCTION

3 How would travel patterns on SR 99, I-5, and city streets be affected during construction?

During construction of the Bored Tunnel Alternative, daily vehicle volumes through the central waterfront section of SR 99 are expected to decrease by about one-third. Vehicles are expected to shift to city streets and, to a lesser degree I-5, and use different access points on SR 99.

Construction of the Cut-and-Cover Tunnel Alternative would have a considerable effect on vehicle traffic patterns in and near the project area, particularly when SR 99 is closed to one or both directions of traffic between the stadium area and Denny Way. While SR 99 is closed, vehicles traveling through downtown will shift to city streets and, to a lesser degree, I-5. Daily volumes on the segments of SR 99 adjacent to downtown are expected to decrease by approximately half south of downtown and by a third north of downtown.

Construction of the Elevated Structure Alternative is expected to reduce daily vehicle volumes through the central waterfront section of SR 99 by about 40 percent. The Broad Street detour would affect the majority of southbound trips, because all SR 99 traffic between

Assumptions for the Construction Traffic Analysis

The transportation analysis for construction modeled conditions during Stage 5 for the Bored Tunnel and Elevated Structure Alternatives and Stage 4 for the Cut-and Cover Tunnel Alternative, which are considered to be the most disruptive to traffic.

Denny Way and Pike Street would have to use surface streets, with a portion of those vehicles connecting back to the SR 99 mainline at Pike Street. Many northbound vehicles on SR 99 are also expected to shift to city streets and, to a lesser degree, I-5 due to increases in congestion and changes in access during construction.

4 How would SR 99 traffic be affected by lane restrictions?

Temporary lane closures and restrictions on SR 99 would increase congestion, reduce travel speeds, and increase average travel times, particularly during peak commute hours. During construction, traffic on SR 99 would be close to capacity and would be more likely to experience increased delay and congestion when there is a disruption in traffic flow, such as an accident. Where increases in travel times are minimal, it is due in large part to rerouting and reduced demand on SR 99. Demand would be reduced because of expected traffic bottlenecks near the south and north areas of the viaduct that would likely cause many drivers to divert to other city streets, such as Second or Fourth Avenues and I-5, resulting in less overall traffic on SR 99.

SR 99 closures will affect congestion and delay on city streets in the area. Effects to city streets are discussed in Question 6 of this chapter. Noticeable effects to congestion and travel times on I-5 are not expected for reasons discussed in Question 5 of this chapter. The Cut-and-Cover Tunnel Alternative would close SR 99 for the longest amount of time, which would affect drivers to a greater degree than the other build alternatives. The Bored Tunnel Alternative would affect drivers the least of the build alternatives because it would keep traffic on the viaduct through the majority of the construction period. The Elevated Structure Alternative would have more effects to SR 99 drivers than the Bored Tunnel Alternative because of the 5- to 7-month closure and lane and ramp restrictions when both directions of traffic are sharing the lower or upper deck of the viaduct.

Average travel times during construction were evaluated for the most disruptive stage of construction. Generally, the most disruptive effects would occur in Stage 5 for the Bored Tunnel and Elevated Structure Alternatives, and Stage 4 for the Cut-and-Cover Alternative. During the most disruptive construction stage for each alternative, average travel times were assessed for two typical SR 99 trips: Woodland Park to S. Spokane Street and Ballard to S. Spokane Street via the Alaskan Way Viaduct in the AM peak hour (8:00 a.m. to 9:00 a.m.) and PM peak hour (5:00 p.m. to 6:00 p.m.). In addition to discussing these specific trips, the text below qualitatively describes how specific SR 99 trips might be affected by lane restrictions during construction.

How would construction affect drivers heading through downtown on SR 99?

During construction, drivers using SR 99 to travel through downtown would be affected by lane restrictions in the south and north areas. SR 99 would be restricted in the south, because there is only enough space for two lanes in each direction through the WOSCA detour. In the north area, SR 99 would also be restricted to two lanes in each direction to allow for construction activities. Finally, all of the build alternatives require closing SR 99 for a period of time during construction, which would affect drivers traveling on SR 99 for through trips.

Exhibit 6-7 shows estimated travel times during construction between Woodland Park and S. Spokane Street. During the morning commute, construction travel times in both the southbound and northbound directions are faster for the Bored Tunnel Alternative (16 to 19 minutes) and are substantially slower for the Cut-and-Cover Tunnel Alternative (approximately 50 minutes). Travel times for the Elevated Structure Alternative are slightly slower than those for the Bored Tunnel Alternative. Large differences in travel times between the Bored Tunnel and Cut-and-Cover Tunnel Alternatives are mainly due to closing SR 99 and Alaskan Way during construction of the Cut-and-Cover Tunnel Alternative. During construction of the Bored Tunnel Alternative, a minimum of two lanes would be provided on SR 99 in both directions and Alaskan Way would be fully functional.

Exhibit 6-7
Construction-Related Travel Times from Woodland Park to S. Spokane Street
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
AM Peak Hour				
Southbound	16	19	49	25
Northbound	16	16	51	19
PM PEAK Hour				
Southbound	15	18	43	28
Northbound	18	21	49	20

During the evening commute, a similar trend in construction travel times would be expected, with the fastest travel times for the Bored Tunnel Alternative and the slowest travel times for the Cut-and-Cover Tunnel Alternative.

How would construction affect conditions for drivers heading to or from northwest Seattle (Ballard, Interbay, and Magnolia)?

Other than the times when SR 99 is completely closed, drivers heading to and from northwest Seattle would likely be most affected by changes and closures of the Elliott and Western Avenue ramps. The Bored Tunnel Alternative would keep these ramps open until the last year of construction, when traffic routed in the newly constructed tunnel and the existing viaduct is demolished. Drivers would then need to use Mercer Street to access the new on-ramp at Sixth Avenue N. or travel south on Alaskan Way and access SR 99 near S. King Street.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would both close the Western and Elliott Avenue ramps for several years. These two alternatives would also restrict traffic on Alaskan Way, which would limit possible travel routes for drivers traveling to and from northwest Seattle. The Elevated Structure Alternative would restrict Alaskan Way to one lane in each direction through most of the construction period and the Cut-and-Cover Tunnel Alternative would close Alaskan Way for most of construction. In addition, when SR 99 is completely closed, drivers headed to or from northwest Seattle would encounter increased congestion and delays as they travel through or around the construction area.

Appendix C, Transportation Discipline Report

Expected travel times during construction are discussed in *Appendix C*, Section 6.6.

What is the AM peak hour (morning commute) and the PM peak hour (evening commute)?

The AM and PM peak hours occur when traffic is heaviest during the morning and evening commutes. For SR 99, the AM peak hour is from 8:00 a.m. to 9:00 a.m. The PM peak hour is from 5:00 p.m. to 6:00 p.m. Traffic conditions during these peak travel times were modeled to understand traffic conditions and effects when traffic is heaviest on a typical day.

Exhibit 6-8 shows the approximate travel times during construction between Ballard and S. Spokane Street. During the morning commute, both north- and southbound travel times for the Bored Tunnel Alternative during construction are expected to be faster than the other build alternatives. The Cut-and-Cover Tunnel Alternative's travel times are expected to be the slowest, because the alternative would close SR 99 and Alaskan Way along the central waterfront. Travel times for the Cut-and-Cover Tunnel Alternative would range from 45 to 53 minutes compared to a range of 16 to 22 minutes for the Bored Tunnel and Elevated Structure Alternatives.

Exhibit 6-8
Construction-Related Travel Times from Ballard to S. Spokane Street
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
AM Peak Hour				
Southbound	16	16	45	18
Northbound	19	21	53	22
PM PEAK Hour				
Southbound	16	21	42	18
Northbound	21	23	53	22

During the evening commute, a similar although not identical pattern is expected, with the slowest construction-stage travel times for the Cut-and-Cover Tunnel Alternative and much faster travel times for the Bored Tunnel and Elevated Structure Alternatives. Travel times for the Cut-and-Cover Tunnel Alternative are expected to be within a range of 42 to 53 minutes, and travel times for the other two build alternatives would likely be between 18 and 23 minutes.

How would construction in the south area affect drivers heading to or from downtown?

All of the alternatives would use the WOSCA detour and temporary on- and off-ramps for at least 4 years of the construction period. The reduced speed limit of 25 mph on the WOSCA detour would cause delays for drivers on SR 99 heading to or from downtown and locations south of the project. Intersections near the temporary southbound off-ramp at S. Atlantic and northbound on-ramp S. Royal Brougham Way would be more congested and cause congestion on nearby streets and intersections, especially during peak commute hours. When SR 99 is closed to all traffic, drivers will have to use surface streets such as First, Second, or Fourth Avenues, or I-5 to travel north-south to or from downtown.

How would construction in the north area affect drivers heading to or from downtown?

For all of the build alternatives, construction will reduce SR 99 capacity, modify access to/from and around SR 99, and increase traffic volumes on north-south surface streets between downtown and areas to the north. Mercer Street will be restricted while it is being widened and converted to a two-way street. This may cause an increase in congestion on local streets such as Sixth Avenue N., Dexter Avenue N., Denny Way, and John, Thomas, Harrison, and Republican Streets. These streets currently operate under capacity and could handle some additional volumes. Some of these streets will have periodic closures, such as Thomas and Harrison Street, which will be reconnected across Aurora Avenue.

When SR 99 is closed, southbound traffic coming into downtown Seattle from the north would be routed off of SR 99 at Broad Street or streets farther north and drivers would use surface streets to reach their destinations. Drivers wishing to travel northbound on SR 99 would be able to use the Denny Way on-ramp for much of construction, but they would have to connect with SR 99 farther north when Aurora Avenue is lowered for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. When SR 99 is closed, there will be substantial congestion and delays for drivers heading to and from downtown and neighborhoods to the north.

5 How would construction affect I-5 traffic?

Noticeable effects to I-5 are not expected because the additional trips that divert to I-5 because of construction are expected to divert during off-peak travel times when I-5 has available capacity. This diversion during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route. Exhibit 6-9 shows the approximate percentage of increase for vehicle volumes on I-5 during construction.

Exhibit 6-9
Increase in Vehicle Volumes on I-5 during Construction
in percentages

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Near I-90	3%	5%	4%
Near Seneca Street	2%	6%	5%
Near SR 520	0.5%	2%	1%

6 How would construction effects compare to traffic on local streets?

This section discusses anticipated congestion levels at intersections during the most disruptive construction stage for each alternative. During construction, vehicle delays at intersections in the project area are expected to increase for any of the build alternatives. For the Bored Tunnel Alternative, increased delays would be influenced by SR 99 restrictions and detours that would reduce speeds, modify access, and lead to the redistribution of SR 99 traffic to local arterials and other parallel roadways such as I-5. Modeling results indicate that this diverted traffic would have little effect on I-5 trips, but it would have a larger effect on local streets. Some drivers may choose to use other routes such as First, Second, and Fourth Avenues, which may add congestion and increase delay at intersections along these routes.

For the Elevated Structure Alternative, increased delays would also be influenced by SR 99 restrictions and detours. During Stage 5, the Broad Street detour would be in place and there would be no southbound on-ramps to SR 99 between Pike Street and S. Spokane Street. The Broad Street detour would have substantial impacts on traffic north of downtown. These changes are expected to reduce SR 99 capacity, modify access at critical points along the corridor, and increase traffic volumes on I-5 and north-south surface streets through downtown more than the Bored Tunnel Alternative.

For the Cut-and-Cover Tunnel Alternative, SR 99 and Alaskan Way along the central waterfront would be closed during Stage 4, which would result in the greatest

Appendix C, Transportation Discipline Report

Construction effects to local streets are discussed in *Appendix C*, Section 6.5.

magnitude of traffic disruption and congestion on local streets of all build alternatives. Traffic volumes on city surface streets and I-5 would increase. Congestion would occur more frequently, with greater severity, and for longer durations during the construction of the Cut-and-Cover Tunnel Alternative than with the other build alternatives.

Bored Tunnel Alternative

South Portal Area

During construction of the Bored Tunnel Alternative, traffic delays at intersections in the south portal area are expected to increase as some traffic diverts from SR 99 to local arterials. Drivers that choose to use local arterials would potentially cause additional congestion on major north-south routes such as Second and Fourth Avenues.

Congestion during construction would increase delay at the following intersections:

- First Avenue S. at S. King Street – Delay would increase by more than 2 minutes during the AM peak hour and more than 1 minute during the PM peak hour.

- Alaskan Way at Yesler Way – Delay would increase by more than 1 minute during the AM and PM peak hours.

- Alaskan Way at S. King Street – Delay would increase by more than 2 minutes during both the AM and PM peak hours.

- Second Avenue at S. Jackson Street – Delay would increase by more than 2 minutes during the PM peak hour.

The temporary northbound on-ramp for the WOSCA detour may experience long queues during the PM peak hour. These queues could back up into adjacent intersection, increasing delay at the following locations by 15 to 25 seconds:

- East Frontage Road at S. Royal Brougham Way
- First Avenue S. at S. Royal Brougham Way
- First Avenue S. at S. Atlantic Street

Central Downtown and Waterfront Area

Traffic congestion at intersections in the central area is expected to increase, although most of the increases are not expected to substantially increase delay. Along north-south arterials such as First, Second, and Fourth Avenues, increases in traffic volumes during the AM and PM peak hour would not result in high levels of congestion.

North Portal Area

Delays on local streets during construction in the north area would be affected by widening and converting Mercer Street to a two-way street and restricting access to and from SR 99 and the local street grid south of Mercer Street. Access at Roy, Republican, Harrison, and Broad Streets would be restricted, and southbound SR 99 traffic would need to shift to access local streets to the north or south. Northbound traffic would not be able to exit SR 99 to Republican Street, but the other northbound exits (Harrison, Mercer, Roy, and Aloha Streets) would be open during the majority of construction. Drivers would likely shift to Harrison Street south of Republican Street or Roy Street to the north.

Congestion levels at intersections near affected on- and off-ramp connections or along affected streets would potentially increase due to higher concentrations of peak hour traffic during construction at the following locations:

- **Denny Way at Dexter Avenue N. –** Delay would increase by more than 1 minute during the AM peak hour.

- **Mercer Street at Dexter Avenue N./SR 99 northbound off-ramp –** Delay would increase by more than 5 minutes during the morning and evening commute.

- **Mercer Street at Fairview Avenue N./I-5 ramps –** Delay would increase by more than 1 minute during the PM peak hour.

In addition, construction of the Bored Tunnel Alternative would close SR 99 once to all traffic for several weeks. During this closure, congestion on local arterials in the project area are expected to increase noticeably compared to congestion during other stages of construction, because all SR 99 traffic would be diverted to city streets and other major freeways such as I-5. Travel times during the 3-week closure would increase substantially. For example, a trip between Woodland Park and S. Spokane Street that typically takes about 15 minutes could take about 45 minutes.

Cut-and-Cover Tunnel Alternative

South Area

When SR 99 is closed, traffic operations at intersections in the south area are likely to be extremely congested. All SR 99 traffic to and from the south would exit via temporary ramps at the intersection just west of S. Royal Brougham Way at First Avenue S. The volume of traffic entering and exiting via these ramps would cause the surrounding intersections to experience very long delays (approximately 10 minutes during the AM peak hour and 6 minutes during the PM peak hour). In addition, Alaskan Way would be closed from S. Atlantic Street to University Street. Traffic from SR 99 and Alaskan Way would redistribute to other local arterials, which would cause severe congestion on major north-south routes such as First and Fourth Avenues.

For the Cut-and-Cover Tunnel Alternative, congestion and delay would be higher than is expected for the Bored Tunnel Alternative. In addition to delay described for the Bored Tunnel Alternative, delay would be experienced at the following intersections:

- **First Avenue S. at Yesler Way –** Delay would increase by more than 1 minute during the PM peak hour.

- **First Avenue S. at S. King Street –** Delay would increase by almost 2 minutes more than the Bored Tunnel Alternative during the AM and PM peak hours.

- **First Avenue S. at S. Royal Brougham Way –** Delay would increase by more than 8 minutes during the AM peak hour and more than 6 minutes during the PM peak hour.

Central Downtown and Waterfront Area
When SR 99 is closed, traffic congestion could occur throughout the day, with the potential to last as long as 10 to 13 hours per day. In addition, the Alaskan Way surface street would be closed. East-west connections across Alaskan Way would be established to provide pedestrian, delivery, and emergency access to waterfront businesses. Access to Colman Dock would be maintained throughout the construction period, but vehicles would experience delays traveling to the ferry terminal.

Intersections in the central area would operate with a substantially longer delay (1 minute or more) during construction of the Cut-and-Cover Tunnel Alternative, as compared to the Bored Tunnel Alternative. Delay is expected to increase at the following locations:

- **Western Avenue at Broad Street –** Delay would increase by more than 1 minute during the AM and PM peak hours.

- **Western Avenue at Spring Street and First Avenue at Spring Street –** Delay would increase by more than 2 minutes during the AM peak hour and by approximately 1 minute during the PM peak hour.

- **Second Avenue at Marion Street –** Delay would increase by more than 1 minute during the AM peak hour.

North Area
Delays on local streets during construction in the north area would increase due to closing SR 99 south of Denny Way, widening and converting Mercer Street to a two-way corridor, and restricting access to and from SR 99 and the local street grid south of Mercer Street.

All traffic traveling southbound on SR 99 (Aurora Avenue) would have to exit onto the street grid north of or at Broad Street. Northbound traffic would not be able to exit SR 99 at Dexter Street, but all the other northbound exits at Denny, Harrison, Republican, Roy, and Aloha Streets would be open.

Congestion levels at intersections near these affected connections to or from SR 99 or along affected arterials would potentially increase due to higher concentrations of peak hour traffic, similar to the Bored Tunnel Alternative. In addition to increases in delay described for the Bored Tunnel Alternative, the following intersections are expected to have increased delay with the Cut-and-Cover Tunnel Alternative:

- **Denny Way at Fifth Avenue –** Delay would increase by more than 1 minute during the AM and PM peak hours.

- **Fifth Avenue N. at Roy Street –** Delay would increase by approximately 1 minute during the AM peak hour.

- **Denny Way at Sixth Avenue and Mercer Street at Westlake Avenue N. –** Delay would increase by more than 1 minute during the AM and PM peak hours.

- **Mercer Street at Fifth Avenue N., Denny Way at Wall Street, and Dexter Avenue N. at Harrison Street –** Delay would increase by approximately 2 minutes during the PM peak hour.

Elevated Structure Alternative
South Area
Most of the intersections evaluated in the south area for the Elevated Structure Alternative would operate with congestion similar to that for the Bored Tunnel Alternative. One exception during the AM peak hour is the intersection of Alaskan Way at Yesler Way. For the Elevated Structure Alternative, this intersection is expected to experience even more congestion due to reduced capacity along Alaskan Way, compared to the Bored Tunnel Alternative.

Three intersections during the PM peak hour would also experience additional congestion compared to the Bored Tunnel Alternative. The intersection of Alaskan Way at Yesler Way is expected to experience delays of more than 8 minutes, and the intersections of First Avenue S. at Atlantic Street and Second Avenue S. at S. Jackson Street are both expected to experience increases in delay of more than 1 minute.

Central Downtown and Waterfront Area
During Stage 5 of the Elevated Structure Alternative, Alaskan Way would be restricted to one lane in each direction and the Broad Street detour would be in place. In addition, there would be no access to southbound SR 99 between Pike Street and S. Spokane Street.

As a result of all of the access changes along SR 99, traffic congestion at intersections in the central area is expected to increase. Most of the intersections evaluated in the central area for the Elevated Structure Alternative would operate with congestion during the AM and PM peak hours, similar to that for the Bored Tunnel Alternative. However, at the intersection of Alaskan Way at Marion Street, delay is expected to increase by more than 2 minutes during the AM peak hour compared to the Bored Tunnel Alternative due to reduced capacity along Alaskan Way.

North Area
Delays on local streets during construction in the north area would be affected by widening and converting Mercer Street to a two-way roadway and restricting access to and from SR 99 and the local street grid south of Mercer Street.

Two lanes of southbound traffic would be routed onto the Broad Street detour and one lane would continue to Denny Way. Access at Roy, Republican, and Harrison

Streets would be restricted, and southbound SR 99 traffic would need to shift to access local streets to the north or south. Northbound traffic would not be able to exit SR 99 between Denny Way and Roy Street.

Congestion levels at intersections near affected on- and off-ramp connections or along affected streets would potentially increase due to higher concentrations of peak hour traffic during construction. Expected congestion levels at intersections are generally similar to the Bored Tunnel Alternative; however, delay at the following intersections would increase substantially compared to the Bored Tunnel Alternative:

- **Denny Way at southbound Aurora Avenue –** Delay would increase by approximately 1 minute during the AM and PM peak hours.

- **Mercer Street at Fifth Avenue N. –** Delay would increase by more than 2 minutes during the PM peak hour.

In addition, construction of the Elevated Structure Alternative would close SR 99 to all traffic for 2 to 4 weeks in Stage 4 and 3 weeks in Stage 7. During these closures, congestion on local arterials in the project area are expected to increase noticeably compared to congestion during other stages of construction, because all SR 99 traffic would be diverted to city streets and other major freeways such as I-5 and I-90. Travel times during the closures would increase substantially. For example, a trip between Woodland Park and S. Spokane Street that typically takes about 15 minutes could take about 45 minutes.

7 How would effects to transit compare?

Transit Effects Overview
Transit travel times were assessed for key transit trips during the most disruptive construction stage for each alternative. The results of this analysis are shown in Exhibits 6-10 and 6-11.

Exhibit 6-10
AM Peak Hour Travel Times during Construction Along Major Transit Corridors
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Elliott Avenue – South of Ballard Bridge to Denny Way				
SOUTHBOUND	8	8	8	7
NORTHBOUND	8	8	8	7
Aurora Avenue – South of Aurora Bridge to Denny Way				
SOUTHBOUND	7	9	14	11
NORTHBOUND	7	6	8	6
Woodland Park to Spokane Street				
SOUTHBOUND	16	19	49	25
NORTHBOUND	16	17	51	19

Exhibit 6-11
PM Peak Hour Travel Times during Construction Along Major Transit Corridors
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Elliott Avenue – South of Ballard Bridge to Denny Way				
SOUTHBOUND	8	8	8	8
NORTHBOUND	8	8	8	7
Aurora Avenue – South of Aurora Bridge to Denny Way				
SOUTHBOUND	6	6	5	11
NORTHBOUND	6	8	5	6
Woodland Park to Spokane Street				
SOUTHBOUND	15	18	43	28
NORTHBOUND	18	21	49	20

For many trips, King County Metro bus services that use SR 99 would be affected by lane and speed restrictions on SR 99 during construction. However, the outside lane of northbound SR 99 north of the S. Spokane Street interchange would be a transit-only bypass lane until SR 99 merges to two lanes near the WOSCA detour. This transit-only lane would help mitigate construction effects on transit travel times. Increased congestion on First Avenue S. or Fourth Avenue S. during construction could affect transit operations. In addition, during times when SR 99 is completely closed or during any other night or weekend closures, buses that currently use SR 99 would need to use alternate routes.

Bored Tunnel Alternative
Bus access would be maintained on SR 99 during construction of the Bored Tunnel Alternative in areas where current access exists; these locations include the Seneca Street off-ramp and the Columbia Street on-ramp in downtown Seattle and the Denny Way ramps near Seattle Center. King County Metro bus services using SR 99 would be affected by the reduced speed limit on SR 99 (40 mph during construction instead of 50 mph), the 25 mph WOSCA detour, and lane restrictions north of Denny Way.

Buses using SR 99 (primarily those that travel between West Seattle/South King County and downtown) and those using the Denny Way ramps north of downtown would experience slightly longer travel times. For buses coming to and from West Seattle, SR 99 would be reduced by one lane and speeds would decrease through the WOSCA detour. Buses that use the Denny Way ramps would also encounter increased congestion. Although transit access routes would be maintained, King County Metro may decide to make routing changes to alleviate effects.

Additional congestion is expected on major north-south transit corridors in the south area, such as Second and Fourth Avenues. The availability of bus-only lanes on these arterials would help to lessen the overall delays to transit service during construction. Delay at the intersection of Second Avenue S. and S. Jackson Street is expected to increase by more than 2 minutes during the PM peak hour.

In the north area, construction on Mercer Street would likely increase congestion and delays at the following locations that are served by transit:

- **Denny Way at Dexter Avenue N. –** Delay of more than 1 minute would be expected during the AM peak hour.

- **Mercer Street at Dexter Avenue N./SR 99 northbound off-ramp –** Delays of more than 5 minutes would be expected during the AM and PM peak hours.

Appendix C, Transportation Discipline Report

Traffic congestion on SR 99 and traffic congestion on surface streets during construction are discussed in *Appendix C, Transportation Discipline Report*, Sections 6.4 and 6.5, respectively.

Additional information on transit and freight traffic during construction is also provided in Sections 6.7 and 6.8, respectively.

Construction effects to transit are discussed in *Appendix C*, Section 6.7.

Cut-and-Cover Tunnel Alternative
Compared to the Bored Tunnel Alternative, the extent of construction-related disruptions from the Cut-and-Cover Tunnel Alternative would be substantially greater for buses traveling through downtown Seattle.

Closing SR 99 for more than 2 years (27 months) would directly affect buses that currently use the Columbia and Seneca ramps to access downtown. Buses that use these ramps come from west and south. In addition, other bus routes operating in the project area, such as those that use the Denny Way ramps to access downtown, would be affected by additional traffic diverting from SR 99 to surface streets, while SR 99 is closed.

When SR 99 is closed, all SR 99 traffic, including buses to and from the south, would exit via temporary ramps at the intersection just west of S. Royal Brougham Way at First Avenue S. The volume of traffic entering/exiting these ramps would cause surrounding intersections to experience long delays (approximately 10 minutes during the morning commute and 6 minutes during the evening commute). Substantial congestion is also expected on major north-south routes that carry high volumes of buses, such as First and Fourth Avenues.

Bus operations will be affected to a greater degree with the Cut-and-Cover Tunnel as compared to the Bored Tunnel. Transit services would experience increased delays at the following intersections with the Cut-and-Cover Tunnel Alternative as compared to the Bored Tunnel Alternative:

- **First Avenue at S. King Street –** Delay would increase by almost 2 minutes during the AM peak hour.
- **First Avenue S. at Yesler Way –** Delay would increase by more than 2 minutes during the PM peak hour.
- **First Avenue S. at Main Street –** Delay would increase by more than 3 minutes during the PM peak hour.
- **First Avenue S. at S. Jackson Street, and First Avenue S. at S. King Street –** Delay would increase by more than 5 minutes during the PM peak hour.
- **First Avenue S. at S. Royal Brougham Way –** Delay would increase by more than 8 minutes during the AM peak hour and more than 7 minutes during the PM peak hour.

When SR 99 is closed, congestion levels through downtown could be similar to peak hour conditions for as much as 10 to 13 hours per day, which would increase travel times for buses.

North of Denny Way, peak hour congestion levels at intersections near on- or off-ramp connections or along affected arterials would potentially increase due to higher concentrations of traffic, similar to the Bored Tunnel Alternative. Transit services would experience increased delays at the following intersections with the Cut-and-Cover Tunnel Alternative as compared to the Bored Tunnel Alternative:

- **Denny Way at Fifth Avenue –** Delay would increase by more than 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Roy Street –** Delay would increase by approximately 1 minute during the AM peak hour.
- **Denny Way at Sixth Avenue and Mercer Street at Westlake Avenue –** Delay would increase by more than 1 minute during the AM and PM peak hours.
- **Mercer Street at Fifth Avenue N., Denny Way at Wall Street, and Dexter Avenue N. at Harrison Street –** Delay would increase by approximately 2 minutes during the PM peak hour.
- **Fifth Avenue N. at Broad Street –** Delay would increase by more than 4 minutes during the PM peak hour.

Elevated Structure Alternative
Transit services would be affected by lane restrictions and changes in access on SR 99 and Alaskan Way during construction of the Elevated Structure Alternative. Bus routes on north-south transit corridors such as Second, and Fourth Avenues could experience increased delay. In addition, routes that leave downtown using the Alaskan Way Viaduct would be rerouted. When compared to the Bored Tunnel Alternative, which would maintain transit access along major transit corridors, construction-related disruptions resulting from the Elevated Structure Alternative would be more severe.

In the south area, congestion at most intersections during the evening commute with the Elevated Structure Alternative would be similar to the Bored Tunnel Alternative. However, when compared to the Bored Tunnel Alternative, delay is expected to increase at the following intersections:

- **Alaskan Way at Yesler Way –** Delay would increase by more than 8 minutes during the PM peak hour.
- **First Avenue S. at Atlantic Street –** Delay would increase by more than 1 minute during the PM peak hour.
- **Second Avenue S. at S. Jackson Street –** Delay would increase by more than 1 minute during the PM peak hour.

King County Metro routes serving West Seattle and south King County would be affected more with construction of the Elevated Structure Alternative than the Bored Tunnel Alternative, because the Seneca ramp to downtown Seattle would be closed and the Columbia Street ramp would be used as a northbound off-ramp to downtown Seattle. Buses travelling south to West Seattle would have to use the ramps on First Avenue S. at S. Spokane Street, while those destined to south King County would need to use the access locations south of S. Spokane Street.

As a result of access changes along SR 99, traffic congestion at intersections in the central area is expected to increase due to greater peak hour volumes, similar to the Bored Tunnel Alternative. The one exception is Alaskan Way at Marion Street. Increased delay is expected at this intersection with the Elevated Structure Alternative as compared to the Bored Tunnel Alternative.

In the north area, construction would affect conditions at intersections near SR 99 and Denny Way. Several bus routes pass through this area. Congestion levels at intersections near the on- or off-ramp connections to SR 99 and along the adjacent streets would potentially increase because of higher concentrations of peak hour traffic. Most of the intersections would experience delays similar to the Bored Tunnel Alternative. However, compared to the Bored Tunnel Alternative additional delay is expected at the following intersections that are served by buses:

- **Denny Way at southbound Aurora Avenue –** Delay would increase by about 1 minute during the AM and PM peak hours.
- **Mercer Street at Fifth Avenue N. –** Delay would increase by more than 2 minutes during the PM peak hours.

8 How would construction affect freight?

Freight mobility and access would be affected by lane closures and traffic congestion during construction for all of the build alternatives. Lane reductions on SR 99 and nearby surface roadways would affect many drivers, including freight operators, and cause increased congestion on alternative routes. Construction vehicles on routes used for hauling construction materials and spoils to and from the south area may also cause delays for some freight traffic. In the south area, the primary route for hauling construction materials would likely include the temporary SR 99 off-ramp to S. Atlantic Street to SR 519 (Edgar Martinez Drive S.) to First Avenue S.

Over-legal loads being transported to the WOSCA construction staging site would likely travel via SR 599 near Boeing Field to West Marginal Way S. to First Avenue S. to the construction site. Over-legal loads traveling within the city are required to obtain a special permit, and appropriate routes are selected by means of the permit approval process. Over-legal loads would likely be allowed to travel on state highways during off-peak hours, from 9:00 p.m. to 5:00 a.m., Monday through Friday, and during all hours on the weekends.

Northbound trucks on East Marginal Way S. would be required to use S. Atlantic Street and the East Frontage Road or First Avenue S., because Alaskan Way S. would be closed from S. Atlantic Street to S. King Street. Many longer-distance freight trips that previously used SR 99 may be diverted to I-5 or shifted to off peak periods because of the expected congestion and reduced speeds on the WOSCA detour.

Freight access to and from Terminal 46 and the Seattle Ferry Terminal at Colman Dock would be maintained during all construction stages. Freight trips from I-5 to the central waterfront would likely use Mercer Street to Fifth Avenue N. and then continue to Broad Street and Alaskan Way.

Preliminary routes designated for hauling construction materials and spoils in the north area include I-5 to Fairview Avenue N. to Denny Way to Sixth Avenue N. to the construction zones, or I-5 to Mercer Street to the construction zones. SR 99 to and from the north would also be available as a potential haul route.

Exhibits 6-12 and 6-13 identify travel time variations between the build alternatives and the 2015 Existing Viaduct for freight vehicles traveling on a major freight corridor, Ballard to S. Spokane Street. Travel times were evaluated during the most disruptive construction stages: Stage 5 for both the Bored Tunnel and Elevated Structure Alternatives, and Stage 4 for the Cut-and-Cover Tunnel Alternative.

Exhibit 6-12
AM Peak Hour Construction-Related Travel Times Along a Major Freight Corridor
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Ballard to S. Spokane Street				
SOUTHBOUND	16	17	45	18
NORTHBOUND	19	21	53	22

Exhibit 6-13
PM Peak Hour Construction-Related Travel Times Along a Major Freight Corridor
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Ballard to S. Spokane Street				
SOUTHBOUND	16	21	42	18
NORTHBOUND	21	23	53	22

Bored Tunnel Alternative

Travel times along the freight corridor between S. Spokane Street and Ballard for the Bored Tunnel Alternative are generally comparable during the morning commute (both directions) to those of the 2015 Existing Viaduct. During construction, it would take about 1 to 2 minutes longer to travel using this route.

During the evening commute, the Bored Tunnel Alternative would increase travel times somewhat relative to the travel times during the morning commute, due to higher demand during the evening commute. In the southbound direction, corridor travel times for the Bored Tunnel Alternative would be about 5 minutes longer than those for the 2015 Existing Viaduct. In the northbound direction, corridor travel times would be 2 minutes longer than those for the 2015 Existing Viaduct.

Cut-and-Cover Tunnel Alternative

When the Cut-and-Cover Tunnel Alternative closes SR 99 and Alaskan Way along the central waterfront, travel times for freight are expected to be much longer than those for the Bored Tunnel Alternative. In both directions during the morning commute, travel times for the Cut-and-Cover Tunnel Alternative would be about 30 minutes longer than those for Bored Tunnel Alternative.

Appendix C, Transportation Discipline Report

Construction effects to freight are discussed in *Appendix C*, Section 6.8.

What is an over-legal truck?

An over-legal truck is one that is oversized or overweight. These trucks are limited to the designated over-legal route along Alaskan Way and Broad Street, or I-5.

Evening commute travel times for the Cut-and-Cover Tunnel Alternative are estimated to take about 20 minutes longer to travel the length of the corridor in the southbound direction, and about 30 minutes longer in the northbound direction compared to the Bored Tunnel Alternative.

Elevated Structure Alternative
Travel times along the freight corridor between S. Spokane Street and Ballard would generally be comparable between the Elevated Structure Alternative and the Bored Tunnel Alternative during the morning and evening commutes. During the morning commute, travel times for the Elevated Structure Alternative would be about 1 minute longer. Travel times during the evening commute would be about 1 to 3 minutes shorter than the Bored Tunnel Alternative.

9 Would ferry traffic be affected?
The Seattle Ferry Terminal at Colman Dock (Pier 52) serves the most customers of any ferry terminal in the State's ferry system. In addition, the adjacent terminal at Pier 50 is home to passenger-only ferry service provided by King County. For all of the build alternatives, access to Colman Dock will be maintained throughout construction.

As planning and design of the project and construction staging progresses, coordination with Washington State Ferries staff will continue to take place to ensure that disruptions or degradations to access to and from the Seattle Ferry Terminal are minimized or avoided. All temporary street-level crossings to the terminal would meet Americans With Disabilities Act (ADA) requirements.

Bored Tunnel Alternative
The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Bored Tunnel Alternative are described below:

- Alaskan Way S. would be closed between S. Atlantic Street and S. King Street in Stages 1 through 7 (approximately 53 months). The permanent alignment would include a new connection for East Marginal Way S. between S. Dearborn Street and S. Atlantic Street.

- Alaskan Way would be reduced to one lane southbound between Yesler Way and S. King Street. To alleviate potential queuing backups on Colman Dock during peak ferry travel periods, a second northbound lane of traffic between Yesler Way and Spring Street would be added, and the signal at Yesler Way/Alaskan Way would be modified to allow left turns out of the ferry terminal.

- Alaskan Way Viaduct demolition would require closing Alaskan Way cross streets two blocks at a time for a period of up to 4 weeks. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.

- Alaskan Way Viaduct demolition would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level. An ADA-compliant alternate route would be provided during construction.

Cut-and-Cover Tunnel Alternative
The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Cut-and-Cover Tunnel Alternative are as follows:

- Alaskan Way would be periodically reduced to one lane for a period of 42 months (3.5 years).

- Alaskan Way would be closed to north-south traffic between S. Atlantic Street and University Street for just over 5 years (63 months).

- Alaskan Way Viaduct demolition would require closing Alaskan Way cross streets two blocks at a time for a period up to 4 weeks. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.

- Alaskan Way Viaduct demolition would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level.

The 5-year closure of Alaskan Way to north-south traffic from S. Atlantic to University Streets with the Cut-and-Cover Tunnel Alternative would likely affect ferry operations much more than the Bored Tunnel Alternative. Ferry traffic coming from the south would need to use Yesler Way via First Avenue S. to access Colman Dock. Traffic volumes on First Avenue S. during Stage 4 of the Cut-and-Cover Tunnel Alternative are expected to be approximately 30 percent higher than those during Stage 5 of the Bored Tunnel Alternative. This added volume is expected to result in more congestion, longer delays, and longer travel times for traffic, including traffic traveling to Colman Dock.

Elevated Structure Alternative
The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Elevated Structure Alternative are as follows:

- Alaskan Way would be periodically reduced to one lane in each direction for a period of about 3 years and completely reduced to one lane in each direction for a period of about 7 years.

- Alaskan Way Viaduct demolition would require closing Alaskan Way cross streets two blocks at a time for a period of up to 4 weeks. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.

- Alaskan Way Viaduct demolition would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another

Appendix C, Transportation Discipline Report

Construction effects to ferries are discussed in *Appendix C*, Section 6.12.

structure is constructed (as part of the project), pedestrians would need to cross at the street level.

Construction of the Elevated Structure Alternative would require reducing Alaskan Way to one lane in each direction for nearly 7 years. This would affect ferry operations more than the Bored Tunnel Alternative. The reduced capacity of Alaskan Way would most likely increase congestion and delay for traffic along the corridor, including traffic traveling to and from Colman Dock.

10 How would event traffic be affected during construction?

Construction activities, roadway restrictions, and periodic lane closures would cause higher levels of congestion in the immediate vicinity of the stadiums and Seattle Center during large events. Travel times into and out of parking facilities during construction are likely to increase for all of the build alternatives. Mitigation measures for traffic are discussed in Chapter 8, Question 9.

Stadium Area

Safeco Field can host up to 47,000 people at a Mariners baseball game, which may translate to roughly 14,000 additional vehicles on local surface streets and highways (based on game-day surveys and traffic counts). Seahawks football games at Qwest Field, although typically held on Sundays, draw even larger crowds and result in greater levels of traffic demand. While a portion of patrons for both types of events travel via ferry or public transit (5,000 to 7,000 persons), the majority of these event-goers are likely to continue to travel via private vehicle and/or carpool.

Event-related detour routes, lane closures, and general traffic management for all transportation modes before and after events would be needed during the construction period for all of the alternatives. Traffic management would be required at entry points to the stadiums, such as the intersection of S. Atlantic Street and First Avenue S. because of substantial vehicle and pedestrian traffic.

Bored Tunnel Alternative

During construction of the Bored Tunnel Alternative, the WOSCA detour would reduce capacity on SR 99 for approximately 4.5 years. The temporary southbound off-ramp at S. Atlantic Street and northbound on-ramp at S. Royal Brougham Way would allow connections similar to existing conditions. Vehicles exiting on the southbound off-ramp at S. Atlantic Street would have to merge with heavy event traffic activity on First Avenue S. or with S. Atlantic Street/SR 519 west of First Avenue S.

The effects of construction activity and changes to ramp access points would potentially result in higher levels of congestion in the immediate vicinity of the stadiums. Therefore, travel times into and out of parking facilities would increase, particularly during large events. SR 99 traffic congestion is not expected to be substantially affected based on the results of preliminary analyses of construction effects because some traffic will divert to alternative routes. Specific pedestrian paths and dedicated barriers through construction areas may be needed to separate non-motorized routes near the stadiums.

Cut-and-Cover Tunnel Alternative

Construction activities for the Cut-and-Cover Tunnel Alternative would have substantial effects on traffic access and circulation to and from the stadiums when SR 99 and Alaskan Way are closed during Stage 4 of construction. Event traffic coming to and from the north would be the most affected and would have to use alternate downtown arterials such as First, Second, and Fourth Avenues or I-5. For event traffic to and from the south, added delays and congestion would occur because of the higher congestion levels on surface streets such as East Marginal Way, First Avenue S., and Fourth Avenue S. Travel times into and out of parking facilities, particularly during large events would increase. Specific pedestrian paths and dedicated barriers through construction may be needed to separate non-motorized routes near the stadiums.

Elevated Structure Alternative

Construction activities for the Elevated Structure Alternative would be the most disruptive to traffic capacity, circulation, and event traffic during Stage 5. Similar to the Bored Tunnel Alternative, the temporary southbound off-ramp to the stadium area would create a high concentration of traffic and congestion at S. Atlantic Street. The northbound on-ramp at S. Royal Brougham Way would potentially lead to backups on the East Frontage Road. In addition, reducing Alaskan Way to a single lane in each direction would shift many event-related trips to First or Second Avenues. The combination of these changes would result in longer delays before and after large events at Safeco Field and Qwest Field. Specific pedestrian paths and dedicated barriers through construction may be needed to separate non-motorized routes near the stadiums.

Seattle Center

Based on data collected in 2007 and 2008, more than 5,000 events are documented annually at Seattle Center, with the largest concentrations of people and traffic occurring during major Key Arena events such as high-profile concerts, Seattle Storm playoff basketball games, and large-scale weekend festivals. Attendance at regional events such as Bumbershoot, the Northwest Folklife Festival, and the Bite of Seattle has been shown to reach up to 60,000 persons per day. Peak loads may approach 17,000 person-trips for a Key Arena event and as high as 200,000 person-trips during a festival weekend such as the Northwest Folklife Festival or Bumbershoot. Construction activities in the north area for all of the alternatives could cause disruptions to these large events at Seattle Center due to temporary lane closures, detours, and access modifications to SR 99 ramps, especially during early stages of the Mercer Street construction.

A wide range of measures related to signage, signal timing and operations, road closures, and detours would be critical for maintaining reasonable levels of traffic flow and circulation near Seattle Center during major events, particularly onto and off of SR 99. Flaggers or police details at key intersections may also be needed during major events at Seattle Center to establish clear event way-finding routes and detours, including turn restrictions. In addition, Seattle Center's 50th Anniversary celebration will

Appendix C, Transportation Discipline Report

Construction effects to event traffic are discussed in *Appendix C*, Section 6.14.

be held from April to October 2012 and may require additional mitigation measures due to potentially higher-than-average patronage. Ongoing coordination with Seattle Center would help identify issues and target specific potential mitigation measures as needed.

Bored Tunnel Alternative

Construction activity in the north area for the Bored Tunnel Alternative could cause major disruptions to these large events at Seattle Center. These disruptions should be reasonably well managed because the access ramps and mainline SR 99 will be open. During the most disruptive stage (Stage 5), the primary effects to event traffic would likely be related to lane restrictions on SR 99 and, to a lesser degree, the temporary absence of east-west connections across SR 99 on arterials between Denny Way and Mercer Street. Travel times to and from Seattle Center during construction are expected to increase.

Cut-and-Cover Tunnel Alternative

Construction effects on local circulation and traffic access to and from Seattle Center during the most disruptive stage (Stage 4) of the Cut-and-Cover Tunnel Alternative would be substantial, because SR 99 and Alaskan Way would be closed. Seattle Center traffic coming from or traveling to the south would be the most affected and would have to use downtown surface streets or I-5. Event traffic to and from the north would also be affected due to added congestion on surface streets such as Mercer Street, Roy Street, and Fifth Avenue.

With SR 99 closed, greater coordination between Seattle Center, the Seattle Department of Transportation, and the Seattle Police Department would be needed to identify issues and target specific potential mitigation measures for event traffic than for the other alternatives.

Elevated Structure Alternative

The effects on event traffic to Seattle Center for the Elevated Structure Alternative would be most noticeable during Stage 5. Impacts to access and circulation in the north area would be substantial because of the closure of southbound SR 99 into the Battery Street Tunnel and the temporary Broad Street detour. Alaskan Way would also be reduced to a single lane in each direction, forcing some event goers to other surface streets such as First and Fourth Avenues. The northbound Western Avenue off-ramp from SR 99 is expected to be open during this stage of construction providing Seattle Center traffic with more than one route. Post-event traffic to the south on SR 99 would be required to travel on the Broad Street detour. Event traffic to and from the north would be adversely affected because of the Broad Street detour and added congestion levels on surface streets such as Mercer Street, Roy Street, and Fifth Avenue N.

11 How would bicyclists and pedestrians be affected during construction?

The effects to bicycles and pedestrians during construction would be similar for all alternatives and are discussed below. However, these effects would last for a longer period of time with the Cut-and-Cover Tunnel and Elevated Structure Alternatives than they would for the Bored Tunnel Alternative.

For safety, bicyclists and pedestrians would be routed around construction zones. During construction, sidewalks and trail facilities would be closed for short periods of time due to utility relocations, construction activities, demolition, and street restoration. To maintain bicycle and pedestrian mobility and accessibility, the duration of the temporary closures would be minimized to the extent practical. As part of the traffic management plan, construction mitigation discussed in Chapter 8, Question 9 will include identifying accessible routes to accommodate persons with disabilities. The location and duration of temporary closures will be determined during final design.

Bicyclists riding in the street may face increased potential for conflicts with vehicles, due to increased traffic volumes, lane restrictions, and reduced space to maneuver on some streets. In particular, First Avenue S., Fourth Avenue S., Denny Way, and Dexter Avenue N. are expected to carry increased volumes of traffic during construction.

South Area

Bicycle and pedestrians access would be maintained on the Port Side Pedestrian/Bike Trail on the western edge of the project area, which runs adjacent to the Port of Seattle facilities. The City Side Trail, which will be constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, may be detoured slightly during construction of this project before being constructed in its final location.

For all of the alternatives in the south area, bicyclists would have the option of continuing to use First Avenue S., using the Port Side Pedestrian/Bike Trail on the western edge of the project area, or diverting to Occidental Avenue S. Depending on their origin or destination, bicyclists may choose to travel on Fourth Avenue S., sharing the roadway with other vehicles but avoiding construction activities in the south portal area. The existing in-street bicycle lanes on Second and Fourth Avenues through downtown would be maintained throughout the construction period.

East-west bicycle travel between S. King Street and S. Atlantic Street would be restricted during nearly all traffic stages, but the bicycle lanes along S. Royal Brougham Way would remain accessible.

Pedestrians would encounter intermittent sidewalk closures on First Avenue S. from S. Royal Brougham Way to S. Jackson Street, as well as additional traffic due to the closures on Alaskan Way. When these sidewalks are closed, pedestrians may be routed to sidewalks on the opposite side of the roadway or they may be required to detour to parallel roadways.

Central Area

Bicycle and pedestrian access would be maintained to the central waterfront during all stages of construction for all of the build alternatives, regardless of whether Alaskan Way is closed or restricted. Bicyclists would experience increased congestion and delays along with vehicle traffic when Alaskan Way is restricted. For the Cut-and-Cover Tunnel Alternative, bicycles would not be able to travel north-south on this surface street when Alaskan Way is

Appendix C, Transportation Discipline Report

Construction effects to pedestrians and bicyclists are discussed in *Appendix C*, Section 6.10 and 6.11, respectively.

closed. East-west crossings would be provided for bicycles and pedestrians but would periodically change due to construction needs and work locations. When viaduct demolition activities are taking place, access to the waterfront could become slightly more circuitous as areas under the viaduct are temporarily closed due to demolition.

From Second Avenue to Sixth Avenue along both sides of Battery Street, bicycle and pedestrian facilities would experience intermittent detours and sidewalk closures due to construction activities proposed for the Battery Street Tunnel. The Bored Tunnel Alternative would have fewer effects to these streets that the Cut-and-Cover Tunnel or Elevated Structure Alternative, since proposed construction activities are more extensive with these alternatives.

North Area

Bicycle and pedestrian facilities and access in the north area would experience intermittent detours and sidewalk closures during construction, particularly on the east side of SR 99 around construction staging areas. Bicycles and pedestrians would be detoured when Sixth Avenue N. between Thomas and Broad Streets and Harrison Street between SR 99 and Sixth Avenue N. are closed or restricted by construction activities.

Bicyclists would generally face the same lane reductions and closures as other traffic in the north area. The in-street bicycle lanes on Dexter Avenue N. would be maintained during construction; however, increased traffic volumes on Dexter Avenue N. and other parallel facilities may increase the potential for automobile and bicycle conflicts.

East-west bicycle and pedestrian travel on Mercer and Broad Streets would be restricted at times during construction activities. East-west pedestrian mobility in this area is already challenging due to limited crossings of SR 99. Particular attention would be focused on minimizing the duration of closures and out-of-direction travel by maintaining sidewalk facilities on the opposite side of the roadway. Sidewalks on SR 99 may be closed during construction of the Mercer Street overcrossing of SR 99.

OTHER TEMPORARY CONSTRUCTION EFFECTS

12 How would soil and contaminated materials be handled and removed during construction?

All of the alternatives would excavate soil and material to relocate utilities and construct foundations. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would also excavate soil to build retained cuts and tunnel sections. Excavated materials may be contaminated, which would require special handling and disposal. Exhibit 6-14 shows the estimated volume of excavated material and the amount of that material that may be potentially contaminated. All of the build alternatives have been designed to avoid contamination where possible.

Exhibit 6-14
Excavated and Contaminated Soil Volumes
cubic yards

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Excavated Material	1,573,500	2,007,000	806,000
Potentially Contaminated Material	1,451,000	1,437,000	660,920

Excavated material would be hauled away by trucks or railcars, or at the south area may be conveyed to a barge at Pier 46, the northern edge of Terminal 46. The conveyer would be located within the construction staging areas and would, therefore, not affect traffic patterns or business access in the area. Materials would be removed to a predetermined site. Excavated materials that are barged would likely be disposed of at the Mats Mats Quarry, near Port Ludlow in Jefferson County, Washington. Trucks will be required to follow City-designated truck routes and could cause increased congestion and delay on these routes. In the south area, the primary route for trucks to haul excavated materials would be the temporary SR 99 off-ramp to S. Atlantic Street to First Avenue S. to SR 519 (Edgar Martinez Drive S.). Routes being considered for hauling excavated material in the north portal area include I-5 to Fairview Avenue N. to Denny Way to Sixth Avenue N. to the construction zone. SR 99 to and from the north is also available as a potential haul route.

There are six general types of contamination found in the project area:

- **Oil –** mid- to heavy-range petroleum hydrocarbons
- **Gasoline**
- **Metals –** such as arsenic, chromium, lead, and mercury
- **Solvents –** such as trichloroethylene and tetrachloroethylene
- **Polychlorinated biphenyls (PCBs)**
- **Polycyclic aromatic hydrocarbon (PAHs) –** associated with oil and creosote-treated timbers

In the south area from S. Royal Brougham Way to S. King Street, wood debris could be encountered, including creosote-treated timbers that are a source of PAHs. Fill in the south area may also contain petroleum and metals. The contaminants most commonly found in the area north of Denny Way are gasoline, petroleum (diesel), and solvents associated with past site uses.

Construction activities would likely result in several types of potential effects related to hazardous materials:

- Spoils containing contaminated soil and debris would be removed.
- Contaminated groundwater would be extracted during dewatering activities.
- Air quality near the project area could be affected by the release of contaminants and dust during construction.

In addition, for all alternatives groundwater pathways could be modified due to subsurface construction activities, which could spread groundwater contaminants. The potential for groundwater pathways to be modified is higher for the tunnel alternatives than for the Elevated Structure Alternative, since the tunnel alternatives require more subsurface construction.

Appendix P, Earth Discipline Report and Appendix Q, Hazardous Materials Discipline Report

Additional information on the geologic setting, soils, and hazards in the project area is provided in *Appendix P*. Information about contamination that could be encountered during construction is provided in *Appendix Q*.

Properties with Contaminated Sites

The number of sites where contamination has a moderate or high potential to impact the project are shown in Exhibit 6-15. A majority of the sites are associated with former railroad operations, metal works, a junkyard, gas stations, and dry-cleaning operations. In addition to these parcels, temporary construction easements and temporary tieback easements would also be acquired for each of the alternatives.

Exhibit 6-15
Sites with Moderate or High Potential of Contamination

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Number of partially and fully acquired parcels[1] with contaminated sites	13	40	35
Number of validated sites[2] with a **moderate** potential impact	18	26	39
Number of validated sites[2] with a **high** potential impact	4	6	6

1 *More than one contaminated site may be located on a parcel*
2 *Validated sites are categorized as having a "high," "moderate," or "low" potential to adversely affect the project, as defined by WSDOT.*

With the Cut-and-Cover Tunnel and the Elevated Structure Alternatives, one site in the central area and five sites in the north area would pose a high potential impact on the project because of potential contamination. With the Bored Tunnel Alternative, four sites located in the north area could have a high potential impact on the project. Two of these sites are owned by the City. The site investigations that have been conducted before construction begins reduce the risk of adverse effects for these sites.

Bored Tunnel Alternative

The quantity of excavated material is estimated to be 1,573,500 cubic yards, which includes material generated during viaduct demolition as shown in Exhibit 6-16. For the south and north areas, the material to be excavated or generated would come from the retained cut section as the roadway transitions from the surface to below grade, cut-and-cover sections, soil improvements, the tunnel operations building, and tunnel boring machine (TBM) launch or retrieval pit. Tunnel boring would excavate about 900,000 cubic yards of material and generate approximately 49,000 cubic yards of spoils from jet grouting above the tunnel to strengthen soils.

Exhibit 6-16
Excavated Material for the Bored Tunnel Alternative
in cubic yards

	Excavated Material	Amount Potentially Contaminated
South Area	284,500	208,500
Bored Tunnel	949,000	949,000
Viaduct Removal	107,000	107,000
North Area	233,000	160,500
Total	**1,573,500**	**1,451,000**

The maximum daily volume of soil that could be excavated in north and south areas is estimated to be approximately 2,800 cubic yards. This is the equivalent of approximately 4,000 to 5,000 tons of soil. The volume of spoils from the bored tunnel would likely range between 3,900 and 6,600 tons per day, assuming that the TBM advances 30 to 50 feet per day. As shown in Exhibit 6-16, much of the excavated material is potentially contaminated. Waste handlers for problem waste estimate that they can accept approximately 5,000 tons of soil per day for disposal at a RCRA Subtitle D landfill that has no restrictions on levels of contamination, organic content, and pH level, as long as it is not considered dangerous waste. Although the estimates indicate substantial spoils disposal volumes, coordination and budgeting for disposal in advance would help to manage the spoils disposal issue. For temporary storage, soil could be stockpiled at proposed staging areas in the south end of the project area shown previously in Exhibit 3-8. More than one waste disposal company may be used to address the volume of soil requiring disposal. Potential effects from construction activities to remove, stockpile, and transport spoils would be minimized or prevented through proper selection and implementation of best management practices (BMPs).

Dewatering would likely be required for the cut-and-cover tunnel sections of the Bored Tunnel Alternative, retained cuts, and deep excavations for the tunnel operations buildings. Water from dewatering would be discharged to the sewer system or it would be reinjected to mitigate the potential effects of dewatering, including settlement of structures and changes to groundwater flow. No dewatering water would be discharged directly to Elliott Bay. Water that is discharged to the combined sewer could require treatment before discharge to comply with the conditions of the King County Wastewater Discharge Permit or Authorization. Water that does not comply would be disposed of off-site. Off-site disposal may also be necessary if the volume of water exceeds the permitted discharge limits or if King County specifically requests discharges to cease. Dewatering water that is directly reinjected could not degrade groundwater quality. The dewatering systems would be designed to minimize drawdown of the water table. This would reduce the volume of groundwater requiring treatment and disposal. It would also reduce the potential for mobilization and spreading of groundwater contaminants in the project area.

Battery Street Tunnel Decommissioning

The Battery Street Tunnel would be decommissioned as part of the Bored Tunnel Alternative. As part of the decommissioning process, proper management and disposal of debris would be required. Any hazardous materials present in the tunnel would need to be removed before decommissioning.

One possible decommissioning option includes partially filling the tunnel with the concrete debris recycled from the viaduct demolition. The remainder of the empty space in the tunnel would then be filled with controlled-density fill. The demolition debris would be appropriately managed and handled to address the specific environmental hazards associated with concrete rubble, including an elevated pH. In addition, necessary regulatory permits and approvals would be procured if they are determined to be necessary to perform this type of construction activity.

Cut-and-Cover Tunnel Alternative

The quantity of excavated material is estimated to be 2,007,000 cubic yards, as shown in Exhibit 6-17. For the south and north areas, the material excavated or generated would come from the retained cut section as the roadway transitions from the surface to below grade, cut-and-cover sections, soil improvements, and the tunnel

Appendix Q, Hazardous Materials Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in *Appendix Q*, Chapter 2. The discipline report includes additional information on the subsurface explorations conducted in the project area in Chapter 3.

Appendix Q, Chapter 4 contains exhibits for each of the alternatives displaying sites with documented and potential contaminant releases.

operations building. The materials excavated or generated along the central waterfront include viaduct demolition, and in the north waterfront include jet grouting for the seawall. Because the outer wall of the cut-and-cover tunnel would replace the seawall, only the south area and area north of Union Street to Broad Street would require soil improvement. Improvements in the Battery Street Tunnel include lowering the floor, extending the tunnel walls below their current base, and constructing emergency egress facilities.

Exhibit 6-17
Excavated Material for the Cut-&-Cover Tunnel Alternative
in cubic yards

	Excavated Material	Amount Potentially Contaminated
South Area	197,000	151,000
Central Area[1]	1,235,000	863,000
Battery Street Tunnel	80,000	33,000
North Area	272,000	170,000
North Waterfront[2]	223,000	220,000
Total	**2,007,000**	**1,437,000**

1 The Central Area includes the material generated from viaduct demolition.
2 The North Waterfront includes the area on Alaskan Way between Pike Street and Broad Street.

Construction of the cut-and-cover tunnel and seawall along the central waterfront would occur in an area that has already been filled. An elevated railroad trestle and/or elevated wood-plank road were constructed along the former waterfront; consequently, the former ground surface may have been contaminated with low concentrations of petroleum due to small releases from the rail cars and/or vehicles. In addition, creosote-treated timbers may have been used to support the former trestles and piers, and contamination from these timbers likely leached into the adjacent soil.

The way contaminated materials are stored and removed and the volumes waste handlers can accept are the same as described for the Bored Tunnel Alternative.

Dewatering along the waterfront tunnel would be accomplished using a series of dewatering wells installed both within the area to be excavated and below the bottom elevation of the excavation. The presence of hydrogen sulfide is documented at the intersection of University Street and Alaskan Way. Groundwater removed from this area may contain high levels of hydrogen sulfide that would necessitate treatment before discharge.

Elevated Structure Alternative

The quantity of excavated material is estimated to be 806,000 cubic yards, as shown in Exhibit 6-18. The Elevated Structure Alternative would generate the same 107,000 cubic yards of material for viaduct demolition as the other build alternatives. In the south end, some of the materials excavated or generated would be from soil improvements. Soil improvement for the Elevated Structure Alternative would occur along the southern and central portions of the alignment near the waterfront and continue north to Broad Street as part of the seawall replacement. Improvements to the Battery Street Tunnel include excavation to extend the tunnel walls below their current base and to build egress facilities. In north areas, the material to be excavated or generated would be the same as for the Cut-and-Cover Tunnel Alternative.

Exhibit 6-18
Excavated Material for the Elevated Structure Alternative
in cubic yards

	Excavated Material	Amount Potentially Contaminated
South Area	84,000	66,000
Central Area[1]	95,000	77,000
Battery Street Tunnel	34,000	27,000
North Area	272,000	170,000
North Waterfront[2]	321,000	320,000
Total	**806,000**	**660,000**

1 The Central Area includes the material generated from viaduct demolition.
2 The North Waterfront includes the area on Alaskan Way between Pike Street and Broad Street.

13 Would settlement during construction affect surrounding areas?

Settlement could occur for all alternatives during construction. Activities such as pile driving, sheet pile installation, or stone column installation could cause vibration resulting in soil or utilities settling. Relocating utilities would require trenching and dewatering. Improper trenching and dewatering techniques could lead to settlement and lateral movement of adjacent facilities.

Settlement would be a greater concern for the tunnel alternatives. The Cut-and-Cover Tunnel Alternative could cause lateral movement of settlement where cuts and excavation occur. The Bored Tunnel Alternative could cause ground loss and settlement above the TBM if adequate measures have not been taken in advance to control groundwater and soil inflow.

Any settlement from construction of the build alternatives is expected to be minor. Some uneven settlement may cause minor cracks in the pavement and sidewalks adjacent to the construction area. Pavement damage would be repaired by temporary overlay of asphalt pavement for use by traffic until the final pavement surface can be placed. Damage to items on the surface streets, such as trees, manholes, drains, and signals are expected to be minor and would be repaired. The streets and sidewalks would be permanently repaired where needed once construction is completed and no further settlement is occurring.

Bored Tunnel Alternative

Settlement from tunnel boring could affect nearby surface streets, various utilities (including traffic signals), and buildings over the proposed bored tunnel alignment. Effects would vary depending on soil conditions, tunnel depth, and other variables. Settlement at the surface is anticipated to be less than an inch over the tunnel for most of the alignment. The area where settlement is of the most concern is located between the south portal and Yesler Way where the TBM would begin boring in relatively shallow fill material. The excavation at the face of the TBM would be performed with positive pressure acting at the face to prevent soil from moving. From about S. Main Street to about S. Washington Street, drilled shafts would be installed only along the east side of the tunnel to mitigate potential viaduct settlement.

Any surface settlement would generally occur incrementally as the TBM advances, with some final settlement occurring over several weeks.

Potentially affected historic buildings would be monitored for settlement effects as listed in the Memorandum of Agreement, which is included as Attachment C of Appendix I, Historic, Cultural, and Archaeological

Settlement Effects to Historic Buildings

Settlement effects to historic buildings are discussed in **Question 20** of this chapter.

Discipline Report. Where needed, protective measures such as compensation grouting or compaction grouting would be used during tunnel boring to prevent or limit damage to buildings and utilities from settlement. Experience in Europe indicates that these measures control settlement to within 22 millimeters (less than 1 inch).[1] The use of these measures is expected to prevent damage to most buildings.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would construct retained cut sections at the tunnel portals on the waterfront and at the south end of the Battery Street Tunnel, as well as the cut-and-cover section along the waterfront. A large amount of material would be excavated from these areas. Where the cuts are near existing roadways, railways, structures, or utilities, lateral movement or settlement of these structures or utilities could occur if the retaining wall is not constructed properly. Excavation in the Battery Street Tunnel would require adequate shoring to avoid lateral ground movement. Jet grouting would be performed below and behind the existing seawall to rebuild the seawall and mitigate liquefaction between Union and Broad Streets. If not controlled properly, lateral movement and settlement could occur.

Elevated Structure Alternative

For the Elevated Structure, settlement could occur during soil improvements, retrofit of the section between Virginia Street and the Battery Street Tunnel, and excavation in the Battery Street Tunnel.

Soil improvement may be performed beneath or around foundations to stabilize soft soils and mitigate potential liquefaction. Jet grouting would be performed below and behind the existing seawall to rebuild the seawall and mitigate liquefaction. If not controlled properly, lateral movement and settlement could occur.

Depending on the retrofit method used between Virginia Street and the Battery Street Tunnel, installation adjacent to or underneath the existing viaduct footings could cause loosening of the soil, which could contribute to settlement and lateral movement of the existing footings. Excavation in the Battery Street Tunnel would require adequate shoring to avoid lateral ground movement.

14 How would construction affect noise levels?

Noise during construction would be disruptive to nearby residents and businesses, because it would make it unpleasant to be outside and hard to hold conversations. Construction could occur up to 24 hours a day, 7 days a week depending on the construction activity and will be determined during final design. A Noise Management and Mitigation Plan that establishes specific noise levels that must not be exceeded for various activities is described in Chapter 8, Mitigation. WSDOT will implement measures to minimize nighttime and weekend construction noise if it exceeds the local ordinance noise levels (except in the case of emergency) during the hours between 10:00 p.m. and 7:00 a.m. on weekdays, or between 10:00 p.m. and 9:00 a.m. on weekends and legal holidays.

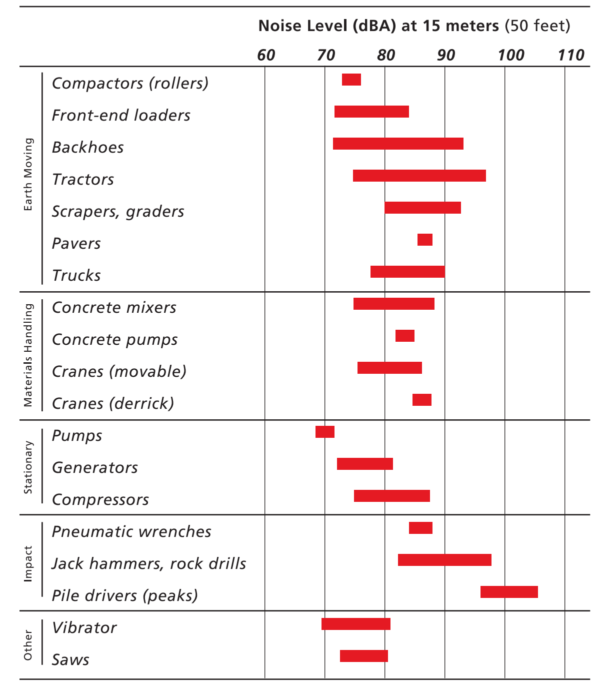
The Bored Tunnel Alternative would have fewer noise effects than the Cut-and-Cover Tunnel or Elevated Structure Alternatives because more of the major construction activities would occur underground and the duration of construction is shorter.

Construction noise levels for all of the alternatives may exceed City noise level limits at 50 feet or the nearest property line (whichever is farther) and require a variance from the City. Nighttime noise level limits would be the same or less than the daytime noise level limits. A construction noise control program, described in Chapter 8, Question 11, would be implemented to reduce construction noise effects.

Noise levels would depend on the type, intensity, and location of construction activities. For all alternatives, the most common noise sources during all stages of construction would be machine engines such as bulldozers, cranes, generators, and other earth- and material-moving equipment. Temporary large-scale stationary equipment or structures could be located at the WOSCA staging area.

Typical noise levels from construction equipment for all build alternatives would range from 69 to 106 A weighted decibels (dBA) at 50 feet as shown in Exhibit 6-19. By comparison, the project area is currently noisy, with peak hour average daytime sound levels that range from 61 to 80 dBA.

Exhibit 6-19
Typical Construction Equipment Noise Levels



Source: EPA 1971 and WSDOT 1991

Because various pieces of equipment would be turned off, idling, or operating at less than full power at any given time and because construction machinery is typically used to complete a short-term task at any given location, average daytime noise levels would be less than the maximum noise levels shown in Exhibit 6-19. The majority of construction activities would fall within the range of about 75 to 95 dBA at 50 feet. Noise at the upper end of this range would be annoying and could interfere with nearby residents and businesses. Some construction activities like impact pile driving could reach levels just over 100 dBA at 50 feet. Pile driving is not currently proposed and would be used only in instances where less disruptive techniques are not available. The only locations where pile driving may be used are for the cut-and-cover sections near the portals for the Bored Tunnel and Cut-

Appendix F, Noise Discipline Report

Additional information about the effects of noise and vibration during construction is provided in *Appendix F*, Chapter 6.

What is dBA?

Sound levels are expressed on a logarithmic scale in units called decibels (dB). A-weighted decibels (dBA) are a commonly used frequency that measures sound at levels that people can hear.

A 2-dBA change in noise levels is the smallest change that can be heard by sensitive listeners.

1 Littlejohn 2009.

and-Cover Tunnel Alternatives. In contrast, the operation of stationary equipment (such as pumps, generators, and compressors) would have sound levels that are fairly constant over time.

Bored Tunnel Alternative
Construction noise would mostly affect areas adjacent to the south and north portals during the 5.4-year (65-month) construction period. The most common source of construction noise would be machine engines, such as bulldozers. In both the north and south portal areas, there would be noise from constructing retaining walls, cut-and-cover sections, and new surface streets. Construction noise levels would change and occur at different times over the 5.4-year construction period throughout the project area.

Noise from tunnel boring operations would occur at the staging areas where the muck generated by boring would be treated, stored, and removed. Noise at the staging areas could also potentially include effects from a temporary concrete batch plant and hopper cars or conveyers to move spoils and muck. The noise may be disruptive to nearby residents and businesses ranging from 69 to 106 dBA at 50 feet, as shown previously in Exhibit 6-19. The TBM would also produce some ground-borne noise, but due to the depth of the machine and the ambient noise levels in the area, the noise would not be noticeable at building level except near the tunnel portals.

Removing the viaduct between S. King Street and the Battery Street Tunnel would take about 9 months and would be the loudest construction activity. Demolition would occur in two-block segments at two locations at a time and is expected to last no more than 4 weeks per segment. The noise would be disruptive to nearby residents and businesses.

Noise associated with construction activities to fill and decommission the Battery Street Tunnel could also be disruptive to nearby residents and businesses. This activity would occur during the same 9-month time period as the viaduct removal.

Cut-and-Cover Tunnel Alternative
Construction noise levels in the south and north areas, and for viaduct demolition, would be similar to the Bored Tunnel Alternative, but the Cut-and-Cover Tunnel Alternative's construction duration would last for 8.75 years.

Along the central waterfront, construction noise effects with the Cut-and-Cover Tunnel Alternative would be more severe than for the Bored Tunnel Alternative. This is because construction activities for the cut-and-cover tunnel and seawall would occur at or near the surface along Alaskan Way. As a result, construction equipment noise for nearby residents and businesses would be higher and more prolonged.

Improvements to the Battery Street Tunnel, including constructing new emergency egress structures near Second, Third, Fourth, and Sixth Avenues would cause construction noise levels that may exceed City noise level limits and disturb the people nearby.

Elevated Structure Alternative
Although the construction activities would differ, the construction noise levels in the south and north areas for the Elevated Structure Alternative would be similar to both the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. However, construction of the Elevated Structure Alternative would last the longest, approximately 10 years. Noise associated with the majority of construction activities for the Elevated Structure Alternative would be disruptive to nearby residents and businesses for a longer period of time than the other build alternatives.

Along the central waterfront, construction of the Elevated Structure Alternative would take place mostly at the surface or above ground. Because of this, the noise effects would be more severe.

Noise levels during viaduct demolition would be similar to the other alternatives, although the Elevated Structure Alternative would demolish the upper and lower levels of the viaduct at different times rather than at once.

Construction of the Battery Street Tunnel improvements would have similar effects on noise levels as the Cut-and-Cover Tunnel Alternative.

15 Would vibration during construction affect surrounding areas?

Construction activities that would cause the highest levels of vibration are viaduct demolition and the use of impact equipment, such as jackhammers and pile drivers. Buildings along the alignment for each alternative would be evaluated on a case-by-case basis during final project design to determine what specific mitigation measures are needed to minimize vibration and potential damage to older, fragile buildings.

Viaduct demolition and removal in locations adjacent to existing buildings would use concrete munchers to control the size and dispersion of concrete debris. In other areas, the viaduct could be demolished using various methods of concrete removal. The use of jackhammers and hoe rams would cause the highest levels of vibration during demolition.

Vibration from other construction activities can be reduced by either restricting their operation to predetermined distances from historic structures or other sensitive receivers (such as sensitive utilities), or using alternative equipment or construction methods. Vibration monitoring will be required at the nearest historic structure or sensitive receiver within 300 feet of construction activities. The monitoring data will be compared to the project's vibration criteria to ensure that ground vibration levels do not exceed the damage risk criteria for historic and non-historic buildings and sensitive utilities. The total number of buildings requiring monitoring will be determined during final design.

The only proposed construction activity that would generate vibration levels that could damage utilities is impact pile driving. Pile driving would be performed only when other methods will not work. Utilities less than 25 feet and older cast-iron water mains less than 100 feet from impact pile driving locations would be evaluated

Vibration Effects to Historic Buildings

Vibration effects to historic buildings are discussed in **Question 19** of this chapter.

during final design to determine whether mitigation is needed.

For the Bored Tunnel Alternative, the TBM would also produce some ground vibration. Between S. Royal Brougham Way and S. Main Street, a perimeter of secant piles would be constructed to isolate the TBM as it begins boring. Once the TBM is north of S. Main Street, the vibration levels would not be noticeable at building level and would not pose a damage risk to buildings due to the depth of the machine and the noise levels along the surface streets. The risk of construction vibration damaging underground and buried utilities would generally be less than the risk of damaging buildings.

16 How would views be affected during construction?

The temporary affects to views during construction would be similar in many ways for the build alternative but would occur for different lengths of time. Views would be affected for about 5.4 years with Bored Tunnel Alternative, 8.75 years with Cut-and-Cover Tunnel Alternative, and 10 years with Elevated Structure Alternative.

Views for drivers and pedestrians during construction would include elements common to construction activities, including staging areas, heavy equipment, scaffolding, cranes, trucks, temporary materials storage and temporary noise barriers. The south area is expected to have extensive staging on the WOSCA property for equipment and materials for all of the alternatives. For all alternatives, the WOSCA site would also be used for a traffic detour and construction offices and possibly a concrete batch plant. These elements would be visible from nearby streets that do not have temporary noise barriers. Temporary noise barriers are planned on the eastern side of the WOSCA property extending from S. Royal Brougham Way to Railroad Way S. and on the south side of S. King Street. The barriers would be 16 feet high and would block views from adjacent streets.

For all of the build alternatives, views will change as construction progresses. Some heavy equipment and elements such as scaffolding would be needed only during a portion of the construction period. Many pieces of equipment would also move as the construction stages and activities progress.

During viaduct demolition, construction equipment and materials would be prominent in street views and could look similar to the photograph shown in Exhibit 6-20. Normal streetscapes would be disrupted with fencing, cranes and other equipment, vehicles, and general construction activity. Views under the viaduct would be interrupted by fencing, construction equipment, and materials.

Bored Tunnel Alternative

Construction of the bored tunnel section would not have visual effects because the tunneling activities would occur below grade or at the portals. At both the WOSCA property in the south end and the north end construction staging areas, views would include construction pits and equipment needed to launch and extract the TBM. For the Bored Tunnel Alternative, views of the WOSCA staging area could also include activities related to assembling and launching the TBM and interior tunnel structures, materials stockpiles and materials transfer to trucks or barges, and a temporary electrical substation to support the TBM. At the north portal, a temporary noise barrier 16 feet high on the north side of Thomas Street and Sixth Avenue N. would block views into the construction site.

Cut-and-Cover Tunnel Alternative

The construction of the Cut-and-Cover Tunnel Alternative would involve a large open cut along the central waterfront that would be open in stages. Temporary east-west pedestrian bridges would maintain access to waterfront piers during construction. Views from the piers on the west side of the corridor would include a variety of equipment, vehicles, and construction activity.

Elevated Structure Alternative

Construction of the Elevated Structure Alternative would be built in sections with traffic maintained on portions of the old and new structures. Normal streetscapes near the viaduct would be disrupted with fencing, cranes and other equipment, construction vehicles, and general construction activity. Seawall construction would also add construction equipment along Alaskan Way.

The Broad Street detour would construct a temporary aerial structure in the Broad Street right-of-way starting at Western Avenue that would continue to the west over Elliott Avenue, the BNSF Railway tracks, and Alaskan Way S. This structure would have temporary visual impacts on the Olympic Sculpture Park and other adjacent properties, as shown in Exhibit 6-4. This aerial structure would be approximately 30 to 35 feet high. Views to the south of the waterfront and Mount Rainier may be somewhat obscured for pedestrians and others using the Olympic Sculpture Park.

17 Would temporary construction easements or relocations be needed during construction?

To facilitate the construction, each of the alternatives would need temporary tieback and construction easements. Temporary tieback easements would be needed for shoring that would be used to construct the permanent walls below the surface.

Construction easements allow the temporary use of a property to facilitate construction and may include the purchase of existing improvements. Temporary construction easements may also be used for implementing the settlement mitigation measures in or under the buildings (e.g., building modifications and grouting).

If any occupants are displaced, they would be compensated and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and the Washington Relocation Assistance – Real Property Acquisition Policy Act of 1970, as amended.

Bored Tunnel Alternative

Temporary tieback easements would be needed on the Port of Seattle's Terminal 46 property in the south portal

Appendix D, Visual Quality Discipline Report

Additional information about construction effects on visual quality is provided in Chapter 6 of *Appendix D*.

Demolition during the first phase of SR 519 project. Photo courtesy of WSDOT.

What is a tieback easement?

A temporary tieback easement allows for temporary use of a property below the surface for a wall shoring system that would be used to build a permanent wall and may be abandoned after the permanent wall is constructed. The tiebacks in the temporary easement areas would be removed or the tension released after construction is completed.

Appendix G, Land Use Discipline Report

All of the properties where temporary tieback easements or construction easements would be needed are indicated in *Appendix G*, Chapter 6. *Appendix G* also provides additional information about construction effects on land uses.

area and three properties in the north portal area along Sixth Avenue N. near Thomas Street.

Temporary construction easements would be needed on 31 properties for the Bored Tunnel Alternative. Twenty-one of these properties are in the approximate area between Western Avenue and First Avenue, and Yesler Way and Union Street. The other 10 properties are in the north portal area. Six affected properties are parking lots that are privately owned pay parking lots between Yesler Way and Marion Street, with one other parking lot between Spring Street and Seneca Street. Some or all of the parking would be removed during the 9 month viaduct demolition period. As a result, businesses and residents that rely on these parking areas may be temporarily inconvenienced. This could result in drivers looking for parking spaces several blocks farther from their destinations, or using pay lots.

In addition, in the central section, about 84 tenants of the Western Building would be relocated. The building would be unavailable for 12 to 20 months during the construction period. Most of the tenants of this building are artists that use the building for studio or workspace. WSDOT is actively working and supporting the efforts of the artists to find replacement accommodations, either nearby in the Pioneer Square neighborhood, if feasible, or other locations in the greater Seattle area where the individual artists may choose to relocate. Relocation assistance would be provided in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, and the Washington Relocation Assistance – Real Property Acquisition Policy Act of 1970, as amended.

Cut-and-Cover Tunnel Alternative

Twenty-seven temporary tieback easements for the Battery Street Tunnel improvements would be needed with the Cut-and-Cover Tunnel Alternative.

Temporary construction easements would be needed on three properties in the north area. Two of the affected properties are currently used for parking and one is a commercial property.

Elevated Structure Alternative

Twenty-four temporary tieback easements for the Battery Street Tunnel improvements would be needed with the Elevated Structure Alternative.

Temporary construction easements would be needed on six properties. Three of these properties (two used for parking and Pier 62/63) are located near the existing viaduct and Pine Street. The other three properties (two used for parking and one commercial property) are located in the north area.

18 How would the local and regional economy be affected during construction?

Construction would inconvenience or disturb businesses and customers of businesses adjacent to the project area. Construction-related effects would vary considerably over time and area. Effects can also vary according to the methods used to stage and construct the alternatives. Mitigation measures would be in place to minimize or avoid economic impacts, as described in Chapter 8, Question 15. These measures would provide local connections and access to buildings and businesses for pedestrians, bicyclists, motorists, and movers of freight.

The inventory of existing businesses identified approximately 1,400 businesses (including multi-family residential buildings) adjacent to or within one block of the existing SR 99 alignment that could experience disruption as a result of the Bored Tunnel or Cut-and-Cover Tunnel Alternatives construction. The Elevated Structure Alternative could affect 1,540 businesses that are located along the Broad Street detour.

These temporary construction effects to businesses would be similar for each alternative in both the north and south areas. The effects would last for a longer period of time with the Cut-and-Cover Tunnel Alternative (8.75 years) and Elevated Structure Alternative (10 years) compared to the Bored Tunnel Alternative (5.4 years). For example, First Avenue S. would be more congested along the WOSCA construction staging area. Businesses whose primary access points are on the east side of First Avenue S. may choose to access their business from the other side of the building on Occidental Avenue S. during construction.

Throughout the project area, trucks servicing businesses would be subject to the same traffic delays that general-purpose vehicles would experience. On-street parking may not be available near the construction areas, which could prevent the use of curbside lanes for truck parking and loading or unloading. Trucks would have to park nearby on side streets. This may inconvenience or disrupt the flow of materials and supplies to and from adjacent businesses.

Along the central waterfront, about 160 active commercial and industrial buildings that would not be acquired for any of the build alternatives are located within 50 feet of the existing viaduct. Many of these buildings are occupied by multiple businesses. The period of active disruption in front of any one building depends on the build alternative. The Bored Tunnel Alternative would have the shortest and the Elevated Structure would have the longest duration of active disruption along the central waterfront. Disruptions could be caused by utility relocations before viaduct demolition, loss of use of loading areas beneath the viaduct, and loss of private parking areas beneath the viaduct. Some of these businesses may suffer little or no adverse effect, whereas others may experience a noticeable decline in sales, increase in costs, and/or decrease in efficiency.

These construction-related effects could adversely affect the comfort and daily life of residents and inconvenience or disrupt the flow of customers, employees, and materials and supplies to and from these businesses.

Bored Tunnel Alternative

In addition to the effects described above, removing spoils generated during tunnel boring from the south portal area to disposal sites could result in up to several hundred truck trips per day if the material is not removed by barge. These truck trips in and out of the WOSCA staging area

Appendix L, Economics Discipline Report

Appendix L, Chapter 6 provides additional information about construction effects on the local and regional economy.

could be disruptive to nearby businesses. Businesses adjacent to the project construction would experience increased noise, dust, and vibrations associated with the tunnel excavation and street improvements.

Along the central waterfront, the 9-month period when the viaduct is being demolished would be the most disruptive to the waterfront businesses.

Cut-and-Cover Tunnel Alternative
Existing businesses within one block of the existing SR 99 alignment along the central waterfront would experience more severe construction effects than the Bored Tunnel Alternative, and the effects would take place over a much longer period of time.

Pedestrian and vehicle access to the waterfront businesses would be provided, but the Alaskan Way surface street would be closed to north-south traffic for just over 5 years. In addition, the presence of construction materials, equipment, and activities, would make access to businesses along the waterfront difficult and would inhibit pedestrian use of Alaskan Way. These effects could result in indirect economic effects to businesses by decreasing the number of customers willing to patronize them.

Elevated Structure Alternative
Existing businesses within one block of the existing SR 99 alignment along the central waterfront would experience more severe construction effects than the Bored Tunnel Alternative and these effects would take place over a longer period of time, because it would take longer to build the Elevated Structure Alternative than the other build alternatives.

The decreased capacity on SR 99 and Alaskan Way for a number of years together with the presence of construction materials, equipment, and activities, would make access to businesses difficult. However, Alaskan Way would remain open with one lane in each direction throughout most of the construction period. Effects to waterfront businesses and pedestrians are expected to be greater than the Bored Tunnel Alternative, but would not be as severe as the Cut-and-Cover Tunnel Alternative.

The Elevated Structure Alternative would also construct the Broad Street detour. Construction of the detour would last about 9 months and cause businesses along Broad Street to experience construction noise, dust, and possibly vibrations. Once the detour is in place, the businesses along Broad Street would experience increased traffic as southbound vehicles from SR 99 are routed onto this detour for approximately 4.25 years.

Economic Benefits
Construction expenditures would occur over a number of years, directly resulting in new demand for construction materials and labor. These direct effects would lead to indirect or secondary effects, as the production of output by firms in other industries increases to supply the demand for inputs to the construction industry. Both the direct and indirect effects of construction expenditures typically cause businesses to employ more workers to meet the increased demand. The increase in employment leads to induced effects because the additional wages and salaries paid to workers foster greater consumer spending.

For all of the build alternatives, the average number of jobs directly related to construction would be 450 per year, although up to 480 workers per day could be required during the most intense period of construction. The direct jobs needed to construct the alternatives would generate approximately $60.8 million in direct wages per year.

Bored Tunnel Alternative
The capital costs associated with construction of the Bored Tunnel Alternative would result in additional activity throughout all economic sectors within the Puget Sound region and the State of Washington. With the Bored Tunnel Alternative, new demand for construction would generate an estimated $1,788 million in construction dollars. Approximately $3,688 million in economic activity would be generated for other industries in the Puget Sound region beyond those directly involved in the project. Of this amount, $1,089 million would be paid to the 6,598 workers as wage and salary earnings for the jobs generated. The amount of new indirect and induced earnings (wages) as a result of money entering the Puget Sound economy would be $79 million.

Approximately 7 percent of the total capital cost for the Bored Tunnel Alternative would come from federal funds, which represents new money coming from outside the Puget Sound region to support the local economy.

Cut-and-Cover Tunnel Alternative
With the Cut-and-Cover Tunnel Alternative, new demand for construction would generate an estimated $3,372 million in construction dollars. Approximately $6,955 million in economic activity would be generated for other industries in the Puget Sound region beyond those directly involved in the project. Of this amount, $2,055 million would be paid to the 10,557 workers as wage and salary earnings for the jobs generated. The amount of new indirect and induced earnings (wages) as a result of money entering the Puget Sound economy would be $82 million.

Approximately 4 percent of the total capital cost for the Cut-and-Cover Tunnel Alternative would come from federal funds, which represents new money coming from outside the Puget Sound region to support the local economy.

Elevated Structure Alternative
With the Elevated Structure Alternative, new demand for construction would generate an estimated $1,831 million in construction dollars. Approximately $3,777 million in economic activity would be generated for other industries in the Puget Sound region beyond those directly involved in the replacement of the viaduct. Of this amount, $1,116 million would be paid to the 11,876 workers as wage and salary earnings for the jobs generated. The amount of new indirect and induced earnings (wages) as a result of money entering the Puget Sound economy would be $78 million.

Approximately 7 percent of the total capital cost for the Elevated Structure Alternative would come from federal funds, which represents new money coming from outside the Puget Sound region to support the local economy.

Effects to Parking

The parking spaces that would be removed during construction generally include the spaces that would be permanently affected (as described in Chapter 5), plus those spaces that are needed for construction, staging, or demolition activities. If any ADA parking spaces are affected, they would be accommodated nearby in accordance with City guidelines and federal requirements.

The Bored Tunnel Alternative would affect fewer parking spaces than the Cut-and-Cover Tunnel and Elevated Structure Alternatives, particularly during Stages 1 through 7, as shown in Exhibit 6-21. Stage 8 of the Bored Tunnel Alternative is reported separately, because demolition of the viaduct would cause the number of affected parking spaces to increase, compared to Stages 1 through 7. The location of these parking spaces is shown in Exhibit 6-22.

Exhibit 6-21
Parking Effects during Construction

	PARKING SPACES				
	On-Street			Off-Street	Total
Alternatives	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Bored Tunnel Stages 1-7	350 to 470	280 to 290	**630 to 760**	50 to 90	**680 to 850**
Bored Tunnel Stage 8	Up to 910	Up to 290	**Up to 1,200**	Up to 310	**Up to 1,510**
Cut-&-Cover Tunnel	1,090	230	**1,320**	480	**1,800**
Elevated Structure	1,090	230	**1,320**	610	**1,930**

Note: The maximum number of spaces in each subarea would not be affected at the same time, so the total is not a sum of all of the high ranges.

All of the build alternatives would affect the same amount of parking spaces in the stadium area south of S. King Street. About 230 on-street and 50 off-street spaces would be removed in this area during construction. Most of the 230 on-street spaces are short-term parking, but about 50 are long-term spaces. The 50 off-street spaces that would be affected are located in a public pay lot south of S. Royal Brougham Way, behind the Pyramid Alehouse.

The 200 off-street parking spaces on the WOSCA property have been removed due to the construction associated with the S. Holgate Street to S. King Street Viaduct Replacement Project. Because this effect was accounted for by the S. Holgate Street to S. King Street Viaduct Replacement Project, they are not included as a construction removal for the build alternatives.

The removal of about 280 parking spaces in the stadium area is not expected to substantially affect parking availability in the area, although some drivers may be slightly inconvenienced. The on-street parking removals along First Avenue S. between S. King Street and Railroad Way S. may affect customer parking for adjacent businesses. However, on-street parking would continue to be available a block to the north and along S. King Street.

Although parking would be reduced compared to existing conditions, ample parking is expected to be available in pay lots near the stadiums. Pay lots in the stadium area are abundant and underutilized on non-event days. The off-street parking utilization rate for the stadium area is about 31.1 percent on an average non-event weekday,[2] suggesting that it is relatively easy to find a pay parking space in the stadium area. In addition, most surface streets in the area allow on-street parking, and some of it is long-term, particularly farther south.

During events such as Seahawks, Mariners, and Sounders games, parking is currently highly utilized and private lots charge a premium for event parking. Removing about 50 off street parking spaces is not expected to noticeably affect the overall parking supply. Approximately 6,900 off-street parking spaces are available in the major parking facilities near the stadiums.

In all areas, parking removals during construction would make it more difficult to find parking in the project area. This could result in drivers looking for parking spaces several blocks farther from their destinations, or using pay lots instead of on street parking.

Parking effects during construction for the areas north of S. King Street are discussed by alternative below.

Bored Tunnel Alternative

During Stages 1 through 7, a total of 680 to 850 spaces would be affected in the project area by the Bored Tunnel Alternative, as shown in Exhibit 6-23. During Stage 8 (the last year of construction, shown in Exhibit 6-24), demolition of the viaduct would cause the number of affected parking spaces to increase, compared to Stages 1 through 7. The 680 to 850 on-street spaces would result in the annual loss of approximately $1.5 million to $1.80 million in parking revenue for the City of Seattle. The loss of 350 to 560 short-term spaces represents about 7.5 percent of the short-term parking in the Seattle Central Business District.

In addition to the spaces identified in Exhibits 6-23 and 6-24, there may be short-term (such as during peak periods of traffic) parking restrictions on some streets near the WOSCA and north end construction staging areas to help accommodate transit or general-purpose traffic during construction. Relatively short-term parking restrictions would likely be needed on Battery Street and on cross-streets above the Battery Street Tunnel during decommissioning. Restrictions would be determined by the contractor when the plans for the decommissioning are finalized. Utility relocations also could affect some parking spaces in the project area for a few days.

Exhibit 6-23
Bored Tunnel Alternative Parking Effects during Construction Stages 1 Through 7

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	70 to 150	10	**80 to 160**	0 to 40	**80 to 200**
Central	0 to 90	0	**0 to 90**	0	**0 to 90**
Belltown	0	0	**0**	0	**0**
North	90 to 140	230 to 240	**320 to 370**	0	**320 to 370**
Total	**350 to 470**	**280 to 290**	**630 to 760**	**50 to 90**	**680 to 850**

Note: The maximum number of spaces in each subarea would not be affected at the same time, so the total is not a sum of all of the high ranges.

Appendix C, Transportation Discipline Report

Construction effects to parking are discussed in *Appendix C*, Section 6.9.

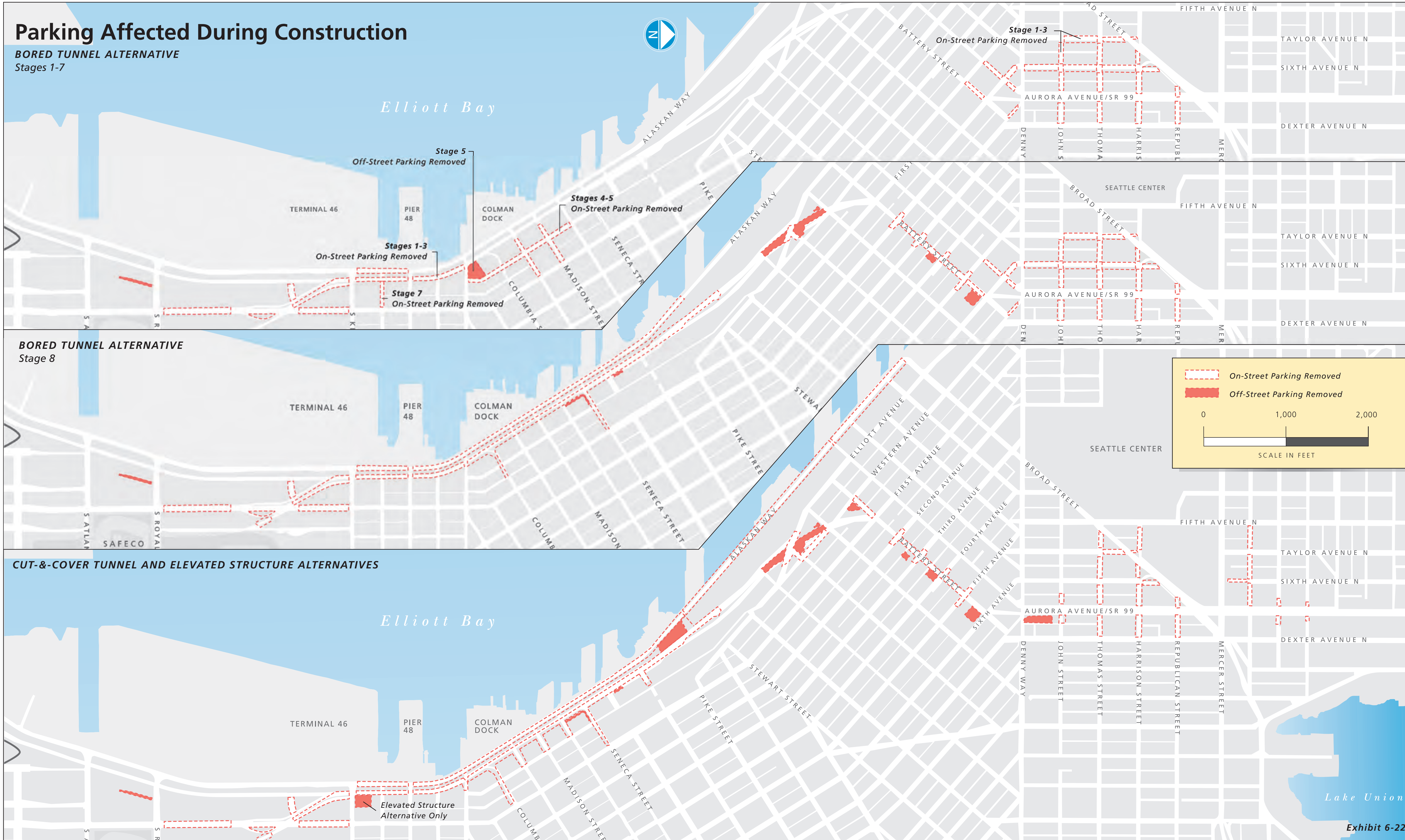
What is on-street parking?

There are two types of on-street parking, short-term and long-term. On-street short-term parking includes metered spaces, time-restricted public parking spaces (such as 1-hour parking and loading zones), bus/taxi zones, and spaces reserved for police parking. On-street long-term parking includes unmetered, unrestricted on-street public parking spaces and metered spaces that allow all day parking.

What is off-street parking?

Off-street parking includes parking garages and lots where people pay to park. Most off-street parking is privately owned or operated.

2 PSRC 2007.



Parking Affected During Construction
BORED TUNNEL ALTERNATIVE
Stages 1-7
Elliott Bay
Stage 5
Off-Street Parking Removed
Stages 4-5
On-Street Parking Removed
Stages 1-3
On-Street Parking Removed
Stage 7
On-Street Parking Removed
Stage 1-3
On-Street Parking Removed
TERMINAL 46
PIER 48
COLMAN DOCK
SEATTLE CENTER
FIFTH AVENUE N
TAYLOR AVENUE N
SIXTH AVENUE N
AURORA AVENUE/SR 99
DEXTER AVENUE N
BATTERY STREET
BROAD STREET
ALASKAN WAY
PIKE STREET
SENECA STREET
MADISON STREET
COLUMBIA
BORED TUNNEL ALTERNATIVE
Stage 8
SAFECO
STEWART STREET
ELLIOTT AVENUE
WESTERN AVENUE
FIRST AVENUE
SECOND AVENUE
THIRD AVENUE
FOURTH AVENUE
FIFTH AVENUE
SIXTH AVENUE
On-Street Parking Removed
Off-Street Parking Removed
0
1,000
2,000
SCALE IN FEET
CUT-&-COVER TUNNEL AND ELEVATED STRUCTURE ALTERNATIVES
Elevated Structure Alternative Only
DENNY WAY
JOHN STREET
THOMAS STREET
HARRISON STREET
REPUBLICAN STREET
MERCER STREET
Lake Union

Exhibit 6-22

Exhibit 6-24
Bored Tunnel Alternative Parking Effects during Construction Stage 8

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	170	10	**180**	0	**180**
Central	390	0	**390**	40	**430**
Belltown	80	0	**80**	220	**300**
North	90	230	**320**	0	**320**
Total	**Up to 920**	**Up to 290**	**Up to 1,210**	**Up to 310**	**Up to 1,510**

Note: The totals presented in Exhibit 6-24 represent all spaces affected during Stage 8 and are not in addition to the totals in Exhibit 6-23.

In the Pioneer Square area, the on-street spaces removed are under the viaduct and along Alaskan Way S., south of Yesler Way. During Stage 5, about 40 off-street parking spaces adjacent to the Western Building would be unavailable for 12 to 20 months while the building is being reinforced. In Stage 8, about 180 on-street spaces would be inaccessible due to construction and viaduct demolition. Directly after viaduct demolition and removal, the City of Seattle expects to begin work on the waterfront promenade and the new Alaskan Way surface street. Construction of these projects will likely affect parking availability until they are completed in 2018.

The parking on Alaskan Way between S. King Street and Pine Street is also expected to be affected at some point during viaduct demolition, but all of these spaces would not be removed at the same time. It is expected that two demolition crews would each work on two blocks at a time, so four blocks of parking would be affected for approximately 4 weeks at a time during demolition in Stage 8.

In the central area, there would be up to 90 short-term spaces in the central subarea affected during the majority of the construction period. These spaces are under the viaduct and along Alaskan Way S. south of Yesler Way. In Stage 8, approximately 390 on-street parking spaces under the viaduct and ramps and along Alaskan Way would be affected during viaduct demolition. In addition, approximately 40 off-street spaces just east of the viaduct would be affected for about a month during demolition.

In the Belltown area, no substantial parking effects are expected until Stage 8. Up to 220 off-street spaces in the Belltown subarea would be affected when the viaduct is demolished and the Battery Street Tunnel is decommissioned. These spaces are parking lots under the viaduct near Elliott and Western Avenues or adjacent to the Battery Street Tunnel. Additionally about 80 on-street spaces would be affected, of which about 70 spaces would be temporarily restricted for only about 3 months during Battery Street Tunnel decommissioning.

In the north area, about 320 to 370 on-street spaces would be removed during construction. The removals would be needed to accommodate new travel lanes, construction traffic, utility relocations, and other construction activities. No public pay lots would be affected in this area. Of the affected on-street parking spaces, the majority are long-term spaces. On-street parking would still be available within several blocks of the removed spaces. There are numerous off-street lots within several blocks of the removed parking spaces. More than 3,100 pay spaces are available between Denny Way and Roy Street, and Fifth Avenue N. and Dexter Avenue N.[3] The 3,100 spaces take into account the spaces removed by the Gates Foundation construction and the new Fifth Avenue Parking Garage. There are no expected direct effects on access to these garages during project construction, although there may be construction activities in the vicinity that affect traffic congestion. It may become slightly more difficult to find parking on event days, and parking in some lots would potentially become more expensive in response to the reduction in the adjacent parking inventory. Puget Sound Regional Council (PSRC) found that the total number of off-street parking stalls in the Uptown area totaled 18,564 in 2006, with an occupancy rate of 47.4 percent.[3]

Cut-and-Cover Tunnel Alternative

The approximately 1,800 on-street and off-street parking spaces expected to be removed or restricted during construction of the Cut-and-Cover Tunnel Alternative are summarized in Exhibit 6-25 and shown in Exhibit 6-22. The loss of 1,320 on street spaces would result in the annual loss of approximately $4.5 million in parking revenue for the City of Seattle. The loss of 1,090 short-term parking spaces during construction represents about 15 percent of the short-term parking in the Seattle Central Business District.

Exhibit 6-25
Cut-&-Cover Tunnel Alternative Parking Effects during Construction

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	170	10	**180**	0	**180**
Central	510	0	**510**	110	**620**
Belltown	150	0	**150**	240	**390**
North	80	170	**250**	80	**330**
Total	**1,090**	**230**	**1,320**	**480**	**1,800**

In the Pioneer Square area, the number of parking spaces affected is the same as the Bored Tunnel Alternative in Stage 8. However, the parking spaces would be removed for a substantially longer time with the Cut-and-Cover Tunnel Alternative.

Along the central waterfront, approximately 510 on-street parking spaces under the viaduct and ramps from Columbia Street to Elliott Avenue and Lenora Street, and along Alaskan Way to Wall Street would be affected during construction. An additional 110 off-street spaces would be removed for at least part of the construction duration. Removing these public parking spaces in the central area for up to 8.75 years is expected to make parking substantially more difficult to find. Several parking garages are located in the Central Business District, which is within walking distance of the central waterfront.

In the Belltown area, 390 spaces would be affected during construction of the Cut-and-Cover Tunnel Alternative. About 70 spaces along and adjacent to Battery Street would be restricted for about 1 year during the Battery Street Tunnel upgrades. The parking removals along Battery Street would continue for about 9 months longer than the duration for the Bored Tunnel Alternative.

In the north area, the Cut-and-Cover would remove fewer on-street spaces during construction compared to the

3 PSRC 2007.

Bored Tunnel Alternative. Of the affected on-street parking spaces, the majority are long-term spaces. On-street parking would still be available within several blocks of the removed spaces. The Cut-and-Cover Tunnel Alternative would also remove an off-street parking lot near Denny Way and Aurora. There are numerous off-street lots within several blocks of the removed parking spaces.

Elevated Structure Alternative

The approximately 1,930 on-street and off-street parking spaces expected to be removed or restricted during construction of the Elevated Structure Alternative are summarized in Exhibit 6-26 and shown in Exhibit 6-22. The loss of 1,320 on-street spaces would result in the annual loss of approximately $4.5 million in parking revenue for the City of Seattle. The loss of 1,090 short-term parking spaces during construction represents about 15 percent of the short-term parking in the Seattle Central Business District. The Elevated Structure Alternative construction period is the longest (10 years), which would extend the period during which parking may be difficult to find.

Exhibit 6-26
Elevated Structure Alternative Parking Effects during Construction

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	170	10	**180**	130	**310**
Central	510	0	**510**	110	**620**
Belltown	150	0	**150**	240	**390**
North	80	170	**250**	80	**330**
Total	**1,090**	**230**	**1,320**	**610**	**1,930**

In the Pioneer Square subarea, the Elevated Structure Alternative would also remove 180 on-street spaces during construction. However, the parking spaces would be removed for a substantially longer time with the Elevated Structure Alternative compared the Bored Tunnel Alternative Stage 8, and slightly longer than the Cut-and-Cover Tunnel Alternative. The Elevated Structure Alternative also would remove a parking garage containing about 130 parking spaces, contributing to a further negative effect on the parking supply in Pioneer Square.

Along the central waterfront, Belltown, and north areas, the Elevated Structure Alternative would affect the same number of parking spaces as the Cut-and-Cover Tunnel Alternative. However, the Elevated Structure Alternative has a longer construction period that is expected to make parking substantially more difficult to find along the waterfront for up to 10 years. There are numerous off-street lots within several blocks of the removed parking spaces.

Construction Worker Parking

For all of the build alternatives, WSDOT would have the contractor identify appropriate parking options for construction workers, as necessary, and would discourage their use of short-term visitor/customer parking in the project vicinity. There would be up to 480 construction workers per day for all of the alternatives during the most intense periods of construction. For the preferred Bored Tunnel Alternative, construction worker parking is expected to be accommodated at Terminal 106 and Pier 48, with contractor shuttles transporting construction workers to job sites. It is likely that these areas would also be used for construction worker parking if the Cut-and-Cover Tunnel or Elevated Structure Alternative is selected.

19 How would historic properties be affected during construction?

For all of the build alternatives, vibration associated with demolition and removal of the existing viaduct is not expected to be substantial, and it would not result in an adverse effect on the adjacent historic properties. The viaduct structure is expected to be taken apart piece by piece. Businesses and residents between S. Jackson and Columbia Streets and near the ramps on Columbia and Seneca Streets would experience noise, reduced access and parking, and traffic congestion during this construction period. The economic effect of viaduct demolition would not be long enough to threaten the maintenance and preservation of the historic buildings or historic neighborhoods. Through the consultation process required by Section 106 of the National Historic Preservation Act (see Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report, for more information) WSDOT, on behalf of FHWA, determined the adverse effects from the Bored Tunnel Alternative. WSDOT, on behalf of FHWA, also determined adverse effects to historic properties for the Cut-and-Cover Tunnel and Elevated Structure Alternatives, listed below in Exhibit 6-27. Adverse affects for the Bored Tunnel Alternative have been resolved by a Memorandum of Agreement developed in consultation with the State Historic Preservation Officer (SHPO), tribes, and the consulting parties. Mitigation measures for historic resources are discussed in Chapter 8, Question 17.

Exhibit 6-27
Construction Effects to Historic Properties

		ALTERNATIVE		
Property	National Register Status	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Pioneer Square Historic District	NRHP historic district	Settlement damage to two buildings – *Adverse effect* Increased traffic congeston	Increased traffic and potential damage to areaways	Increased traffic and potential damage to areaways
Western Building *619 Western Avenue*	Contributing property in PSHD	Damage due to settlement – *Adverse effect on PSHD*	Temporary utility easement	Temporary utility easement
Polson Building *83 Columbia Street*	Contributing property in PSHD	Damage due to settlement – *Adverse effect on PSHD*	Temporary utility easement	Temporary utility easement
Pike Place Market Historic District	NRHP historic district	*No construction effect*	Long-term reduction in parking and waterfront connections – *Adverse effect*	Long-term reduction in parking and waterfront connections – *Adverse effect*
Piers 54, 55, 56, and 57	NRHP eligible	*No construction effect*	Long-term severe traffic disruption, reduced access, and reduced parking – *Adverse effect* Temporary pedestrian bridges	Long-term severe traffic disruption, reduced access, and reduced parking – *Adverse effect* Temporary pedestrian bridges
Buckley's – *MGM-Loew's* *2331 Second Avenue*	NRHP eligible	*No construction effect*	6-month vacation for underpinning – *Adverse effect*	Temporary tieback easement
Old Spaghetti Factory *2800 Elliott Avenue*	NRHP eligible	*No construction effect*	*No construction effect*	Economic, visual, and vibration effects due to Broad Street detour structure – *Adverse effect*
Dearborn South Tideland Site *45KI924*	NRHP eligible	South portal excavation and utilites work – *Adverse effect*	South portal excavation and utilites work – *Adverse effect*	Pilings supports and utilites work – *Adverse effect*

NRHP: *National Register of Historic Places*

Bored Tunnel Alternative

Effects Due to Settlement

The primary construction effects on historic resources would occur from settlement due to soil subsidence as the TBM moves beneath buildings in the northwest corner of the Pioneer Square Historic District.

Vulnerable buildings along the bored tunnel alignment may be damaged by settlement as the TBM bores beneath or close to them. The Bored Tunnel Alternative is being designed to avoid or minimize settlement near historic resources. Where needed, improvements such as compensation grouting or compaction grouting would be

Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report

Additional information about construction effects on historic, cultural, and archaeological resources is provided in *Appendix I*, Chapter 6.

Historic and Archaeological Memorandum of Agreement

For more information about effects to historic and archaeological resources, see the Memorandum of Agreement in Attachment C of *Appendix I, Historic, Cultural and Archaeological Resources Discipline Report*.

used to prevent damage to vulnerable buildings due to ground settlement. Damage that is unavoidable would be repaired in accordance with the Secretary of the Interior's Standards for Rehabilitation of Historic Buildings (36 CFR 67.7). An assessment of buildings in the study area was conducted to determine the risk of building damage due to settlement.[4] To avoid and minimize these effects, structural engineers have inspected every building within the anticipated settlement zone (approximately one block on each side of the proposed alignment).

The anticipated amount of settlement along most of the alignment is small because of the depth of the tunnel boring. However, near the portals where the tunnel is shallower, there is greater potential for settlement. Of particular concern is settlement-related damage to two contributing properties in the Pioneer Square Historic District:

- Western Building (619 Western Avenue)
- Polson Building (61 Columbia Street)

WSDOT, on behalf of FHWA, determined that settlement damage to the Western and Polson Buildings would result in an adverse effect upon the Pioneer Square Historic District. The Section 4(f) use is of the District, but the area of use is confined to the Western Building. WSDOT has identified a high potential for settlement damage to the Western Building, since the TBM would excavate soils directly beneath the building. Engineering evaluations of the building found it to be in very poor structural condition due to prior settlement, deterioration of its wooden pile foundation, the effects of the Nisqually earthquake in 2001, and general deterioration over time. The building today has many large cracks in columns and large visible cracks on external walls, in most other structural and interior walls, and on the ground floor slab.

WSDOT's engineering assessment rates the potential settlement damage to the Western Building as "very severe" if the project does not provide protective measures. Without protective measures, settlement would damage major structural and architectural elements of the building, perhaps enough to make the building collapse. In response, WSDOT has defined a program of protective measures that would protect the building by constructing structural reinforcements and bracing for the interior and exterior of the building. The tenants would be relocated. The building would be unavailable for approximately 12 to 20 months during the construction period.

The Polson Building may also experience settlement, if unmitigated. However, this building is in good structural condition and would be protected by compensation grouting to stabilize the surrounding soil before construction. Along with high levels of monitoring during construction, stabilizing the soil underneath the building would prevent major structural damage, and the remaining structural and aesthetic damage could be repaired. The Polson and Western buildings are assessed in more detail in the Section 4(f) Evaluation.

For all historic structures, in the event that minor damage occurs, such as minor cracks or aesthetic damage that require interior painting or repointing of brick walls, or slightly sticking doors and windows, it would be mitigated as required and in accordance with the Secretary of the Interior's Standards for Rehabilitation of Historic Buildings (36 CFR 67.7). Any such minor damage and repairs would not adversely affect the properties under the NRHP.

No damage to areaways (spaces beneath the sidewalks adjacent to some buildings) is expected. Areaways in Pioneer Square are located one block or more away from the tunnel alignment and are typically in fair condition but are vulnerable because of their age and materials. Other areaways near Pike Place Market are also some distance away and the bored tunnel would be at depth when it reaches the area.

Effects Due to Construction Activities Other Than Settlement

The Alaskan Way Viaduct and the Battery Street Tunnel are collectively a NRHP-eligible structure and would be demolished and decommissioned, respectively, as part of the Bored Tunnel Alternative. The viaduct structure is expected to be taken apart piece by piece. With this approach, vibration associated with demolition and removal is not expected to be substantial, and it would not result in an adverse effect on the adjacent historic properties.

Cut-and-Cover Tunnel Alternative

Construction of the Cut-and-Cover Tunnel Alternative would cause access and traffic disruptions for many years, especially along the central waterfront, affecting nearby historic resources. Alaskan Way along the central waterfront would be limited to local traffic only for a period of just over 5 years, and it would be periodically reduced to one lane for an additional 3.75 years, limiting vehicle access. The impacts to specific historic resources would vary over that time, depending on the work being done and its location. However, construction and traffic disruption would continue throughout the entire period. Potential effects of cut-and-cover tunnel construction include exposure of building occupants and customers to high levels of noise and dust, prolonged limited access, reduced parking, and possible utility disruptions. WSDOT, on behalf of FHWA, determined that the Cut-and-Cover Tunnel Alternative would have adverse effects to the Pike Place Market Historic District and NRHP-eligible Piers 54, 55, 56, and 57 during construction because of the long-term traffic and parking effects.

The Washington Street Boat Landing pergola would also be adversely affected during construction. The pergola and historical markers on the waterfront guardrail would be removed during construction and replaced appropriately upon project completion. Along the central waterfront, temporary pedestrian bridges would be constructed between Piers 54 and 55 and Piers 56 and 57 to help maintain access for customers.

The Buckley's (MGM-Loew's) building at Second Avenue and Battery Street would be adversely affected because it would have to be vacated for safety reasons for approximately 6 months to complete the underpinning work inside the building for construction of the Battery Street Tunnel.

Section 4(f) and Protection of Historic and Archaeological Resources

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic and archaeological sites. The project is adjacent to some of Seattle's best-known historic buildings and neighborhoods. Historic and cultural resources that would be subject to use under Section 4(f) are discussed in the Section 4(f) Evaluation:

- Alaskan Way Viaduct and Battery Street Tunnel
- Western Building – located within the NRHP-listed Pioneer Square Historic District
- Lake Union Sewer Tunnel – manhole shaft
- Seattle Maintenance Yard – Archaeological Site 45KI958

The **Section 4(f) Evaluation** can be found at the end of this *Final EIS* on page 239. The **Section 4(f) Supplemental Materials** are provided in *Appendix J*.

Construction Effects to Utilities

Question 25 of this Chapter discusses the construction effects on utilities.

4 Coughlin Porter Lundeen et al. 2010.

Temporary easements for utility relocation may be required for five historic buildings: Western Building (619 Western Avenue), Maritime Building (911 Western Avenue), Polson Building (61 Columbia Street), Olympic Warehouse (1203-1207 Western Avenue) and the Pacific Net and Twine Building (51 University Street). The easement would not affect the structures.

The Alaskan Way Viaduct and Battery Street Tunnel are collectively a NRHP-eligible structure and would be demolished and altered, respectively, as part of the Cut-and-Cover Tunnel Alternative.

Elevated Structure Alternative
With the Elevated Structure Alternative, Alaskan Way would be restricted to one lane in each direction for 7 years and periodically restricted to one lane in each direction for 3 years, limiting vehicle access. The impacts to specific historic resources would vary over that time period, depending on the work being done and its location. However, construction and traffic disruption would continue throughout the entire construction period, especially on the central waterfront. The potential traffic impacts and adverse effects would be generally the same as those described above for the Cut-and-Cover Tunnel Alternative.

Temporary easements for utility relocation may be required for six historic buildings: Western Building (619 Western Avenue), Maritime Building (911 Western Avenue), Polson Building (61 Columbia Street), Olympic Warehouse (1203-1207 Western Avenue), Pacific Net and Twine Building (51 University Street), and Fix Building (1507 Western Avenue). An aerial easement may also be needed at the Polson Building for construction of the new ramp. Temporary easements for construction tiebacks for the Battery Street Tunnel may be needed for three historic buildings: Austin Bell Building (2326 First Avenue), Buckley's (MGM-Loew's) Building (2331 Second Avenue), and Lexington-Concord Apartments (2402 Second Avenue). These temporary easements would not adversely affect the structures.

Construction of the Broad Street detour with a temporary trestle over the BNSF railroad tracks would potentially result in adverse effects to the Old Spaghetti Factory, a building that is eligible for listing in the NRHP and for Seattle landmark designation. Vibration associated with the construction of the detour would potentially result in direct impacts on the brick building, as well as visual impacts and economic impacts due to noise, dust, and altered traffic patterns.

The Alaskan Way Viaduct and the Battery Street Tunnel are collectively a NRHP-eligible structure and would be demolished and altered, respectively, as part of the Elevated Structure Alternative.

20 Would construction affect archaeological resources?
Two archaeological sites would be affected by all of the build alternatives during construction. Near the south area, construction would adversely affect the NRHP-eligible Dearborn South Tideland Site (45KI924). It is not feasible to avoid the Dearborn South Tideland Site, because it occupies most of the area west of First Avenue between S. Royal Brougham Way and S. Dearborn Street. Avoiding the site would require that the SR 99 corridor to be moved east, which could cause additional impacts on the Pioneer Square Historic District and several historic buildings. FHWA and WSDOT have determined that the site is considered eligible under Section 106 Criterion D for its potential to yield information about early development in Seattle, but its value is in the data that may be recovered and does not depend on its being preserved in place. Section 4(f) regulations provide an exception for the use of these types of archaeological properties (23 CFR 774.13(b)), and the SHPO has concurred with FHWA's finding.

The other historic-period archaeological site is located in the north area, the Seattle maintenance yard (45KI958). Although this archaeological site has not been formally determined to be eligible for the NRHP, WSDOT will treat it as eligible under Section 106 Criterion D for planning purposes. Given the constraints imposed by the urban environment and deep historic fill, evaluation and, if necessary, data recovery at this archaeological site would be undertaken in concert with construction. Intact peat deposits, which date to the time of earliest human occupation of the area, also exist in this location. However, no Native American archaeological sites have been identified.

For all of the alternatives, construction would also affect the following archaeologically sensitive areas:

- The area between the southern project extent and S. King Street, where historic resources are likely to be present beneath regrade fill. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would include a cut-and-cover trench in this location, and the Elevated Structure Alternative would include piling supports.

- Former tidal flat areas between the southern project extent and S. King Street, and in the Alaskan Way alignment from just south of S. Jackson Street to just south of Columbia Street, where Native American resources may be present. These areas were probably used as resource gathering locations and travel corridors, and some artifacts or features may be present. All of the build alternatives would disturb the ground for trenching, piling supports, or ground improvements through the entire depth of potential resources in these areas.

- Holocene sediments near the modern ground surface in the Alaskan Way Viaduct alignment between Pike and Bell Streets. Disturbance during the historic era has reduced the potential for the presence of Native American Pre-Contact archaeological resources, but such resources may still be present. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would disturb the ground through the entire depth of potential deposits, and the Bored Tunnel Alternative would disturb of the upper 5 feet of the deposits.

Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report

Additional information about construction effects on historic, cultural, and archaeological resources is provided in *Appendix I*, Chapter 6.

- The area from the Battery Street Tunnel to the northern extent of the project area. Historic surfaces are known to exist beneath fill, and all of the build alternatives would excavate a cut-and-cover trench and relocate utilities in this area.

- A peat deposit in the northern part of the study area (between John Street and Valley Street, along Aurora Avenue N.) dating to the Pre-Contact period that may contain Native American deposits. No archaeological materials have been found in the peat layer, but such materials may be present and as yet undiscovered. All of the build alternatives would excavate a cut-and-cover trench and relocate utilities in this area.

An archaeological treatment plan will be developed and implemented before the initiation of construction. The plan will detail measures to evaluate archaeological sites for NRHP eligibility and recover information that qualifies a site for the NRHP. An Unanticipated Discovery Plan will be prepared for the project that provides for notification and consultation among SHPO, the tribes, and the consulting parties related to discoveries of unknown archaeological material or human remains. All of the measures were developed in consultation with SHPO, the tribes, and the consulting parties and are included as commitments of the Memorandum of Agreement to avoid, minimize and mitigate adverse effects on historic resources.

Bored Tunnel Alternative
The primary construction effects on cultural and archaeological resources would likely occur during excavation of the tunnel portal areas, which would disrupt fill and potentially cultural deposits in the Dearborn South Tideland Site and Seattle Maintenance Yard.

Cut-and-Cover Tunnel Alternative
In addition to the archaeological resources and sensitive areas listed above, the Cut-and-Cover Tunnel Alternative would probably adversely affect two more archaeological sites and two more archaeologically sensitive areas. The two archaeological sites are below the bluff north of the Pike Place Market and would likely be affected by the seawall replacement. The area where the Cut-and-Cover Tunnel Alternative would disturb the ground is west of the known extent of both sites. However, the sites may well extend farther west than their mapped boundaries. Therefore, the Cut-and-Cover Tunnel Alternative may adversely affect one or both sites.

The Cut-and-Cover Tunnel Alternative would also affect two archaeologically sensitive areas:

- The Ballast Island area, where Native Americans camped during the historic period. The Cut-and-Cover Tunnel Alternative would involve trenching in this area through the entire depth of the deposit.

- The area between Alaskan Way and Elliott Avenue, from Blanchard Street to the northern project extent. Historic resources are known to occur in the area. The Cut-and-Cover Tunnel Alternative includes seawall replacement in this area, which would disturb the entire depth of the deposit.

Elevated Structure Alternative
The effects and potential effects to archaeological resources for the Elevated Structure Alternative are very similar to the Cut-and-Cover Tunnel Alternative. However, in the Alaskan Way alignment between S. Dearborn Street and Pike Street, the area disturbed by building the piles for the Elevated Structure Alternative would be smaller than the area disturbed by trenching for the Cut-and-Cover Tunnel Alternative. Therefore, impacts to the former tidal flats areas in the Alaskan Way alignment would be less for the Elevated Structure Alternative than the Cut-and-Cover Tunnel Alternative.

21 How would parks, recreation, and open space be affected during construction?
In general, for all build alternatives, construction could disrupt access to approximately 40 park and recreation facilities, including shoreline access points, in the project area. During construction, use of local streets and sidewalks would be periodically restricted, disrupting access to specific sites. Parking would also be reduced during construction, potentially reducing visits by those who normally drive to the area and use park and recreation facilities.

The following resources could experience indirect effects of increased traffic congestion during construction:

- Occidental Park
- Pioneer Square Park
- Boat access to Blake Island
- Waterfront Park
- Victor Steinbrueck Park
- Pier 62/63 Park
- Pier 66 Shoreline Access
- Belltown Cottage Park
- Olympic Sculpture Park
- Myrtle Edwards Park
- Elliott Bay Park
- Denny Park
- Seattle Center
- Tilikum Place
- Lake Union Park

However, the build alternatives would not impair the activities and features of these resources.

Bored Tunnel Alternative
In the south area, traffic congestion may cause some people attending events at Safeco or Qwest Fields to use different routes or different modes of transportation. During construction, the trail connection from the Mountains to Sound Greenway Trail to the waterfront would likely be rerouted. The existing Waterfront Bicycle/Pedestrian Facility would be maintained but rerouted to nearby areas during construction.

When the viaduct is demolished in the central waterfront area, it would occur in two-block segments at two locations at a time, and is expected to last no more than 4 weeks per segment. During this time, access to the existing waterfront promenade and other waterfront facilities would be disrupted near the sections being removed, but access would still be available elsewhere along the central waterfront. Visitors to the Seattle Aquarium would experience these short-term changes in access. Resources adjacent to the viaduct would experience noise and temporary changes in access while it is being demolished. During viaduct demolition, pedestrian and bicycle access would be maintained on the Port Side Pedestrian/Bike Trail adjacent to the Port of Seattle facilities. The short segments of the Waterfront Bicycle/Pedestrian Facility adjacent to active viaduct removal would be temporarily closed, but elsewhere the facility would remain open. Bicyclists would have the option of continuing to use First Avenue S. or using in-street bicycle lanes (sharing the road with vehicles) on Second Avenue or Fourth Avenue.

The pedestrian bridge at Marion Street would be replaced after the viaduct has been demolished. Pedestrian access would need to occur at street level while the replacement bridge is being constructed and would be ADA-compliant. The Lenora Street pedestrian bridge would not be altered but would likely be closed for a short time while demolition activities are occurring adjacent to the bridge.

In the north area, traffic congestion, restrictions, changes in access, and loss of parking could affect people attending events at Seattle Center during construction. Construction noise may disturb users at Denny Park, although the park itself would not be affected.

Cut-and-Cover Tunnel Alternative

Construction effects to parks and recreation facilities in the south area would be the same as those described for the Bored Tunnel Alternative.

In the central waterfront area, access along the waterfront would be disrupted throughout the duration of construction. Pedestrian access to the waterfront piers and parks would be maintained throughout construction. However, the appeal of the waterfront would likely be diminished on account of the actual lack or perceived lack of access. Noise from construction may affect portions of parks and recreation resources, and park attendance would likely be influenced by overall levels of construction activity on the waterfront. Furthermore, the asphalt trail for the Waterfront Bicycle/Pedestrian Facility would be displaced early in the construction process and functions would not be available again until Alaskan Way is rebuilt near the end of the construction period. Bicycle and pedestrian traffic would likely divert to Western Avenue south of Pine Street and continue to use the surface street north of Pine Street. Pedestrians using east-west streets to connect to the waterfront, such as the Marion Street Green Street, would likely be reduced as some people avoid the construction area.

Access to the Colman Dock public access facilities in the main terminal will be maintained as part of pedestrian access to ferries. However, the shoreline public access areas on Pier 50 and the plaza area at Yesler Way are not likely to be maintained during construction. Boat access by Argosy Cruise Lines from Pier 55 to Blake Island State Park could be temporarily relocated to portions of the waterfront less affected by the cut-and-cover tunnel and seawall construction.

Attendance at the Seattle Aquarium could be reduced during construction, even with pedestrian access maintained in the construction area. With major waterfront construction activities expected to last more than 5 years, and potential public perceptions of difficulty in travel and parking in the area, the appeal of the waterfront as a recreational destination could be diminished. These perceptions could persist and could affect attendance and revenue.

In the north area, the parks and recreation resources would be predominantly affected by increased traffic congestion during construction caused by lane restrictions and detours. In addition, resources along the northern portion of the waterfront would experience minor effects, such as noise, vibration, and dust during the seawall reconstruction.

Elevated Structure Alternative

The construction effects of the Elevated Structure Alternative on parks and recreation facilities would be similar to those described for the Cut-and-Cover Tunnel Alternative but for a longer duration.

22 How would neighborhoods be affected during construction?

For all build alternatives, businesses, government offices, services, and residents would be inconvenienced by the construction traffic detours, congestion, noise and vibration, light and glare, and dust. Construction would likely be perceived as a barrier to reaching or traveling through a neighborhood. People living or working within approximately two blocks of the construction zone would be able to hear construction noises; construction could occur up to 24 hours a day and 7 days per week during some construction activities at specific locations. During nighttime hours, light and glare would especially affect residents who have direct line-of-sight views to construction zones and staging areas.

Neighborhood linkages, such as pedestrian walkways, bicycle paths, and sidewalks, would be altered intermittently due to temporary road closures. Short-term road closures may cause temporary hardships and stress for some residents. However, the detours and road closures would not adversely affect a neighborhood's sense of community or its ability to function cohesively because they would be temporary and would not entirely eliminate access to a certain part of a neighborhood. Finding parking would be difficult in some locations during construction and could discourage visitors to adjacent neighborhoods.

Bored Tunnel Alternative

Construction of the Bored Tunnel Alternative is not expected to prevent neighborhoods from maintaining their social identity. Because most of the construction effects would occur underground, the adjacent neighborhoods along the bored tunnel alignment would not likely experience substantial adverse construction effects. Construction activities at the north and south portals and during viaduct demolition would be above ground. Therefore, neighborhoods adjacent to those areas would experience construction effects, but they are not expected to be severe enough to reduce the sense of community or the ability of a neighborhood to function and be recognized as a unit.

Cut-and-Cover Tunnel Alternative
Unlike the Bored Tunnel Alternative, construction activities would be aboveground throughout the duration of project construction for the Cut-and-Cover Tunnel Alternative. The noise, light and glare, and dust of construction activities would affect the neighborhoods along the entire alternative alignment.

The Cut-and-Cover Tunnel Alternative would close the viaduct for the longest time (27 months) of all the build alternatives. Adjacent neighborhoods including SODO, the International District, Pioneer Square, Central Business District, and Belltown would experience the effects of detoured traffic traveling through them to avoid the construction along the waterfront for the longest period of time with this alternative. This additional traffic could be perceived as a barrier to reaching or traveling through these neighborhoods.

Elevated Structure Alternative
The long duration of construction associated with this alternative (10 years) would contribute more than the other build alternatives to a diminished ability of people to communicate and interact with each other in ways that lead to a sense of community. The construction effects experienced by the adjacent neighborhoods would not be notably different than for the Cut-and-Cover Tunnel Alternative, but the severity of the effects would be exacerbated by the length of the time they would occur.

23 How would community and social services be affected during construction?

In general, community and social services would be affected by construction noise, vibration, light and glare, dust and exhaust, and truck traffic. Pedestrian detours around construction areas will be ADA-compliant. These effects would be common for all build alternatives.

Bored Tunnel Alternative
Near the south portal, the area is primarily industrial and commercial, but also contains 13 community or social service providers are located within two blocks of planned construction activities and would be affected. These include social and employment services, cultural institutions (e.g., museums and performance venues), and government services. These social resources are not expected to experience substantial construction effects.

Vehicle and transit access to these social resources could be more difficult during the 5.4-year construction period but would be maintained in coordination with the social service providers. Access to buildings may also change for short periods as construction activities shift but would be maintained throughout the construction period. The social resources in this area are primarily active during daytime hours when people generally have higher thresholds for loud noises, vibration, light, and glare, so substantial effects to social resources in the south portal area are not expected. In the central section, the Western Building's 118 tenants would be permanently relocated. The building would not be available for 12 to 20 months. The tenants include a community of artists using the space for a studio or workspace. The artists benefit from their close spaces and opportunities to share ideas and inspiration. WSDOT is actively working and supporting the efforts of the artists to find replacement accommodations, either nearby in the Pioneer Square neighborhood, if feasible, or wherever the individual artists may choose to relocate. The building also includes a community art education program for at-risk youth called Youth Art Space, which is run by the City of Seattle Parks and Recreation Department.

Near the north portal, 12 social resources are located within approximately two blocks of the construction area. These include 4 educational institutions, 3 churches, 3 social services, a cultural institution, and City of Seattle Parks and Recreation Department offices. All of these resources are generally used during daytime hours. Construction noise could be disruptive to services held by religious organizations and classes at the educational institutions in nearby buildings.

Similarly, operators of the two childcare facilities in the north portal area could be concerned about potential disruptions from construction activities. Depending on the hours of operation and the age of the children at the facilities, construction noise could disrupt nap time, or other activities, and construction noise, dust, or emissions from construction vehicles could disrupt play time for the children.

Removing the existing viaduct, which extends over 20 city blocks, would occur in two 2-block segments at a time. An estimated 22 social resources would be affected by noise, vibration, light, glare, dust, and truck traffic during demolition activities. These include seven childcare or educational facilities, one religious institution, three social services, eight cultural institutions, and three government offices or other facilities. Most of these social resources are visited during daytime or early evening hours, when people have higher thresholds for construction-related disturbances. However, depending on the hours of operation and the age of the children, viaduct demolition could disrupt nap time, or other activities, at the childcare facilities. Viaduct demolition also could also be disruptive to services held by the religious organization and classes at the educational institutions nearby. Vehicle and transit access and access to the buildings are anticipated to be the major concerns of the operators of these social resources.

Eleven social services providers, plus dorms for Cornish College of the Arts are located within about two city blocks of the Battery Street Tunnel. Most of the work to decommission (fill) the Battery Street Tunnel would occur underground during the same 9-month period that viaduct demolition is occurring. Vehicle and transit access to and from these community resources, as well as access in and out of the buildings, is not expected to change. As a result, effects would not be expected for most providers.

Appendix H, Social Discipline Report

Additional information about construction effects on neighborhoods, community, social services, environmental justice, and park and recreational resources is provided in *Appendix H*.

Attachment E of *Appendix H* contains a detailed inventory and maps of the social resources in the project area.

However, three social service providers could be sensitive to increased noise levels during the decommissioning.

Cut-and-Cover Tunnel Alternative

For the south area, viaduct demolition along the waterfront, and north area, effects to community and social services would be the same as described for the Bored Tunnel Alternative.

Construction of the cut-and-cover tunnel along the waterfront would have a substantial effect on the neighborhood social resources adjacent to the construction activities, including social and employment services, cultural institutions, and government services. These resources would be affected by construction noise, vibration, light and glare, dust, and truck traffic during the 8.75-year construction period.

Modifications to the Battery Street Tunnel would occur underground. Light, glare, and dust from the construction activities that occur inside the Battery Street Tunnel would not affect nearby social resources. Access to community and social resources could be affected by roadway closures and detours near the Battery Street Tunnel, as shown in Exhibit 6-1.

Elevated Structure Alternative

For the south area, central waterfront, and north area, effects to community and social services would be the same as described for the Cut-and-Cover Tunnel Alternative. However, the Elevated Structure Alternative's construction period is 10 years, so effects would be experienced for a longer period with this alternative. Modifications to the Battery Street Tunnel would result in the same effects as described for the Cut-and-Cover Tunnel Alternative above.

In addition, viaduct demolition effects may be experienced differently, because with this alternative the viaduct would be demolished and rebuilt one deck at a time, rather than being demolished during one period of time as with the other build alternatives.

24 How would low-income and minority populations be affected during construction?

Like the effects on downtown commuters and residents, the construction effects to minority and low-income populations would include increased traffic congestion, travel delays, increased response time for emergency services, changes to transit services, equipment noise, and decreased parking. If not mitigated, these changes could have an adverse effect on the minority and low-income populations in the project area and the organizations that strive to serve them. With the mitigation discussed in Chapter 8, the project would not have a disproportionately high and adverse effect on low-income or minority populations.

An estimated 9,500 housing units and more than 15,500 residents are located within about two blocks of planned construction areas. Almost 2,050 (21 percent) of the housing units in the project area and 3,650 people (24 percent of the population) may be low-income. The concentration of residents and proportion of low-income individuals differ in the project area. Exhibit 6-28 shows the approximate number of dwelling units and population near SR 99 for each area along the corridor.

Exhibit 6-28
Housing and Population Within Two Blocks of SR 99 Construction Activities

	Total Housing Units[1]	Total Population[2]
South Area	550	1,300
Central Area	5,750	9,500
Battery Sreet Tunnel	5,300	8,400
North Area	1,700	2,700
Entire Project Area[3]	9,500	15,500

Note: Additional housing units and people would be affected by the Broad Street Detour when it is in use for the Elevated Structure Alternative.

1 *Housing units are those that would be located within approximately two blocks of the construction area. The term "housing" does not include stays in hotels, motels, or shelters. Buildings that house homeless shelters are counted as one housing unit, no matter how many beds are provided at the facility.*

2 *Population is calculated using the Seattle average household size 1.58 persons per household (2000 census) plus the total capacity of the shelters.*

3 *The entire project area is the total for the two-block area on each side of the project corridor; it is not the sum of the component parts, due to an overlap of project corridor sections.*

In the south area, there is a large number of subsidized, emergency, and transitional housing units; a disproportionate share, more than 40 percent, of these residents are low-income. The St. Martin de Porres emergency shelter, The Compass Housing Alliance (formerly the Compass Center), and the Bread of Life facilities are key emergency housing resources near the south area. As part of the effort to determine possible construction effects on low-income and minority populations in the project area, members of the project team have held individual meetings with social service providers. Concerns expressed at these meetings included maintaining access for clients and employees, service deliveries, and emergency services; wayfinding through constructions sites; and preventing access by homeless persons or others to potentially dangerous construction locations.

Construction activities also may adversely affect persons with disabilities. Traffic and sidewalk detours, barricades, and other temporary construction measures could present substantial hurdles for these persons.

Construction activities would affect homeless persons living on downtown streets. As reported by area social service providers, the homeless population is concerned with the loss of parking areas used for car camping and the displacement of campsites under the viaduct. Although the concerns raised are valid, because these encampments are illegal they are ineligible for mitigation.

In addition, the general area around the project has a substantial number of small businesses, some of which could be minority-owned. During project meetings, several non-minority business owners expressed concern that during construction, actual or perceived traffic congestion could discourage customers from driving to patronize businesses in the project area.

The lead agencies will continue to look for ways to avoid or reduce construction-related effects on these populations through careful planning and design, and by providing solutions to construction-related problems when they do occur.

25 How would public services and utilities be affected during construction?

Public Services

Public services could be affected by lane closures and increased traffic congestion and delays on roadways in and around the construction area for all of the alternatives during construction. As previously discussed in the transportation effects text, traffic effects for all drivers, including public and emergency service providers, would be least with the Bored Tunnel Alternative followed by the Elevated Structure and Cut-and-Cover Tunnel Alternatives, since traffic effects would be the least intense and would occur over a shorter duration with the Bored Tunnel Alternative. Response times for police, fire, and emergency medical aid to locations within and near the construction area would likely increase. The increase in response time may be a few seconds or a couple minutes depending on the time of day and route. Fire and emergency medical services outside the project area also could be affected due to changes in traffic patterns on local roads. Increased travel times and reduced efficiency could be experienced by other public services, such as solid waste and recycling collection and disposal services, postal services, and school bus routes.

Construction in some high-volume traffic and pedestrian areas could require additional police support services to direct and control traffic and pedestrian movements.

During construction, fire hydrants would need to be relocated. Most of these relocations would occur along surface streets throughout the project area, requiring sidewalk and street curb relocations. Water line relocations during construction could temporarily affect water supplies used for fire suppression.

Utilities

All of the build alternatives are being designed to accommodate the utilities currently located in the project area, where feasible. Relocations would be performed according to agency regulations and permits, utility provider requirements, and appropriate BMPs.

Coordination with utility providers is ongoing to prepare for emergency repair situations and address potential mitigation. The project area contains numerous utilities that would be relocated or protected in place during construction:

- Wet vaults or regulators
- Water distribution mains, large water feeder mains, water services, and hydrants
- Sanitary sewer mains, large conveyances, and manholes
- Storm drainage and combined sewer facilities
- Natural gas facilities including low-pressure, intermediate-pressure, and high-pressure mains, metering equipment, and valves
- Low-pressure and high-pressure steam lines, valves, and vaults
- Telephone service and fiber-optic cable lines
- Electrical distribution and transmission lines
- Electrical systems (underground and overhead wire) serving transit systems

Underground utility relocations typically involve pavement demolition, excavation, repaving, ground support systems, groundwater control, relocation effects on other localized utilities, dust and noise control requirements, traffic disruptions, and lane or sidewalk closures. Aboveground utility relocations typically include placement of new or temporary poles. Direct effects for all utilities include disruptions of utility service during the cutover from existing to temporary service feeds, and again when the permanent utilities are completed.

Bored Tunnel Alternative

Utilities along the bored tunnel alignment could also be affected by settlement induced by tunnel boring. The length of time a utility is affected and specific construction methods used will be determined by the contractor during final design and would influence whether a utility requires replacement or support. These utilities include Seattle City Light clay tile duct banks, brick vaults, Orangeburg duct banks, lead-jointed cast-iron water mains, water main thrust blocks, gravity utilities, side sewers, water services, steam lines, and natural gas mains. Coordination with Seattle Public Utilities, King County, Seattle City Light, Seattle Department of Information Technology, private communications providers, Puget Sound Energy, and Seattle Steam would occur to verify that they are aware of potential settlement and vibration caused by tunnel boring and to seek their guidance regarding mitigation.

Several major construction activities could cause temporary interruptions for utility service customers within the project area. Removing concrete pavement and installing foundations or other structures are anticipated construction activities that may adversely affect vibration- and settlement-sensitive underground utilities, such as water lines. Cast-iron lead-joint water lines, sewers, and drains could require replacement or joint reinforcement before these construction activities begin.

Utilities may be temporarily taken out of service in order to remove them from the excavation area and to connect to the new facilities, or periodically as part of a major construction activity. These interruptions would be planned in advance.

Inadvertent damage to underground utilities could also occur during construction. Although such incidents do not occur frequently, they could temporarily affect services to customers of the affected utility while emergency repairs are being made.

Cut-and-Cover Tunnel Alternative

The general effects to utilities for this alternative would be similar to those described above for the Bored Tunnel

Appendix K, Public Services and Utilities Discipline Report

Additional information about construction effects on public services and utilities is provided in *Appendix K*.

Alternative. One different effect for this alternative as compared to the Bored Tunnel Alternative is that it would result in more disruptive effects to underground utilities located on the central waterfront along its alignment. Another difference is that the Cut-and-Cover Tunnel Alternative is not expected to result in settlement effects to utilities.

Elevated Structure Alternative

The general effects to utilities for this alternative would be similar to those described above for the Bored Tunnel Alternative. However, because the Elevated Structure Alternative requires less underground work, there would be fewer effects to utilities than for the other build alternatives.

26 How would air quality be affected during construction?

Air quality effects during construction would occur primarily as a result of dust and emissions from construction equipment (such as bulldozers, backhoes, and cranes), diesel-fueled trucks, diesel- and gasoline-fueled generators, and other project-related vehicles such as service trucks. The general construction-related effects to air quality would be similar for all the build alternatives, even though some of the specific construction activities may vary by alternative. For the Bored Tunnel Alternative, the TBM would be electrically powered and have negligible emissions.

Dust from construction is associated with demolition, land clearing, ground excavation, grading, cut-and-fill operations, and building structures. The amount of dust in the air due to construction would vary from day to day, depending on the level of activity, specific operations, and soil and weather conditions. Larger dust particles would settle near the source, and fine particles would be dispersed over greater distances from the construction site.

In addition, heavy trucks and construction equipment powered by gasoline and diesel engines would generate particulate matter less than 2.5 micrometers in size (also known as $PM_{2.5}$), carbon monoxide, and nitrogen oxides in exhaust emissions. Traffic restrictions during construction are expected to increase congestion in the area, which would temporarily increase emissions from traffic while vehicles are delayed. These emissions would be temporary and limited to the immediate area where congestion is occurring.

Some construction phases (particularly those involving paving operations using asphalt) would result in short-term odors. These odors might be detectable to some people near the site and would be diluted as distance from the site increases.

Because the total construction period for all of the alternatives would be longer than 60 months, the potential impacts on carbon monoxide concentrations are also subject to the EPA's Transportation Conformity Rule (40 CFR 93). For the preferred Bored Tunnel Alternative, the results indicate that carbon monoxide concentrations during construction would conform to the National Ambient Air Quality Standards.

27 How would greenhouse gas emissions be affected during construction?

Bored Tunnel Alternative

Energy consumption related to construction activities, including the use of construction equipment, such as diesel- and gasoline-powered equipment and trucks, contributes to greenhouse gas emissions.

Of all the build alternatives, the Bored Tunnel Alternative would produce the second highest estimated total amount of greenhouse gas emissions (reported as carbon dioxide equivalents, or CO_2e) during construction, as shown in Exhibit 6-29. However, these emissions would occur over the shortest build alternative construction period of 65 months.

Exhibit 6-29
Total Construction CO_2e Emissions Estimates

Alternative	Months of Construction	Total Metric Tons
Bored Tunnel	65	69,947
Cut-&-Cover Tunnel	105	63,485
Elevated Structure	120	72,853

Annual CO_2e emissions during construction were estimated to be 12,913 metric tons with the Bored Tunnel Alternative, and the daily emissions were estimated to be 35 metric tons. The daily CO_2e emissions would be the highest for the Bored Tunnel Alternative because of the short construction period as compared to the construction periods of the other build alternatives. However, the 35 metric tons that would be produced by the Bored Tunnel Alternative construction each day is a negligible portion of the total regional emissions of CO_2e projected for the 2015 Existing Viaduct, as shown in Exhibit 6-30.

Exhibit 6-30
Daily CO_2e Emissions Estimates

	Metric Tons per Day
Bored Tunnel Alternative Construction	35
Cut-&-Cover Tunnel Alternative Construction	20
Elevated Structure Alternative Construction	20
2015 Existing Viaduct – Regional	46,997

Cut-and-Cover Tunnel Alternative

The estimated total greenhouse gas emissions for this alternative are 63,485 metric tons, as shown in Exhibit 6-29. This alternative would have the lowest total of greenhouse gas emissions over the course of construction. Annual CO_2e emissions during construction were estimated to be 7,255 metric tons, and the daily emissions were estimated to be 20 metric tons. Similar to the Bored Tunnel Alternative, the estimated 20 metric tons of daily CO_2e emissions produced for this alternative would be a negligible portion of the regional daily emissions of CO_2e, as shown in Exhibit 6-30.

Elevated Structure Alternative

The estimated total greenhouse gas emissions for this alternative are 72,853 metric tons, as shown in Exhibit 6-29. This alternative would have the highest total of greenhouse gas emissions. Annual CO_2e emissions during construction were estimated to be 7,285 metric tons, and the daily emissions were estimated to be 20 metric tons. The estimated 20 metric tons of daily CO_2e emissions produced for this alternative would be a negligible portion of the regional daily emissions of CO_2e, as shown in Exhibit 6-30.

Appendix M, Air Discipline Report

Additional information on air quality during construction is provided in *Appendix M*.

The air quality conformity compliance determination is discussed in Section 3.7 of *Appendix M*.

Appendix R, Energy Discipline Report

Additional information on energy consumption and greenhouse gases during construction is provided in *Appendix R*.

What are CO_2 equivalents?

Greenhouse gases have different abilities to trap heat. To compare different greenhouse gases, scientists use a weighting factor. CO_2 is used as the standard. Other gases are converted into CO_2 equivalents using the weighting factor.

28 How much energy would be needed to construct the project?

For all of the alternatives, energy would be consumed by the following construction activities:

- Excavation and grading
- Material and debris handling and transport (e.g., trucks, barges, and conveyors)
- Operation of diesel- and gasoline-powered construction equipment
- Operation of diesel trucks involved in the transport of excavated material and delivery of construction material, both within construction areas and on local streets
- Operation of barges, which would likely transport construction material and excavated materials, particularly for spoils excavated from the bored tunnel
- Viaduct demolition
- Operation of the TBM (electric-powered – only for the Bored Tunnel Alternative)

The energy required for each construction area was estimated based on horsepower requirements, equipment usage, equipment load factors, and construction schedule.

Bored Tunnel Alternative

The estimated total construction energy requirements of the Bored Tunnel Alternative are provided in Exhibit 6-31. This alternative has the highest energy consumption of all the build alternatives. Construction activities specific to this alternative, such as interior tunnel construction are included in the estimate. The annual energy consumption is estimated to be 70,401 million British thermal units (BTUs) and the daily energy consumed during construction for this alternative would be about 193 million BTUs. The current daily energy consumption by vehicles in the city center is 13,221 million BTUs, so the daily energy consumed by this project would be just a small percentage of the overall energy consumption in the region.

Exhibit 6-31
Construction Energy Consumption
in million BTUs

	ALTERNATIVE		
Construction Area	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
South	109,513	54,845	118,844
Central – tunnel or elevated structure	155,503	155,926	158,578
North	88,519	112,469	43,134
Viaduct Demolition	27,806	27,806	27,806
Total	**381,341**	**351,046**	**348,362**

The TBM would be powered by electricity. A substation would be built in the WOSCA staging area to supply power for the TBM, interior tunnel construction activities, and Intelligent Transportation Systems signage. Existing electrical service would not be affected by activities powered by the substation.

Cut-and-Cover Tunnel Alternative

The estimated construction energy consumption for this alternative is 351,046 million BTUs, as presented in Exhibit 6 31. This alternative would consume about 9 percent less energy than the Bored Tunnel Alternative. The annual energy consumption is estimated to be 40,120 million BTUs and the daily energy consumed during construction would be about 120 million BTUs. As with the Bored Tunnel Alternative, the daily energy consumption for this alternative would be a small percentage of the overall energy consumed in the region.

Elevated Structure Alternative

The estimated construction energy consumption for this alternative is 348,362 million BTUs. The Elevated Structure Alternative would use the least amount of energy compared to the other alternatives; however, the differences in energy consumption between the alternatives is small, as shown in Exhibit 6-31. The annual energy consumption is estimated to be 34,836 million BTUs and the daily energy consumed during construction for this alternative would be about 95 million BTUs. The daily energy consumption for this alternative would be a small percentage of the overall energy consumed in the region.

29 How would water resources be affected during construction?

For all the build alternatives, construction effects related to water resources and water quality would be minimized or prevented through proper selection and implementation of BMPs. Construction staging, material transport, earthwork, stockpiling, and dewatering are all construction activities that could affect water resources in the project area. Construction-related pollutants such as sediment, oil, and grease can increase turbidity and affect other water quality parameters, such as the amount of available oxygen in the water. In addition, pH can be altered if runoff comes in contact with curing concrete, for example, which could have serious effects on aquatic species.

Much of the construction-related water quality effects would come from erosion of disturbed soil areas or soil stockpiles, which could result in stormwater runoff carrying silt, sediment, or other contaminants to receiving waters. Staging areas that are close to Elliott Bay and the East Duwamish Waterway have a greater potential of affecting water quality as a result of sediment transport and spills due to their close proximity to receiving waters.

Runoff water and dewatering water would likely be discharged to the combined sewer system for treatment at the West Point wastewater treatment plant. Before discharge to the combined sewer, stormwater runoff from active construction areas would need to be treated as necessary to comply with applicable permit requirements and project specifications.

Sediment and other contaminants also could fall onto roadways and be captured in stormwater runoff along haul routes. In addition, because construction materials and excavation spoils may be transported over water by barge, there is a risk of water quality effects on Elliott Bay during material transfer from the staging areas.

What is a British thermal unit?

A British thermal unit (BTU) is the approximate amount of energy needed to heat 1 pound of water 1 degree Fahrenheit.

Appendix O, Surface Water Discipline Report

Additional information about construction effects on water resources is provided in *Appendix O*.

Demolition of the viaduct is expected to generate fugitive dust, which also could temporarily affect water quality in the project area. The effects could include slight changes in water quality along the nearshore area, either from the dust settling on the water surface or from stormwater runoff that reaches Elliott Bay.

Bored Tunnel Alternative
Dewatering would be required during construction of the south portal and most of the retained cut sections, and it would likely continue until construction of the south portal retaining walls is completed. Dewatering during construction could result in groundwater flow from adjacent areas being drawn toward excavated areas. If this adjacent water contains contaminants, these contaminants could migrate and increase pollutant concentrations in dewatering water.

Given the rates of pumping for dewatering water in some areas, detention may be needed to avoid overwhelming existing conveyance systems. Depending on the volumes and timing, off-site disposal may be required. Large amounts of dewatering can also increase the risk for settlement. This would be mitigated by reinjecting water from the dewatering operation back into the ground. Any water that is not used for reinjection would need to be treated and disposed of in the sanitary sewer or at an off-site location. Construction dewatering systems would be designed to minimize reductions in the water table.

Cut-and-Cover Tunnel Alternative
In addition to the effects common to all build alternatives discussed above, the Cut-and-Cover Tunnel Alternative would require substantial earthwork, especially along the central waterfront, because a large part of the project would require excavation. This could result in a greater quantity of spoils stockpiles in the project area subject to erosion, which could mean more stormwater runoff carrying sediment and contaminants to receiving waters.

Soil improvements, which would likely consist of jet grouting, are proposed behind the Elliott Bay Seawall. Potential water quality impacts from soil improvement include grout seepage into Elliott Bay through cracks in the existing seawall.

After the new seawall is completed, the old seawall would be removed, which would require in-water work. This work would be performed primarily at low tide and with the use of appropriate BMPs (e.g., silt curtains) to minimize or eliminate effects to water quality.

The Cut-and-Cover Tunnel Alternative would require continuous dewatering throughout the construction process. As mentioned for the Bored Tunnel Alternative, dewatering could lower the groundwater table, and the reinjection of dewatering water could mitigate for this effect. Any water not reinjected would need to be treated and disposed of in the sanitary sewer or at an off-site location.

Elevated Structure Alternative
This alternative would have similar effects as described for the Cut-and-Cover Tunnel Alternative, except that large amounts of dewatering are not expected during construction. There are no major excavations planned; however, localized dewatering may be required for utility excavations. As a result, effects relating to dewatering activities would be minor with this alternative.

30 How would fish, aquatic, and wildlife species and habitat be affected during construction?

Bored Tunnel Alternative
Unlike the other build alternatives, the Bored Tunnel Alternative would not include replacing the Elliott Bay Seawall. Effects to fish and wildlife, in the project area would most likely be associated with construction noise and potential temporary and localized sedimentation and turbidity in Elliott Bay. Increased turbidity could occur due to erosion; spoils handling, stockpiling, and dewatering; and potential spills.

Some of the construction activities are likely to require the use of a nearshore loading and unloading facility to transport construction materials to the construction site and to remove excavation spoils. This operation would use existing facilities, and no in-water construction would be required. The associated vessel movement would be similar to existing navigation movements along the shoreline and would not represent a new or different effect.

Viaduct demolition would result in a temporary substantial change in the noise levels along the central waterfront. In addition, the viaduct demolition is expected to generate fugitive dust, which could temporarily affect habitat conditions in the area. The effects could include slight changes in water quality along the nearshore area, either from the dust settling on the water surface or from stormwater runoff that reaches Elliott Bay, which could have some minor effects on fish and wildlife species in the area. However, these effects are expected to be temporary and minor and are not expected to affect the long-term conditions of the species or their habitat. Consultation under the Endangered Species Act has been completed for construction of the Bored Tunnel Alternative and is summarized in Chapter 5, Question 32.

Cut-and-Cover Tunnel Alternative
In addition to the effects discussed for the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would excavate and transport an amount of soil that greatly exceeds the amount of soil generated by the tunneling process for the Bored Tunnel Alternative (see Exhibit 6-14). This large quantity of excavated soil would increase the potential to release dust and sediment to the environment.

Construction of a new seawall is a component of this alternative and would require the construction of a temporary access bridge over open-water habitat between Pier 48 (near S. Jackson Street) and the Seattle Ferry Terminal to provide ferry access during construction. This temporary bridge could be in place for more than 7 years. Pile driving, removal, and shading of about 15,000 square feet of shallow subtidal habitat would be associated with the construction of this structure. Also, to help maintain pedestrian access along the waterfront, it is possible that

Appendix N, Wildlife, Fish, and Vegetation Discipline Report

Additional information about construction effects on wildlife, fish, and vegetation is provided in *Appendix N*.

temporary overwater pedestrian walkways between some piers would be constructed.

Any pile-driving activities needed to install these temporary over-water structures could potentially harm fish and aquatic species due to the underwater sound impulses generated by the pile driver, and/or disturb other wildlife species due to airborne sound levels.

After the new seawall is completed, the old seawall would be removed, which would require in-water work. This work would be performed primarily at low tide and with the use of appropriate BMPs (e.g., silt curtains) to minimize or eliminate effects on the nearshore habitat. Marine organisms affected by the removal of the existing seawall would eventually be replaced by means of recolonization from adjacent habitat areas.

Elevated Structure Alternative
The Elevated Structure Alternative would also replace the Elliott Bay Seawall in the central waterfront. The potential effects to fish, aquatic habitat, and wildlife that would occur as the result of seawall replacement, as described above for the Cut-and-Cover Tunnel Alternative, would apply for this alternative as well.

Other potential effects to fish, aquatic habitat, and wildlife would be the same as described above for the Bored Tunnel Alternative.

31 Would construction have any indirect effects?
An indirect effect is a reasonably foreseeable effect caused by a project but that would occur in the future or outside of the project area. Construction of a viaduct replacement would primarily have direct effects on areas next to the construction sites and to local traffic. Specific indirect effects during construction are described earlier in this chapter for each environmental resource. Indirect effects are only discussed in instances where they are anticipated (meaning that if indirect effects are not discussed for a resource, effects are not expected). Indirect effects of construction would occur as people change their travel patterns and where they shop or go out to eat to avoid construction activity or congestion caused by closures or restrictions on SR 99. This means that the indirect effects are primarily related to the extent and duration of direct construction effects. The indirect effects would be dispersed throughout the greater Seattle area outside of downtown. Businesses away from the project area could see a small benefit, but the overall indirect effects are not expected to be significant. Parks could experience indirect effects of increased traffic congestion during construction; however, the activities and features of these resources would not be impaired.

Bored Tunnel Alternative
The Bored Tunnel Alternative would have the least indirect effects during construction. Except for the 9 months when the viaduct is being demolished, construction activity is limited to the two portal areas. Traffic on SR 99 is interrupted for just 3 weeks and otherwise is restricted only by the WOSCA detour.

Cut-and-Cover Tunnel Alternative
The Cut-and-Cover Tunnel Alternative would have the greatest indirect effects during construction. Construction activity along the central waterfront and the extended closure of SR 99 (more than 3 years) would lead some people to change how they travel and where they shop and go out to eat. Because SR 99 would be closed for a period of years, it is possible that some of these changes in travel and shopping patterns would be permanent.

Elevated Structure Alternative
The indirect effects of construction of the Elevated Structure Alternative would be greater than for the Bored Tunnel but less than the Cut-and-Cover Tunnel. Like the Cut-and-Cover Tunnel, there is extensive construction activity along the central waterfront, but SR 99 is closed for a much shorter time (5 to 7 months instead of 3 years). It is unlikely these changes would be permanent.

32 Would construction have any cumulative effects?
Cumulative effects are the combined effects of past, present, and reasonably foreseeable future projects. When we consider cumulative effects we look at long-term trends and large-scale effects, so the relatively short-term effects of construction usually do not make much difference. However, if multiple projects are under construction in the same general area at the same time, they can have combined effects that need to be considered. Construction of the following projects may overlap with construction of any of the alternatives:

- **Gull Industries on First Avenue S. –** This project is located west of First Avenue between S. Massachusetts Street and S. Atlantic Street. The project would develop the entire site with a mixture of office, retail, and restaurant uses. If construction of this project coincides with construction on the WOSCA site north of S. Atlantic Street, excavation and dewatering could draw down the local water table. This could cause settling that could affect nearby structures, roadways, and utilities. These effects could be minimized by coordinated planning appropriate mitigation (such as recharge) to maintain the water table.

- **North Parking Lot Development at Qwest Field –** The construction timeline for this planned development is unknown, but it is possible that part of it could overlap with construction activity on the WOSCA site. The development would include the construction of a 20-story office tower and three residential towers of 10, 20, and 25 stories. Likely effects could be the temporary loss of parking adjacent to the stadiums and the Pioneer Square Historic District and effects from noise and dust for those located next to the site.

- **Washington State Ferries Seattle Terminal Improvements –** To maintain service at this busy transportation hub, one of the slips needs to be rebuilt and the terminal building needs to be replaced to meet current seismic standards. Additional improvements are planned to help pedestrian and vehicle traffic flow more smoothly. Construction of these improvements would overlap with viaduct replacement construction along the central waterfront. The primary effects would be temporary traffic restrictions on Alaskan Way and construction noise.

- **Bill and Melinda Gates Foundation Campus Master Plan –** Major construction related to the $500 million headquarters for the Bill and Melinda Gates Foundation was completed in spring 2011. A third building is expected to be built on the site between 2014 and 2017. Possible effects could be noise, dust, and truck traffic for those next to the site.

- **Mercer Street West Corridor Improvements –** These improvements will convert Mercer Street to two-way operation, with two lanes in each direction and turn pockets between Fifth Avenue N. and Queen Anne Avenue N.; and convert Roy Street to a two-way street with bicycle lanes between Fifth Avenue N. and Queen Anne Avenue N. With the improvements now under construction on Mercer Street between I-5 and Dexter Avenue and those included with the viaduct replacement project, there will be a direct, two-way connection between I-5 and Elliott Avenue West. Likely construction effects would be temporary traffic restrictions and parking reduction.

- **South Lake Union Redevelopment –** Several large-scale commercial, retail, and residential construction projects are planned in the South Lake Union area. Specific projects that may have timelines coinciding with the north portal construction are unknown. Possible effects could be noise, dust, and truck traffic.

With the Bored Tunnel Alternative, the Elliott Bay Seawall would be replaced at the same time as the tunnel is under construction, from 2013 to 2015. Because the existing viaduct would still be in use, the concurrent construction would not cause any additional effects. The seawall work would be completed before the viaduct is demolished in 2016. Directly after viaduct demolition and removal, the City of Seattle expects to begin work on the waterfront promenade and the new Alaskan Way surface street. With the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the seawall would be replaced at the same time as construction of the viaduct replacement.

CHAPTER 7 - CUMULATIVE EFFECTS

What is in Chapter 7?

This chapter identifies possible cumulative effects of the build alternatives when combined with past trends and other ongoing or expected plans and projects.

CUMULATIVE EFFECTS OVERVIEW

1 What are cumulative effects, and why do we study them?

Cumulative effects result from the proposed action when added to other past, present, and reasonably foreseeable projects or actions. Cumulative effects are not caused by a single project, but include the effects of a particular project in conjunction with other projects (past, present, and future) on the particular resource. Cumulative effects are studied to enable the public, decision-makers, and project proponents to consider the "big picture" effects of a project on the community and the environment.

2 How does WSDOT evaluate cumulative effects?

Several sources of guidance are available to Washington State Department of Transportation (WSDOT) to conduct the cumulative effects analysis. These include general guidance in Section 412 of the *Environmental Procedures Manual*[1] and in Federal Highway Administration (FHWA) Technical Advisory T 6640.8A.[2] Specific guidance is provided in *Guidance on Preparing Cumulative Impact Analyses*,[3] including the eight-step procedure shown in Exhibit 7-1.

Exhibit 7-1
WSDOT's Approach for Assessing Cumulative Effects

Step	Approach
1	Identify resources to consider
2	Define the study area for each resource
3	Describe current status/viability and historical context for each resource
4	Identify direct and indirect project effects that might contribute to a cumulative effect
5	Identify other current and reasonable foreseeable actions
6	Identify and assess cumulative effects
7	Document the results
8	Assess the need for mitigation

All resources evaluated for permanent and short-term construction-related effects were considered in the cumulative effects analysis for this Final Environmental Impact Statement (EIS). Please note that hazardous materials are not a resource and that the effects of encountering hazardous materials are included in the discussion of water quality and earth and groundwater resources.

3 How did WSDOT evaluate the cumulative effects for this project?

Following the eight-step procedure shown in Exhibit 7-1, WSDOT completed Steps 1 through 4 during the development of the resource-specific discipline reports. Chapters 5 and 6 describe the direct and indirect effects on the resources and further detailed information can be found in the discipline reports for each resource. Chapter 4 of this Final EIS specifically addresses Step 3 above in providing the current status and historic context of the resources within the study area.

The study area for each resource is listed in Exhibit 7-2. WSDOT determined the cumulative effects study area for each resource by determining:

1 The distribution of the resource itself.

2 The area within that distribution where the resource could be affected by the project in combination with other past, present, and reasonably foreseeable actions.

Exhibit 7-2
Study Areas for Cumulative Effects

Resource	Study Area
Transportation	Regional Effects – four-county area (King, Snohomish, Pierce, Kitsap) Local Effects – Seattle Center City
Visual Quality	Viewshed of the proposed project
Noise	Seattle Center City with focus on the waterfront area
Land Use	Interstate 5 (I-5) to the east and Elliott Bay to the west; S. Atlantic Street to the south and Valley Street to the north
Social	Seattle Center City with focus on the waterfront area
Historic and Archaeological	The project Area of Potential Affect (APE) as shown in Chapter 5
Public Services and Utilities	Seattle Center City with focus on the waterfront area
Economics	Regional effects – Puget Sound region and state Local effects – Seattle Center City with focus on the waterfront area
Air Quality	Regional effects – four-county area (King, Snohomish, Pierce, Kitsap) Local effects – Seattle Center City
Wildlife, Fish, and Vegetation	Upland habitat in the vicinity of the proposed improvements, nearby shorelines and open water habitats of Elliott Bay and Lake Union
Water Quality	Elliott Bay, Lake Union, central Puget Sound, and associated surface water draining to these water bodies
Earth and Groundwater	Seattle Center City with focus on the waterfront area
Energy	Washington State

The timeframe for the cumulative effects assessment for each resource begins when past actions began to change the status of the resource from its original condition, setting the long-term trend currently evident and likely to continue into the reasonably foreseeable future. For all resources, the timeframe begins in the mid-19th century,

What are cumulative effects?

Cumulative effects are defined as: "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7)

1 WSDOT 2010.

2 FHWA 1987.

3 WSDOT et al. 2008.

when the central Puget Sound region began to be altered by non-indigenous settlers, and ends in 2030, the project design year.

WSDOT characterized the baseline (present) condition of each resource by describing its current status and providing historical context for understanding how the resource got to its current state[4] (see Exhibit 7-1, Step 3). WSDOT used information from field surveys, interviews, and literature searches to assess the current condition of the resource.

Chapter 4 of this Final EIS, the chapter describing the current conditions, presents information on the baseline condition of each resource addressed in the cumulative effects assessments. The transportation section in Chapter 5 of this Final EIS describes how traffic would grow in the region with and without the project. Through the use of a travel demand model, traffic volumes were predicted for the year 2030 with and without the project. Future traffic was forecast for morning and evening commutes (peak hour travel), which enabled an assessment of how travel times would be affected and where congestion would occur. This section also examined how the project would affect transit facilities and service, non-motorized facilities, and parking.

To identify other present and reasonably foreseeable actions (see Exhibit 7-1, Step 5), WSDOT compiled information from local and state agencies, past environmental analyses, and comments received during the scoping process for this Final EIS.

"Reasonably foreseeable actions" were defined as actions or projects with a reasonable expectation of actually happening, as opposed to potential developments expected only on the basis of speculation. Accordingly, WSDOT applied the following criteria:[4]

- Is the proposed project included in a financially constrained plan (e.g., a capital improvement program)?
- Is it permitted or in the permit process?
- How reasonable is it to assume that the proposed project will be constructed?
- Is the action identified as high priority?

Based on these criteria, the following projects were identified as being reasonably foreseeable and were included in this cumulative effects analysis:

- Independent projects included as part of the Alaskan Way Viaduct and Seawall Replacement Program (Program) if the Bored Tunnel Alternative is built.
- Twenty-eight projects that may be built within a similar timeframe or in a nearby location, are currently under construction, or have recently been completed. These projects are listed in Exhibit 7-3.

Exhibit 7-3 summarizes the actions considered for the cumulative effects analysis. The Program is described in Chapter 2.

The Alaskan Way Viaduct Replacement Project (project) complements a number of other projects with independent utility. All of these projects are intended to improve safety and mobility along SR 99 and the Seattle central waterfront from the area south of downtown to Seattle Center. These improvements include the Moving Forward projects identified in 2007 and the improvements recommended as part of the Partnership Process. Collectively, these individual projects are referred to as the Alaskan Way Viaduct and Seawall Replacement Program (Program).

The 2004 Draft EIS and 2006 Supplemental Draft EIS did not refer to the Alaskan Way Viaduct and Seawall Replacement Program. The distinction between the project and the Program came after the Moving Forward projects were announced in 2007.

Exhibit 7-3
Current and Reasonably Foreseeable Actions Considered for Cumulative Effects

	ALTERNATIVE		
	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Independent Projects that Complement the Bored Tunnel Alternative			
Elliott Bay Seawall Project	X[2]	Included inalternative	Included in alternative
Alaskan Way Surface Street Improvements	X[2]	Included in alternative	Included in alternative
Alaskan Way Promenade/Public Space	X[2]	Included in alternative	Included in alternative
Elliott/Western Connector	X[2]	Function provided[1]	Function provided[1]
First Avenue Streetcar Evaluation	X[2]	Included in alternative	Included in alternative
Transit Enhancements	X[2]	Not proposed	Not proposed
Independent Projects that Complement All Build Alternatives			
S. Holgate Street to S. King Street Viaduct Replacement Project	X	X	X
Transportation Improvements to Minimize Traffic Effects During Construction	X	X	X
Seattle Planned Urban Development			
Gull Industries on First Avenue S.	X	X	X
North Parking Lot Development at Qwest Field	X	X	X
Seattle Center Master Plan (EIS) – Century 21 Master Plan	X	X	X
Bill and Melinda Gates Foundation Campus Master Plan	X	X	X
South Lake Union Redevelopment	X	X	X
U.S. Coast Guard Integrated Support Command	X	X	X
Seattle Aquarium and Waterfront Park	X	X	X
Seattle Combined Sewer System Upgrades	X	X	X
Local Roadway Improvements			
Bridging the Gap Projects	X	X	X
S. Spokane Street Viaduct Widening	X	X	X
SR 99/East Marginal Way Grade Separation	X	X	X
Mercer East Project from Dexter Avenue N. to I-5	X	X	X
Mercer Street West	X	X	X
Regional Roadway Improvements			
I-5 Reconstruction	X	X	X
SR 520 Bridge Replacement and HOV Program	X	X	X
I-405 Corridor Program	X	X	X
I-90 Two-Way Transit and HOV Operations Stages 1 and 2	X	X	X
Transit Improvements			
First Hill Streetcar	X	X	X
Sound Transit University Link Light Rail Project	X	X	X
RapidRide	X	X	X
Sound Transit North Link Light Rail	X	X	X
Sound Transit East Link Light Rail	X	X	X
Washington State Ferries Seattle Terminal Improvements	X	X	X
Transportation Network Assumptions			
HOV Definition to 3+ Throughout the Puget Sound Region	X	X	X
Sound Transit Phases 1 and 2	X	X	X

X – *Evaluated as a reasonably foreseeable action.*

1 *While the listed project is not part of the Program, the project alternative would provide a similar function for traffic purposes.*

2 *These projects are included in the Alaskan Way Viaduct and Seawall Replacement Program (Program).*

Appendix C, Transportation Discipline Report

Transportation information is contained in *Appendix C*.

Appendix B, Alternatives Description and Construction Methods

The projects considered in this cumulative effects analysis are described in *Appendix B*.

4 WSDOT et al. 2008.

The 2010 Supplemental Draft EIS evaluated the short- and long-term environmental effects of the project and the cumulative effects of complementary projects included in the Program. Studying the combined effects of the project and the Program helps the public and decision-makers understand how our transportation system would function in the future when the planned improvements are completed.

This Final EIS evaluates the project build alternatives: Bored Tunnel (preferred alternative), Cut-and-Cover Tunnel, and Elevated Structure with and without tolls. The environmental effects of the independent projects that comprise the Program are examined in detail through separate environmental processes for those projects. After considering the combined effects of this project and the Program, this Final EIS then considers their effects combined with other ongoing or expected plans or projects.

4 What are the results of the cumulative effects analysis?

The rest of this chapter describes the results of WSDOT's analysis of cumulative effects. Exhibit 7-4 summarizes the cumulative effect on the resource with and without the project (the build alternatives are discussed as a whole unless otherwise noted), and the remainder of the section discusses each resource. The cumulative effects analysis discusses future conditions as follows:

- Without the project – Viaduct Closed (No Build Alternative)
- With the project – Bored Tunnel Alternative with Program, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative, with and without tolls for all build alternatives

Exhibit 7-4
Cumulative Effects by Resource

Resource	Without the Project	With the Project
Land Use	No change	Does not contribute
Visual Quality	No change	Does not contribute
Transportation	Adverse	Beneficial contribution
Noise	No change	Slight beneficial contribution for tunnel alternatives Does not contribute for elevated structure
Economics	Slight adverse	Slight beneficial contribution
Social and Neighborhood Resources	Slight benefit	Slight beneficial contribution
Historic, Cultural, and Archaeological Resources	Slight adverse	Slight adverse contribution
Public Services and Utilities	Slight adverse	Does not contribute
Energy and Greenhouse Gas Emissions	No change	Does not contribute
Water Quality	Slight adverse	Beneficial contribution
Air Quality	No change	Does not contribute
Wildlife, Fish, and Vegetation	No change	Does not contribute
Earth and Groundwater	No change	May have beneficial contribution if contaminated soil or groundwater removed

Note: These cumulative effects are relative to a baseline that reflects existing conditions and trends.

The project, Program, and other plans and projects would not contribute to a cumulative effect for public services, utilities, energy, greenhouse gas emissions air quality, wildlife, and fish and vegetation. For these resources, there are direct effects as indicated in Chapter 5. However, the project will not contribute to a cumulative effect as explained below.

Public Services and Utilities

All of the build alternatives would modify the transportation network in and around downtown including having direct effects on public services and utilities. However, the project would not contribute to cumulative effects on public services beyond the numerous minor traffic revisions that public service providers normally have to accommodate. Existing utilities may be impacted during construction; however, these would be rerouted and upgraded, resulting in a neutral cumulative effect. Operation of the build alternatives would not impact future utility projects.

Energy and Greenhouse Gas Emissions

Modeling shows that greenhouse gas emissions, through the consumption of fuel by vehicles on the roadway, would be less with the project than without it. The energy used for operating the tunnel and energy demands of other projects would not be significant in the regional context, and overall there would be no contribution to a cumulative effect on energy use or greenhouse gas emissions.

Air Quality

The project is not expected to result in or exacerbate a violation of air quality standards. The project, Program, and all transportation improvements considered in the cumulative effects analysis are part of the conforming Metropolitan Transportation Plan maintained by PSRC and are not expected to contribute to an adverse cumulative effect on air quality.

Wildlife, Fish, and Vegetation

The project is not expected to have adverse effects on wildlife, fish, and vegetation, and it will improve water quality. Therefore, it would not contribute to cumulative effects. Other elements of the Program,[5] such as the Elliott Bay Seawall Project, would likely have long-term beneficial effects on habitat, although some short-term adverse effects are likely during construction. The Washington State Ferries Seattle Terminal Improvements have not been defined but are not expected to result in new long term adverse effects.

5 What is the cumulative effect on the built environment?

The existing built environment was established early in Seattle's history. The central waterfront played a key role in the development of Seattle as the historic gateway from the water to the city. The Mosquito Fleet was the primary transport around Puget Sound from the 1850s to the 1930s and was replaced by the modern ferry system; cargo vessels have been an important part of the city's long-time function as a major West Coast port. Seattle also became part of a north-south route for railroads and later vehicle traffic.

5 Note that replacement of the seawall is an element of the Cut-and-Cover Tunnel and Elevated Structure Alternatives and a Program element under the Bored Tunnel Alternative, as it has separate utility.

With development came significant topographic changes, including earth-moving projects like the Denny Regrade and the filling of Elliott Bay tidelands. Drawing on the historic trends briefly described above, as well as in Chapter 4 of this Final EIS, this section describes the cumulative effect on the built environment without and with the project.

There are differences in direct effects whether the project is tolled or not as indicated in Chapter 5. However, these differences are not significant enough to change the project contribution to cumulative effects for the following resources: Visual Quality, Economics, Social and Neighborhood Resources, and Historic, Cultural, and Archaeological Resources.

LAND USE

Historic Trend

Large earth-moving projects over the past 100 years and development of multiple modes of transportation infrastructure have shaped the land use patterns in the Seattle area. Many of the land use patterns that were established by 1900 are still in effect today, with commercial, industrial, and port development in the south project area; retail businesses, hotels, and office space in the downtown core; and retail businesses, hotels, and residential uses in the Belltown and north project area.

6 What cumulative effects are anticipated?

There is a new emphasis on increasing livability in Seattle by bringing people closer to jobs and amenities. The City has also been studying development plans for the area South of Downtown (SODO) that are intended to stimulate housing and development in the area. In the north, recent zoning changes encourage housing and job opportunities in the South Lake Union neighborhood, with residential, commercial, and manufacturing uses. The provision for commercial uses was intended in part to support biotechnology uses and biotechnology research and development laboratories.

Without the project, there would be limited opportunity to redevelop the central waterfront area. The City is currently engaged in efforts to develop a new central waterfront plan, which will be the primary guide for determining the types and areas of future land uses along the waterfront. The City can continue with redevelopment plans, although somewhat revised from current vision, under the Viaduct Closed (No Build) Alternative, which would alter land use in the area by encouraging housing and commercial development. The change in land use would be consistent with locally approved plans.

The Bored Tunnel or Cut-and-Cover Tunnel Alternative would contribute to a beneficial cumulative effect by complementing the numerous ongoing improvements in Seattle, particularly the central waterfront Alaskan Way Promenade/Public Space project.

The Elevated Structure would result in a condition similar to what exists today. While the construction of the Elevated Structure Alternative does not fit in with specific future development plans along the central waterfront (e.g., Alaskan Way Promenade), the Elevated Structure Alternative would not change existing land uses into the future. All build alternatives would connect the street grid north of Denny Way. This would support planned urban development in the South Lake Union area.

Because the Bored Tunnel, Cut-and-Cover Tunnel, or Elevated Structure Alternatives would replace an existing facility that is included in local and regional plans rather than expand or build new routes, they are expected to support other currently planned land uses and densities including projects planned along the central waterfront.

VISUAL QUALITY

Historic Trend

The visual character of the landscape has been dramatically transforming ever since the first Europeans settled in the area. The area was logged and cleared for farming and development; hills were moved; shoreline areas were filled; rivers were channelized; and other activities such as mining, shoreline development, and road building all contributed to changes in the landscape. The urban character of the project area has also changed over time as the architecture of the city evolved and building materials have improved. Historic structures within the project area contribute to the visual landscape. Even though development has blocked some views of the landscape, Seattle benefits from many natural features such as Mount Rainier, Puget Sound, and the Olympic and Cascade Mountains, which are so dominant that they can still be seen from many viewpoints.

7 What cumulative effects are anticipated?

There would be no immediate major changes in the visual character along the waterfront if the project is not built. Once the viaduct is closed the urban landscape will continue to be the dominant feature. In addition, once the viaduct is closed, dramatic views from the viaduct would be lost. Other development would continue to occur and continue the trend of slowly altering the visual landscape of the urban environment over time. While individual visual features may change, the general visual setting would remain urban.

The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would change the visual features in the waterfront area, which would largely be due to removing the existing viaduct (a dominant visual feature in the urban landscape). Viaduct removal would open up views and allow projects such as the Alaskan Way Surface Street Improvements and Alaskan Way Promenade/Public Space to occur, resulting in more green space and improvements to pedestrian facilities that would improve the aesthetics of the urban environment. There still will be some visual obstruction by the elevated portion of the Cut-and-Cover Tunnel Alternative between the north portal and Aloha Street. The visual effects of these projects in combination with the Washington State Ferries Seattle Terminal Improvements and other future projects will be the continuation of the urban visual character in this area. Visual conditions in the north project area from near Aurora Avenue to about Harrison Street will also be slightly modified by planned development and changes to Aurora Avenue as it is

Appendix G, Land Use Discipline Report

Land uses and densities are described in *Appendix G*.

Appendix D, Visual Quality Discipline Report and Appendix E, Visual Simulations

A description of visual quality and visual simulations are provided in *Appendices D* and *E*.

converted to a roadway with fewer lanes, less traffic, and at-grade signalized intersections, which would result in reduced SR 99 traffic.

The Elevated Structure Alternative would be wider than the existing viaduct and would, therefore, be a more dominant visual element of the central waterfront urban landscape. It would reduce opportunities for opening views and providing green spaces, and thus would reduce the opportunity to improve the aesthetics in the waterfront area. However, this alternative would not result in a change to the urban character of the study area.

None of the build alternatives would contribute to an adverse cumulative effect on overall visual quality. The view with the elevated structure would be similar to the current view but different from the view with the two tunnel alternatives. Similar to the discussion of visual quality without the project, none of the alternatives would contribute to a change in the visual conditions of an urban setting.

TRANSPORTATION

Historic Trend

Transportation has had a significant role in the development of the downtown area, including marine vessels, surface streets, railroads, and highways. Neighborhoods and districts have changed little since the early 1900s when the street grid was established and pattern of development set in place.[6] Growth and development in Seattle and the Puget Sound region have resulted in increased traffic volumes and congestion for many decades. SR 99, which includes the Alaskan Way Viaduct, is a significant north-south route through the Seattle downtown and was built to provide a bypass through downtown.

8 What cumulative effects are anticipated?

Viaduct closure would cause a large number of trips to redistribute. This would accelerate the trend of increased roadway and intersection congestion at a faster rate than if the viaduct functions were replaced. Even with other planned transportation improvements, the increased congestion would discourage vehicle travel through downtown, causing longer travel trips to avoid the downtown area. Key north south routes, including I-5 and possibly I-405, would experience higher traffic volumes due to the loss of SR 99, and travel times would increase while travel speeds would decrease. This would adversely affect public transit travel times and the reliability of bus operations, as well as cause delay for heavy trucks involved in freight movement.

Certain intersections would experience heavy queuing and long backups:

- **South end –** along First Avenue S. at S. Atlantic Street and S. Royal Brougham Way
- **Downtown area –** most intersections on First Avenue between S. King Street and Madison Street, and at intersections along Second and Fourth Avenues
- **North end –** Battery, Broad, and Wall Streets in Belltown

Other planned transportation improvements, including rail projects, would help to decrease congestion to some extent, but the large contribution of traffic to the downtown street network from loss of the viaduct would contribute to an adverse effect.

Replacing the Alaskan Way Viaduct is part of the Puget Sound Regional Council's (PSRC) adopted Regional Transportation Plan and a key link in maintaining regional mobility and transportation infrastructure. The Bored Tunnel, Cut-and-Cover Tunnel, or Elevated Structure Alternatives with or without tolls, combined with other planned transportation improvements, will continue to facilitate the safe and efficient movement of passenger vehicles, transit, and freight to and through downtown Seattle. However, the tolled build alternatives would result in diversion onto city streets and I-5 that would affect passenger vehicles, transit, and freight going to and through downtown Seattle.

The number of parking spaces would be reduced under all of the build alternatives relative to the Viaduct Closed (No Build Alternative). Generally, the Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative would result in loss of greater numbers of parking spaces than the Bored Tunnel Alternative. This continues a trend of limiting parking opportunities in the downtown area to encourage use of public transportation and thereby reducing vehicle traffic.

The build alternatives would contribute to a beneficial cumulative effect for neighborhoods located north and south of downtown (such as Ballard, Fremont, Greenwood, West Seattle, White Center, and Georgetown) that use SR 99 as an alternative route to access downtown and other parts of Seattle from the various transportation and transit improvements that are expected, such as the new public transit RapidRide projects. These improvements would make access easier and more desirable for individuals from surrounding neighborhoods.

NOISE

Historic Trend

Cities tend to be noisy places. Seattle has steadily developed as an urban center, with commercial, industrial, and port development in the south project area; retail businesses, hotels, and office space in the downtown core; and retail businesses, hotels, and residential buildings in Belltown and the north project area. Historically, noise would have come from construction activity, and transportation noises would have been associated with whistles on trains and ships and wheels on cobblestone streets. Today, traffic, especially along the central waterfront, is the main noise source; in many areas, the noise levels are high enough to interfere with outdoor activities.

9 What cumulative effects are anticipated?

Under the Viaduct Closed (No Build Alternative), traffic noise from the viaduct would decrease when the facility is closed. Along Alaskan Way, traffic would increase once the

Appendix C, Transportation Discipline Report

Transportation effects are discussed in *Appendix C*.

Appendix F, Noise Discipline Report

Noise effects are discussed in *Appendix F*.

6 See **Question 5** of this chapter; *Appendix G, Land Use Discipline Report*; and *Appendix I, Historic, Cultural, and Archaeological Resource Discipline Report*.

viaduct is closed and hence noise levels near the surface street would increase.

The Elevated Structure Alternative would maintain the current noise levels produced from the viaduct and continue to be the dominant source of traffic noise in the waterfront area. Noise reducing design features of the Elevated Structure Alternative would improve noise levels as might the introduction of quieter vehicles like all electric cars.

With the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, the levels of traffic noise near the south area, including the area near the south portal, would be similar to conditions without the project. However, along the central waterfront and north of Denny Way to Harrison Street (including the area around the north portal), traffic noise levels would be greatly reduced compared to the Viaduct Closed (No Build Alternative). These build alternatives would contribute to a slight beneficial cumulative effect on noise levels; however, general sound levels would remain high and would continue to increase over time as additional development occurs. With or without tolls, traffic noise will continue to approach or exceed FHWA's noise abatement criteria in the study area due to increased traffic.

ECONOMICS

Historic Trend

The economy of the Puget Sound region has fluctuated greatly because of the strong dependence on natural resource-based industries such as logging, fishing, and agriculture and, more recently (in the second half of the 20th century), aerospace. With the growth of high-technology industries, tourism, clean technology, medical care, and other trade and service-sector businesses, the economy has become more diversified and the fluctuations are less severe. However, the region's continued prosperity is challenged by the increasingly competitive global economy. Washington depends on foreign trade more than any other state, and the Puget Sound region is vital to this trade, with companies such as Boeing, Costco, Microsoft, Amazon.com, Paccar, Starbucks, and Weyerhaeuser based in the region.

10 What cumulative effects are anticipated?

In the short term, there would be no changes to the existing conditions for the Viaduct Closed (No Build Alternative) because the viaduct would remain open; however, once the viaduct was closed, the movement of vehicles and goods would be adversely affected by the increased congestion and delays on the downtown street network. The ability of the street network to support existing and future development is one factor in keeping existing businesses and attracting new businesses to the area. This may have a slight negative effect on the economy. By maintaining local and regional mobility along the SR 99 corridor, the Bored Tunnel, Cut-and-Cover Tunnel, or Elevated Structure Alternatives would help businesses that depend on the efficient movements of goods and freight and would support a core part of the local economy.

It is very difficult to predict economic impacts due to the many external factors, such as worldwide economic conditions and local economy fluctuations. However, on Seattle's central waterfront, the Bored Tunnel or Cut-and-Cover Tunnel Alternatives could help facilitate more pedestrian and tourist activity for the waterfront businesses that rely on this traffic. Viaduct removal, implementation of the central waterfront plan, and improvements to the Seattle Ferry Terminal and Alaskan Way Promenade would cumulatively provide economic benefits in the form of increased investment, revitalization, and development opportunities. This could stimulate more economic activity, allow opportunities for new or expanded business and employment, and generate more tax revenues.

SOCIAL AND NEIGHBORHOOD RESOURCES

Historic Trend

Social conditions in the project area have changed over time due to the development and redevelopment of the downtown core and surrounding neighborhoods and due to major events such as the Great Seattle Fire of 1889, which destroyed the downtown area.

As the population grew, social services and community facilities, including parks and recreational spaces, also increased to serve the growing population. Seattle's population includes minorities and low-income persons. Historically, many of these populations have been in the Pioneer Square area. A variety of community facilities and social services are now provided by the City, as well as numerous private and nonprofit organizations.

11 What cumulative effects are anticipated?

In the short term, there would be no contribution to cumulative effects on social or neighborhood resources for the Viaduct Closed (No Build Alternative).

The Elevated Structure Alternative would not contribute to any cumulative effects on social or neighborhood resources; although the alternative would provide a minimal beneficial contribution to improvements in recreational, park and open spaces.

The Bored Tunnel and Cut-and-Cover Tunnel Alternatives, combined with other transportation and urban development projects, are expected to contribute to a beneficial cumulative effect on social resources in downtown Seattle neighborhoods. Viaduct removal and redevelopment of the central waterfront area would invigorate community life and strengthen neighborhood identity by accommodating plans for businesses and residential development, including low- and moderate-income housing. This would enhance and diversify community life, provide improved opportunities for people to live closer to their work, and sustain economic growth. These alternatives contribute to the beneficial cumulative effect of the planned projects in the study area on recreational, park, and open spaces enabling other projects to move forward as planned.

Enhanced transit and extension of the City's streetcar network along First Avenue and S. Jackson Street would substantially improve downtown access to affordable,

Appendix L, Economics Discipline Report

A discussion of economic effects is provided in *Appendix L*.

Appendix H, Social Discipline Report

Neighborhoods, community, social services, and environmental justice are discussed in *Appendix H*.

convenient, and reliable transportation, which would be especially beneficial to low-income and transit-dependent populations in the downtown area.

HISTORIC, CULTURAL, AND ARCHAEOLOGICAL RESOURCES

Historic Trend

The central Puget Sound area has a long history of occupation by indigenous peoples and was settled by European-Americans in 1851. Development of a city began shortly after settlement, including exporting natural resources such as coal and timber. Originally, marine vessels were the primary mode of transportation of goods and people through the region, but these were supplanted almost entirely by roads, railroads, airplanes, and eventually freeways.

The Great Fire of 1889 destroyed a large portion of the city and led to significant redevelopment and expansion of the commercial district; most of this area is now the Pioneer Square Historic District. Aurora Avenue (SR 99) opened to traffic in 1933, and the Battery Street Tunnel opened in the 1950s to connect with the new Alaskan Way Viaduct.

Land development efforts in Seattle involved extensive modification to the landscape, including filling wetlands and nearshore areas (e.g., seawall development in the central waterfront area and creation of the industrial area at the mouth of the Duwamish River) as well as removing hilltops (e.g., Denny Hill Regrade) and digging canals (e.g., Lake Washington Ship Canal).

12 What cumulative effects are anticipated?

The occasional loss of historic sites is likely to continue with or without the project. However, since the 1960s and even more so today, there are increased regulatory protections and awareness of the value of historic structures, which have slowed the pace of loss and spurred the development of reasonable alternative and mitigation options. We note that the Alaskan Way Viaduct and Battery Street Tunnel are eligible for listing on the National Register for Historic Places, and that under the Viaduct Closed (No Build Alternative) the Alaskan Way Viaduct would no longer be in use and its future uncertain while the Battery Street Tunnel would likely be retrofitted and remain in use.

With all of the build alternatives, the incremental loss of historic and culturally important resources would continue, as it would under the Viaduct Closed (No Build Alternative). As cited in Chapter 4, the existing Alaskan Way Viaduct would be removed for any of the build alternatives. Construction of the build alternatives as well as other reasonably foreseeable actions such as other transportation and land development projects would potentially adversely affect several other buildings and have the potential to disturb archaeological resources, which occurs only with the project. Overall, the build alternatives would contribute to the trend of the gradual loss or disturbance to historic or archaeology resources over time and thus contribute to the negative cumulative effect.

13 What is the cumulative effect on the natural environment?

In general, the natural environment within the study area has been dramatically altered by the past 100 years of urbanization. As discussed in Question 5, this includes significant topographic changes with projects like the Denny Regrade and the filling of Elliott Bay tidelands. Also of significance is the channelization of the Duwamish and other rivers in the area, as well as the use of waterways for municipal discharges and stormwater runoff. This section describes the cumulative effect on the natural environment without and with the project.

WATER QUALITY

Historic Trend

From 1850 through the 1950s, water bodies such as Elliot Bay, Puget Sound, and the Duwamish River provided convenient locations for discharging municipal sewage, stormwater runoff, and other industrial wastes. Logging and land clearing resulted in sedimentation in streams, lakes, and marine water bodies. Pesticides and fertilizers used on landscaped areas and contaminated runoff from impervious surfaces made their way into surface water via stormwater runoff.

These past and ongoing actions have resulted in poor water quality in the project area. Elliott Bay, the Duwamish River, and Lake Union all have water quality problems. Current regulations target point discharge sources, and new development or redevelopment is required to control and treat stormwater runoff. However, water quality problems persist, particularly temperature and bacterial contamination.

14 What cumulative effects are anticipated?

The long-term trend is the slow improvement in water quality resulting from regulatory requirements for treating discharges to water. As redevelopment occurs, requirements are triggered and updated methods of treating and managing discharges are implemented. The reasonably foreseeable future without the project includes several road improvements and other projects that will help improve water quality, reduce pollution, and retrofit older stormwater systems. In addition, the region has invested in public education and pollution prevention programs that will help to keep contaminants from reaching the waters.

The project will provide a slight benefit through the measures designed to treat stormwater and control surface water flow. The project and other reasonably foreseeable actions would improve water quality in Elliott Bay and Lake Union by providing currently untreated stormwater discharges with basic water quality treatment. These measures would include detention facilities and reduced pollutant-generating impervious surfaces, with the potential benefits of reduced peak flows, lower frequency of combined sewer overflows, and removal of contaminated sediments that may be leaching pollutants into Elliott Bay. The project will have a minor beneficial contribution to the cumulative effects on water quality.

Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report

A discussion of affected historic resources is provided in *Appendix I*.

Appendix O, Surface Water Discipline Report

A discussion of effects to water quality is provided in *Appendix O*.

EARTH AND GROUNDWATER

Historic Trend
The significant land alterations and long term development, especially industrial uses, in the project area has affected the earth and groundwater in the study area through removal, filling, and contamination.

15 What cumulative effects are anticipated?
Under the Viaduct Closed (No Build Alternative), there would be no effects to soil or groundwater including the lost opportunity to remove contaminated soils and/or groundwater. Under all the build alternatives, soil improvements and other protective measures included in the project would prevent impacts on earth resources, which are primarily limited to construction (direct) effects. Operation of either tunnel alternative could alter groundwater flow including causing mounding, which could raise the water table. If this occurs, it is more likely to affect buildings and utilities in the southern portion of the tunnel including in the Pioneer Square Historic District. Replacement of the seawall either as part of this project[7] or as a separate project also has the potential to affect groundwater flow including raising the water table. Current modeling capabilities cannot predict where the water table will rise so this will be closely monitored. The Elevated Structure Alternative could require removal of contaminated soil and/or groundwater although to a lesser extent than either tunnel alternative.

Construction of the reasonably foreseeable projects in the study area will likely lead to reduced soil and groundwater contamination because these are removed and treated off site when encountered, leading to a beneficial cumulative effect. There is sufficient capacity in regional landfills and there are improved treatment options for contaminated soil and groundwater to meet development needs.

CLIMATE CHANGE

16 How did the project consider future conditions related to climate change?
WSDOT acknowledges that effects of climate change may alter the function, sizing, and operations of our facilities. Therefore, in addition to mitigating greenhouse gas emissions, WSDOT must also ensure that its transportation facilities can adapt to the changing climate. To ensure that WSDOT facilities can function as intended for their planned 50-, 70-, or 100-year lifespan, they should be designed to perform under the variable conditions expected as a result of climate change.

Climate projections for the Pacific Northwest are available from the Climate Impacts Group at the University of Washington.[8] The climate projections indicate that Washington State is likely to experience some or all of the following effects over the next 50 to 100 years:

- Increased temperature (e.g., extreme heat events, changes in air quality, glacial melting)
- Sea-level rise, coastal erosion, salt water intrusion
- Changes in volume and timing of precipitation (e.g., reduced snow pack, increased erosion, flooding)
- Ecological effects of a changing climate (e.g., spread of disease, altered plant and animal habitats, negative impacts on human health and well-being)

WSDOT is working with other state agencies to develop the state's integrated climate response strategy. The strategy is under development at the time of this writing, it will be delivered to the state legislature in December 2011. As part of this work, Washington state agencies are looking at the complex interplay between these climate variables and our communities. For example, rising sea levels can inundate the transportation infrastructure; ports and their associated facilities; drinking water, wastewater, and stormwater facilities; housing; and businesses. Inundation from rising sea levels and heavy surface flows from storms will challenge the capacity of storm drains, natural conveyances (creeks and rivers), and wastewater treatment facilities.[9] Recommendations contained in this strategy will include consideration of future climate conditions in state-funded capital projects to improve resilience.

The project team considered the information on climate change with regard to preliminary design, as well as the potential for changes in the surrounding natural environment. The current projected median change in Puget Sound sea level is 13 inches by 2100 (with a range of 6 to 50 inches).[10] Overall, recent studies appear to be converging on projected increases in the range of 2 to 4 feet.[11, 12, 13]

With help from the Puget Sound Regional Council, WSDOT provided the project team with maps showing 2- and 4-foot rise in the project area.

The design team confirmed that the project would not be at risk from projected sea-level rise. The proposed project will be designed to withstand sea-level rise and increased storm intensities. Other forecasted climate variables such as temperature and precipitation are within the wide range of climate conditions experienced in the Seattle area. The design/build process will continue to examine project features to provide greater resilience and function with the potential effects brought on by climate change.[14]

MITIGATION

17 How could the cumulative effect on the resources be mitigated?
In addition to efforts to minimize effects on resources, WSDOT has proposed mitigation measures for project effects as discussed in Chapter 8. While these project-specific mitigation measures are intended to mitigate for direct and indirect effects, they also help to mitigate cumulative effects.

By using the steps in the WSDOT guidance, the analysts considered how the effects of the proposed project may combine with other effects to create a cumulative effect on

Appendix P, Earth Discipline Report

A discussion of effects to soil is provided in *Appendix P*.

7 The Cut-and-Cover Tunnel and Elevated Structure Alternatives include replacement of the seawall as part of the alternative.

8 Mote et al. 2008a.

9 Washington State Climate Change Response Strategy 2011.

10 Mote et al. 2008b.

11 Binder, personal communicaton March 2011.

12 Jevrejeva et al. 2010.

13 Pfeffer et al. 2008.

14 Roalkvam and Williamson, personal communicaton April 2011.

the resource. For the majority of the resources, they concluded that there is no contribution to an adverse cumulative impact. Per the guidance, WSDOT considers potential mitigation options where there is an adverse cumulative effect (see Exhibit 7-1, Step 8). The project has a minor contribution to the adverse cumulative effects to historic and archaeological resources that is mitigated through the Memorandum of Agreement with the State Historic Preservation Office. In addition, WSDOT notes that the City has a strong commitment to protecting its cultural heritage as do a number of groups in the region including Historic Seattle and Washington Trust for Historic Preservation, among others.

Western/Polson Buildings Looking Southwest from the Norton Building Towards Colman Curve

CHAPTER 8 - MITIGATION

What is in Chapter 8?

This chapter identifies WSDOT's mitigation commitments as well as other possible mitigation measures that could be used for permanent and construction (temporary) project effects.

MITIGATION OVERVIEW

Mitigation commitments are project actions and performance standards, often established by regulation, that are used to address project effects. To meet these commitments, Washington State Department of Transportation (WSDOT) will implement best management practices (BMPs) during construction and carry out specific mitigation measures based on the project's effects.

In this chapter, the word "will" is used to describe mitigation measures to which WSDOT is committed if a build alternative is selected. The word "could" generally precedes a suite of specific BMPs from which WSDOT could choose to achieve its mitigation commitments. If a mitigation measure is found to be ineffective, WSDOT will develop other appropriate mitigation with FHWA's approval. If the Viaduct Closed (No Build Alternative) is selected, then the mitigation measures discussed here will not be implemented.

The project will not result in permanent adverse effects for all of the resources considered in this Final Environmental Impact Statement (EIS). For some resources, the project will result in beneficial permanent effects; for others, there are simply no permanent effects. For the resources with beneficial or no permanent effects, mitigation is not proposed. Exhibit 8-1 shows the resources for which mitigation is proposed and for what type of effect (permanent and/or construction). If mitigation is not proposed for a resource, it is not discussed in this chapter.

Exhibit 8-1
Mitigation for Permanent and Construction Effects

Resource	Permanent Effects	Construction Effects
Transportation	X	X
Noise	No mitigation proposed	X
Vibration	No mitigation proposed	X
Views	X	X
Land Use	No mitigation proposed	X
Economics	No mitigation proposed	X
Parking	No mitigation proposed	X
Historic Resources	X	X
Archaeological Resources	No mitigation proposed	X
Parks, Recreation, and Open Space	No mitigation proposed	X
Neighborhoods and Community Resources	X	X
Minorities and Low-Income Populations	X	X
Public Services	No mitigation proposed	X
Utilities	No mitigation proposed	X
Air Quality	No mitigation proposed	X
Energy and Greenhouse Gas Emissions	X	X
Water Resources	No mitigation proposed	X
Fish, Aquatic, and Wildlife Species and Habitat	X	X
Soils and Groundwater	X	X
Hazardous Materials	X	X

Note: No mitigation is proposed for resources that are not permanently affected or have a beneficial permanent effect.

Mitigation Commitment Tracking

WSDOT has an established department-wide program that identifies and manages commitments, including environmental mitigation measures. Projects assign a Commitment Lead who reviews project commitment documents, such as interagency agreements, requests for proposals, environmental documents, permits, and agency directives and concurrence letters. From these documents, the Commitment Lead develops an inventory of commitments that are entered into an electronic Commitment Tracking System (CTS). The CTS allows the Commitment Lead to assign staff to commitments and to identify existing guidance documents that help them successfully comply with the commitment. Commitments that require monitoring are noted in this chapter, as appropriate.

The CTS also facilitates developing the contract during the Plans, Specifications, and Estimates process. It also allows the Design and Construction offices to manage the status of their commitments. The CTS provides compliance recording and reporting features that are consistent with existing program policy and permit requirements. Updating and tracking commitment status from project design to construction and closeout is coordinated via team meetings. Regular updates to the CTS are made in order to generate current commitment status reporting, reviewed during meetings by project and program management.

MITIGATION FOR PERMANENT EFFECTS

Proposed mitigation for the tolled and non-tolled build alternatives would be the same for elements of the environment discussed below, except as indicated for transportation and minority and low-income populations.

1 What mitigation is proposed for permanent transportation effects?

Permanent transportation mitigation measures are not proposed for the build alternatives without tolls because there are no permanent adverse effects on the transportation network.

As discussed in Chapter 5, if the build alternatives are tolled, some traffic is expected to divert from SR 99 to avoid paying a toll. This diverted traffic would affect traffic, including freight and transit, on downtown surface streets as well as the SR 99 mainline due to queues exceeding off-ramp capacity. However, the transportation network would operate more effectively even with the diverted traffic than it would under the Viaduct Closed (No Build Alternative).

Nevertheless, WSDOT has acknowledged that an acceptable long-term tolling solution should be sought to minimize the amount of diverted traffic in order to optimize operation of the transportation network for all users. Strategies for optimization will be developed by the Tolling Advisory Committee (TAC), which will be established by WSDOT, as outlined in section 2.12 of Memorandum of Agreement GCA 6486. When the TAC completes the first phase of its work in 2012 and in further phases, WSDOT and the City will jointly review the recommendations developed by the TAC. For improvements on state facilities or requiring state funding, WSDOT will recommend strategies developed by the TAC (or other strategies as appropriate) to the State Transportation Commission and seek funding for such strategies. WSDOT will work with the State, City, Port of Seattle, and King County in order to implement TAC strategies or other tolling mitigation strategies. Subject to legislative appropriation, WSDOT will fund recommendations agreed to by WSDOT and the City. If needed, additional environmental analysis may be performed to evaluate the potential effects of proposed strategies before implementation. The TAC is expected to refine its analysis and recommendations through 2015 when toll implementation is expected to begin. The TAC will continue its work for up to one year after tolling begins to review the effects of the implemented tolling and diversion minimization strategies and to make further recommendations, if necessary.

Potential Strategies to Reduce Traffic Diversion

- Refine the tolling strategy; this may include modifying toll rates and times that tolls would be charged as well as implementing regional tolling and/or tolls on other facilities.
- Reduce the level of toll revenue needed (and thereby lower the toll rate needed) by identifying alternative funding sources consistent with funding agreements among the parties.

Potential Strategies to Manage Diverted Traffic

- Set priorities for street use by time of day for various users (cars, trucks, bicycles, pedestrians, transit, parking) consistent with the City's Complete Streets policy goals
- Identify opportunities for traffic calming and other restrictions on certain modes of travel
- Create "transit first" policies through transit priority streets and other methods to improve transit speed and reliability
- Use other traffic demand management measures
- Fund enhanced transit services and vanpools

2 What mitigation is proposed for permanent effects on views?

Bored Tunnel Alternative

In addition to the mitigation inherent with this alternative (construction of a bored tunnel avoids the visual effect of an above-grade or at-grade transportation facility), WSDOT has developed architectural (tunnel operations buildings) and portal design guidelines for the project to create a consistent visual palette and to match the character of the surrounding streetscape. The guidelines are appropriate for the urban environment in the project area and apply to the tunnel portals, ramps, connections to the urban street system, city streets, sidewalks, bicycle and pedestrian trails, and the urban landscape.

The design guidelines will include, but are not limited to, the following elements:

- Develop a design theme for structural elements
- Soften the appearance of roadway areas by using landscape materials and street trees and placing trees where they do not block view corridors
- Provide lighting that meets functional requirements and enhances the scenic qualities and night-time experience of the city
- Enhance intuitive wayfinding and a sense of orientation and destination
- Complement the context and qualities of adjacent neighborhoods with an appropriate scale, massing, and character of the structures

The Seattle Design Commission will review the design features of buildings and above-grade elements to be incorporated into the design for the project.

Cut-and-Cover Tunnel Alternative

Potential mitigation measures would be the same as described above for the Bored Tunnel Alternative.

Elevated Structure Alternative

Potential mitigation measures would be the same as described above for the Bored Tunnel Alternative, except for the measures related to the tunnel operations buildings at the south and north portals.

WSDOT would likely receive input from the Seattle Design Commission on architectural features that could be incorporated into the concrete columns, retaining walls, and other features to enhance the visual quality of this alternative.

3 What mitigation is proposed for permanent effects on historic resources?

Bored Tunnel Alternative

WSDOT, FHWA, the State Historic Preservation Officer, the City Preservation Officer, and affected tribes have

What is the Tolling Advisory Committee?

The Tolling Advisory Committee (TAC) has 15 members who are appointed by the Mayor of Seattle, Seattle City Council, and WSDOT. The purpose of the TAC is to make advisory recommendations to the project lead agencies, Governor, Legislature, Transportation Commission, Seattle City Council, and Seattle Mayor on strategies for:

- Tolling
- Minimizing traffic diversion due to tolling
- Mitigating traffic diversion effects on city streets and I-5.

The TAC was established by City of Seattle Ordinance 123542, passed February 7, 2011 (http://clerk.ci.seattle.wa.us/~archives/Ordinances/Ord_123542.pdf).

completed a Memorandum of Agreement for the S. Holgate Street to S. King Street Viaduct Replacement Project that addresses mitigation for demolishing the viaduct and decommissioning the Battery Street Tunnel. Decommissioning the Battery Street Tunnel was included in the Memorandum of Agreement because it and the Alaskan Way Viaduct are considered one historic resource. Under that Memorandum of Agreement, implementation of mitigation measures is ongoing and includes commitments, such as a podcast and an interactive website about the history of the Alaskan Way Viaduct.

WSDOT also has completed and submitted a Historic American Engineering Record (HAER) report to the National Park Service.[1] The HAER includes photographs and narrative essays of the viaduct and Battery Street Tunnel.

WSDOT has outlined mitigation for adverse construction effects on other historic resources in a Memorandum of Agreement, which is discussed in Question 17 of this chapter.

Cut-and-Cover Tunnel Alternative
In addition to the mitigation measures described above for the demolition of the viaduct and decommissioning of the Battery Street Tunnel, WSDOT would mitigate the relocation of the Washington Street Boat Landing pergola through restoration and replacement of the pergola at the water's edge.

WSDOT would mitigate the Elliott Bay Seawall demolition through (1) HAER documentation of the seawall, and (2) preservation and appropriate replacement of the historical plaques and markers along the seawall.

Elevated Structure Alternative
Mitigation for effects associated with this alternative would be the same as those discussed above for the Cut-and-Cover Tunnel Alternative.

4 What mitigation is proposed for permanent effects on neighborhoods and community services or resources?

Mitigation Common to All Build Alternatives
Each year, WSDOT develops a comprehensive public outreach and communications plan, which incorporates the use of a variety of communication methods, such as websites, community e-mail updates, media relations, public meetings, interviews with social service providers, presentations to neighborhood groups, written materials, and information booths at community events to communicate project information and engage agencies, tribes, and the public. In an effort to minimize effects related to changes in travel patterns due to access changes, WSDOT will use these outreach activities to communicate with the public to help people learn about and adjust to the new facility. WSDOT will communicate with owners and operators of community facilities, park and recreation facilities, religious and cultural institutions, social and employment services, and government agencies. These efforts will occur before the new facility opens.

5 What mitigation is proposed for permanent effects on minorities and low-income people?

Mitigation Common to All Build Alternatives
As part of the public outreach and communications plan, as discussed in Question 4 above, WSDOT will communicate news about the new roadway facilities to disadvantaged populations, including low-income people, persons with limited English proficiency, accessibility or mobility disabilities, the elderly, and the transit-dependent. The outreach would use English and, when appropriate, materials would be translated into other languages such as Chinese, Spanish, Tagalog, and/or Vietnamese to accommodate the area's diverse population.

Other measures WSDOT will implement to help avoid, minimize, and mitigate potential effects on minority and low-income people are:

- Encourage mass transit agencies to conduct outreach activities to communicate transit operations to persons who are low income and dependent on transit.

- Work with citizen participatory groups and service providers, such as committees, task forces, advisory bodies, housing authorities and social services to communicate and assist disadvantaged populations with transportation options.

- Work with homeless service providers, neighborhood groups, the City, and King County to ensure the safety and survival of nearby homeless people. Nearby homeless people include those living outdoors or in vehicles located under or near transportation facilities within the project area.

Measures Specific to the Tolled Build Alternatives
Tolling the build alternatives would not result in disproportionately high and adverse impacts to low-income or minority populations. However, WSDOT will employ the following measures to reduce the inconvenience of tolling, such as the requirement to purchase transponders, for low-income and minority populations:

- Establish customer service center storefronts in the travelshed. Find locations online at: http://www.wsdot.wa.gov/goodtogo/contacts.htm.

- Provide public service announcements in multiple languages, such as Chinese, Spanish, Tagalog, and/or Vietnamese, regarding the Good To Go!™ accounts and transponders.

- Sell Good To Go!™ transponders at convenient locations, such as grocery stores, convenience stores, or pharmacies throughout the travelshed and convenient to lower-income neighborhoods.

- Share information with and through other public service providers.

1 Sheridan 2009.

- Promote rideshare opportunities such as those in Rideshareonline.com, carpoolworld.com, commuteseattle.com, and vanpool providers.

- Enable people without credit cards or checking accounts to obtain transponders by paying with cash or Electronic Benefit Transfer (Quest) cards issued by the Washington State Department of Social and Health Services.

- Provide social service agencies with tolling information and options to avoid the tolls.

The mitigation proposed in Question 1 would also benefit low-income drivers. These mitigation measures would result in improved traffic operation on SR 99, less diversion to city streets, and better management of diverted traffic. These measures are expected to improve travel times on alternate routes (streets other than SR 99) that low-income drivers likely would use if they choose not to pay the toll. This work will be evaluated by the Tolling Advisory Committee and may be the subject of recommendations by that body.

6 What is proposed to minimize long-term energy consumption?

Mitigation Common to All Build Alternatives
Measures that WSDOT will implement to reduce operational energy consumption (reduced fuel or electricity use) include, but are not limited to, the following:

- Encourage use of carpools and transit to reduce vehicle miles of travel on roadways in accordance with Washington State's Commute Trip Reduction Efficiency Act and WSDOT's Commute Trip Reduction Program. The expected results of the Act and Program are fewer vehicle trips traveled, reduction in greenhouse gas emissions, and energy savings through use of less fuel.

- Build energy-efficient tunnel operations buildings. The buildings will be designed to LEED Silver standards, though certification may be unattainable due to current LEED definitions.

- Use energy-efficient ventilation equipment, lighting, signals, and signage.

- Use variable-message signs to help drivers avoid congested areas to reduce slow moving traffic and idling, which leads to extra fuel consumption. WSDOT will determine sign locations by using existing condition traffic counts in conjunction with the project's maintenance of traffic (MOT) plan, both of which would identify the congested areas.

7 What mitigation is proposed for permanent effects on fish, aquatic, and wildlife species and habitat?

Bored Tunnel Alternative
There are no proposed mitigation or habitat enhancement measures for the Bored Tunnel Alternative because there are no permanent effects on fish, aquatic, and wildlife species and habitat. The seawall would not be replaced with this alternative so there would be no aquatic habitat disturbance. This alternative is expected to either improve or maintain the water quality of stormwater runoff discharged from the study area by reducing or maintaining the overall amount of pollutant-generative impervious surface and/or discharging more stormwater to the combined sewer system. Improved water quality would be beneficial to fish, aquatic, and wildlife species and habitat.

However, the National Marine Fisheries Service (NMFS) Biological Opinion (BO) outlined terms and conditions related to stormwater management to avoid effects. They are:

- WSDOT will ensure compliance with the biological effects thresholds for dissolved copper and dissolved zinc at the established points of compliance in Elliott Bay and Lake Union. The thresholds are 2.0 μg/L over ambient levels not exceeding 3.0 μg/L for dissolved copper, and 5.6 μg/L over ambient levels between 3.0 μg/L and 13.0 μg/L for dissolved zinc.

- If the final stormwater design differs from the design evaluated in the BO, then WSDOT will evaluate pollutant loadings and concentrations for that design to determine if they differ significantly from those considered in the consultation. If the predicted pollutant loadings or concentrations exceed those addressed in the BO, WSDOT will provide to NMFS a description of the design change(s) and a revised stormwater analysis.

- WSDOT will implement the programmatic approach to stormwater monitoring, as outlined in the "Programmatic Monitoring Approach for Highway Stormwater Runoff in Support of Endangered Species Act (ESA) Section 7 Consultation," dated June 2009.[2] WSDOT will notify NMFS immediately if the results of this program trigger any of the relevant reinitiation requirements.

Cut-and-Cover Tunnel Alternative
WSDOT will mitigate the effects on fish, aquatic, and wildlife species and habitat that result from the replacement of the seawall. Specific mitigation and habitat enhancement measures will be identified through additional coordination with agencies and tribes, the evaluation of potential project effects, and development of the project design.

Elevated Structure Alternative
WSDOT will mitigate the effects on fish, aquatic, and wildlife species and habitat that result from the replacement of the seawall. The coordination process to identify specific mitigation measures would be the same as described above for the Cut-and-Cover Tunnel Alternative.

2 FHWA et al. 2009.

8 What mitigation is proposed for permanent effects on soils and groundwater?

Mitigation Common to All Build Alternatives
WSDOT will mitigate for effects on soils. A potential effect is groundwater mounding, which results in raised groundwater levels that could lead to flooding in buildings adjacent to the new facility. Groundwater mounding will be evaluated for all walls or soil improvement zones that are longer than 100 feet and may block groundwater flow. If the magnitude of the groundwater mounding is less than the current measured natural fluctuation of groundwater in the soil, then no mitigation measures would be necessary because the groundwater mounding levels would be consistent with existing water table levels in the study area so there would be no effect. If higher mounding is anticipated, WSDOT will implement appropriate mitigation measures into the design of the facility during final design. Such measures could consist of providing a path for groundwater via pipes, or drainage trenches, through the retaining walls or soil improvement zones to eliminate the potential for an adverse level of groundwater mounding.

Bored Tunnel Alternative
In addition to the mitigation discussed above that would apply to all the build alternatives, the tunnel liner would be monitored on a long-term basis to determine whether openings are developing in the liner segments and whether groundwater seepage and soil migration are occurring through the openings. Maintenance would be performed as needed based on the monitoring results.

Cut-and-Cover Tunnel Alternative
The mitigation measures would be those described above that are common to all the build alternatives.

Elevated Structure Alternative
The mitigation measures would be those described above that are common to all the build alternatives.

MITIGATION FOR CONSTRUCTION EFFECTS

Proposed mitigation for the tolled and non-tolled build alternatives would be the same for the elements of the environment discussed below.

9 What mitigation is proposed for transportation effects during construction?

Mitigation Common to All Build Alternatives
WSDOT, King County, and the City have developed and are implementing transportation improvements to minimize traffic effects during construction to keep people and goods moving. These measures are designed to increase transit options, shift traffic away from construction areas, and provide drivers with the information they need to choose less congested routes.

These improvements, which are all completed except for the one noted as under construction, include the following:

- Installing and operating variable speed signs and travel time signs on I-5 to help maximize safety and traffic flow.

- Providing funding for the SR 519 Phase 2 Project to improve connections from I-5 and I 90 to the waterfront.

- Providing funding for the S. Spokane Street Viaduct Widening Project, which includes building a new Fourth Avenue S. off ramp for West Seattle commuters. This project is under construction.

- Providing funding for increased bus service in the West Seattle, Ballard/Uptown, and Aurora Avenue corridors for some of the construction period, as well as a bus travel time monitoring system. Increased bus service is currently provided for the S. Holgate Street to S. King Street Viaduct Replacement Project through 2014. Funding for this service may be extended as mitigation for this project, but funding for this extension has not yet been secured.

- Installing new traffic technology on SR 99 and major routes leading to SR 99 to keep people and goods moving.

- Upgrading traffic signals and driver information signs for the Elliott Avenue W./15th Avenue W., West Seattle, and South of Downtown (SODO) corridors to support transit and traffic flow.

- Providing information about travel alternatives and incentives to encourage use of transit, carpool, and vanpool programs.

In addition, WSDOT will develop localized mitigation measures, as construction details are refined. Examples of localized measures are:

- Constructing temporary signals, where necessary

- Stationing flaggers at key intersections to facilitate freight and general-purpose traffic movements and expedite travel for emergency vehicles

Before construction begins, WSDOT will prepare a traffic management plan, to be approved by the City, to ensure that construction effects on local streets, property owners, and businesses are minimized. The traffic management plan will include the following measures:

- Descriptions of traffic phasing to accommodate construction staging. The phasing will include conceptual MOT plans, expected general-purpose traffic restrictions by construction phase and roadway, and transportation-mode-specific effects and mitigation for the effects.

- Descriptions of requirements for temporary roadways.

- Procedures for identifying and incorporating the needs of transit operators, utility owners, ferry traffic, Port of Seattle traffic, the Seattle Center, and business owners in the project area.

- Procedures for identifying and incorporating the needs of pedestrian and bicycle flow, including, for example, mitigation for sidewalk closures and requirements related to the Americans with Disabilities Act (ADA).

- Procedures for seeking concurrence of stakeholders and implementing road and lane closures.

- Procedures for identifying and incorporating the needs of local agencies affected by the work, specifically, but not limited to, the Port of Seattle and access to Terminal 46.

- Processes for signing transitions during construction from one stage to the next, and from interim to permanent signing.

- Procedures for identifying and incorporating the needs of emergency service providers, firefighters, law enforcement entities, and other related corridor users, as well as procedures for ensuring that all information required by these agencies to protect the public is made available.

- Provisions for incident and emergency response.

- Processes for identifying, producing, and obtaining acceptance of the designs of temporary traffic signals.

- Methods and frequency of inspection and maintenance of all traffic control throughout the project area.

- Descriptions of contact methods, personnel available to make decisions and ensure that issues are addressed in a timely and appropriate manner, and response times for any conditions requiring attention and response 24 hours a day.

- Identification of measurable limits for the repair and replacement of traffic control devices, including temporary and permanent pavement markings.

- Processes for determining the needs for revised traffic signal timings, and if revisions are required, detailing the procedures for the development, review and acceptance, implementation, testing, and maintenance of all affected signals.

- Provisions for maintaining existing access to properties, whenever possible.

- Provisions for providing continuous access to established hazardous material routes, transit routes, and school bus routes.

- Procedures for modifying the plans as needed to adapt to current project circumstances.

- Procedures for incorporating the needs of event traffic, including coordination with Seattle Center, Safeco Field, and Qwest Field.

- Procedures for determining detour routes.

- Procedures for communicating MOT information and issues for the project to public information personnel and the public.

- Procedures for accommodating MOT plans of adjacent projects, if applicable.

- Procedures for accommodating MOT plans when the staging schedule changes for the Alaskan Way Viaduct Replacement Project or any adjacent project.

- Identification of temporary access connections between facilities.

- Identification of haul routes.

10 What can be done to minimize traffic effects when multiple projects are being constructed?

Constructing multiple projects within the same area can compound transportation effects. Other projects that may be constructed during the same time as the Alaskan Way Viaduct Replacement Project and that would contribute to concurrent effects on transportation in the study area are:

- Mercer West Project
- S. Spokane Street Viaduct Widening Project
- S. Holgate Street to S. King Street Viaduct Replacement Project
- Elliott Bay Seawall Project (if the Bored Tunnel Alternative is selected)

WSDOT and the City communicate regularly regarding construction staging and coordination for these projects. Both lead agencies are striving to minimize construction-related disruptions. As mentioned above in Question 9, WSDOT, King County, and the City have developed and are implementing transportation improvements to minimize traffic effects on keep people and goods moving in and through Seattle.

11 What mitigation is proposed for noise effects during construction?

Mitigation Common to All Build Alternatives

Because of the magnitude of the project, WSDOT will obtain Major Public Project Construction Noise Variances, which involves the preparation of a Noise Management and Mitigation Plan. The noise variances will be obtained prior to the start of nighttime construction activities. To grant this type of noise variance, the City requires that the public have an opportunity to comment on the proposal. To date, two public meetings have already been held as part of the application process. WSDOT will implement the following mitigation measures to comply with the Major Public Project Construction Noise Variances (the variances could include more measures than listed here) and the project's Noise Management and Mitigation Plan.

WSDOT will implement measures to minimize nighttime and weekend construction noise to prevent exceeding the noise variance levels (except in the case of emergency) during these hours: between 10:00 p.m. and 7:00 a.m. on weekdays, or between 10:00 p.m. and 9:00 a.m. on weekends and legal holidays. Measures implemented to minimize construction noise and comply with the noise-level limits established in the Major Public Project Construction Noise Variances are listed below:

- Ensure that all equipment meets the noise limits and is properly maintained and operated.

- Construct noise barrier walls or functionally equivalent materials at stationary construction sites. The length and height of the noise barrier walls will be confirmed during final design. WSDOT will confirm the length and height of the noise barrier walls prior to nighttime construction. For the Bored Tunnel Alternative, noise barrier walls are planned at both portal construction areas. The location(s) and dimensions of the noise barrier walls will be determined during final design.

- Construct gates and/or doors in noise barrier walls for sound containment. Edges of the gates and doors will overlap the fence to eliminate gaps; during nighttime hours, gates and doors will be kept closed, except to allow access to the construction site; and access doors (or man doors) will be incorporated into the gates to limit the need to open large gates at night.

- Use broadband or strobe backup warning devices or backup observers instead of backup warning devices that make noise for all equipment, except dump trucks, in compliance with Washington Administrative Code (WAC) Sections 296-155-610 and 296-155-615.

WSDOT will control nighttime construction noise levels through two methods: noise-level limits and noise-control measures. This approach provides the flexibility of either prohibiting certain noise-generating activities during nighttime hours or implementing noise-control measures (e.g., temporary noise barriers, noise curtains, noise tents, or the use of quieter equipment) to meet the noise limits (as outlined in the project's Noise Management and Mitigation Plan). WSDOT will use the following noise-control measures, as appropriate or necessary:

- Use temporary construction site noise barriers (both stationary and movable).

- Employ noise control curtains.

- Prohibit jack hammering and impact pile driving during nighttime hours; impact or impulse tools used from 5:00 p.m. to 10:00 p.m. would be subject to a noise-level limit of 5 dBA above the existing noise level.

- Use two-way radios for communication and prohibit the use of public address systems during nighttime hours, except for emergency notifications.

- Grade surface irregularities on construction sites to prevent impact noise and ground vibrations from passing vehicles.

- Use bed liners for trucks performing export haul. The bed liners may consist of but are not limited to aluminum, rubber, sand, or dirt.

- During pavement removal, remove material spilled on the roadway by hand or by sweeping, rather than scraping, during nighttime hours.

WSDOT will provide up-to-date information on construction activities and construction noise to project area neighbors and project stakeholders. WSDOT will provide a 24-hour hotline and project email, and an answering service to respond to calls during nighttime hours.

12 What mitigation is proposed for vibration effects during construction?

Mitigation Specific to the Bored Tunnel Alternative

Specific mitigation measures to address potential vibration effects during tunnel boring activities are outlined in the design-builder's proposal. These measures are discussed below. If the Bored Tunnel Alternative is not selected, WSDOT will develop specific vibration mitigation measures for the selected alternative.

WSDOT will measure, analyze, and mitigate ground vibration by and continuously gathering comprehensive vibration data during construction.

Before the start of construction, WSDOT will implement the following measures,:

- Develop a detailed Vibration Mitigation and Monitoring Plan according to WSDOT requirements.

- Identify and categorize potentially impacted receptors (building occupants), buildings (especially historic buildings in the Pioneer Square area), above ground structures (including the Seattle Monorail), and underground utilities.

- Determine appropriate vibration measurement and/or monitoring locations.

- Perform a baseline ambient vibration survey at selected locations.

- Identify expected sources of vibration during construction activities, including the TBM, muck conveyor system, pile driving, and demolition of the existing viaduct.

- Estimate ranges of expected vibration levels at potentially impacted receptors, buildings and underground utilities.

If determined to be necessary and practical for specific receptors, WSDOT will implement the following mitigation measures:

- Develop an empirical site-specific ground vibration propagation model to improve accuracy of predictions as necessary.

- Perform ground vibration propagation tests at selected locations along tunnel alignment in conjunction with a geotechnical consultant.

- Compare predictions with specified criteria, summarize expected impacts, and recommend vibration mitigation measures where needed.

During construction, WSDOT will implement the following mitigation measures, as necessary:

- Review vibration data according to the Vibration Mitigation and Monitoring Plan.

- Perform ongoing refinement of predictions of building vibration levels as directly measured ground vibration data become available, especially with regard to portal operations, as necessary.

- Support the public relations effort to ensure that outreach activities and materials address vibration.

- Respond to construction vibration issues and/or complaints quickly to re-assure the public that their concerns are being heard.

13 What mitigation is proposed for effects on views during construction?

Mitigation Common to All Build Alternatives
To mitigate effects on visual quality during construction, WSDOT will design and place construction screens or barriers to limit the visibility of work areas that would intrude on adjacent activities, such as pedestrians or those gathering for sports events. WSDOT will also direct temporary construction site lighting away from nearby residences and businesses.

14 What mitigation is proposed for land use effects during construction?

Mitigation Common to All Build Alternatives
Mitigation for potential effects on land use during construction activities will include providing advance notice to property owners in the project area regarding demolition and construction activities, utility disruptions, and detours. In addition, a construction website with a 24-hour project information line will be established and updated regularly.

There would be no adverse effects on the General Services Administration (GSA) Federal Office Building because the subsurface acquisition for this project would not interfere with potential future development opportunities.

WSDOT is coordinating with the Port of Seattle to address potential effects that would result from the use of Terminal 46 for construction staging. WSDOT will ensure that safety, access, security, and operations during the use of the terminal for project activities are not compromised.

Construction traffic, noise, and dust will be mitigated, as described in Questions 9, 11, and 24.

15 What mitigation is proposed for economic effects during construction?

Bored Tunnel Alternative
Mitigation measures for transportation are also important to mitigate effects on businesses and the economy. WSDOT will prepare a traffic management plan to ensure that construction effects on local streets, property owners, and businesses are minimized. For more information on the mitigation measures to be included in the plan, see Question 9.

The following mitigation measures are intended to counteract the diminished quality of the business environment for those businesses adjacent to construction activities. These measures would maintain access and the general setting for businesses and potential customers that existed before the project-related construction. WSDOT will implement the following mitigation measures:

- Minimize obstructions and/or delays along the routes to facilitate access to businesses, homes, cruise ships, ferry terminals, and waterfront attractions.

- Avoid all work in the City right-of-way from Thanksgiving Day through January 1 in the area bounded by Columbia Street, Second Avenue, S. King Street, and Alaskan Way unless a City-approved variance is obtained.

- Use signage and a communications plan to inform people about businesses open during construction.

Additional mitigation measures to reduce effects on economics would be related to communicating information and maintaining pedestrian access. WSDOT will continue to prepare a public outreach and communications plan each year during construction, which will include, among other things, outreach activities designed to provide notification about construction activities, pedestrian detours and parking changes during construction so that businesses can inform their clients, customers, and vendors. Public outreach activities and communications will be ongoing during project construction.

Cut-and-Cover Tunnel Alternative
In addition to the mitigation measures discussed above for the Bored Tunnel Alternative, WSDOT could provide experts in business marketing to give technical assistance to affected businesses to help them operate during disruptive portions of the project. If implemented, this measure would be designed specifically for businesses abutting the project area along the waterfront and in the manufacturing and industrial centers.

Elevated Structure Alternative
Mitigation measures would be the same as discussed above for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives.

16 What mitigation is proposed for parking effects during construction?

Mitigation Common to All Build Alternatives
The project has allocated $30 million to mitigate parking effects during project construction, and specific strategies are being developed. The Seattle Department of Transportation (SDOT), in coordination with WSDOT, has conducted parking studies as part of the process to develop mitigation strategies and better manage the city's parking resources. Potential strategies to offset the loss of short-term parking in the central waterfront include providing new or leased parking and increased utilization of and access to existing parking. The City-led Central Waterfront Project is currently evaluating these strategies in the context of improved access to the central waterfront. The City will recommend strategies that could be implemented between 2011 and 2018. SDOT will implement the final parking mitigation strategies based on these recommendations.

WSDOT will identify appropriate parking options for construction workers, as necessary, and will discourage their use of short-term visitor or customer parking in the project vicinity.

17 What mitigation is proposed for effects on historic resources during construction?

Mitigation Common to All Build Alternatives
Adverse effects due to traffic, noise levels, vibration, and air quality would impact historic resources adjacent to project construction. Therefore, the mitigation measures implemented to address those effects would also minimize effects on historic resources.

In addition, WSDOT will minimize effects on historic resources by implementing the following measures:

- Provide construction traffic mitigation, as described in Question 9
- Compliance with construction management plans, such as the Fugitive Dust Control Plan and Spill Prevention, Control, and Countermeasure (SPCC) Plan
- Ensure access to stores, offices, and residences in historic areas
- Minimize disruptions of utility service in historic areas and for historic buildings during construction
- Use newsletters, websites, posters, community e-mail updates, community events, and other methods of communication to keep property owners, residents, businesses and employees in historic districts and in other historic buildings informed about construction issues
- Provide parking mitigation, as described in Question 16

Specific mitigation measures to address adverse effects of the Bored Tunnel Alternative are outlined in a Memorandum of Agreement between WSDOT, Federal Highway Administration (FHWA), State Historic Preservation Officer (SHPO), affected tribes, and other consulting parties. These measures are discussed in the section below. If one of the other build alternatives is selected, a Memorandum of Agreement will be developed to outline the mitigation needed for that alternative.

Mitigation Specific to the Bored Tunnel Alternative
WSDOT has outlined mitigation for adverse effects on historic resources in a Memorandum of Agreement between WSDOT, FHWA, SHPO, affected tribes, and other consulting parties. The requirements of the Memorandum of Agreement include the following measures, to be implemented by WSDOT:

- Historic building monitoring and preparation of settlement management plans for each historic building prior to start of proposed tunneling.
- Establish a claims and repair process to repair any damage to buildings. The process will include:
  - The damage claim submittal process;
  - The process by which damage claims will be inspected and evaluated;
  - The process for and personnel involved in preparing damage evaluations, repair cost estimates, findings and recommendations;
  - The process for making and documenting repairs based on the reported cost estimates and recommendations; and
  - The process for making appeals.

  A licensed architect with a background in historic architecture, who meets the professional qualifications outlined in the Memorandum of Agreement, will participate in the claims and review process involving any historic buildings within the Area of Potential Effects.

Damage caused by the project will be repaired in kind and in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties and in compliance with the City of Seattle's Municipal Code, as appropriate. As required, there will be review and approval by the Pioneer Square Preservation Board, the Seattle Landmarks Preservation Board, the Pike Place Market Historical Commission, or Washington State Department of Archaeological and Historic Preservation for National Register of Historic Places eligible, but not locally designated, buildings.

- In the unlikely event that any one of the historic buildings suffers significant structural damage, emergency measures will be implemented as outlined in the Memorandum of Agreement.

WSDOT has outlined mitigation for adverse effects on the Pioneer Square Historic District, in the Memorandum of Agreement. The requirements include:

- Development and implementation of a communications plan.
- Establishment of a project information center to provide information and educational opportunities to the public, residents, and businesses in Pioneer Square.
- Development and implementation of marketing activities to promote Pioneer Square.
- Development and implementation of a traffic management and construction coordination plan.

To minimize damage to the Western Building, WSDOT will implement a building protection solution. WSDOT has prepared a conceptual design for this which includes foundation stablization, the stabilization of existing cracked structural elements, the installation of temporary shoring inside the building, the construction of a temporary exterior steel frame around the building, and a stabilizing regime of compensation grouting into the soil for added stability.

Approximately 118 tenants of the Western Building would be permanently relocated. Most of the tenants of this building are artists who use the building for studio or workspace. The artists benefit from their proximity to each other and the associated opportunities to share ideas and inspiration. Because of this, WSDOT is actively working to support the efforts of the artists by finding replacement accommodations nearby, either in the Pioneer Square neighborhood, if feasible, or in other locations in the greater Seattle area where the individual artists may choose to relocate.

The Polson Building is a historic building adjacent to the Western Building. WSDOT will avoid settlement damage to the Polson Building by using compensation grouting to stabilize the surrounding soil.

For the Lake Union Sewer Tunnel, the project has already modified the design of the Republican Street off-ramp to raise it to minimize impacts to the manhole shaft. WSDOT will mitigate the adverse effect on the sewer tunnel by recording the structure and researching its history as part of a National Register nomination form. Mitigation measures for settlement effects on non-historic buildings are discussed in Question 28.

18 What mitigation is proposed for effects on archaeological resources during construction?

Mitigation Common to All Build Alternatives

WSDOT will develop an Archaeological Treatment Plan which will guide the actions of cultural resources professionals for archaeological investigations and data recovery. The Archaeological Treatment Plan also will include the protocol for handling unanticipated archaeological and human remains discoveries, and archaeological monitoring during project construction.

The purpose of these plans is to make sure that archaeological resources, if unearthed during construction, are handled in compliance with applicable regulations. This plan will be developed before excavation begins and will remain in effect until construction is completed.

19 What mitigation is proposed for effects on parks, recreation, and open space during construction?

Adverse effects due to traffic, noise levels, vibration, and air quality would have effects on parks, recreation, and open space adjacent to project construction. The mitigation measures implemented to address those construction effects would also minimize effects on recreational facilities.

Bored Tunnel Alternative

WSDOT will implement the following mitigation measures to address potential adverse effects on parks, recreation, and open space:

- Provide ADA-compliant detour routes when trails, pedestrian bridges, or other pathways are closed temporarily. Detours would be within a reasonable distance of the closed facility.
- Coordinate regularly with park and recreation facility operators to ensure that changes in viaduct removal activities and associated changes in access points and corridors are known in advance.
- Continue public outreach through project construction to keep the community informed about temporary closures or rerouting of facilities, and other potential effects.

As appropriate, WSDOT would provide way-finding signage to indicate detour routes along the corridor and on streets surrounding the construction areas.

Cut-and-Cover Tunnel Alternative

Mitigation measures would include those discussed above for the Bored Tunnel Alternative and the measures discussed below.

To address disruption of existing and usual patterns of movement along the waterfront during construction, which has the potential of reducing the overall attractiveness of the waterfront as destination, WSDOT would implement the following strategies:

- Provide temporary overwater pedestrian connections to allow continuity between Piers 54 and 59 while the waterfront promenade is not in operation
- To the extent possible, schedule construction activities to quickly complete waterfront work and restore a continuous, if temporary, corridor as soon as possible, while work continues on related activities that do not directly disrupt movement along the corridor

In addition, WSDOT could implement the following measures, with the decision to be made later in project planning:

- Provide specific locations for charter bus parking with clear and convenient access to the waterfront to preserve and enhance group attendance
- Publicize alternative modes of access to the waterfront by public transit or by dedicated transit service on peak demand days from park-and-ride lots or other facilities

The effects of noise and vibration on passive recreation activities such as walking, picnicking, and viewing the aesthetic amenities of the area will be addressed by construction scheduling and any noise attenuation measures, as required by the Major Public Project Construction Noise Variances. See Questions 11 and 12 for discussions of potential noise and vibration mitigation.

If determined necessary during project final design or as construction progresses, access to Blake Island cruises (Pier 55) would be relocated to portions of the waterfront less affected by cut-and-cover tunnel construction or seawall reconstruction. Potential locations may include portions of Terminal 46, Pier 66, or Pier 70 within the general area or the Pier 91 or Fauntleroy areas. Such relocation would be communicated through public information methods to ensure that potential users are aware of the change.

Because of disruptive construction along the waterfront, the public may perceive that the waterfront would not be a convenient or pleasant environment to visit. WSDOT could work with tourism groups, local businesses, existing stakeholder groups, the media, and others to ensure critical access to the waterfront is maintained and accurate information about current and long-term construction activities is shared.

To mitigate impacts on recreational resources that depend on admission fees, such as the Seattle Aquarium or Qwest Field, mitigation measures that address access and parking effects, as discussed in Questions 9 and 16 would help to alleviate the perceived hassle of visiting the waterfront.

Elevated Structure Alternative
Mitigation measures would be the same as discussed above for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives.

20 What mitigation is proposed for effects on neighborhoods and community services or resources during construction?

Mitigation Common to All Build Alternatives
Adverse effects due to changes in traffic, parking, noise levels, and the relocation of businesses would have varying effects on the overall social environment that defines how neighborhood residents, workers, and visitors interact. Therefore, the proposed construction mitigation measures for other disciplines, such as transportation, visual quality, noise, public services and utilities, and economics would also reduce effects on neighborhoods.

Each year, WSDOT develops a comprehensive public outreach and communications plan, which incorporates the use of a variety of communication methods, such as websites, community e-mail updates, media relations, public meetings, interviews with social service providers, presentations to neighborhood groups, written materials, and information booths at community events to communicate project information and engage agencies, tribes, and the public.

The purpose of the communications plan is to make sure that the public is informed about construction happenings, such as detours and road closures. An informed public will result in less confusion and frustration for the communities located near the project area, and better trip planning for those traveling near construction activities.

During construction, WSDOT will continue to hold community briefings, maintain a presence at community events, and provide project information to the public via communications, such as e-mails and folios.

WSDOT will also maintain a project 24-hour hotline and e-mail so that people can call to receive information about the project or express a concern. If a concern is expressed by a member of the public, WSDOT will respond in a timely manner and work to address the issue.

WSDOT will communicate with owners and operators of community facilities, park and recreation facilities, religious and cultural institutions, social and employment services, and government agencies, throughout construction of the project to ensure that current construction activities and project milestones are known and concerns are addressed when possible. In addition, WSDOT will implement the following mitigation measures to address potential effects on neighborhoods and community services or resources:

- Coordinate with community service or resource providers to determine whether additional or special mitigation measures are needed.
- Work with representatives of Seattle Center, Safeco Field, Qwest Field, and the Qwest Field Event Center

to develop specific mitigation measures to address vehicle and transit access and parking issues related to workers and attendees at large events, as needed.

- Work with representatives of religious institutions close to construction zones to develop mitigation measures to address potential noise that could adversely affect services, meditation sessions, or other events, as needed.

- Include government agencies located near the project construction areas on distribution lists to notify them about planned construction activities.

Mitigation Specific to the Bored Tunnel Alternative
Approximately 118 tenants of the Western Building would be permanently relocated. Most of the tenants of this building are artists who use the building for studio or workspace. WSDOT is actively working to support the efforts of the artists by finding replacement accommodations.

21 What mitigation is proposed for effects on minorities and low-income people during construction?

Mitigation Common to All Build Alternatives
In addition to the public outreach and communication plan outlined above in Question 20, Mitigation Common to All Build Alternatives, WSDOT will implement the following measures to address effects on specific adjacent providers of services to minority and/or low-income people:

- Identify a safe and ADA-compliant pedestrian route between Pioneer Square/downtown and the St. Martin de Porres shelter to allow movement of people to and from the shelter throughout the construction period. Information about the route would be distributed to social service providers, placed in proper notification areas, and marked with directional signs.

- Work with The Compass Housing Alliance (formerly The Compass Center), Heritage House, Bread of Life Mission, Pike Market Senior Center, Plymouth Housing Group, Catholic Seamen's Club, and Rose of Lima House to identify concerns and solutions for potential construction-related effects.

WSDOT will implement these measures to address general effects on minority and/or low-income populations:

- Ensure access to buildings, properties, and loading areas used by social service providers during construction.

- Hold briefings and interviews with social service providers to keep them up to date on the project and to gather feedback as the project progresses from design through construction.

- Work with citizen participatory groups and service providers, such as committees, task forces, advisory bodies, housing authorities and social services to identify, communicate and assist disadvantaged populations with transportation options.

- Cooperate with social service providers on emergent issues that affect minority and low-income populations.

- Ensure continuous utility service during construction to the extent feasible. If periodic outages are unavoidable, provide ample notice.

- Work with homeless service providers, neighborhood groups, the City, and King County to ensure the safety and survival of nearby homeless people during construction of the new transportation facilities. Nearby homeless people include those living outdoors or in vehicles located under or near transportation facilities in the project area.

- Secure construction sites to prevent entry and injuries (especially by homeless persons). Light construction areas during the night and conduct security sweeps to look for unauthorized people seeking shelter within construction sites.

- Train construction workers on appropriate interactions with homeless persons they may encounter at construction sites.

- Maintain regular communication with minority-owned businesses, if identified, affected by construction-related traffic congestion.

- Distribute flyers to service providers, ethnic media, and local businesses and place flyers on windshields of cars parked in long-term parking areas; these flyers should specify when vehicles should be moved. List other long-term parking alternatives in the area, if any exist.

22 What mitigation is proposed for effects on public services during construction?

Mitigation Common to All Build Alternatives
WSDOT will coordinate with public service providers throughout project design and construction to ensure that project effects are understood in advance, planned for, and minimized. The purpose of this coordination is to eliminate or reduce disruptions to public services that may occur during project construction.

WSDOT will coordinate with the City and Port of Seattle police and fire departments, regional transportation agencies, and other related agencies during the final design of the selected alternative. This coordination will make sure that reliable emergency access and alternative plans or routes to avoid preventable delays in response times are developed, and to ensure that general emergency management services are not compromised. Providers of emergency and nonemergency public services will be notified early on of detours and lane restrictions.

When water lines and fire hydrants are being relocated, WSDOT will coordinate in advance and provide schedule notifications to the affected fire stations to allow advanced planning and to reduce the effects associated with service interruptions.

WSDOT will coordinate with construction personnel and, if necessary, with the City and Port of Seattle police departments to ensure that adequate staffing is available during construction for traffic and pedestrian movement control and other necessary policing efforts.

WSDOT will implement the following mitigation measures to address effects on specific public services:

- **School Buses –** The Seattle School District has established rerouting plans for use when the existing viaduct is unusable. It is anticipated that these rerouting plans would be implemented when SR 99 is closed.

- **Solid Waste Collection, Disposal, and Recycling –** Waste processing haulers and facilities will be informed that additional loads would be delivered during construction. The area transfer stations and regional landfills have sufficient capacity to accommodate the construction waste and debris generated from construction activities associated with any of the build alternatives.

WSDOT would also implement the following mitigation measures to address effects on these public services, if such measures are found necessary to adequately address construction effects:

- **Law Enforcement Services –** The need for additional police support services could be addressed by providing additional permanent or temporary law enforcement officers and/or stations.

- **Fire and Emergency Medical Services –** Response times for fire and emergency medical services could be affected, particularly during construction. Intelligent traffic signal controls at signalized intersections would be used as a partial mitigation measure. If intelligent traffic signals cannot adequately mitigate the effects on emergency response, then additional staff, equipment, and facilities may be proposed.

23 What mitigation is proposed for effects on utilities during construction?

Mitigation Common to All Build Alternatives

WSDOT will coordinate with utility providers on utility relocation plans that identify impacts and temporary and final locations. WSDOT will develop construction sequence plans and coordinate schedules for utility work to minimize service disruptions and provide ample advance notice when service disruptions are unavoidable, consistent with utility owner policies. Affected utility providers will review and approve relocation plans and service disruptions before construction begins.

Specific mitigation measures for effects on utilities will be developed during the ongoing coordination process between WSDOT, Seattle Public Utilities, Seattle City Light, and other providers. Some of the potential mitigation measures for effects on utilities during construction are:

- Assemble a multidisciplinary task force to monitor settlement during construction (Bored Tunnel Alternative only).

- Ensure all utilities are accessible during construction.

- Expose critical utilities before beginning construction in the vicinity.

- Coordinate utility relocation plans with utility owners and customers to minimize the impacts of service disruptions.

- Require contractors to comply with utility owner notice requirements for planned outages.

- Coordinate with utility owners to ensure that owner contingency plans for management of any potential utility service disruptions are accommodated.

- Provide backup on-site electrical generation, as needed, to minimize or eliminate power outages to customers as determined by Seattle City Light on a case-by-case basis.

- Coordinate construction-related mitigation with other construction projects in the vicinity to minimize utility and traffic disruptions.

In addition to the above potential mitigation measures, Washington State law and standard specifications require adherence to additional measures during construction:

- If inadvertent damage to utilities occurs during construction, the appropriate utility provider would be contacted immediately to restore service. WSDOT will also be required to take immediate measures to ensure public safety and protect property.

- Traffic revision equipment and personnel would be provided as required during utility relocations.

- Construction activities in the street right-of-way would be conducted during off-peak hours whenever possible to lessen traffic effects.

- All utilities determined to need protection in place would require a protective measure, such as pipe and conduit support systems, trench sheeting, and shoring.

- Construction techniques to avoid or minimize vibration effects on utilities would be used where needed. Such techniques may include using drilled shafts in lieu of driven piles.

- A safety watch would be provided through coordination with Seattle City Light. The safety watch would minimize the interruption of power to customers and to speed up power restoration in the event of accidental interruption of power caused by project construction. Critical utilities, such as transmission ducting, may need to be exposed during construction to lessen the chance of damage that could result in unplanned outages.

24 What mitigation is proposed for air quality effects during construction?

Mitigation Common to All Build Alternatives
A Memorandum of Agreement between WSDOT and Puget Sound Clean Air Agency is in place to identify appropriate mitigation to help eliminate, confine, or reduce construction-related emissions, in the form of fugitive dust, for WSDOT projects. The Memorandum of Agreement will apply to this project.

Per the MOA, WSDOT will create a plan for controlling fugitive dust during construction. This fugitive dust control plan will reduce air pollutant emissions near the construction site, including residences located along Battery Street adjacent to the open street grates. Some measures that will be included in the plan are:

- Cover trucks transporting materials to reduce particulate emissions during transportation on paved public roads

- When feasible and where practicable, route construction trucks away from residential and business areas to minimize annoyance from dust

- Coordinate construction activities between WSDOT and the Seattle Department of Transportation with respect to other projects in the area to reduce the cumulative effects of concurrent construction projects

In addition to the strategies detailed above, other measures for reducing air quality effects during construction include:

- Spray exposed soil with water or other dust palliatives to reduce emissions and deposition of particulate matter

- Remove particulate matter deposited on paved public roads to reduce mud and windblown dust on area roadways

- Enclose conveyor systems used to transport dirt from the tunnel excavation sites to the waterfront, if barges are used

WSDOT's traffic management plan will include best management practices to reduce activities such as idling and traffic congestion, which produce concentrated vehicle emissions. Implementation of this plan will also mitigate the effects of vehicle emissions on air quality.

The mitigation measures to reduce energy consumption and greenhouse gas emissions (discussed below) also will mitigate air quality effects.

25 What is proposed to minimize energy consumption and greenhouse gas emissions during construction?

Mitigation Common to All Build Alternatives
The traffic management plan that WSDOT will develop for the project includes detours and strategic construction planning to continue moving traffic through the area and reduce backups to the extent possible. Construction areas, staging areas, and material transfer sites will be set up in a way that reduce standing wait times for equipment, engine idling, and the need to block the movement of other activities on the site. This traffic management plan will help minimize energy consumption through the promotion of reduced vehicle and equipment idling, which leads to reduced fuel consumption. Because fuel consumption is directly related to greenhouse gas emissions, any steps taken to minimize fuel consumption will reduce greenhouse gas emissions as well.

In addition to the traffic management plan, WSDOT will implement the following other measures to reduce energy consumption during construction:

- Use electrical equipment where feasible

- Use relatively new, well-maintained equipment

- Promote ridesharing and other efforts, such as WSDOT's Commute Trip Reduction program, to reduce commute trips for employees working on the project

- Coordinate construction activities with other projects in the area to reduce the cumulative effect of concurrent construction projects

26 What mitigation is proposed for effects on water resources during construction?

Bored Tunnel Alternative
WSDOT will incorporate water quality BMPs into the project design to ensure that the proposed project will comply with the applicable federal, state, and local regulations to protect water resources. WSDOT may be required to obtain a National Pollutant Discharge Elimination System (NPDES) construction permit from the Washington State Department of Ecology (Ecology) if the extent of exposed soils and anticipated discharge locations require one.

Construction-related runoff and dewatering water will be discharged to the combined sewer system for treatment at the West Point Wastewater Treatment Plant. WSDOT will treat stormwater runoff from active construction areas and any dewatering water that reaches contaminant thresholds as necessary to meet the requirements of King County before discharge to either the combined sewer or the separated storm drain. If required, WSDOT will obtain a wastewater discharge permit or authorization from King County before discharging construction stormwater or dewatering water to the combined sewer. Depending on the volumes and timing, if discharging dewatering flows to the stormwater or combined sewer system is not feasible, WSDOT will use off-site disposal.

WSDOT will avoid, minimize, and mitigate construction effects on water resources by developing, implementing, and updating as site conditions change throughout the duration of project construction, the following plans:

- Temporary Erosion and Sediment Control Plan
- Spill Prevention, Control, and Countermeasures Plan
- Concrete Containment and Disposal Plan

Each of these plans include performance standards based on state regulations, such as turbidity and total suspended solids levels in stormwater discharged from construction staging and work areas, which are established to eliminate or reduce pollutants entering bodies of water.

Cut-and-Cover Tunnel Alternative
The mitigation measures would be the same as those discussed above for the Bored Tunnel Alternative.

In addition, WSDOT will implement mitigation measures to minimize or prevent construction-related pollutants from entering Elliott Bay during the seawall replacement: a containment system would be installed on the waterward side of the existing seawall.[3] The following steps would be followed for construction of the containment system:

1 The existing seawall will be surveyed for size and location of cracks and other potential leakage points.

2 Temporary repairs will be made to the existing seawall to retain upland grout when it is placed.

3 A turbidity curtain will be installed to minimize turbidity in the construction area and prevent water quality impacts outside the work area.

4 A movable containment panel will be installed adjacent to the existing seawall, including impervious matting to be placed over the riprap adjacent to the seawall. The size and location of the panel-mat system would be determined by the secant pile installation and grouting operations.

If spoils from jet grouting were dewatered on site, a temporary treatment facility will likely be required to treat the water before discharge.

If the removal of riprap were necessary, WSDOT will install a turbidity curtain before starting this task.

Outfalls that require replacement will be constructed at the same time as the seawall construction activities, using similar BMPs. WSDOT would implement measures to continue drainage service during construction during the replacement of stormwater outfalls and combined sewer overflow structures.

Elevated Structure Alternative
Potential mitigation measures would be the same as described above for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives.

27 What mitigation is proposed for effects on fish, aquatic, and wildlife species and habitat during construction?

Bored Tunnel Alternative
The primary activity that could affect fish and other aquatic species is the operation of a barge landing facility along Terminal 46. This operation would use existing facilities, and no in-water construction would be required.

WSDOT will implement construction BMPs to minimize or eliminate effects on species or their habitat. Standard construction BMPs will minimize short-term construction effects, including the discharge of sediment from the disturbed construction areas into Elliott Bay.

WSDOT will handle all pollutants to avoid contaminating surface water in the study area. Materials that modify pH, such as cement, cement grindings, and cement saw cutting, will be managed or isolated to minimize the spread of these materials by surface water runoff or other means of entering the area waterways; see Question 26 for details about measures to avoid and minimize effects on water resources. WSDOT will ensure that all work activities comply with the necessary water quality requirements.

Unlike the other build alternatives, the Bored Tunnel Alternative would not include the replacement of the Elliott Bay Seawall, so no in-water construction activities would take place. Since there would be no effects on fish and aquatic resources as a result of in-water work, mitigation for such effects is not proposed.

Cut-and-Cover Tunnel Alternative
Mitigation measures would be similar to those described above for the Bored Tunnel Alternative.

However, because the Cut-and-Cover Tunnel Alternative includes replacing the seawall, WSDOT would implement standard in water construction BMPs, such as silt curtains, sound attenuation measures, and cofferdams to reduce or eliminate the potential effects of in-water construction activities on aquatic species and habitat. WSDOT will replace any habitat loss or reduction in function with appropriate mitigation measures, as required by applicable federal, state, and local regulations that govern fish, aquatic resources, wildlife species and habitat. Specific mitigation measures to replace habitat loss and function would be established if this alternative is selected.

WSDOT will mitigate for the effects of the temporary access bridge to the Colman Ferry dock and the pedestrian access walkways with the eventual removal of these structures and the permanent increase in aquatic habitat provided by moving the Elliott Bay seawall landward of the existing position.

Elevated Structure Alternative
Potential mitigation measures would be similar to those described above for the Cut-and-Cover Tunnel Alternative.

3 Parsons Brinckerhoff 2006.

28 What mitigation is proposed for effects on soils and groundwater during construction?

Mitigation Common to All Build Alternatives
Many of the effects on soils and groundwater during construction can be mitigated with BMPs, proper techniques, and good workmanship. Project construction will be observed by experienced engineers or technicians to ensure compliance with WSDOT standards.

Settlement
To mitigate for effects related to settlement, WSDOT will:

- Perform soil improvement in areas where existing structures need to be protected from settlement; to be determined during final design.
- Use reinjection wells near the excavation area, supplied by water from the dewatering operation, to minimize settlement that may result from dewatering activities.
- Establish a claims and repair process by which owners of buildings, including historic buildings, can file claims for damages to their properties that result from the project; see Question 17 for more details about the claims and repair process.
- Use structural fill material appropriate for site conditions to construct fills.
- Perform construction sequencing so that project structures that could be sensitive to settlement are installed after most of the fill settlement has occurred, if necessary.
- Avoid placing stockpiles directly over utilities or pavements without appropriate subsurface support to prevent potential damage. In areas where this is not possible, stockpile heights could be limited to avoid damage to underlying utilities or pavement.
- If necessary, shore temporary excavations to mitigate potential sloughing of soils and lateral movement or settlement of nearby existing roadways, railways, structures, and utilities.

In addition to the measures described above, WSDOT would use these measures to address settlement, if needed:

- Preload the site as needed in areas where site availability and time schedules allow.
- Perform soil improvement or alternative construction methods (e.g., use of compressible foundation material over hard spots or installation of structural elements) to mitigate for potential differential settlement.
- Relocate existing utilities located beneath or near proposed fill embankments if loads and settlements would cause damage to the utilities. Alternatively, monitor utilities to determine if settlement tolerances are being exceeded.
- Use lightweight fill materials in areas where settlements must be minimized and alternative measures are not feasible.

Soil Improvement
WSDOT will implement soil improvement measures, such as jet grouting and compensation grouting, to stabilize soft soils where necessary (except between S. Main Street and S. Washington Street to avoid potential archaeological deposits).

Erosion and Sediment Control
WSDOT will implement BMPs for erosion and sediment control. Erosion and sediment control measures suitable to specific site conditions will be used. Site conditions will dictate the possible BMPs used, which include using construction staging barrier berms, covering loads during transport, filter fabric fences, temporary sediment detention basins, and slope coverings to contain sediment on site.

Temporary erosion and sediment control plans will be prepared for approval in accordance with BMPs included in the current Seattle Municipal Stormwater Code (Ordinance 123105) and the Seattle Municipal Grading Code (Ordinance 123107), as appropriate, and the WSDOT *Highway Runoff Manual*.[4]

Proposed mitigation measures will be consistent with stormwater design and treatment procedures in the current version of the WSDOT *Highway Runoff Manual* and also will follow the permits necessary for this project.

Bored Tunnel Alternative
In addition to the mitigation measures common to all the build alternatives, the following measures are proposed for the Bored Tunnel Alternative:

- Dewatering systems will be designed to minimize the drawdown of the water table outside of the excavation in areas where adjacent structures may be affected. Potential mitigation measures include the use of groundwater recharge wells, dewatering in small sections, or use of barriers (e.g., sheet piles) to isolate the water table within the excavation.
- Use soil improvement, such as jet grouting and deep soil mixing, along the bored tunnel alignment to stabilize soft soils and reduce the potential for settlement.
- Control and monitor the tunnel boring machine to minimize ground loss and settlement during tunnel boring.
- Inspect critical structures and utilities likely to be affected by tunneling-induced settlement prior to construction to evaluate their existing condition and potential for damage.
- Instrumentation may be installed to monitor ground movements on and below the ground surface during tunnel boring; see Question 12 for more

4 WSDOT 2010.

information on vibration monitoring during tunnel boring.

Cut-and-Cover Tunnel Alternative
The mitigation measures discussed above for the Bored Tunnel Alternative would apply for this alternative, except for measures directly related to the tunnel boring machine used for the Bored Tunnel Alternative.

Elevated Structure Alternative
The mitigation measures common to all build alternatives would apply for this alternative.

29 What mitigation is proposed for effects related to hazardous materials during construction?
For all build alternatives, WSDOT will prepare a Spill Prevention, Control, and Countermeasures Plan, which outlines procedures to be used if a spill of hazardous materials occurs; a fugitive dust plan to control dust-generating activities; a water quality monitoring plan; and a Soil and Groundwater Management Plan that addresses handling and disposal of known and unanticipated contamination.

For contamination already identified by WSDOT, additional investigations and characterization may be performed to determine whether the project would disturb contaminants present, and appropriate necessary mitigation. For instance, if WSDOT's final construction plans are unable to avoid previously identified site contamination, additional investigations, characterizations, and surveys would be performed to support appropriate management and disposal of the contaminated materials. These investigations may include environmental site assessments, contamination delineations, asbestos surveys, lead surveys, and/or geophysical surveys.

WSDOT will manage and dispose of contaminated soil in accordance with applicable permits and regulations and will implement construction techniques that minimize disturbance, release, and migration of contaminants in the project area. Construction activities will be selected in order to reduce the spread of contamination; specific construction methods, such as use of special drilling method or dewatering wells that minimize drawdown, may be necessary to prevent cross-contamination and to minimize the migration of contaminated groundwater during construction.

Groundwater that is encountered during project construction dewatering will be handled in accordance with applicable permits and regulations. Shallow groundwater is more likely to contain contaminants than groundwater from deeper soil. Water quality treatment for shallow dewatering could consist of storing the water to allow particles to settle or reducing suspended particles by adding chemical flocculants. If required, WSDOT will treat contaminated dewatering water to acceptable standards according to the Washington State Surface Water Quality Standards prior to discharging to waters of the state or King County, or WSDOT will dispose of it offsite at a facility permitted to accept contaminated water.

To reduce the effect of odors due to contaminants that could become airborne during construction or demolition activities, engineering controls would also be implemented, such as ventilation with fans to dissipate volatile contaminants and air filtration methods to remove particulates and volatile compounds.

INDIRECT EFFECTS

30 Are mitigation measures proposed for indirect effects?
Indirect effects, such as people changing where they shop, where they eat out, or what services they use as they adjust travel patterns during project construction are possible. In addition, if the Bored Tunnel Alternative or Cut-and-Cover Tunnel Alternative is selected, a new tunnel facility may support renovation and revitalization of existing urban land uses in some areas because the viaduct structure would be removed and new development on vacant or under-used property or redevelopment may take place around the new Alaskan Way surface street. However, project indirect effects are not expected to be significant; mitigation beyond what would be implemented to address direct effects is not proposed.

EFFECTS NOT MITIGATED

31 What permanent project effects would not be mitigated?
In general, WSDOT avoids, minimizes, or mitigates permanent effects associated with the project. However, the permanent effects discussed below will not be mitigated.

Transportation Changes
The tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives would permanently change travel patterns compared to the existing viaduct. The Elevated Structure Alternative would maintain access similar to the existing viaduct. Changes to travel patterns may permanently increase travel times for some routes. However, changes to travel patterns, increased travel times, and/or changes to access will not be mitigated.

Parking Losses
All three of the build alternatives are expected to result in a reduction in parking facilities relative to existing conditions, but there are no proposed mitigation measures for permanent parking losses. No mitigation is proposed because the parking removals are consistent with Seattle's Comprehensive Plan:[5] Goal TG18 indicates that in making decisions about on-street parking, transportation is the primary purpose of the city's street system.

Noise
Compared to 2015 existing conditions, the number of modeled sites that exceed the noise abatement criteria in 2030 would be:

- Reduced by 12 sites with the Tolled Bored Tunnel
- Reduced by 13 sites with the Non-Tolled Bored Tunnel
- Reduced by 10 sites with the Tolled Cut-and-Cover Tunnel

5 City of Seattle 2005.

- Reduced by 13 sites with the Non-Tolled Cut-and-Cover Tunnel
- Increased by 4 sites with the Tolled Elevated Structure
- Increased by 4 sites with the Non-Tolled Elevated Structure

Measures for noise abatement as required by federal regulations (23 CFR 772) were evaluated for each alternative to determine what measures are feasible and reasonable. These measures include the following:

- **Traffic management –** measures include time restrictions, traffic control devices, signing for prohibition of certain vehicle types (e.g., motorcycles and heavy trucks), modified speed limits, and exclusive lane designations. For example, speed limits could be reduced, but a reduction of 10 to 15 miles per hour would be required to decrease traffic noise by 5 dBA. Implementation of these measures for the sole purpose of noise mitigation would not be reasonable.

- **Land acquisition for noise buffers or barriers –** in an urban area such as the study area, this would require relocating numerous residents and businesses and would not be reasonable for the purpose of noise mitigation.

- **Realigning the roadway –** the alignment is defined by available right-of-way and the design features of the project. The cost of realigning the roadway would not be reasonable exclusively as an operational noise mitigation consideration.

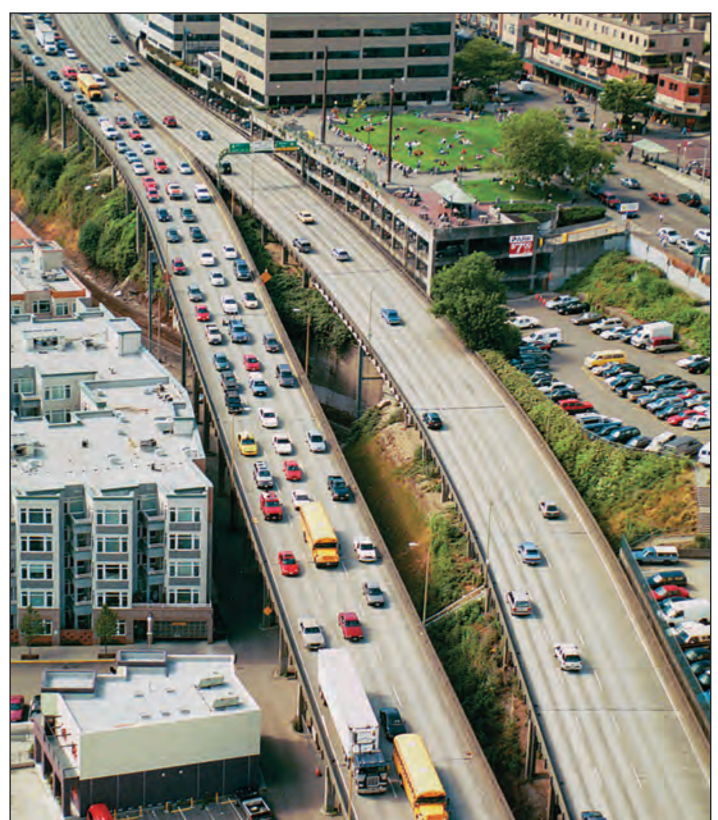
- **Noise insulation of buildings –** this measure does not apply to commercial and residential structures and is not eligible for federal funding.

- **Noise barriers –** to be effective, noise barriers would have to block access to the surface streets. There are no feasible mitigation measures to reduce traffic noise levels because the surface streets provide local access to downtown and the waterfront throughout the central waterfront.

None of these measures were identified to be feasible and/or reasonable for any of the build alternatives.

32 What temporary construction effects would not be mitigated?

WSDOT will implement mitigation measures to avoid or minimize effects during construction for all build alternatives. However, it will not be possible to prevent some effects, even with mitigation. For many of the effects described in this chapter, some residual temporary construction effects would remain. For example, mitigation measures will be in place during construction to minimize noise impacts, but people near the construction area will still hear construction activities. Another example is pedestrian access. Mitigation will be in place to maintain access for pedestrians, but there likely will be periods when a favored pedestrian route is temporary closed. Similarly, access to the stadiums and waterfront attractions will be maintained, but the convenience of visiting these attractions will likely be diminished. Such residual effects are not expected to be substantial and will be temporary as the project moves along the corridor.



CHAPTER 9 - EIS COMMENTS AND RESPONSES

What is in Chapter 9?

This chapter discusses the comments received during public comment periods for the Alaskan Way Viaduct Replacement Project 2004 Draft EIS, 2006 Supplemental Draft EIS, and 2010 Supplemental Draft EIS. This chapter also presents the lead agencies' general approach to reviewing and responding to these comments. All the comments received and the lead agencies' formal responses are included in Appendix S and Appendix T of this Final EIS.

1 How did the public comment on the 2004 Draft, 2006 Supplemental Draft, and 2010 Supplemental Draft EISs?

As required by the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA), each published Draft Environmental Impact Statement (EIS) had a public comment period when the public, agencies, and interested tribes were given an opportunity to provide comments on the document. Each comment period was at least 45 days long. The dates that the EISs were issued and the first day of the comment period for each EIS are shown below:

- Draft EIS – March 31, 2004
- Supplemental Draft EIS – July 28, 2006
- Supplemental Draft EIS – October 29, 2010

Copies of the EISs were distributed to agencies, tribes, libraries, and members of the public, including elected officials and community organizations. The environmental documents were also available online at the project website for review and comment.

Public hearings and open houses were conducted during the comment period for each EIS. At the public hearings, both oral and written comments were accepted. The hearing dates and locations are listed below:

2004 Draft EIS
- April 27, 2004 – Downtown Seattle
- April 28, 2004 – West Seattle
- April 29, 2004 – North Seattle

2006 Supplemental Draft EIS
- September 7, 2006 – Downtown Seattle
- September 12, 2006 – West Seattle
- September 13, 2006 – Ballard
- September 14, 2006 – Downtown Seattle

2010 Supplemental Draft EIS
- November 16, 2010 – West Seattle
- November 17, 2010 – Ballard
- November 18, 2010 – Downtown Seattle

Comments were also accepted through e-mail, regular postal mail, and on comment forms distributed by mail and available at the public hearings.

2 How many comments were received?

All public, agency, and tribal comments received during the public comment periods and lead agency's responses are provided in Appendix S, 2004 Draft EIS and 2006 Supplemental Draft EIS Comments and Responses, and Appendix T, 2010 Supplemental Draft EIS Comments and Responses.

The number of submitted items (e.g., letters, e-mails, comment forms, oral transcripts) received for each EIS during the public comment periods are presented in Exhibit 9-1.

Exhibit 9-1
Number of Submitted Items

Type of Commenter	2004 Draft EIS	2006 Supplemental Draft EIS	2010 Supplemental Draft EIS
Federal Agency	4	5	5
State Agency	5	1	2
Local Agency	11	7	7
Tribe	2	0	0
Community Organization	46	13	25
Business	18	4	5
Hearing Transcript	38	17	11
Individual	546	131	158
Total	**670**	**178**	**213**

Each submitted item (e.g., letter from an agency) was delineated into individual comments by topic. The result was more than 3,200 comments for all the EISs.

3 What happened to the comments received on the 2004 Draft and 2006 Supplemental Draft EIS?

The lead agencies have read and responded to all comments received on the 2004 Draft EIS and 2006 Supplemental Draft EIS. In some cases, comments are addressed by sections in the EIS that have been revised. In other cases, the responses refer the commenter to existing text that addresses the concern.

The project has evolved considerably since the publication of these two environmental documents; some of the comments refer to project components that are no longer being considered, or the comments do not reflect the project's current definition. Because the project has

Appendix A, Public Involvement Discipline Report

Appendix A discusses public outreach and involvement activities leading up to and during construction of the project.

Appendix S, 2004 Draft EIS and 2006 Supplemental Draft EIS Comments and Responses

Appendix T, 2010 Supplemental Draft EIS Comments and Responses

Appendices S and *T* contain all comments received and lead agency responses.

changed over the past several years, a good portion of these comments are out of date. For a comment that is outdated, the responses generally provide a project update and locations of current project information that relates to the comment. Specific responses are provided when the comment references a component of the project that is current and evaluated in the Final EIS.

Many of the comments received on the 2004 Draft EIS helped the lead agencies to refine the proposed build alternatives. Examples are provided below:

- Elimination of Battery Street Flyover Detour – There were numerous comments about the detrimental effects from the Battery Street Flyover Detour proposed in the 2004 Draft EIS. The lead agencies considered these objections and took a closer look at the detour. As the design for the Cut-and-Cover Tunnel and Elevated Structure Alternatives moved forward, the Battery Street Flyover detour was eliminated.

- Consideration of Construction Plans – The 2004 Draft EIS considered only one construction plan, and many people asked the lead agencies to consider more than one, primarily to see if there was a feasible way to build the project in a shorter amount of time. In response, the 2006 Supplemental Draft EIS evaluated three different construction plans to give people an idea of what could be done to alter the duration of construction. Since then, the construction approach for each build alternative has been further refined and is presented in Chapter 3 of this Final EIS.

- Addition of a Tunnel Lid – A lid was incorporated into the design of the 2006 Cut-and-Cover Tunnel Alternative in part due to the numerous comments on the 2004 Draft EIS requesting the lead agencies to consider a lid in the Pike Place/Belltown area. The current design for this lid structure is described in Chapter 3 of this Final EIS as a component of the Cut-and-Cover Tunnel Alternative.

From the many comments on the 2006 Supplemental Draft EIS, the lead agencies identified two key themes:

- There is widespread concern about the duration and intensity of effects from construction. Members of the public, business owners, and government agency officials all were interested in finding better ways to avoid and minimize the extensive construction effects that were anticipated.

- The public has comments and questions about other concepts not considered as build alternatives in the EIS. These concepts include retrofitting, other types of elevated structures, and surface street concepts.

These themes, other 2006 comments, and the project events that have taken place since then contributed to the Bored Tunnel Alternative analyzed in the 2010 Supplemental Draft EIS and the build alternatives analyzed in this Final EIS.

4 What did the lead agencies learn from the comments received on the 2010 Supplemental Draft EIS, and how did they respond?

The lead agencies reviewed all of the comments received during the 2010 Supplemental Draft EIS comment period. As needed, some factual corrections and language clarifications were made to this Final EIS. The lead agencies prepared formal responses for all the comments received, and they are presented in Appendix S, 2004 Draft EIS and 2006 Supplemental Draft EIS Comments and Responses, and Appendix T, 2010 Supplemental Draft EIS Comments and Responses.

For the 2010 Supplemental Draft EIS, the lead agencies identified almost 20 different topic categories that received 10 or more comments. This indicates that the interests and concerns surrounding this project vary greatly. Many comments were statements of either support of or opposition to the project or particular alternatives; some focused on the redevelopment of the waterfront once the existing viaduct is removed; and others expressed concerns about the effects of the project to historic buildings in the project area. Some of the categories that received the most comments are discussed below:

Alternatives

These comments include statements suggesting that more work should be done to identify other possible alternatives or to further refine or modify the current build alternatives. Some comments question the revised purpose and need statement and identification of the Bored Tunnel Alternative as the preferred alternative; others indicate concern that building a bored tunnel is too risky. Several commenters want the surface and transit hybrid scenario evaluated as one of the build alternatives.

The lead agencies have studied a wide range of possible viaduct replacement options as documented in the 2004 Draft EIS, the 2006 Supplemental Draft EIS, the 2010 Supplemental Draft EIS, and this Final EIS in Chapter 2. The alternatives development process has been subject to extensive public review. In addition, due to continued interest from some individuals and groups in a surface and transit hybrid concept, the lead agencies evaluated transportation effects of a surface and transit hybrid to test the rationale for screening it out; see Chapter 2, Questions 6 and 7 for this discussion.

Many comments indicate people's support of the Bored Tunnel Alternative and the open waterfront that this alternative would provide. Along with support that a preferred alternative had been identified, many commenters expressed a desire for the project to start construction as soon as possible.

The Bored Tunnel Alternative has been identified as the preferred alternative because it best meets the project's stated purposes and needs, and it has received support from diverse interests. Specifically, the Bored Tunnel Alternative avoids substantial closure of SR 99 during construction, and it can be built in a shorter period than the other build alternatives.

The bored tunnel will be built to meet current seismic safety standards. Tunnel design includes improving relatively soft, liquefiable soils found near the south tunnel portal. In addition, the alignment of the bored tunnel through the central waterfront area runs under First Avenue through soil that is more compact than the soil found adjacent to the Elliott Bay Seawall.

Tolling

The possibility of tolling the viaduct's replacement facility has become one of the main areas of interest of this project. The lead agencies received many comments focused on tolling. There are comments that speak about traffic effects of tolling as drivers attempt to avoid the toll by diverting onto adjacent surface streets. Other comments express the opinion that tolling the viaduct should be part of a regional tolling strategy. Comments about the cost of the toll were also received. In general, the tolling comments request that the lead agencies provide more information about how the toll would be implemented and what its associated potential effects would be.

The general response to tolling comments is that this Final EIS evaluates all of the build alternatives with tolls or without tolls. WSDOT will be working with the Seattle Department of Transportation and other agencies to refine and optimize how to toll the facility in a manner that minimizes traffic diversion to city streets. A Tolling Advisory Committee has been formed to monitor and provide input to the decision-making process (as described in Chapter 8, Question 1).

Project Costs

Among the common financial comments, there are many comments about the potential for cost overruns and concern about who would pay for them. Other comments question building a costly tunnel given the state's current economic crisis. Questions about the project's funding plan are also expressed.

The lead agencies' response to these comments is that they are taking steps to manage the risks and prevent cost overruns. The Bored Tunnel Alternative is estimated to cost $1,960 million. Extensive planning and analysis has been completed to minimize the potential for cost overruns, and contingencies are included in the project's cost estimates.

The Washington State Legislature authorized funding to replace the Alaskan Way Viaduct in 2009 (RCW 47.01.402). WSDOT is authorized to obligate $2.8 billion for the project. In order to fund this obligation, the legislation identified two sources of funding: state funding of $2.4 billion and toll funding of $400 million. In the absence of toll funding, new or reprioritized federal, state, or local funding sources would be necessary.

Construction

Many people commented on the long construction period required for this project. In general, people are concerned with the negative effects of construction (traffic, noise, and lack of access, for instance) on businesses and residents. There is concern that some businesses would not be able to survive the economic disruption during project construction.

In response, it is acknowledged that the construction period for this project would be relatively long, but the lead agencies are committed to implementing mitigation measures to address construction-related effects, as discussed in Chapter 8. A major benefit of the Bored Tunnel Alternative is that it has the shortest, least disruptive construction plan of all the build alternatives. With this alternative, only a several-week closure would be required to connect SR 99 with the new bored tunnel and ramps. The result would be less intense construction effects to nearby businesses and residents, and fewer traffic-related effects, as fewer road closures and detours would be necessary.

Transportation

Capacity and Access

Many people commented on each alternative's capacity and questioned the new facility's ability to accommodate all the projected traffic. Other comments in this category are concerned with the alternatives' ability to provide access to the downtown core, or the effects of increased traffic in the areas near the tunnel portals, such as pedestrian-oriented Pioneer Square. In addition, several of the comments in this category are from transit agencies asking the lead agencies to more fully discuss transportation operations related to capacity, access, and transit operations.

In response, one of the several purposes identified in the project's purpose and need statement (Chapter 1, Question 5) is to provide capacity for automobiles, freight, and transit to move people and goods efficiently to and through downtown Seattle. All of the build alternatives were evaluated against this purpose, and they meet it to varying degrees.

The lead agencies know that public transit will continue to be an important component of transportation in the project corridor. Chapter 5 presents information on transportation operations along major transit corridors, and Chapter 8 discusses mitigation for effects related to tolling.

Parking

The temporary and permanent loss of parking spaces along the central waterfront is also a topic of concern for those who provided comments. The parking spaces underneath the existing viaduct are an amenity that many are concerned about losing. The availability of parking during construction for events in the stadium area is also a concern.

In response, the lead agencies recognize that businesses along the central waterfront, Western Avenue, and Pioneer Square rely on the short-term parking in the area. The City of Seattle Department of Transportation, in coordination with the project, has conducted parking studies as part of the process to develop mitigation strategies and better manage the city's parking resources. The City of Seattle Department of Transportation's studies identified a number of strategies to offset the loss of short-term parking in this area, including providing new or leased parking and working to increase utilization of existing parking.

Section 4(f) Resources Subject to Use by the Preferred Alternative

Exhibit 4(f)-1

FINAL SECTION 4(F) EVALUATION

BACKGROUND

The Alaskan Way Viaduct Replacement Project (the project) has prepared this evaluation to respond to a federal environmental law known as Section 4(f), which protects parks, recreation areas, historic and cultural resources, and wildlife and waterfowl refuges.

The Federal Highway Administration (FHWA), Washington State Department of Transportation (WSDOT), and City of Seattle (City) are proposing to replace the Alaskan Way Viaduct because it is likely to fail in an earthquake. The viaduct is located in downtown Seattle, King County, Washington. The viaduct structure needs to be replaced from approximately S. Royal Brougham Way to the Battery Street Tunnel. Alternatives to replace the viaduct within its existing corridor were considered previously in a 2004 Draft Environmental Impact Statement (EIS), a 2006 Supplemental Draft EIS, and the 2010 Supplemental Draft EIS.

The section describes Section 4(f) of the U.S. Department of Transportation Act and explains its role in FHWA's decision-making. It also summarizes several key terms, concepts, and legal standards. This is followed by the final Section 4(f) evaluation for the project.

1 What is Section 4(f)?

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic sites. Section 4(f) applies to transportation projects that require the approval of the U.S. Department of Transportation (e.g., a highway project that uses federal funds). Congress established Section 4(f) as part of the

Exhibit 4(f)-2

Resources Subject to Use Under Section 4(f)

Name Location	**Owner**	**Section 4(f) Status**	**Primary Function**	**Bored Tunnel (Preferred) Alternative**	**Cut-&-Cover Tunnel Alternative**	**Elevated Structure Alternative**
Alaskan Way Viaduct Above Alaskan Way on waterfront and	**Public** WSDOT	National Register Eligible	Transportation	●	●	●
Battery Street Tunnel Under Battery Street between First Avenue and Denny Way	**Public** WSDOT	National Register Eligible	Transportation	●	●	●
Alaskan Way Seawall Along Alaskan Way	**Public** City of Seattle	National Register Eligible			●	●
S. Washington Street Boat Landing S. Washington Street at Alaskan Way	**Public** City of Seattle	Pergola Structure National Register Park Resource	Views Relaxation Fishing		●	●
Pioneer Square Historic District ***Western Building*** 619 Western Avenue	**Private**	Historic District Contributing Building National Register	Retail/Office	●		
Archaeological Site 45KI958 (Seattle Maintenance Yard) Broad Street & Sixth Avenue	**Public** City of Seattle	Assumed to be National Register Eligible		●	●	●
Lake Union Sewer Tunnel	**Public** King County	National Register Eligible	Utility	●	●	●

Department of Transportation Act of 1966 (49 United States Code [USC] 303 and 23 USC 138).

FHWA and the Federal Transit Administration have issued joint regulations to implement their responsibilities under Section 4(f). The regulations can be found at 23 Code of Federal Regulations (CFR) Part 774. These Section 4(f) regulations were comprehensively updated in March 2008 to reflect amendments to Section 4(f) that were made in August 2005 as part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA LU).

FHWA has provided further guidance for implementing Section 4(f) in its Section 4(f) Policy Paper,[1] and in other documents.[2]

2 What is a "Section 4(f) resource"?
A Section 4(f) resource is "publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of a historic site of national, State, or local significance."

Parks, Recreation Areas, and Refuges
Section 4(f) applies to parks, recreation areas, and wildlife and waterfowl refuges only if they are "significant" and are located on publicly owned lands. In most cases, the resource is presumed significant as long as the resource is located on publicly owned land and its primary use is as a park or recreation property, or as a wildlife or waterfowl refuge.

Historic Sites
Section 4(f) applies to all "significant" historic sites, regardless of whether they are publicly or privately owned. Section 4(f) regulations further define a significant historic property as "a prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP)." The term "historic site" also includes archaeological properties, and properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that are included in, or are eligible for inclusion in, the National Register. FHWA identifies such historic sites through a consultation process that is required under a separate law, known as Section 106 of the National Historic Preservation Act.

3 What is a "use" of a Section 4(f) resource?
Section 4(f) restricts the authority of the U.S. Department of Transportation (in this case, FHWA) to approve transportation projects that "use" land from Section 4(f) resources. As defined in Section 4(f), a "use" occurs when a project permanently incorporates land from a Section 4(f) property, even if the amount of land used is very small. In addition, a use can result from a temporary use of land within a Section 4(f) property, unless the temporary use meets specific criteria that allow an exception to a use. A use also can result from proximity effects (such as noise, visual impacts, or vibration) if those effects "substantially" impair the protected features of the property. A use that results from proximity effects is known as a "constructive use."

4 How can FHWA approve an alternative that uses a Section 4(f) resource?
There are two different ways that FHWA can approve the use of a Section 4(f) resource for a transportation project, as discussed below.

Finding of "De Minimis Impact"
FHWA can approve the use of a Section 4(f) resource if it finds that the project would result in a "de minimis impact" on that resource. For historic sites, de minimis impact means that FHWA has determined, in accordance with 36 CFR Part 800, that no historic property is affected by the project or that the project will have "no adverse effect" on the historic property in question. For parks, recreation areas, and wildlife and waterfowl refuges, a de minimis impact is one that will not adversely affect the features, attributes, or activities qualifying the property for protection under Section 4(f).

Finding of "No Feasible and Prudent Avoidance Alternative" and "Alternative with the Least Overall Harm"
FHWA also can approve the use of a Section 4(f) resource by preparing a Section 4(f) evaluation. This is the case with the Alaskan Way Viaduct Replacement Project. Therefore, the Section 4(f) evaluation is required to show that the project has considered alternatives to the use of the Section 4(f) resource. The Section 4(f) regulations establish a two-step process for considering alternatives:

1 **Avoidance Alternatives –** First, FHWA must determine whether there is any "feasible and prudent avoidance alternative." An avoidance alternative that is not feasible and prudent can be rejected. If there is any feasible and prudent avoidance alternative, FHWA cannot approve an alternative that uses a Section 4(f) resource.

2 **Alternatives to Minimize Harm –** If feasible and prudent avoidance alternatives are not available, FHWA must consider alternatives to minimize harm resulting from the use of the Section 4(f) resource. In this situation, FHWA's regulations require it to select the alternative that causes the "least overall harm."

Based on this analysis of alternatives, FHWA can approve the use of a Section 4(f) resource if it finds that:

- There is no feasible and prudent alternative that completely avoids the use of any Section 4(f) properties and the alternative with the least harm to Section 4(f) resources has been selected

  and

- The project includes all possible planning to minimize harm to all of the Section 4(f) properties

These findings, and the supporting analysis considering the relative importance of the Section 4(f) resources, must be included in a Section 4(f) evaluation. The Section 4(f) regulations require these findings to be presented first in a

1 FHWA 2005.

2 Available at: http://www.environment.fhwa.dot.gov/4f/index.asp.

draft Section 4(f) evaluation, which is provided to the U.S. Department of Interior and other agencies for comment. After considering any comments, FHWA can issue a final Section 4(f) evaluation.

5 What factors must FHWA consider when determining whether an avoidance alternative is "feasible and prudent"?

The Section 4(f) regulations (23 CFR 774.17) list the factors that FHWA must consider when determining the prudence and feasibility of an avoidance alternative. An alternative is not **feasible** if it cannot be built as a matter of sound engineering judgment. An alternative is not **prudent** if:

i. It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;

ii. It results in unacceptable safety or operational problems;

iii. After reasonable mitigation, it still causes:

   a) Severe social, economic, or environmental impacts;
   b) Severe disruption to established communities;
   c) Severe disproportionate impacts to minority or low-income populations; or
   d) Severe impacts to environmental resources protected under other federal statutes;

iv. It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;

v. It causes other unique problems or unusual factors; or

vi. It involves multiple factors in paragraphs (i) through (v) of this definition, that while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

6 What factors must FHWA consider when determining which alternative causes "least overall harm"?

The regulations list specific factors that FHWA must consider when determining which alternative causes the "least overall harm." See 23 USC 774.3(c)(1). These factors include:

i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property);

ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection;

iii. The relative significance of each Section 4(f) property;

iv. The views of the official(s) with jurisdiction over each Section 4(f) property;

v. The degree to which each alternative meets the purpose and need for the project;

vi. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f); and

vii. Substantial differences in costs among the alternatives.

These factors are considered when comparing alternatives that all would use one or more Section 4(f) resources.

7 What does Section 106 consultation involve, and how does it relate to this Section 4(f) evaluation?

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their undertakings on historic properties (including archaeological resources) that are listed in or eligible for listing in the NRHP. The NRHP is administered by the National Park Service (NPS).

Parties Involved in Section 106 Consultation

Compliance with Section 106 involves consultation between the federal action agency (e.g., FHWA) and the State Historic Preservation Officer (SHPO). Other parties may also be involved in Section 106 consultation, including local governments, Native American tribes, historic preservation groups, and property owners. The parties for the Section 106 consultation for the Alaskan Way Viaduct Replacement Project are listed later in this Section 4(f) evaluation.

Criteria for Determining National Register Eligibility

To be listed in or eligible for inclusion in the NRHP, properties must meet one or more of the following criteria:

- **Criterion A –** The property is associated with events that have made a significant contribution to the broad patterns of our history.

- **Criterion B –** The property is associated with the lives of persons significant in our past.

- **Criterion C –** The property embodies distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

- **Criterion D –** The property has yielded, or may be likely to yield, information important in prehistory or history. This criterion is generally associated with below-ground (archaeological) resources.

Relationship Between Section 106 and Section 4(f)

This Section 4(f) evaluation builds on the project's Section 106 compliance and consultation efforts. These two laws have several important linkages:

- **Identifying Historic Resources –** Agencies use the Section 106 process to identify historic properties that are listed in or eligible for the NRHP and to document the characteristics that contribute to the historic significance of those properties. Any properties that are listed or eligible for listing in the NRHP are subject to the requirements of Section 4(f).

- **Determining Adverse Effects –** The Section 106 process includes an assessment of each alternative's effects on historic properties. Specifically, Section 106 requires the federal action agency to determine whether the project would have any "adverse effects" on historic properties. These findings play two important roles in Section 4(f):
  - First, when an alternative directly uses land from a historic site, a finding of "no adverse effect" in the Section 106 process can support a finding of de minimis impact under Section 4(f).
  - Second, when an alternative avoids a use of land or physical alteration of a resource but has proximity impacts on a historic site (for example, noise impacts), a finding of "no adverse effect" under Section 106 allows FHWA to conclude that there is no constructive use under Section 4(f), per 23 CFR 774.15 (f)(1).
- **Minimization of Harm –** The Section 106 process requires consultation to determine what can be done to avoid, minimize, or mitigate the adverse effects. This consultation typically results in a binding Memorandum of Agreement (MOA), in which the federal action agency commits to implement measures to minimize and/or mitigate impacts. Commitments made in the Section 106 process may also satisfy the requirement under Section 4(f) to minimize harm resulting from the use of the historic property.

What is the process for parks and other Section 4(f) resources?

To identify Section 4(f) resources and evaluate potential uses, the Section 4(f) evaluation also builds on the overall EIS analysis, documentation, and related public, agency and tribal involvement and coordination activities. This includes the EIS's analysis of park and recreation effects, as sources of proximity effects such as changes in visual, noise and vibration, or traffic conditions. WSDOT, the City, and FHWA have consulted directly with the agencies with jurisdiction over Section 4(f) resources, such as the public entities that own a specific park or recreation property, helping to confirm the ownership, important characteristics, and boundaries of the resources.

SECTION 4(F) EVALUATION

The remainder of this chapter serves as the Final Section 4(f) evaluation for this project. The evaluation is organized as follows:

1 **Agency Involvement –** This section describes the involvement of the U.S. Department of the Interior, Washington SHPO, the City of Seattle, King County, the Port of Seattle, and Washington State Parks in this Section 4(f) evaluation.

2 **Purpose and Need –** This section summarizes the purpose and need of the project. The lead agencies have updated the project's purpose and need since issuing the previous Supplemental Draft EIS in 2006. For additional detail, refer to Chapter 1, Question 5 in this Final EIS.

3 **Alternatives Considered –** This section provides a basic description of the three build alternatives that are the primary focus of this Final EIS and this draft Section 4(f) evaluation. See Chapter 3 for more detailed descriptions of these alternatives. This evaluation also briefly reconsiders alternatives that were dismissed in the 2004 Draft EIS and 2006 Supplemental Draft EIS and related planning, in order to assess their potential to avoid Section 4(f) properties or minimize harm.

4 **Section 4(f) Resources –** This section identifies the Section 4(f) resources that would result in a use by one or more alternatives. These resources and other Section 4(f) resources located in the project area are also described in Appendix J of the Final EIS.

5 **Bored Tunnel Alternative –** This section describes the impacts of the project's Preferred Alternative, the Tolled Bored Tunnel Alternative, on Section 4(f) resources. It determines whether this alternative would result in a "use" of Section 4(f) resources. Where there would be a use, it considers the potential for a de minimis impact finding. Where the impact would not be de minimis, it considers potential variations on this alternative to avoid or minimize harm to the resource.

6 **Effects of Other Alternatives on Section 4(f) Properties –** This section covers the findings regarding Section 4(f) uses for the other two build alternatives: Cut-and-Cover Tunnel and Elevated Structure Alternatives.

7 **Other Alternatives Considered to Avoid and Minimize Harm –** This section considers other alternatives, including those previously dismissed in the National Environmental Policy Act (NEPA) process and related planning, to determine whether any of them have the potential to avoid or minimize harm to Section 4(f) resources, in comparison to the three build alternatives that are currently being considered.

8 **Conclusion on Search for Feasible and Prudent Avoidance Alternatives –** This section describes the information FHWA used to conclude there is no feasible and prudent alternative that completely avoids the use of Section 4(f) resources.

9 **Identifying a Least Harm Alternative –** This section compares the three build alternatives to one another to determine which of them causes the "least overall harm" based on the factors listed in Section 774.3(c)(1) of the Section 4(f) regulations.

Appendix J, Section 4(f) Supplemental Materials

Appendix J describes Section 4(f) resources in the project area.

It identifies the Bored Tunnel Alternative as the alternative that causes the least overall harm.

10 **Conclusions –** This section summarizes the conclusions of the draft Section 4(f) evaluation. It finds that there is no feasible and prudent alternative that completely avoids the use of Section 4(f) property. It also finds that the Bored Tunnel Alternative is the alternative that causes "least overall harm" and that the Bored Tunnel Alternative incorporates all possible planning to minimize harm to Section 4(f) resources.

1 Agencies Involved in Developing This Section 4(f) Evaluation

FHWA has prepared this Section 4(f) Evaluation based in part on Section 106 consultation with the SHPO, the City, and King County. In addition, the entire EIS process and its public, tribal, and agency involvement efforts and related documentation contribute to the Section 4(f) evaluation.

For the Alaskan Way Viaduct Replacement Project, the focus of the coordination has been on agencies with jurisdiction over the area's many public parks and recreation facilities and its historic and cultural resources. There are no nature refuges in the project area that could be affected.

Throughout the development of the project and its EIS, representatives from FHWA and WSDOT have coordinated with NPS, the Seattle Parks and Recreation Department, King County, and the Port of Seattle, to identify and evaluate the potential for impacts to public parks and recreation resources in the project area.

In conjunction with the Section 106 process, the following parties have been coordinated with to determine historic and cultural resources and impacts:

- The SHPO at the Washington State Department of Archaeological and Historic Preservation
- The City of Seattle Preservation Officer
- Tribal governments, including eight federally recognized tribes: the Muckleshoot Indian Tribe, Snoqualmie Indian Tribe, Suquamish Tribe, The Tulalip Tribes, Confederated Tribes and Bands of the Yakama Nation, the Lower Elwha Klallam Tribe, Jamestown S'Klallam Tribe, Port Gamble S'Klallam Tribe; and the Duwamish Tribe (a non-federally recognized tribe)

Park and Recreation Resources

Park and recreation facilities in the project area have been identified with the cooperation of Seattle Parks and Recreation, the Port of Seattle, and the Seattle Department of Planning and Development. Local plans and guidelines that address park and recreation policies and provide a framework for the evaluation of use were consulted in development of this report. A complete list of resources is provided in Appendix J of the 2004 Draft EIS, 2006 Supplemental Draft EIS, 2010 Supplemental Draft EIS, and this Final EIS. All park and recreation facilities within three to five blocks of the proposed project alternatives were identified for further analysis of their effects. Appendix J, Part B of this Final EIS provides further detail on the resources identified as being eligible for protection under Section 4(f).

Historic Properties

Historic properties, which include historic buildings, sites, districts, as well as archaeological sites, have been identified through the Section 106 consultation process. The locations of historic properties in the project area are shown in Chapter 4, Exhibit 4-19 of this Final EIS. Detailed maps are also provided in Appendix J, Section 4(f) Supplemental Materials, Exhibits 1 through 3.

The lead agencies, following WSDOT standard practice, in consultation with the Section 106 consulting parties defined an area of potential effects that extends horizontally one block on each side of alternative alignments (including both surface or tunnel features), as well as around the existing viaduct structure. In the areas of potential effects they identified properties that are listed in or eligible for the NRHP; evaluated alternatives to assess potential adverse effects; and considered measures to avoid, minimize, and mitigate adverse effects. Records of this consultation are included in the following documents:

- 2004 Draft EIS, Appendix L, Historic Resources Technical Memorandum
- 2006 Supplemental Draft EIS, Appendix L, Historic Resources Technical Memorandum
- 2010 Supplemental Draft EIS, Appendix I, Section 106: Historic, Cultural, and Archaeological Resources Discipline Report
- 2011 Final EIS, Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report
- 2011 Memoranda of Agreement among the Federal Highway Administration, the Washington State Department of Transportation, and the Washington State Historic Preservation Officer to Resolve Adverse Effects of the Alaskan Way Viaduct Replacement Project

National Park Service

NPS is a bureau within the U.S. Department of the Interior. The project's lead agencies (FHWA, WSDOT, and the City) consulted with NPS through project scoping, correspondence, and in meetings and correspondence with NPS staff during the development of the 2004 Draft EIS, the 2006 Supplemental Draft EIS, the 2010 Supplemental Draft EIS, and in the development of this Final EIS. The dates of meetings and the supporting correspondence are provided in Appendix U, Final EIS Correspondence.

Department of the Interior

The Department of the Interior was provided the 2010 Supplemental Draft EIS, which included a Draft Section 4(f) Evaluation of the EIS alternatives. In the preparation of the Final EIS and this Final Section 4(f) Evaluation, FHWA provided the Department of the Interior with a preliminary Final Section 4(f) Evaluation in April 2011. After a 45-day review period and an additional 15-day waiting period, FHWA confirmed the Department of Interior's lack of objection.

2 Purpose and Need of the Proposed Action

The Alaskan Way Viaduct is seismically vulnerable and at the end of its useful life. To protect public safety and provide essential vehicle capacity to and through downtown Seattle, the viaduct must be replaced. Because this facility is at risk of sudden and catastrophic failure in an earthquake, FHWA, WSDOT, and the City seek to implement a replacement as soon as possible. Moving people and goods to and through downtown Seattle is vital to maintaining local, regional, and statewide economic health. FHWA, WSDOT, and the City have identified the following purposes and needs the project should address.

The purpose of the proposed action is to provide a replacement transportation facility that will:

- Reduce the risk of catastrophic failure in an earthquake by providing a facility that meets current seismic safety standards
- Improve traffic safety
- Provide capacity for automobiles, freight, and transit to efficiently move people and goods to and through downtown Seattle
- Provide linkages to the regional transportation system and to and from downtown Seattle and the local street system
- Avoid major disruption of traffic patterns due to loss of capacity on State Route (SR) 99
- Protect the integrity and viability of adjacent activities on the central waterfront and in downtown Seattle

For further discussion of these needs, refer to Chapter 1 of this Final EIS.

3 Alternatives Considered

This Section 4(f) evaluation focuses on the Bored Tunnel Alternative, which is the project's Preferred Alternative.

In addition, the Section 4(f) Evaluation summarizes the effects on Section 4(f) properties for the other two "build" alternatives that are addressed in the Final EIS:

- Cut-and-Cover Tunnel Alternative
- Elevated Structure Alternative

The 2010 Supplemental Draft EIS Draft Section 4(f) Evaluation previously described the effects on Section 4(f) resources for all three of the build alternatives. The Final Section 4(f) Evaluation and Final EIS update this information, incorporating updated analyses on Section 106 resources, public park and recreation resources, and other environmental topics that have the potential to affect Section 4(f) resources. It also incorporates information and responses to public comments on the 2010 Supplemental Draft EIS, as well as assessments of the effects of tolls that could be implemented with the Bored Tunnel Alternative or other alternatives.

This Section 4(f) evaluation also considers other alternatives, including those that were previously considered and dismissed, as well as other potential alternatives or design options, to assess their potential to avoid or minimize harm to Section 4(f) resources. See the discussion below, "Other Alternatives Considered to Avoid and Minimize Harm."

Bored Tunnel Alternative

The Bored Tunnel Alternative is the Preferred Alternative to replace SR 99 between S. Royal Brougham Way and Roy Street (see Exhibit 3-1 in Chapter 3 of this Final EIS). The alternative includes constructing a tunnel that would replace the viaduct and the Battery Street Tunnel. The Bored Tunnel Alternative would begin with a southern section connecting to the section of SR 99 that is being replaced by the S. Holgate Street to S. King Street Viaduct Replacement Project. It would then transition to a tunnel beginning near S. King Street, curving away from the waterfront at S. Washington Street and aligned below First Avenue near University Street. It would travel under First Avenue to Stewart Street, going east to connect to Aurora Avenue near Mercer Street.

As part of the development of the new facility, the existing viaduct would be demolished and the Battery Street Tunnel decommissioned, but they would remain in use for most of the construction period for the SR 99 replacement facility.

The south portal of the new tunnel would be located north of S. Royal Brougham Way and immediately west of the existing viaduct. In this area, a new street, S. Dearborn Street, would be constructed from Railroad Way S. to Alaskan Way S., and would include a new signalized intersection at Alaskan Way S. This intersection would provide access to and from East Marginal Way S., which would run along the west side of SR 99. A tunnel operations building would be constructed in the block bounded by S. Dearborn Street, Railroad Way S., and Alaskan Way S.

The north portal of the tunnel would be located at Harrison Street and Sixth Avenue N. A tunnel operations building would be constructed between Thomas and Harrison Streets on the east side of Sixth Avenue N.

Full northbound and southbound access to and from SR 99 would be provided near Harrison and Republican Streets. The existing on- and off-ramps provided at Denny Way would be closed. New ramps at Republican Street would provide northbound access from SR 99 and southbound access to SR 99. The northbound off-ramp to Republican Street would be provided on the east side of SR 99 and routed to an intersection at Dexter Avenue N. Drivers would access the southbound on-ramp via a new connection with Sixth Avenue N. at Republican

Street on the west side of SR 99. Access to SR 99 would continue to be available at Roy Street as it is today.

Other north portal area surface street improvements include rebuilding Aurora Avenue at grade level between Denny Way and Harrison Street. John, Thomas, and Harrison Streets would be connected as cross streets with signalized intersections on Aurora Avenue at Denny Way and John, Thomas, and Harrison Streets. The rebuilt section of Aurora Avenue would connect to SR 99 via the ramps at Harrison Street.

In addition, Mercer Street would become a two-way street and would be widened from Dexter Avenue N. to Fifth Avenue N. Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N. A new roadway would be built to extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets, and with a signalized intersection at the southbound on-ramp.

For a more detailed description of the Bored Tunnel Alternative, refer to Chapter 3 of this Final EIS.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would develop a cut-and-cover or lidded tunnel to replace the Alaskan Way Viaduct (see Exhibit 3-5). The alternative would be generally along the alignment of the existing viaduct and Alaskan Way. At the south end, it would transition from the section of SR 99 replaced by the S. Holgate Street to S. King Street Viaduct Replacement Project, which is elevated, to descend to a cut-and-cover tunnel section that would also replace the seawall. At the north end, the tunnel would rise to connect to the existing SR 99 Battery Street Tunnel. This would require lowering the southern end of the Battery Street Tunnel and making other safety and structural improvements through the entire length of the tunnel; however, these improvements to the Battery Street Tunnel would not upgrade the alignment to current WSDOT standards. This alternative would also provide improvements to better connect SR 99 and local streets in the area from Denny Way to Aloha Street. From Denny Way to Republican Street, SR 99 would be lowered in a retained cut with Thomas and Harrison Streets crossing over Aurora Avenue. Mercer Street would continue to cross under Aurora Avenue but would be reconfigured to a two-way street. In addition, Roy Street would be regraded to connect to SR 99.

Elevated Structure Alternative

The Elevated Structure Alternative would develop a new, wider, double-level aerial structure to replace the existing Alaskan Way Viaduct (shown in Exhibit 3-7). The southern section would connect to the section of SR 99 replaced by the S. Holgate Street to S. King Street Viaduct Replacement Project. It features a double-level stacked structure through most of the central waterfront, incorporating a replacement for the seawall, and transitioning to a side-by-side structure as it climbs the hill to the Battery Street Tunnel. The Elliott/Western Avenues ramp configuration for the Elevated Structure Alternative would be the same as the existing ramps. SR 99 would then pass over Elliott and Western Avenues. The Battery Street Tunnel would be retrofitted to provide seismic and other structural improvements through the entire length of the tunnel, including other fire and life safety improvements, and the vertical clearance would be increased to 16.5 feet by lowering the existing roadway. However, these improvements to the Battery Street Tunnel would not upgrade the alignment to current WSDOT standards. New ventilation buildings would be located above each Battery Street Tunnel portal. This alternative would also provide improvements to better connect SR 99 and local streets in the area from Denny Way to Aloha Street, similar to those described for the Cut-and-Cover Tunnel Alternative.

The Elevated Structure Alternative was previously examined in detail in the 2006 Supplemental Draft EIS and its accompanying draft Section 4(f) evaluation. The analysis of the alternative was updated in the 2010 Supplemental Draft EIS and this Final EIS. For a more detailed description of the Elevated Structure Alternative, refer to Chapter 3 of this Final EIS.

4 Section 4(f) Resources

The project area includes a rich array of Section 4(f) resources, including park and recreation resources, historic structures and districts, and archaeological sites. At the end of this evaluation, Exhibit 4(f)-5 provides a listing of all the Section 4(f) resources that were evaluated for potential use by FHWA.

The project area encompasses the Area of Potential Effects (APE) defined through the Section 106 process. The APE includes portions of two districts that are listed in the NRHP: the Pioneer Square Historic District and the Pike Place Market Historic District. It also includes multiple properties outside of the districts that are NRHP-eligible.

There are also a number of park and recreation properties in the project area. The project area encompasses at least three blocks from any alternative, but in some cases is extended out to the limits of other potential effects such as noise, parking or traffic that could result in an impact to the resource.

The project area includes other properties that were reviewed for their recreational or historic characteristics, but the project found that they do not possess the essential attributes to qualify them as Section 4(f) resources. Appendix J of this Final EIS provides a complete inventory of all the properties that the lead agencies have evaluated for their potential to qualify as Section 4(f) resources. This includes a waterfront pedestrian/bicycle facility along the east side of Alaskan Way that has been determined to be a transportation facility, and not subject to Section 4(f), consistent with 23 CFR 774.139f)(4).

For the properties that qualify as Section 4(f) resources, the lead agencies reviewed each to assess the potential for a use from direct impacts as well as proximity effects, including noise, visual, or traffic effects, both long term and during construction. Appendix J of this Final EIS provides a map of all Section 4(f) resources in the APE and details the Section 4(f) resources that have been evaluated. This appendix also documents that the project would not impact properties that have received funding from the federal Land and Water Conservation Fund, also known as Section 6(f).

The resources that would be subject to use under Section 4(f) by the Bored Tunnel Alternative are shown in Exhibit 4(f)-1. Resources subject to use under Section 4(f) by all build alternatives are listed in Exhibit 4(f)-2.

Resources Used by the Bored Tunnel Alternative

The Bored Tunnel Alternative will affect four Section 4(f) resources in a manner that constitutes a use of the resources. The four properties used by the Bored Tunnel Alternative are historic resources that would be affected because of the direct impacts of removing the existing viaduct and Battery Street Tunnel, and constructing the bored tunnel and its related facilities. The alternative avoids uses of Section 4(f) park or recreation facilities because most of the effects of construction occur within existing transportation rights-of-way, with no physical impacts to park or recreational properties, and no indirect effects that would result in a constructive use.

Through the Section 106 process, FHWA has concluded that the effects on the four historic properties would result in an adverse effect that would constitute a use under Section 4(f):

- Alaskan Way Viaduct and Battery Street Tunnel
- The Pioneer Square Historic District – Western Building
- Seattle Maintenance Yard – Archaeological Site 45KI958
- Lake Union Sewer Tunnel

Alaskan Way Viaduct and Battery Street Tunnel

The Alaskan Way Viaduct and Battery Street Tunnel have been determined eligible for listing in the NRHP as a single resource. The Alaskan Way Viaduct and Battery Street Tunnel are eligible for the NRHP under Criterion A for their association with bridge and tunnel building in Washington in the 1950s and under Criterion C for their type, period, materials, and methods of construction. The Alaskan Way Viaduct is the only multi-span, concrete, double-level bridge in the state. It is also significant for its role in the development of the regional transportation system and of Seattle's waterfront.

The Battery Street Tunnel is significant because of its association with tunnel building in Washington in the 1950s and its status as the first tunnel designed and built by the City of Seattle Engineering Department. It is also significant for the type, period, materials, and methods of construction. It was designed and built to minimize disruption to street traffic and to minimize the risk to adjacent buildings. In addition to its engineering importance, it is significant for its contribution to the development of the local transportation system, connecting SR 99, built in the 1930s, with the Alaskan Way Viaduct, completed in the 1950s.

Pioneer Square Historic District – Western Building

The Western Building is a contributing building within the Pioneer Square-Skid Road National Historic District. The district, (referred to here as the Pioneer Square Historic District) was established as a National Historic District and listed in the National Register of Historic Places in 1970. The district is generally bounded by Columbia and Cherry Streets to the north, Alaskan Way to the west, Fourth Avenue S. to the east, and S. Royal Brougham Way to the south. This area began to be developed in 1852. It was largely rebuilt in a 2-year period after the devastating Great Fire of 1889 and expanded into the filled tidal flats to the west of the original downtown. The district features late 19th century brick and stone buildings and is one of the nation's best surviving collections of the "Chicago Style" of Romanesque Revival style urban architecture.

The nomination form that established the definition of the district in the National Register identified properties that were considered to be contributing properties. A contributing property is any building, structure, or object that adds to the historical integrity or architectural qualities that distinguish the district. Many of the historic buildings within the district were built within a 2-year period following the Great Fire, and Pioneer Square was the center of Seattle's economic activity at the peak of the Alaska Gold Rush in 1897. However, development within the District's defined boundaries include properties constructed through the early part of the 20th century, as development continued to expand into former tidal flats to the west of Pioneer Square.

The Western Building is the only property within the district with effects that rise to a level that constitute a Section 4(f) use. This six-story warehouse building at 619 Western Avenue, constructed in 1910, is a contributing resource to the Pioneer Square Historic District. While less ornate than other warehouse buildings in the district, it remains an intact example of utilitarian warehouses constructed of reinforced concrete and featuring large multi-light windows.

Seattle Maintenance Yard – Archaeological Site 45KI958

This historic archaeological resource site was discovered during investigations for the Bored Tunnel Alternative, and it is located near the north portal near Harrison Street. The site contains stratified remains of residential and commercial structures dating to the first half of the 20th century. The remains are beneath 15 to 20 feet of fill that was placed on the site and surrounding areas (including the south Lake Union area) in the 1920s and 1930s when Denny Hill was regraded. The site has potential to yield information on residential life, commerce, and trade that is not available from written sources. The site also has an underlying peat layer, which indicates that it has the potential to contain prehistoric archaeological resources. While the project has conducted an archaeological investigation in one section of the site, allowing them to confirm the presence of remnants of structures, the depth of fill does not safely allow extensive investigation.

WSDOT and FHWA anticipate the site is NRHP-eligible under Criterion D for its potential to yield information about early development in Seattle, but its value is in the data that may be recovered and likely does not depend on being preserved in place. If this is the case, the site would meet the conditions needed for an exception to a

Historic and Archaeological Memorandum of Agreement

For more information about effects to historic and archaeological resources, see the Memorandum of Agreement in Attachment C of *Appendix I, Historic,* Cultural, *and Archaeological Resources Discipline Report*.

Section 4(f) use, as established by 23 CFR 774.13(b), with written agreement from the SHPO. As there is a limited amount of archaeological information that can be collected prior to construction, the MOA defines the process the lead agencies will use to determine if the remains of the early 20th century historic occupation require protection in place. The MOA also includes provisions to guide further investigations for potential prehistoric artifacts in the underlying peat layer. Because the information needed to allow an exception cannot be obtained until after construction activities begin, construction within the site is evaluated as a Section 4(f) use.

The Lake Union Sewer Tunnel

The Lake Union Sewer Tunnel is one of Seattle's oldest sewer tunnels. The eastern section was completed in 1891, with the remainder being completed by 1894. The brick-lined tunnel appears to be largely intact. The Section 4(f) evaluation is focused on a manhole shaft, which is one element of the larger system. The manhole is located east of Republican Street and Sixth Avenue. The tunnel is eligible for listing in the NRHP under Criterion A for its association with the development of the City of Seattle and its infrastructure, and under Criterion C as an example of an early brick-lined sewer tunnel with original materials, design, and workmanship.

Resources Used by the Cut-and-Cover Tunnel or Elevated Structure Alternatives

The other two build alternatives considered in this Final EIS addresses would use the following Section 4(f) resources:

- The Alaskan Way Viaduct and Battery Street Tunnel
- The Alaskan Way Seawall
- Seattle Maintenance Yard – Archaeological Site 45KI958
- Washington Street Boat Landing
- Lake Union Sewer Tunnel

The Alaskan Way Viaduct and the Battery Street Tunnel, Seattle Maintenance Yard (Archaeological Site 45KI958), and the Lake Union Sewer Tunnel are described above in the discussion of the Bored Tunnel Alternative. The other affected Section 4(f) resources are described below.

Alaskan Way Seawall

The Alaskan Way Seawall is eligible for listing in the NRHP under Criterion A for its association with development of the central waterfront from the early 1900s to the mid-1930s. It is significant under Criterion C for the type, period, materials, and methods of construction. It was designed and built by the Seattle Engineering Department using a unique piling and platform design.

Washington Street Boat Landing

The Washington Street Boat Landing is both a park property and a historic resource. It has been determined eligible for listing in the NRHP under Criterion C for its design characteristics. It is on City right-of-way at the end of S. Washington Street. The pergola is listed individually in the NRHP. The park facility consists of the pergola and an additional feature, the dock, which has included a float and ramp to connect with the pergola. This facility has been operated by the Seattle Parks and Recreation Department for public open space and includes benches. However, the floats typically were removed in winter to avoid possible storm damage. The floats were not replaced in the summer of 2001, after the Nisqually earthquake, due to the need for replacement of pilings and because the investment was deemed unwise due to uncertainty about future plans for the viaduct and seawall.

5 Bored Tunnel Alternative

The Section 4(f) resources with a use by the Bored Tunnel Alternative are shown on Exhibit 4(f)-1 and discussed below.

Alaskan Way Viaduct and Battery Street Tunnel

Would this alternative result in a use of this resource?

The Bored Tunnel Alternative is located to the east of the existing viaduct, so complete demolition is not needed. However, the Bored Tunnel Alternative will require alteration and closure of the Battery Street Tunnel, the other element of this historic property. Given the existing viaduct's inherent structural limitations and high risk of failure during a seismic event, and the fact that its functions would be replaced by the bored tunnel, leaving the viaduct in place would create unacceptable public safety risks and is not prudent.

Similarly, the Bored Tunnel Alternative will replace the function provided by the Battery Street Tunnel, which will be decommissioned. While other uses of the old tunnel could be possible (such as pedestrian or bicycle use), the tunnel would require costly retrofits to meet current standards, including structural, seismic, and health and safety standards. These improvements would still result in a Section 4(f) use. Further, the Battery Street Tunnel may be used for debris disposal from the Alaskan Way Viaduct, which would avoid the need for seismic retrofits and reduce construction-related traffic, noise, and debris disposal costs.

Can this alternative be modified to avoid the use or to minimize the harm resulting from the use?

Design modification of the Bored Tunnel Alternative would not avoid or minimize the use. As described above, the primary reason that a use occurs is that the Bored Tunnel Alternative replaces the function of the viaduct and Battery Street Tunnel. The viaduct is unsafe and will be demolished as part of the project. High levels of investment in the viaduct and the Battery Street Tunnel would still be needed to avoid unacceptable safety risks.

What measures to minimize harm to this resource have been incorporated into this alternative?

Measures to minimize harm to the Alaskan Way Viaduct and the Battery Street Tunnel include documenting the historic attributes of the viaduct and tunnel in accordance with Historic American Engineering Record (HAER) standards. The lead agencies have completed HAER documentation (including photography) for the viaduct and the tunnel and have submitted the HAER report to NPS.

Pioneer Square Historic District – Western Building

Would this alternative result in a use of this resource?

FHWA has determined that settlement damage and related activities to protect the Western Building, a contributing resource to the Pioneer Square Historic District, would result in the Section 4(f) use of the District, but the area of use is confined to the Western Building. The loose fill soils beneath the Western Building have a high potential for causing settlement damage, since the bored tunnel alternative would excavate soils directly beneath the building. Engineering evaluations of the building found it to be in very poor structural condition due to settlement, deterioration of its wooden pile foundation, the effects of the Nisqually earthquake, and general deterioration over time. The building today has many large cracks in columns and large visible cracks on external walls, in most other structural and interior walls, and on the ground floor slab. Some cracks or gaps are 5 inches or more wide and extend through several floors of the building. There are visible variations in building settlement resulting in floor slopes of up to 5 percent, and there are gaps between floors and walls.

WSDOT's engineering assessment rates the potential settlement damage as "very severe" if the project does not provide protective measures. Settlement otherwise would damage major structural and architectural elements of the building. There are also concerns about the building's instability and potential for collapse, given its poor existing structural condition. In response, WSDOT has defined a program of protective measures that are needed to protect the building, but this will involve construction of structural reinforcements and bracing for the interior and exterior of the building, and relocating all tenants for up to a year.

In conducting the Section 106 consultation process, WSDOT and FHWA have determined that the settlement damage to the Western Building would result in an adverse effect to the building and to the Pioneer Square Historic District, as the building is a contributing element to the District.

The preferred approach that WSDOT has developed to protect the building calls for:

- Strengthening the foundation with micropiles and grade beams, or constructing a reinforced concrete wall system, or using a combination of both approaches
- Installing epoxy grout and wrap on cracked concrete columns and beams
- Constructing a temporary exterior steel frame and interior shoring and bracing
- Injecting compensation grout to manage building settlement to less than 0.5 inch

The steel framing and the interior shoring and bracing would be removed when the risk of settlement diminishes, leaving the exterior appearance of the building approximately the same as it is currently. The interior would also have a similar appearance as today, but some interior bracing may remain. With this approach, the risk of irreparable damage is low, but there is a moderate risk that building movement may transfer the structural load to the temporary framing and/or shoring, meaning that additional structural work would be required to remove the framing. The process would take about 10 months, including construction of the temporary framing, monitoring while the tunnel boring machine advances, and removal of the framing and restoring utilities. The work would be reviewed by the Pioneer Square Preservation Board and would be done in compliance with the Secretary of the Interior's Standards for Rehabilitation of Historic Buildings (36 CFR 67.6).

In the 2010 Supplemental Draft EIS, FHWA identified a Section 4(f) use of the Western Building as a contributing building to Pioneer Square Historic District. It also identified a Section 106 adverse effect for the Western Building. This was because the anticipated settlement damage to the building was severe enough for the lead agencies to consider demolition to avoid the collapse of the building and preserve public safety, and WSDOT anticipated the need to fully acquire the building.

WSDOT's protection measures are designed to return the building to its current condition or better, and full acquisition of the building can be avoided. The extent of work required to preserve the building are temporary but they would not be minor, and there is still the potential for at least aesthetic damage that would require repair, consistent with the Secretary of Interior Standards. Through subsequent Section 106 consultation, FHWA and WSDOT identified a Section 106 adverse effect to the Pioneer Square Historic District, since the Western Building contributes to the District. As the building contributes to the Pioneer Square Historic District, the Section 4(f) use is of the District, but the area of use is confined to the Western Building.

Other Resources Within the District with Effects Not Resulting in a Use

The Bored Tunnel Alternative has the potential to cause settlement resulting in damage to the Polson and Yesler buildings, if no protective measures are provided. Both buildings are contributing resources to the Pioneer Square Historic District. WSDOT and FHWA have concluded that the protective measures defined through the project's MOA would avoid a Section 4(f) use, and no other effects would rise to the level of causing a constructive use.

Polson Building

This six-story warehouse building at 61 Columbia Street was constructed in 1910 and is immediately north of the Western Building. The building was designed by Charles Saunders and George Lawton, who designed several other warehouses in the district as well as other notable buildings in Seattle. It is significant because it was part of the reconstruction of the Pioneer Square District in the original heart of Seattle and the former tidal flats of Elliott Bay.

The potential settlement damage to the Polson Building was rated "severe to very severe." However, this building is in good structural condition; therefore, protective measures prior to construction and high levels of monitoring during construction would prevent major structural damage. Any remaining structural and aesthetic damage could be repaired.

The tunneling activities beneath this building have the potential to cause settlement that could result in severe to very severe damage, including damage to architectural finishes and distortion of windows and doors. WSDOT, the City, and FHWA have concluded that without protective measures and additional mitigation, the structural and architectural damage to this building would result in an adverse effect to the property under Section 106.

The Bored Tunnel Alternative would include a comprehensive program of protection measures for the Polson Building, beginning prior to tunnel construction. These measures, which are described in the project's Section 106 MOA, include preconstruction protection, a monitoring plan, and an action plan for addressing ground changes or building settlement. Preconstruction prevention measures to protect and stabilize the building would include the use of various soil improvement and grouting techniques to improve soil strength or compensate for ground loss due to excavation.

While construction is under way and as construction is completed, the building would be monitored for any signs of damage. If damage does occur, all restoration and repair work would be done in compliance with the Secretary of the Interior's Standards for Rehabilitation. This and other mitigation actions are defined in the MOA developed through the Section 106 process.

With these measures for protection, repair, and rehabilitation of the building, the lead agencies expect the property to retain the qualities, features, and attributes that qualify it as a Section 4(f) resource.

No temporary or permanent acquisition of the building is needed. The building would also maintain the warehouse building features and characteristics that are part of its historic significance. Other proximity effects, including the short-term effects of construction disruption for areas surrounding the building, are also not expected to result in a substantial short- or long-term impairment to the building or remove the characteristics that qualify it as a Section 4(f) resource. Considering all of these factors, WSDOT and FHWA have concluded that no Section 4(f) use or constructive use would occur.

One Yesler Building

This three-story brick building in the Pioneer Square Historic District could have very slight structural damage due to ground settlement. In the Section 106 MOA, the project commits to measures needed to avoid direct adverse effects due to structural damage, including the use of micro piles to increase the stability of soils near the building, prior to tunnel construction, monitoring and protection during construction. Any repairs or restoration, if needed, would be done in compliance with the Secretary of the Interior's Standards for Rehabilitation. WSDOT and FHWA have determined that effects would be "not adverse" under Section 106.

No temporary or permanent acquisition of the building would occur. The building will retain the features and characteristics that are part of its historic significance. Other proximity effects, including the short-term effects of construction disruption for areas surrounding the building, are also not expected to result in a substantial short- or long-term impairment to the building or remove the characteristics that qualify it as a Section 4(f) resource. Considering all of these factors, WSDOT and FHWA have concluded that no Section 4(f) use or constructive use will occur.

Other Effects to the District

Demolition of the viaduct would also occur in close proximity to buildings that are part of the historic district. The potentially affected buildings within the district are adjacent to the viaduct between S. Jackson and Columbia Streets and near the ramps on Columbia and Seneca Streets. Demolition would take approximately 9 months, but it is expected to occur in two-block segments, which would affect specific properties for a much shorter period. Employees, customers, and residents will be able to occupy the buildings continually but may be affected by noise, dust, and limited access and parking for a period. The Bored Tunnel Alternative does not require acquisition of the buildings, will not involve their physical alteration, and would not change the historic features or characteristics of the buildings or their importance to the District.

No other buildings or resources within the District would have settlement damage or other effects that would rise to the level of a use. With the measures to protect and preserve all of the buildings within the district, the district will retain the features, attributes, and associations that make it historically significant.

Additional details on the assessment of potential effects to other properties within the District, including long term or construction effects are provided in Appendix J.

Can this alternative be modified to avoid the use of the District's Western Building or to minimize the harm resulting from the use?

The Bored Tunnel Alternative has been modified to include a program of extensive protective measures to preserve the Western Building and avoid potential loss of the resource through collapse or demolition. In addition, several design variations of the Bored Tunnel Alternative have been considered in an effort to avoid or minimize impacts to the Western Building and a use of the Pioneer Square Historic District. These variations include:

- Move the alignment to the west or south
- Move the alignment to the east
- Increase the depth of the tunnel
- Use other construction methods
- Change the size or type of tunnel being constructed

There are many engineering constraints and other factors that limit the opportunities to shift this alternative away from the Western Building. The tunnel alignment and its size are driven primarily by geotechnical conditions, highway and tunnel design standards, and project constraints to the north, south, east, and west. The project has also made engineering and construction modifications to minimize the effects to Section 4(f) resources, including the Western Building. After thorough consideration, potential alignment variations that would reduce or avoid impacts to the Western Building have been rejected. The discussion below identifies the reasons for rejecting these variations as being either not prudent or feasible or because they do not avoid the use of Section 4(f) resources.

Move the alignment to the west or south – The tunnel's south portal was sited to avoid other major foundations and buildings, including the existing Alaskan Way Viaduct structure immediately west. Moving the tunnel alignment to the west or the south would potentially require closing the Alaskan Way Viaduct. Either would also require a substantial deviation from geometric standards for the bored tunnel, affecting factors such as grades, sight distance, and other features important to the safe and effective operation of the tunnel. With the earlier closure of the Alaskan Way Viaduct before a replacement facility is available, there would be higher environmental and transportation impacts throughout the downtown area during the construction period. The lead agencies have concluded that such major deviations in geometric standards for the highway in the new tunnel would carry unacceptable safety risks to traffic operations. As improved safety is a key element of the project's purpose and need, and these realignment options would fail to address critical safety factors, they are not considered prudent.

Shift the tunnel alignment to the east to avoid the Western Building – The project has extensively reviewed the potential for using other tunnel alignments to the east. This includes an earlier alignment for the bored tunnel that placed a tunnel portal near First Avenue S. and S. Charles Street. This location would have involved a Section 4(f) use of the Triangle Building, a historic property that is also part of the Pioneer Square Historic District, and it would have affected at least 11 other historic structures within the Pioneer Square Historic District. The extent of potential damage for the earlier alignment was more severe than for the current alignment. This would have constituted higher levels of Section 4(f) uses, and would not be an avoidance measure. The project also reviewed the potential for aligning the tunnel even farther east, but this area is occupied by several blocks of buildings, which include multistory structures and other Section 4(f) resources. Construction period settlement affecting historic properties and other buildings would have remained an issue, particularly in the Pioneer Square Historic District where the tunnel alignment would have remained shallow. The net effect of shifting the tunnel alignment east would be to increase the use of Section 4(f) resources, and therefore would not be a prudent avoidance option.

Increase the depth of the tunnel – Deepening the tunnel would result in unacceptable grades to the north and south for effective connections to surface streets, making it not prudent. A greater depth also would not be likely to reduce the potential for settlement to the Western Building, given soil and groundwater conditions and the building's currently weakened foundation and structural characteristics. Therefore, it is not likely to avoid the Section 4(f) use.

Use other construction methods – The project is already incorporating innovative methods for initiating the tunnel construction to help minimize construction impacts. The Cut-and-Cover Tunnel Alternative reflects the other most commonly used construction method for a major tunnel. Because it involves open excavation, this method is most appropriate where right-of-way is potentially available, such as where the Alaskan Way Viaduct is currently located. The alignment identified for the Bored Tunnel Alternative, which is designed to allow the viaduct to remain in place until the replacement is built, would not be appropriate using a cut-and-cover method. A cut-and-cover tunnel through the Pioneer Square Historic District would require excavating all soils between the bottom of the tunnel and the surface, which would have a greater potential for archaeological impacts, as well as increased traffic impacts, property impacts, historic resource impacts, utility impacts, and long-term construction disruption than any of the other identified alternatives. For these reasons, other construction methods were not considered prudent.

Change the size or type of tunnel being constructed – During the development of the bored tunnel concept, several variations were considered, including a twin bored tunnel, each containing two lanes, as well as hybrids that could return to the surface north of Pioneer Square. However, none of these options would avoid the underlying geotechnical and soil stabilization issues present in the area of the Western Building and the Pioneer Square Historic District. Other smaller tunnels with fewer lanes or with reduced shoulders were not considered to be prudent because they did not provide sufficient capacity to replace the existing viaduct facility or meet current safety standards, and therefore would not meet the project's purpose and need.

What measures to minimize harm to this resource have been incorporated into this alternative?

The lead agencies' detailed engineering assessments have defined measures that the project can take to minimize harm to the Western Building in the Pioneer Square Historic District. These measures and procedures are described in the MOA developed through the Section 106 process, and are designed to preserve the Western Building and prevent the loss of a contributing resource to the District.

To address potential damage to the Western Building and to avoid or minimize harm to other historic buildings in the District, the MOA includes these mitigation commitments:

- Damage to historic buildings caused by the project will be repaired in kind and in accordance with the Secretary of the Interior's Standards for Rehabilitation of Historic Buildings. If exterior alterations are necessary, approval would be sought, as required, from the Pioneer Square Preservation Board, the Seattle Landmarks Preservation Board, or the Pike Place Market Historical Commission, as appropriate.

- An architectural historian will be involved in evaluating and repairing damage to historic buildings.

Seattle Maintenance Yard – Archaeological Site 45KI958
Would this alternative result in a use of this resource?
The Bored Tunnel Alternative would require excavation of this site to allow construction of the new north tunnel portal and related ramps, structures, and roadways connecting to local streets and to the existing SR 99 facility to the north. The lead agencies are presuming this archaeological site will be determined eligible, and construction activity and the redevelopment of the site as a transportation facility would result in an adverse effect under Section 106. The lead agencies are defining this as a Section 4(f) use.

Can this alternative be modified to avoid the use or to minimize the harm resulting from the use?
Several variations of the Bored Tunnel Alternative's north portal access features have been considered in an effort to avoid this archaeological site. However, the variations would introduce other construction, safety, or operational factors that jeopardized the ability of the Bored Tunnel Alternative to satisfy the project's purpose and need, or they had a high potential for affecting other Section 4(f) resources or worsening overall environmental effects. As in the southern portion of the tunnel, the north tunnel alignment and the portal location are driven primarily by geotechnical conditions, highway and tunnel design standards, the need to connect to the local street system and existing portions of SR 99, and the need to minimize construction period effects by maintaining traffic on SR 99 during much of the construction period. The potential variations that have been considered include the following:

- **Placing the portal to the south –** To avoid the archaeological site or other properties that have a similar potential to contain historic archaeological resources from early 20th century development, the portal would need to be placed at least two blocks to the south, which would require substantially increased grades and bring the tunnel closer to the surface in other areas. The resulting geometry would affect operating conditions and create safety concerns for the tunnel. The revised vertical alignment would likely undermine or directly affect portions of the existing Battery Street Tunnel, which would likely need to be closed during construction, eliminating a primary benefit of the Bored Tunnel Alternative. Raising the vertical profile of the tunnel would also introduce a higher potential for ground settlement and other impacts to historic properties, other structures, and major utilities.

- **Moving the portal to the east or north –** Other locations to the east or north would also be likely to contain historic archaeological resources as well as prehistoric resources, and would be unlikely to avoid a Section 4(f) use. The Seattle Maintenance Yard (Archaeological Site 45KI958) is not extensively developed, which minimizes property, displacement, or major utility impacts. The site also provides the opportunity to meet standards for roadway connections to the existing SR 99 to the north as well as other connections to local streets, while also allowing SR 99 traffic to be maintained during several years of construction. If the tunnel were moved to the east, such as to Dexter Avenue, the environmental effects to property and traffic would be substantially higher. This location would require removal of several blocks of developed property to make the necessary connections to SR 99 and improvements to Sixth Avenue and other east-west streets. Extending the portal to the north would have similarly worsened effects, with fewer opportunities to reconnect the street grid. In addition, based on photographs of historic Seattle and other records that show the locations of the original streets and buildings that were removed and then buried as part of the Denny Regrade, WSDOT and FWHA have concluded that other sites for the portal would have a similar or higher potential to encounter other archaeological resources from Seattle's early development.

- **Moving the portal to the west –** Moving the tunnel to the west would still involve construction within the Seattle Maintenance Yard (Archaeological Site 45KI958), and would not avoid a Section 4(f) use. Several other features essential to safety and improved traffic circulation and access to and from the portal and nearby streets either could not be made or would directly conflict with a major new development complex for the Gates Foundation, as well as the Bored Tunnel Alternative's Mercer Street features.

What measures to minimize harm to this resource have been incorporated into this alternative?
Since the site has not yet been determined eligible for listing in the NRHP, additional investigations will be undertaken as construction begins. The MOA outlines the procedures for addressing the site. The results of additional investigations will be used to determine the NRHP eligibility of the site. If WSDOT and FWHA determine that the site is NRHP eligible and the SHPO concurs, data recovery will be undertaken to recover the information that qualifies the site for the NRHP.

In concert with the investigation of site 45KI958, additional archaeological investigation will also be undertaken in other areas within the footprint of the cut-and-cover trench where peat deposits and extant historic surfaces have been identified. If archaeological deposits are discovered and are determined eligible for the NRHP Criterion D (important chiefly for the information they may yield), data recovery would also be undertaken at these locations. If significant archaeological deposits are discovered that warrant preservation in place, FHWA and WSDOT would consult further with the SHPO, and FHWA would be required to conduct an additional Section 4(f) evaluation prior to approving activities that result in the use of the resource. In either case, the archaeological treatment plan will guide the procedures to be followed for this investigation, including potential data recovery. During construction, archaeological monitoring would be required for ground disturbing activities that would intersect the elevation of peat deposits and extant historic surfaces identified during geoarchaeological investigations.

Lake Union Sewer Tunnel

Would this alternative result in a use of this resource?

The proposed off-ramp from SR 99 at Republican Street is approximately 6.5 feet below the existing top of a manhole shaft connecting to the main tunnel. Construction would require removing the upper section of the brick manhole shaft; this includes approximately 4.7 feet of the original brick lining material. The opening would be covered with a reinforced concrete top slab with an integral manhole ring and will continue to function as an access point to the sewer tunnel. While the function of the sewer tunnel will be maintained, and this alteration affects a portion of the tunnel, the alteration would result in a Section 4(f) use.

Can this alternative be modified to avoid the use or to minimize the harm resulting from the use?

The use of part of the sewer tunnel is caused by the off-ramp to Republican Street, which is vital to maintaining connections to the South Lake Union and Seattle Center areas and the area transportation network. Eliminating this off-ramp is not prudent because it is the first northbound exit after the Alaskan Way S. off-ramp, near the south portal, and would greatly reduce the transportation mobility benefits the project is intended to provide.

The location of the Republican Street off-ramp depends on the location of the north portal itself, which is part of a complex multi-level solution allowing the bored tunnel to connect to an improved local street network while avoiding a sustained closure of SR 99.

Potential variations of the Bored Tunnel Alternative's north portal have been described above as part of the search for measures to avoid the Seattle Maintenance Yard (Archaeological Site 45KI958). The need to maintain the north portal's currently proposed location and depth constrain the potential for altering the location of the off-ramp to Republican Street and the intersection with Dexter Avenue.

Variations to the grade or geometrics of the off-ramp to connect with Republican Street would introduce other construction, safety and transportation problems that jeopardize the ability of the Bored Tunnel Alternative to satisfy the project's purpose and need, and would not be prudent.

The design of the off-ramp has already been modified to raise the grade of the off-ramp by more than 5 feet, in order to minimize the amount of the manhole shaft that would be altered. Further modifications to the grade would result in unsafe sight distances and an unacceptable grade for effective traffic operations, including for trucks. The resulting safety and operation problems from a steeper grade would be contrary to the project's purpose and need.

Shifting the alignment of the off-ramp to the south side of Republican Street to avoid the manhole would also result in unsafe conditions due to curves, grades, and sight distance leading to the new intersection with Dexter Avenue. Shifting the alignment to the north side of Republican Street would have similar problems, again due to curves and limited sight distance. Locating the off-ramp even further north toward Mercer Street would conflict with the location of the northbound on-ramp to SR 99, and would result in poor connectivity and high levels of traffic impacts to the street network, including to Dexter Street and the reconfigured Mercer Street. These results would be contrary to the project's purpose and need and would not be prudent.

What measures to minimize harm to this resource have been incorporated into this alternative?

The project has already modified the design of the off-ramp to raise it to minimize impacts to the manhole shaft. The project's MOA defines further mitigation measures to be taken for the resources, including documentation of its historic attributes.

Other Historic Resources Potentially Affected by Construction

No other historic properties outside the Pioneer Square Historic District are expected to result in a Section 4(f) use, but there are other properties that may experience settlement during construction. The lead agencies have conducted a preconstruction assessment of all buildings along the tunnel alignment to determine which properties may be affected by tunnel settlement. Structural engineers have inspected every building within the anticipated settlement zone (approximately one block on each side of the proposed alignment).

Based on these investigations, WSDOT has identified the potential for minor levels of settlement damage (rated as slight or very slight) affecting the following historic buildings shown on Exhibit 4(f)-3 and listed in Exhibit 4(f)-4. These buildings qualify as Section 4(f) resources because they are listed in or have been determined eligible for the NRHP. Through the Section 106 process, FHWA has determined that the potential effects to the following buildings would be minor and "not adverse."

- Federal Office Building – 901 First Avenue
- National Building – 1000 Western Avenue
- Alexis Hotel/Globe Building – 1001 First Avenue
- Arlington South/Beebe Building – 1015 First Avenue
- Arlington North/Hotel Cecil – 1015 First Avenue
- Grand Pacific Hotel – 1115 First Avenue
- Colonial Hotel – 1123 First Avenue
- Fire Station No. 2 – 2334 Fourth Avenue
- Two Bells Tavern – 2313 Fourth Avenue
- Archstone Belltown – Grosvenor House, 500 Wall Street

The Bored Tunnel Alternative would not incorporate land from these properties, and the alternative would not directly or indirectly impair the features that make the buildings historically significant. The Section 106 MOA defines the monitoring, protection and repair commitments for these properties. The MOA also defines monitoring and protection commitments for a longer list of historic properties where no damage is anticipated. The measures ensure that these buildings will not incur permanent damage from construction of the bored tunnel. If temporary damage occurs, it would not be severe. Restoration and repair work for these buildings, if needed, will comply with the Secretary of the Interior's Standards for Rehabilitation, which would avoid impacts due to alteration of each building's historic attributes.

The properties with potential settlement effects listed in Exhibit 4(f)-4 were evaluated for potential constructive use as a result of construction effects or other project effects. However, the historic attributes of all of the properties would be maintained given the MOA commitments to protect the buildings during construction and to repair potential damage consistent with the Secretary of the Interior's Standards for Rehabilitation.

Therefore, no use or constructive use is anticipated for the properties in Exhibit 4(f)-4 with effects that are anticipated to be determined "not adverse" under Section 106.

In addition, there would be no use or constructive use of the larger set of historic resources within the APE. Through the Section 106 process, WSDOT and FWHA have evaluated and determined these other properties would have "no effect" under the Bored Tunnel Alternative.

WSDOT will be obtaining underground easements for the tunnel for the properties that are above the tunnel, but an underground easement does not involve physical alteration of buildings, and does not alter the ownership of the subject properties. Easement would not directly or indirectly alter the historic integrity of the properties. Therefore, the easements would not constitute a use.

Archaeological Resources Affected During Construction

One archaeological property within the APE (the Dearborn South Tideland Site) may be disturbed during construction of the Bored Tunnel Alternative. The site contains foundations, structural, and other materials from commercial and industrial development that occurred between 1895 and 1910 on filled tidelands. FHWA and WSDOT have determined and SHPO has agreed the site is eligible under Criterion D for its potential to yield information about early development in Seattle, but its value is in the data that may be recovered and does not depend on being preserved in place. Section 4(f) regulations provide an exception for the use of these types of archaeological properties in 23 CFR 774.13(b).

The SHPO agreed in writing on March 29, 2010 with FHWA's request to concur with a Section 4(f) exemption for the site (Appendix U provides this correspondence). Therefore, under FHWA's Section 4(f) regulations, construction activities affecting this site are exempt from Section 4(f), and there is no requirement to consider avoidance alternatives and incorporate all possible planning to minimize harm. The MOA still commits the project to developing an Archaeological treatment plan for the project, which will include monitoring and data recovery measures for the Dearborn South Tideland Site.

Other Archaeological Sites

Additional sub-surface exploration would be undertaken in areas identified as highly sensitive for archaeological deposits prior to construction. The construction schedule would be designed to accommodate evaluation and mitigation of significant archaeological sites found during construction in areas inaccessible for examination prior to construction. Construction would proceed in compliance with an archaeological treatment plan, which shall provide the procedures guiding internal WSDOT notification protocols and consultation with the SHPO, the tribes, and consulting parties upon unanticipated discovery of archaeological material or human remains, in accordance with Section 106 requirements. Depending on the significance of resources that may be discovered, an additional Section 4(f) evaluation may also be required before the project resumes further construction activities that affect the resource.

6 Effects of the Cut-and-Cover Tunnel and Elevated Structure Alternatives on Section 4(f) Properties

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would result in uses of Section 4(f) properties due to the activities described below for each alternative. The 2010 Supplemental Draft EIS provided further discussions of the potential for the alternatives to avoid or minimize their Section 4(f) uses, but concluded they were unavoidable without creating higher levels of impacts or compromising the project to a degree that it would no longer be reasonable to continue with the project in light of the stated purpose and need.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would require the use of the Alaskan Way Viaduct, the Battery Street Tunnel, the Alaskan Way Seawall, the Washington Street Boat Landing, and the Seattle Maintenance Yard (Archaeological Site 45KI958).

Alaskan Way Viaduct and Battery Street Tunnel

The Cut-and-Cover Tunnel Alternative is located directly on the existing location of the Alaskan Way Viaduct. Therefore, it would require the removal of the viaduct and result in an unavoidable Section 4(f) use.

The Cut-and-Cover Tunnel Alternative would include substantial modification of the Battery Street Tunnel to meet seismic design criteria and improve safety. These improvements would involve the removal of existing historically significant features of the tunnel, including the tiled walls. To satisfy the purpose and need for objective for safety, this alternative must modify the tunnel, and results in an unavoidable Section 4(f) use.

The alternative requires the continued use of the Battery Street Tunnel to connect to the termini of the project. Continued use of the Battery Street Tunnel is possible only if the necessary upgrades are made so that the tunnel meets current fire safety standards.

Section 4(f) Resources With Potential Minor Effects but Not Subject to Use by the Preferred Alternative

National Building

Fire Station # 2

Grosvenor House

1 Yesler Building

Polson Building

Federal Office Building

Alexis Hotel (Globe)

Arlington North (Hotel Cecil)

Arlington South (Beebe Building)

Colonial Grand Pacific (Colonial, left, Grand Pacific, right)

Exhibit 4(f)-3

Alaskan Way Seawall

The Cut-and-Cover Tunnel Alternative would replace the seawall from S. Washington Street up to Broad Street. Between S. Washington Street and Union Street, the existing seawall would be replaced by the outer wall of the tunnel. From Union Street to Broad Street, the seawall would be rebuilt by improving the soils and replacing the existing seawall in most locations. Therefore, this alternative would result in an unavoidable use of the seawall.

Washington Street Boat Landing

The Cut-and-Cover Tunnel Alternative would affect the Washington Street Boat Landing pergola, which is also a historic resource. Construction of this alternative would displace the pergola, and it would then be relocated to a nearby site at the foot of S. Washington Street. Additional discussion of this alternative's effect on this site was included in the 2006 Supplemental Draft EIS Appendix N, Part A. Therefore, this alternative would result in a use of the Washington Street Boat Landing park.

Seattle Maintenance Yard – Archaeological Site 45KI958

The Cut-and-Cover Tunnel Alternative would require excavation and construction within this site. Construction activity and the redevelopment of the site as a transportation facility would result in an adverse effect under Section 106, and would constitute a Section 4(f) use.

Lake Union Sewer Tunnel

The Cut-and-Cover Tunnel Alternative would require the reconstruction of Republican Street, altering a manhole shaft. This would result in an adverse effect under Section 106, and would constitute a Section 4(f) use.

The Elevated Structure Alternative

The Elevated Structure Alternative would require the use of the Alaskan Way Viaduct and Battery Street Tunnel, the Alaskan Way Seawall, the Washington Street Boat Landing, and the Seattle Maintenance Yard (Archaeological Site 45KI958), and the Lake Union Sewer Tunnel. The uses are substantially the same as the uses resulting from the Cut-and-Cover Tunnel Alternative, because the Elevated

Exhibit 4(f)-4

Section 4(f) Resources With Potential Minor Effects but Not Subject to Use by the Preferred Alternative

Name (Historic Name) Address	Historic Status	Key Characteristics	*Potential Effect*	Proposed Protection and Impact Minimization Actions	Section 106 Effects Determination	Section 4(f) Evaluation Results
Dearborn South Tideland Site West of First Avenue S. between S. Dearborn Street and S. Royal Brougham Way	Eligible for National Register	Archaeological site eligible under Criteria A and C. Contains building remains, refuse accumulations and other cultural features from 1898 to 1910.	*Risk of ground disturbance from construction activities*	Monitoring and data recovery measures defined in archaeological treatment plan.	**Not adverse**	**No use. No constructive use.**
1 Yesler Way	Pioneer Square Historic District (contributing building)	Three-story brick-clad building constructed in 1911 as a hotel. Significant for its part in the reconstruction of the Pioneer Square Historic District **(Criterion A)** and for the building type and characteristics **(Criterion C).**	*Very Slight Building damage due to ground settlement*	Level 3 Monitoring, Possible compensation grouting.	**Not adverse**	**No use. No constructive use.**
Polson Building 61 Columbia Street	Pioneer Square Historic District (contributing building)	Six-story warehouse building, constructed in 1910. Significant for its part in the reconstruction of the Pioneer Square Historic District **(Criterion A)** and for the building type and characteristics **(Criterion C)**.	*Severe to Very Severe building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting, Foundation strengthening.	**Adverse**	**No use. No constructive use.**
Federal Building 901 First Avenue	Listed in the National Register	Completed in 1933. 7- and 8- story Art Deco brick and terra cotta building. Significant for **Criterion A**, as the first Seattle building designed for federal offices, and for **Criterion C**, for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
National Building 1000 Western Avenue	Listed in the National Register	Completed in 1904. A 6-story brick building designed for the Northern Pacific Railroad. Significant under **Criterion A** for its role in Seattle's development, and for **Criterion C** for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Alexis Hotel (Globe) 1001 First Avenue	Listed in the National Register	Part of the "First Avenue" group developed as a block. Significant under **Criterion A** as a work by noted architect (Umbrecht) and as part of Seattle development after the Great Fire, and for **Criterion C**, for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Arlington South (Beebe Building) 1015 First Avenue	Listed in the National Register	Developed in 1901. Part of the "First Avenue" group developed as a block. Significant under **Critierion A** as a work by noted architect (Umbrecht) and as part of Seattle development after the Great Fire, and for **Criterion C**, for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Arlington North (Hotel Cecil) 1015 First Avenue	Listed in the National Register	Completed in 1904. Part of the "First Avenue" group developed as a block. Significant under **Criterion A** as a work by noted architect (Umbrecht) and as part of Seattle development after the Great Fire, and for **Criterion C**, for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Colonial Grand Pacific (Grand Pacific) 1119 First Avenue	Listed in the National Register	Designed in 1901. Part of the "First Avenue" group, significant under **Criterion A** as a work by noted architect (Umbrecht) and as part of Seattle development, and for **Criterion C**, for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Colonial Grand Pacific (Colonial) 1123 First Avenue	Listed in the National Register	Part of the "First Avenue" group, significant under **Criterion A** as a work by noted architect (Umbrecht) and as part of Seattle development, and for **Criterion C**, for building type and characteristics.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Fire Station #2 2334 Fourth Avenue	Eligible for National Register	Built in 1920. The City's oldest fire station still in use. Significant under **Criterion A** for its association with the city's development and its fire department, and under **Criterion C** as an example of finely detailed industrial architecture and a work by Seattle's most prominent municipal architect (Huntington).	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**
Grosvenor House 500 Wall Street	Eligible for National Register	Built in 1949. Significant under Criterion C as one of the first large apartment building built during Post-World War II Seattle.	*Slight building damage due to ground settlement*	Level 3 Monitoring, Compensation grouting.	**Not adverse**	**No use. No constructive use.**

Structure Alternative would be in the same location as the existing viaduct, requiring its removal. However, the Elevated Structure Alternative would be more than twice as wide as the existing structure in the Pioneer Square area. This would affect views and the pedestrian environment along Alaskan Way. It also would require replacing the seawall to provide support for the soils surrounding the foundation of the new elevated structure. The same modifications to the Battery Street Tunnel would be needed, along with local street improvements near the portal.

7 Other Alternatives Considered to Avoid and Minimize Harm

WSDOT began the planning and alternatives evaluation process for the replacement of the Alaskan Way Viaduct in 2001. Nearly 100 different approaches to the project have been considered since that time, covering six groups of improvements, including improvements to the viaduct, to the Battery Street Tunnel, to the seawall, to roadways, and for multimodal systems. These formed the basis for five alternatives that were considered in the 2004 Draft EIS, in addition to a No Build Alternative:

- Rebuild
- Aerial
- Surface
- Tunnel
- Bypass Tunnel

A public vote in 2007 rejected both elevated and cut-and-cover tunnel replacements of the viaduct. In 2008, the lead agencies initiated the Partnership Process, a public evaluation of scenarios that took a systems-level approach to SR 99 replacement solutions.

Through the Partnership Process, three hybrid scenarios were considered, each incorporating an element with the potential to address the need for an SR 99 replacement, supported by other projects and strategies at the system level:

- I-5, Surface, and Transit Hybrid
- Elevated Bypass Hybrid
- Twin Bored Tunnel/Single Bored Tunnel Hybrid

In the 2010 Supplemental Draft EIS, the lead agencies updated and confirmed their findings, and documented the reasons for removing alternatives considered prior to the 2006 Supplemental Draft EIS. The 2010 Supplemental Draft EIS provided an additional opportunity for public review and comment. The Final EIS provides further discussion on alternatives considered in Chapter 2.

In the following sections, the Section 4(f) evaluation briefly summarizes the primary reasons that other alternatives, including potential new alternatives or variations, as well as alternatives no longer being considered in the current EIS process, do not constitute prudent or feasible avoidance alternatives to Section 4(f) uses, or because they do not represent an opportunity to further minimize harm compared to the remaining EIS alternatives.

No Build Alternative

Under the No Build Alternative, there would be no construction project to replace the existing Alaskan Way Viaduct within the termini of this project. For safety reasons, the Alaskan Way Viaduct would need to be closed. The No Build Alternative is not considered a feasible and prudent avoidance alternative because it takes no action to address the problems presented in the project's purpose and need.

In addition to the loss of transportation service that would occur, the uncertainty of when the SR 99 closure would be needed would make this alternative imprudent, because it would hamper the lead agencies' ability to provide for an orderly program to preserve public safety and replace capacity or develop and implement programs to maintain transportation and minimize construction and demolition period impacts. This alternative would leave SR 99 vulnerable to seismic events for an undetermined amount of time, which would be an unacceptable risk to public safety as well as a presenting the high potential for major transportation, community, and other environmental impacts if a seismic event occurred.

Rebuild Alternative

The Rebuild Alternative (considered in the 2004 Draft EIS) proposed replacing the viaduct with a structure similar to what is there today; it did not include safety-related alterations to the Battery Street Tunnel. This alternative was refined into the current Elevated Structure Alternative. It did not avoid uses of Section 4(f) resources, including the Alaskan Way Viaduct, the Alaskan Way Seawall, and the Washington Street Boat Landing. This alternative was also eliminated because it had longer construction period and long-term impacts than other alternatives, and because a rebuild would require major deviations from design standards to a degree that substantially compromised the project's ability to achieve the safety and capacity objected presented in the purpose and need. The lead agencies have concluded that it does not constitute a prudent and feasible Section 4(f) avoidance alternative.

Surface Alternative

The Surface Street Alternative would replace the viaduct with an at-grade roadway, which would have three lanes in each direction between Yesler Way and Pike Street, and two lanes in each direction north of Pike Street. The Battery Street Tunnel would be improved with modernized safety and operational features, and there would be improvements to surface streets in the South Lake Union and Seattle Center areas.

The 2004 Draft EIS found that while the surface street alternative offered cost advantages and allowed the visual reconnection between the waterfront and downtown, it had the worst congestion impacts of any of the alternatives considered. In addition, the Battery Street Tunnel's design deficiencies would not be improved, the alternative would lower capacity in the transportation system, and it would not improve safety conditions in the tunnel. With a projected 7.5 years of major construction, it had a longer construction period and related environmental impacts of congestion and economic disruption than the other alternatives. Due to these factors, the lead agencies removed the alternative from further consideration. Further, since this alternative requires the removal of the viaduct and modifications to the Battery Street Tunnel, both of which are Section 4(f) resources, it does not provide a Section 4(f) avoidance alternative. It also would not provide a "least harm" alternative compared to the effects of the three build alternatives currently considered in this Final EIS.

Tunnel and Bypass Tunnel Alternatives
This set of alternatives proposed replacing the viaduct with a tunnel, and they have been modified to result in the Cut-and-Cover Tunnel Alternative that is still under consideration. As with the current Cut-and-Cover Tunnel Alternative, these alternatives do not avoid the use of Section 4(f) properties, with uses including the Alaskan Way Viaduct, the Alaskan Way Seawall, and the Washington Street Boat Landing. These earlier alternatives were removed from further consideration by the project because they were superseded by the Cut-and-Cover Tunnel Alternative, which added measures to address Battery Street Tunnel safety and operating deficiencies.

Partnership Process Scenarios
I-5, Surface, and Transit Hybrid
This scenario would replace SR 99 with a pair of northbound and southbound one-way streets, modifying Western Avenue and Alaskan Way, coupled with additional transit investments serving downtown along with a program of I-5 improvements to improve operations. This scenario was not advanced as a project alternative because it would not address Battery Street Tunnel design deficiencies and would reduce mobility, increase travel times for some trips, and reduce north-south capacity. It also did not avoid the use of Section 4(f) resources.

Elevated Bypass Hybrid
This scenario would replace SR 99 with two side-by-side elevated roadways along the waterfront, coupled with improvements to I-5 and additional transit investments serving downtown. This scenario was not advanced as a project alternative because it would still involve the use of Section 4(f) resources. It would carry similar noise, visual, and barrier impacts as the existing viaduct; it did not address design deficiencies for the Battery Street Tunnel that are critical to the improved safety conditions identified in the project's purpose and need; it increased travel times; and it caused several years of high construction period impacts because SR 99 would need to be removed before the replacement structures could be built.

Twin Bored Tunnel/Single Bored Tunnel Hybrid
This scenario would replace SR 99 with a bored tunnel and included additional transit investments through downtown. It was adapted to become the Bored Tunnel Alternative currently being evaluated in this Final EIS. It would not represent a Section 4(f) avoidance option and it carried similar environmental consequences as the current Bored Tunnel Alternative.

8 Conclusion on Search for Feasible and Prudent Avoidance Alternatives
For the reasons given above, there are no feasible and prudent alternatives that completely avoid the use of Section 4(f) resources.

9 Identifying a Least Harm Alternative
Of the three build alternatives that are considered in this Final EIS, all would require the use of Section 4(f) resources.

In past planning and ongoing project development efforts, other alternatives have been considered and rejected, because they failed to meet the project's purpose and need, because they are not feasible and prudent avoidance alternatives, or because they would not cause less overall harm.

In this final step of the Section 4(f) evaluation, the three remaining alternatives are compared to one another to determine which alternative would cause the least overall harm. In this step, the alternatives are compared to one another based on the relevant factors listed in Section 774.3(c)(1) of the Section 4(f) regulations.

Ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property), and the relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection.
Each of the three build alternatives would involve a use of the Alaskan Way Viaduct and Battery Street Tunnel. These facilities are considered a single property under Section 106, and the Section 4(f) analysis also considers them a single resource, although the effects to each part of the resource have been described separately. All three of the current alternatives encompass the same mitigation programs, which primarily involved documentation. None of the alternatives offers the ability to preserve the existing facilities without altering the characteristics that qualify them as Section 4(f) resources.

All three build alternatives would require excavation and construction within the Seattle Maintenance Yard site (Archaeological Site 45KI958), which is presumed to be a Section 4(f) resource until further investigations during construction can determine its significance. Construction activity and the redevelopment of the site as a transportation facility are being evaluated as a Section 4(f) use for all three build alternatives, and the same impact measures to minimize harm would be applied.

All three build alternatives will require alteration of part of the Lake Union Sewer Tunnel, resulting in a Section 4(f) use. The street improvements that result in the use are similar with all three alternatives, and the same mitigation measures would be applied.

The Elevated Structure and Cut-and-Cover Tunnel Alternatives both involve a use of the Washington Street Boat Landing. Both of these uses would be accompanied by mitigation to restore these resources to a level that maintains the characteristics that qualify them as Section 4(f) resources. This, along with the additional information and documentation involved in these efforts, would help reduce the remaining harm after the Section 4(f) use occurs.

The Bored Tunnel Alternative would result in a use of the Pioneer Square Historic District's Western Building, a contributing building to the District. However, the project has defined mitigation measures to protect the building and confine the use to a short-term activity that would occur only during construction. These mitigation measures would preserve the building and restore it to its current condition, avoiding the loss of a contributing building to the District. After the mitigation is complete, FHWA anticipates no remaining harm to the building or the District. In addition, the project would avoid the permanent displacement of the Western building's tenants, a community of artists and other businesses. Public comments on the 2010 Supplemental Draft EIS encouraged the project to avoid the relocation of the artists' businesses, which commenters stated were important to the current identity and economic vitality of the Pioneer Square Historic District.

The Elevated Structure Alternative would be more than twice as wide as the existing structure in the Pioneer Square area, which would affect views and the pedestrian environment along Alaskan Way.

The relative significance of each Section 4(f) property. The views of the official(s) with jurisdiction over each Section 4(f) property.

The relative significance of each affected Section 4(f) property can be a distinguishing factor when the set of alternatives for a project involve uses of different resources, including different types of resources (for instance, a park or a trail, along with a historic property). With this project, most of the resources that would be used are common to all three alternatives.

The affected resources are all historic. Section 106 processes do not provide procedures for evaluating relative significance among historic properties, as the consultation process is focused on identifying historic resources and minimizing potential harm.

The use of the Alaskan Way Viaduct and Battery Street Tunnel is common to all alternatives. The facilities are historically significant for their association with the region's major transportation infrastructure projects developed in the 1950s, the shaping of downtown Seattle's waterfront, and for the characteristics of their design, construction and materials. In comparison to the set of Section 4(f) resources affected by alternatives, it has a high level of relative historic significance.

The Seattle Maintenance Yard site (Archaeological Site 45KI958), which is used by all alternatives, encompasses an area of Seattle that had buildings removed for the regrading of Denny Hill and contains foundations and other artifacts from this earlier period of Seattle's development. Although further investigation will be conducted during construction when access to the site can more safely be provided, FHWA and WSDOT believe that the site may be significant for the information it may yield about Seattle's development, not because of an association with a historically important person or event. The SHPO has indicated it cannot concur with any determination of significance until further site investigation has been completed. Based on current information, FHWA and WSDOT anticipate that this resource may be less significant than other resources affected by the project's alternatives. Still, it would be affected by all alternatives.

The Lake Union Sewer Tunnel would have a use by all alternatives due to the alteration of a part of the tunnel system. The resource is significant for its materials and type, but it is considered less significant than other resources affected by the project's alternatives.

The Cut-and-Cover Tunnel Alternative and the Elevated Alternative would result in a use of the Washington Street Boat Landing and the Alaskan Way Seawall. The Bored Tunnel Alternative would avoid these uses, and instead would have a use to the Western Building, a contributing resource in the Pioneer Historic District.

The Washington Street Boat Landing is significant because of its design features, but it is not associated with a major historic person or event. It is also a park and recreation resource owned by the City, but most of its park and recreation features are not currently open. As either a historic or a park or recreation property, it could be considered relatively less significant than other resources affected by the project's alternatives.

The Alaskan Way Seawall is significant because it shaped the development of Seattle's central waterfront from the 1900s to the 1930s, and because it is an example of the type, period, methods and materials used during that time. These historic features and associations with Seattle's historic development indicate it has a high level of relative significance.

The Western Building, a contributing building of the Pioneer Square Historic District, would have a Section 4(f) use with the Bored Tunnel Alternative. The District marks the site of Seattle's original downtown, and the Western Building is significant as an example of the warehouse types of buildings constructed in the district, and its location is in an area that marked a specific phase in the district's development. The City Historic Preservation Officer, the SHPO, consulting parties, and the public have encouraged the lead agencies to seek measures to preserve the Western Building and avoid the loss of a building within the Pioneer Square Historic District. These parties have all emphasized the importance of preserving the integrity, character and vitality of the District. Therefore, the Western Building is considered to have a high level of relative significance.

The degree to which each alternative meets the purpose and need for the project.

The lead agencies have concluded that the Bored Tunnel Alternative is best able to meet the purpose and need for the project. In doing so, they considered the relative ability of the alternatives to address seismic problems, traffic safety problems, provide adequate transportation capacity to and through downtown, provide effective regional and local transportation linkages, avoid major disruptions of traffic, and protect adjacent activities on the central waterfront and in downtown Seattle.

While the three alternatives were designed to achieve the longer term seismic and transportation capacity and safety objectives stated in the purpose and need, they are primarily different in terms of how they meet the final two factors, including disruption of traffic, and the ability of the project to protect the integrity and viability of the central waterfront and downtown Seattle.

The Bored Tunnel Alternative would allow the project to avoid years of disruption of traffic on SR 99 during construction. The other two alternatives must remove the viaduct and close the Battery Street Tunnel in order to construct a replacement, and the EIS findings predict years of heavy congestion and lost capacity, negatively affecting transportation performance for downtown Seattle and the larger transportation system.

The difference in how the alternatives approach construction also affects how well they protect and enhance the integrity and viability of the central waterfront and nearby areas. The Bored Tunnel Alternative would reduce the period of construction immediately adjacent to the land uses and economic activities along the existing viaduct, including central waterfront businesses and attractions, as well as the Pioneer Square Historic District and the Pike Street Historic District. The other two alternatives would require several years of construction for the viaduct's removal and replacement. The adjacent areas of downtown would experience several years of negative effects such as reduced parking, reduced access due to closed streets, detours, delays, and increased hauling and related heavy construction activities. Other impacts would include noise, vibration, dust, dirt, a loss of visibility, and the potential perception by customers that these areas are difficult to reach. The Final EIS anticipates the Elevated Structure and Cut-and-Cover Tunnel Alternatives would have a higher potential for several years of lower economic activity for area businesses. This would make these alternatives less effective at satisfying the project's purpose and need, compared to the Bored Tunnel Alternative.

Exhibit 4(f)-5
List of Section 4(f) Resources Evaluated for Potential Use

Park Name	Location
Washington Street Boat Landing*	S. Washington Street at Alaskan Way
Occidental Park	Occidental Avenue S. between S. Washington and S. Main Streets
Pioneer Square Park	Yesler Way and First Avenue
Boat Access to Blake Island	Pier 55 – Alaskan Way and Seneca Street
Waterfront Park	Alaskan Way between University and Pike Streets
Victor Steinbrueck Park	Western Avenue at Virginia Street
Pier 62/63 Park	Alaskan Way at Pine Street
Pier 66, the Bell Street Terminal, Shoreline Access	Alaskan Way at Bell Street
Belltown Cottage Park	2512 Elliott Avenue
Olympic Sculpture Park	Between Western Avenue and Alaskan Way at Broad Street
Myrtle Edwards Park	Alaskan Way at Bay Street
Elliott Bay Park	Pier 86 Waterfront Between Harrison Street and 16th Avenue West
Denny Park	Between Dexter Avenue N. and Ninth Avenue N. and Denny Way and John Street
Seattle Center	Between Broad Street and Mercer Street and First Avenue N. and Fifth Avenue N.
Tilikum Place	Fifth Avenue and Denny Way
Lake Union Park	Valley Street and Terry Avenue N.

Historic District Name	Location
Pioneer Square Historic District	*See Exhibit 4(f)-1 on page 238*
Pike Place Market Historic District	*See Exhibit 4-19 on page 100*

Building Name	*Historical Name*	Address
101 King Street	*Norfin Building*	500 First Avenue S.
2nd and James parking garage		515 Second Avenue
606 Post	*Post Hotel*	90 Yesler Way
80 S. Jackson Condo	*Steinberg Building*	80 S. Jackson
83 King Street and garage	*Seattle Hardware Co.*	83 S. King Street
Ace Hotel	*Glaser Building/Latona Hotel*	2419 First Avenue
Adams Apartments		304 Bell Street
Alaska Trade Building		1915 First Avenue
Alaskan Way Viaduct and Battery Street Tunnel		Alaskan Way/Battery Street
Alexis Hotel	*Globe Building*	1001–1011 First Avenue
All-Rite Parking Garage/US Bank		701–723 First Avenue
Archstone Belltown	*Grosvenor House*	500 Wall Street
Argens Safe and Lock Co.		80 S. Main Street
Arlington North	*Hotel Cecil*	1019 1023 First Avenue
Arlington South	*Beebe Building*	1013 First Avenue
Artforte Gallery		213 First Avenue S.
Austin Bell Building		2326 First Avenue
Barnes Building		2320 First Avenue
Bedlam	*Bell Street Studios*	2235 Second Avenue
Bergman's	*Donohoe Garage*	1907 Third Avenue
Boston Hotel		76 S. Main Street
Bread of Life Mission	*Matilda Winehill Block*	301 First Avenue S.
Broderick Building		619 Second Avenue
Buckley's	*MGM-Loew's*	2331 Second Avenue
Burlington Northern Railway Tunnel	*Great Northern Railway Tunnel*	S. Main Street to Bell Street
Butler Garage		601 Second Avenue
Butterworth Building		1921 First Avenue
Buttnick Building		202 First Avenue S.
C&H Company	*Otto Sturham & Sons*	304 Alaskan Way S.
Castle Apartments		2132 Second Avenue
Champion Building		1928 Pike Place
Cherry Street Coffee House	*Colski Building*	2121 First Avenue
City Club Building		112 First Avenue S.
City Hostel	*William Tell Hotel*	2327 Second Avenue
City Loan Building		206 First Avenue S.
Colman Building		801–821 First Avenue
Compton Building	*Bon Marché Stable*	2315 Western Avenue
Corner Market		1505 First Avenue
Crown Hotel		313 First Avenue S.
Delmar Hotel		108 S. Washington Street
Denny Park Lutheran Church		766 John Street
Devonshire Apartments		420 Wall Street
Diller Hotel		1216–1222 First Avenue
Doyle Building	*J.S. Graham Store*	119 Pine Street
E.O. Graves Building		1020–1022 First Avenue S.
Economy Market		1423 First Avenue
Eitel Building		1501 Second Avenue
Elephant Car Wash Sign		616 Battery Street
Elliott Bay Seawall	*Alaskan Way Seawall*	Alaskan Way
Elysian Fields/Reedo Building	*Carstens Brothers/Nordic Cold Storage*	548 First Avenue S.
Emerald City Building	*K&R/Pioneer Office Equipment*	625 First Avenue
Exchange Building		821 Second Avenue
F.X. McRory's		419 Occidental Avenue S.
Fairmount Apartments		1901 First Avenue
Federal Office Building		901 First Avenue
Federal Reserve Bank		1015 Second Avenue
Fire Station No. 5		925 Alaskan Way
Fire Station No. 2		2334 Fourth Avenue
Fisher Building		115 S. Jackson Street
Fix Building		1507 Western Avenue
Florentine Condominiums	*Seattle Security Co. Warehouse*	508–534 First Avenue S.
Fobes Supply Co.		558 First Avenue S.
Fourth and Blanchard	*Otis Elevator*	2200 Fourth Avenue
Franklin Apartments		2302 Fourth Avenue
Garden Center Building		1600 Pike Place
Gatewood Apartments		107 Pine Street
Globe Building		310 First Avenue S.
Grand Central	*Squire-Latimer Building*	216 First Avenue S.
Grand Pacific	*Colonial Hotel*	1123 First Avenue
Grand Pacific	*Grand Pacific Hotel*	1115 1117 First Avenue
Guiry Hotel		2101–2105 First Avenue
Haddon Hall Apartments	*Kelley-Gorham Building*	1921 Third Avenue
Heritage Building	*Wax & Raine*	101 S. Jackson
Heritage House/garage		1527–1531 Western Avenue
Herman Blumenthal Building		122 S. Jackson Street
Hoge Building		705 Second Avenue
Holyoke Building		1018 First Avenue
Howard Building		612 First Avenue
Hull Building		2401 First Avenue
Inn at the Market		86 Pine Street
J&M Hotel & Café		201–205 First Avenue S.
Jackson Building		322 First Avenue S.
Jackson Square Building		123 S. Jackson Street
Jetway Apartments/E.E. Robbins	*Donald/Alexandria Hotel*	2200–2204 First Avenue

After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f); and substantial differences in costs among the alternatives. The primary difference among the alternatives is related to their ability to minimize construction period impacts while the viaduct is being replaced. In addition, there are substantial differences in the environmental performance of the alternatives.

As noted above, the Elevated Structure and Cut-and-Cover Tunnel Alternatives would require the closure of SR 99 for its demolition, and they would include the reconstruction of the seawall. Demolition of SR 99 would be followed by several years of construction throughout the central waterfront area. Transportation impacts during construction would be high, resulting in high levels of congestion, delay, and reduced capacity throughout the downtown area, especially in the central waterfront area. Access between the central waterfront and adjacent downtown neighborhoods would be restricted, affecting not only north-south but also east-west movements, such as those for Washington State Ferries users or for transportation between properties on either side of the current viaduct alignment. This long period of reduced access and transportation mobility would affect properties, businesses, employees, patrons, and residences nearby, including in the Pike Place Market Historic District and the Pioneer Square Historic District, the waterfront, and the many other historic and nonhistoric properties, institutions, and public facilities that occur throughout the central downtown area. Because this portion of SR 99 provides important linkages for the regional transportation system, reducing its capacity for an extended period would have economic impacts throughout the Puget Sound region.

The Bored Tunnel Alternative would have construction period impacts related to the demolition of the viaduct and the decommissioning of the Battery Street Tunnel, but it would allow a much more rapid transition to a replacement facility, greatly reducing the project's construction period transportation and mobility impacts, including to the Pioneer Square Historic District. It also

Exhibit 4(f)-5
List of Section 4(f) Resources Evaluated for Potential Use *(continued)*

Building Name	Historical Name	Address
Josephinum	*New Washington Hotel*	1902 Second Avenue
Journal Building		83 Columbia Street
Key Bank	*Bank of California*	815 Second Avenue
Korn Building		119 Yesler Way
La Salle Apartments		1430 Western Avenue
Labor Temple		2800 First Avenue
Laguna Pottery	*Scandinavian Hotel/Clancy Building*	116 and 118 S. Washington Street
Lake Union Sewer Tunnel		Republican Street east of Aurora Avenue
Last Supper Club	*Interurban Hotel*	124 S. Washington Street
Lewiston Hotel		2205 First Avenue
Lexington-Concord Apartments		2402 Second Avenue
Lippy Building		104 First Avenue S.
Livingston Baker Apartments		1931 First Avenue
Lowman & Hanford Building		616 First Avenue
Lowman Building		107 Cherry Street
Lucky Hotel		211 First Avenue S.
Lutheran Compass Center	*Pacific Coast Co.*	77 S. Washington Street
Marathon Building		209 First Avenue S.
Maritime Building		911 Western Avenue
Market House		1531 First Avenue
Marketside Flats	*U.S. Immigration Building*	84 Union Street (1400 Western)
Maud Building		309 First Avenue S.
Maynard Building		117 First Avenue S.
McKinnon Furniture	*Frederick & Nelson Warehouse*	1518 First Avenue S.
Merchants' Café		109 Yesler Way
Merrill Place		79 S. Jackson
Merrill Place	*Schwabacher Hardware Co.*	401 First Avenue S.
Merrill Place	*Hambach Building*	419 First Avenue S.
Merrill Place	*Seller Building*	411 First Avenue S.
Merrill Place Garage		410 Alaskan Way S.
Metropolitan Printing Company	*Metropolitan Printing Company*	2107 Third Avenue
Moore Hotel/Theater		1926 Second Avenue
Mutual Life Building		605 First Avenue
National Building		1000–1024 Western Avenue
New England Hotel		217–19 First Avenue S.
Nord Building		314 First Avenue S.
Norton Building		801 Second Avenue
OK Hotel		212 Alaskan Way S.
Old Seattle Parking Garage		316 Alaskan Way S.
Old Spaghetti Factory		2800 Elliott Avenue
Olympic Block		102 First Avenue S.
Olympic Warehouse	*Olympic Warehouse*	1203 1207 Western Avenue
Olympic Reprographics	*M.F. Backus Warehouse*	1014 First Avenue S.
One Yesler Building	*Bedford Hotel*	1 Yesler Way
Oregon Hotel		2301–2305 First Avenue
Our Home Hotel		75 S. Main Street
Oxford Apartments		1920 First Avenue
Pacific Net and Twine Building	*Pacific Net and Twine Building*	51 University Street
Pacific Science Center		200 Second Avenue N.
Palladian Apartments	*Calhoun Hotel*	2000 Second Avenue
Palmer Court	*A.L. Palmer Building*	1000 First Avenue S.
Parking garage		706 First Avenue
Pathé Building		2025 Third Avenue
Pier 54	*NPRR 3/Galbraith Dock*	1001 Alaskan Way
Pier 55	*NPRR 4/Arlington Dock*	1101 Alaskan Way
Pier 56	*Frank Waterhouse House*	1201 Alaskan Way
Pier 57	*John P. Agen's/Milwaukee Dock*	1301 Alaskan Way
Pike & Virginia Building		1930 Pike Place
Pike Place Market Main Arcade		1501 Pike Place
Pioneer Building, Pioneer Place and Pergola		606 First Avenue at Yesler Way
Pioneer Square Hotel	*Yesler Hotel*	77 Yesler Way
Pioneer Square Hotel	*Heffernan Engine Works*	110 Alaskan Way S.
Polson Building		61 Columbia Street
Provident Building		568 First Avenue S.
Prudential Building		114 Alaskan Way S.
Rivoli Apartments		2125 Second Avenue
Roebling Building		900 First Avenue S.
Roq la Rue	*RKO*	2312 Second Avenue
Royal Typewriter	*Royal Typewriter*	2221 Fifth Avenue
Sanitary Market		1513 First Avenue
Saveway Market		109 Occidental Avenue S.
Scargo Apartments		2209 First Avenue
Scheuerman Building		102–110 Cherry Street
Schillestad Building		2111 First Avenue
Schoenfeld Furniture Store Building		1012 First Avenue
Schwabacher Building		93 Yesler Way/103–107 First Avenue S.
Seattle Alweg Monorail		Fifth Avenue from Pine Street to Seattle Center
Seattle City Light Broad Street Substation		319 Sixth Avenue N.
Seattle Hardware Annex	*Seattle Hardware Annex*	501 First Avenue S.
Seattle Housing Authority		120 Sixth Avenue N.
Seattle Image Setting	*People's Supply Company*	210 Alaskan Way S.
Seattle Parks Maintenance Facility	*Puget Sound Power & Light*	701 Dexter Avenue N.
Seattle Plumbing Building	*Seattle Plumbing Building*	590 First Avenue S.
Seattle Publishing		72 S. Washington Street
Seattle Quilt Building		316 First Avenue S.
Seattle Steam		619 Post Avenue
Seattle's Best		1530 Post Alley
Skagit Hotel		207 First Avenue S.
Sluggers	*Kaufman Warehouse*	538 First Avenue S
Smith Block		1923 First Avenue
Soames Dunn Building		1924 Pike Place
Space Needle		400 Broad Street
St. Charles Hotel		81 S. Washington Street
Star Theater		115 Occidental Avenue S.
Starbucks		505 First Avenue S.
Starbucks Coffee		1912 Pike Place
State Hotel		114 First Avenue S.
Stewart House		1900 Pike Place (80 Stewart Street)
Swenson Say Faget	*Rex Land Company*	2124 Third Avenue
Terminal Sales Annex	*Puget Sound News*	1927 Second Avenue
Terminal Sales Building		1932 First Avenue
Terry-Denny Lofts	*Northern Hotel*	109–115 First Avenue S.
The Copy Machine	*Bornstein & Sons*	562 First Avenue S.
Travelers Hotel	*Travelers Hotel*	76–84 Yesler Way/611 Post Avenue
Triangle Building		1534 Pike Place

does not tie the SR 99 replacement to the replacement of the seawall, which further minimizes the construction period impacts in the central waterfront area and downtown compared to other alternatives. The central waterfront area also includes several piers (Piers 54, 55, 56 and 57) that are eligible for the NRHP and comprise a potential historic district. Most of the heavy construction of the replacement facility for SR 99 would be underground, compared to the surface level construction and seawall replacement activities required for the other two build alternatives throughout the central waterfront area. Therefore, the Bored Tunnel Alternative avoids the most severe construction impacts to the central waterfront area, including access and economic disruption to the uses along the waterfront. The Bored Tunnel Alternative's impacts would primarily occur in the tunnel portal areas, rather than throughout the central waterfront area. This reduces construction period impacts to properties, activities, and neighborhoods adjacent to the existing viaduct, and it reduces impacts to Washington State Ferries users and other activities that require crossing between downtown and the waterfront.

Longer term, the two tunnel alternatives are expected to offer lower long-term environmental effects and greater land use, aesthetic, and economic benefits compared to the Elevated Structure Alternative. The tunnel alternatives would remove and not replace an elevated structure that is adjacent to two historic districts and creates high levels of noise and visual impacts to adjacent properties. The alternatives would also remove an existing barrier between downtown neighborhoods and the waterfront and support opportunities to redevelop the urban space now occupied by the elevated structure.

10 Conclusions

Based on the analysis described in this Final Section 4(f) Evaluation and on the environmental findings contained in the Final EIS, FHWA is proposing to determine in a Record of Decision for this project:

1 There is no feasible and prudent alternative that completely avoids the use of Section 4(f) property.

2 The Bored Tunnel Alternative is the alternative that causes "least overall harm."

3 The Bored Tunnel Alternative incorporates all possible planning to minimize harm to Section 4(f) resources.

With the 2010 Supplemental Draft EIS, the lead agencies provided a Draft Section 4(f) evaluation to allow public comments on these determinations leading to the conclusion that the Bored Tunnel Alternative is the least overall harm alternative. As required under Section 4(f) regulations, the Supplemental Draft EIS and Section 4(f) evaluation was provided to the Department of Interior for review. The Department of the Interior responded in writing, confirming a lack of objections to the conclusions of the Section 4(f) evaluation. This correspondence is included in Appendix U.

Exhibit 4(f)-5
List of Section 4(f) Resources Evaluated for Potential Use *(continued)*

Building Name	*Historical Name*	Address
Triangle Hotel		553 First Avenue S.
Trust Building	*Heiden Building*	1925 Third Avenue
Two Bells Bar and Grill		2313 Fourth Avenue
Union Livery Stable		2200 Western Avenue
Union Trust Annex		117 S. Main Street
Union Trust Building		119 S. Main Street
US Bank		2401 Third Avenue
Virginia Inn	*Landes Block*	1937 First Avenue
Walgreen's	*Seattle First National Bank*	566 Denny Way
Waltham Block		311½ Occidental Avenue S.
Washington Park Building		68 S. Washington Street
Washington Shoe Building		542 First Avenue S.
Washington Street Boat Landing		Foot of S. Washington Street
Western Building		619 Western Avenue
Westland Building		100 S. King Street
Windham Apartments		420 Blanchard Street
Yam Oriental Rugs	*Silver Hotel*	627 First Avenue
Yesler Building	*Bank of Commerce*	95 Yesler Way

REFERENCE PAGES

ACRONYMS & ABBREVIATIONS

A

ADA Americans With Disabilities Act
APE Area of Potential Effects

B

BINMIC Ballard Interbay Northend Manufacturing and Industrial Center
BMP best management practice
BNSF BNSF Railway Company
BO Biological Opinion
BTU British thermal unit

C

CAFE Corporate Average Fuel Economy
CFR Code of Federal Regulations
CH_4 methane
City City of Seattle
CO_2 carbon dioxide
CO_2e carbon dioxide equivalents
CTS Commitment Tracking System
CZMA Coastal Zone Management Act

D

dB decibel
dBA A-weighted decibel

E

Ecology Washington State Department of Ecology
EIS Environmental Impact Statement
EO Executive Order
EPA U.S. Environmental Protection Agency
ESA Endangered Species Act

F

FHWA Federal Highway Administration
FONSI Finding of No Significant Impact

H

HAER Historic American Engineering Record
HOV high-occupancy vehicle

I

I-5 Interstate 5
I-90 Interstate 90

L

L_{eq} equivalent sound level

M

MIC Manufacturing and Industrial Center
MOA Memorandum of Agreement
MOT maintenance of traffic
mph miles per hour
MSAT mobile source air toxics

N

N_2O nitrous oxide
NAAQS National Ambient Air Quality Standards
NEPA National Environmental Policy Act
NFPA National Fire Protection Association
NMFS National Marine Fisheries Service
NO_2 nitrogen dioxide
NOAA Fisheries National Marine Fisheries Service
NOI Notice of Intent
NPDES National Pollutant Discharge Elimination System
NPS National Park Service
NRHP National Register of Historic Places

O

O_3 ozone

P

PAH polycyclic aromatic hydrocarbon
Pb lead
PCB polychlorinated biphenyl
PM_{10} particulate matter 10 micrometers in diameter or less
$PM_{2.5}$ particulate matter 2.5 micrometers in diameter or less
Program Alaskan Way Viaduct and Seawall Replacement Program
project Alaskan Way Viaduct Replacement Project
PSRC Puget Sound Regional Council

R

RCW Revised Code of Washington
ROD Record of Decision

S

SDOT Seattle Department of Transportation
Sea-Tac Seattle-Tacoma International Airport
SEPA State Environmental Policy Act
SHPO State Historic Preservation Officer
SIG Seattle International Gateway
SO_2 sulfur dioxide
SODO South of Downtown
SPCC Spill Prevention, Control, and Countermeasure
SR State Route

T

TAC Tolling Advisory Committee
TBM tunnel boring machine

U

USC United States Code
USFWS U.S. Fish and Wildlife Service

V

VdB vibration decibel level
VHD vehicle hours of delay
VHT vehicle hours of travel
VMT vehicle miles of travel

W

WAC Washington Administrative Code
WASIST Washington State Intersection Screening Tool
WDFW Washington Department of Fish and Wildlife
WOSCA Washington-Oregon Shippers Cooperative Association
WSDOT Washington State Department of Transportation

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Belltown Business Association
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People for Puget Sound
Pike Place Market PDA
Pioneer Square Historic Preservation Board
Seattle Aquarium
Seattle Parks Board
Union Pacific
Washington State Public Stadium Authority
Washington Trust for Historic Preservation

Libraries

Ballard Branch, City of Seattle Library
Burien Library, King County Library System
Capitol Hill Branch, City of Seattle Library
Central Library, City of Seattle Library
Delridge Branch, City of Seattle Library
Shoreline Library, King County Library System
North East Branch, City of Seattle Library
Seattle Central Community College Library
Sound Transit Information Center
University of Washington – Engineering Library
University of Washington – Architecture and Urban Planning Library
Washington State Library
Washington State DOT Library

Neighborhood Service Centers

Ballard Neighborhood Service Center
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Seattle Weekly
The Hispanic News
The Seattle Medium
The Stranger
Real Change
West Seattle Blog

Tribes

Duwamish
Jamestown S'Klallam
Lower Elwha Klallam
Muckleshoot Indian Tribe
Port Gamble S'Klallam
Snoqualmie Indian Tribe
Suquamish Tribe
The Tulalip Tribes
Confederated Tribes and Bands of the Yakama Nation

Federal Agencies

Advisory Council on Historic Preservation
Department of the Interior
Environmental Protection Agency, Region 10
Federal Highway Administration
Federal Transit Administration
National Marine Fisheries Service
National Park Service
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Fish and Wildlife Service
U.S. General Services Administration

State Agencies

Washington State Department of Archaeology and Historic Preservation
Washington State Department of Ecology
Washington State Department of Fish and Wildlife
Washington State Department of Natural Resources

Local Agencies

City of Seattle
King County
Port of Seattle
Puget Sound Clean Air Agency

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L. Economics Discipline Report
M. Air Discipline Report
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P. Earth Discipline Report
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R. Energy Discipline Report
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T. 2010 Supplemental Draft EIS Comments and Responses
U. Final EIS Correspondence
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TECHNICAL INDEX

TECHNICAL INDEX

King County

RON SIMS KING COUNTY EXECUTIVE	CHRISTINE O. GREGOIRE GOVERNOR	GREG NICKELS MAYOR OF SEATTLE

March 14, 2007

To: Seattle Legislative Delegation, City Council, and County Council

Thanks for all your thoughts and concerns about the Alaskan Way Viaduct and its replacement. Major transportation projects in large cities are very challenging. And the path to success is not always smooth.

The past months have been particularly challenging for all of us as we have tried to forge a path forward on the viaduct replacement project. Clearly there are legitimate and heartfelt differences about the specific approach that path should take. Now that Seattle voters have expressed their opinions on two specific approaches to replacing the Alaskan Way Viaduct, we have the opportunity to renew our commitment to key principals and to find common ground.

In 2005, we secured the dollars necessary to replace the viaduct. In 2006, we started to develop options and estimate costs. Now in 2007, we have a much better understanding of the will of our citizens. We are making much needed progress and we appreciate all of your support in the effort.

We all agree that the viaduct is a significant safety risk and must come down within the project's existing timeframes. We all agree that delay is not an option. We further agree that any final selected alternative must adequately address the three fundamental criteria of safety, capacity, and financial responsibility. We all agree that the core elements of any solution must address issues such as vigorous public transit, freight mobility, business disruption, urban design, job creation, the preservation of our marine economy and the future of Seattle's central waterfront. With these principles and criteria in mind we are writing to invite you to join us in continuing our efforts to move forward.

Over the next several months we have a lot of work to do. We will begin by meeting to establish guidelines and a collaborative process that is timely and centers on determining a final alternative. The process needs to be inclusive and guided by the principles and criteria we hold in common. The process also needs to be open to creativity. We must rely on the best available engineering and design through the renewed efforts of the integrated project team from the State of Washington and the City of Seattle with representation from King County. Assuming you agree with this next step, we will be in touch with you in the near future as we get it started.

Seattle Legislative Delegation, City Council, and County Council
March 14, 2007
Page 2

Second, beginning this summer, we have agreed to initiate a series of projects that significantly advance the overall replacement project in time to avoid the $10 million in project costs for every month of delay. These early safety and mobility projects are detailed in the enclosed graphic. None of these projects rely on the final design of the center one-mile portion of the overall project. However, by moving forward we will be on track to take down the existing viaduct in a timely manner.

Lastly, we must remain vigilant about the safety of the existing structure for its continued use of approximately 110,000 vehicles per day. To this end, the Washington State Department of Transportation will increase the safety monitoring program and will undertake a series of temporary safety repairs on key portions of the structure described in the enclosure.

It has been six years since the Nisqually Earthquake. We must continue to move forward. We look forward to working with all of you on the next steps. We are confident that we are on the right track to break through the challenges of the past and develop a final design for replacing the Alaskan Way Viaduct in time for the next bi-annual budget.

Sincerely,

Ron Sims King County Executive	Christine O. Gregoire Governor	Greg Nickels Mayor of Seattle

Enclosure

Governor Christine O. Gregoire
State of Washington

Executive Ron Sims
King County

Mayor Gregory J. Nickels
City of Seattle

A Letter of Agreement
Between the State of Washington, King County, and the City of Seattle

January 13, 2009

Consensus on the Recommended Alternative for Replacing the Alaskan Way Viaduct & Seawall

Over the course of the last 18 months, after developing and evaluating numerous scenarios, the State of Washington, City of Seattle, and King County have reached consensus on replacement for the SR 99 Alaskan Way Viaduct and Seawall.

We have decided jointly that a four-lane bored tunnel, together with improvements to city streets, the city waterfront, and transit, is the recommended alternative for replacing the existing viaduct, referred to as "The Project." This letter represents the governments' commitment to this solution and outlines responsibilities for funding and implementation.

The total estimated cost of this solution is approximately $4.24 billion and the allocation of specific project responsibility to each jurisdiction carries with it the responsibility for project management, environmental work, design, construction, and project cost overruns.

The State of Washington is responsible for taking down the existing viaduct structure, building a bored tunnel from approximately north of S. Royal Brougham Way to Harrison St., providing a surface connection from approximately Yesler Way to Elliott Avenue, completion of the projects associated with the Moving Forward program and partial construction transportation mitigation. The total estimated cost to the State of this work is $2.82 billion.

King County is responsible for additional Rapid Ride and peak express bus service to downtown Seattle. In addition, the County will simplify downtown trolley service and provide city street improvements related to improved bus operations. The total estimated cost of this work for King County is $190 million in capital and $15 million in annual operating expenses which shall be paid for through a countywide 1% Motor Vehicle Excise Tax imposed by the King County Council for transit services.

The City of Seattle is responsible for Seattle public utility relocation costs associated with the project, a promenade along the central waterfront, other city street improvements, and a First Avenue streetcar. The total estimated cost of this work for the City is $937 million.

The Port of Seattle is being asked to contribute $300 million to portions of the program that benefit their operations.

The parties agree to seek state legislative approval of the project and will support efforts to obtain state legislative authority for King County to implement a 1% Motor Vehicle Excise Tax. In addition, the parties agree to support efforts to obtain local authority for the development of a Local Infrastructure Financing Tool. The parties further agree to support an $88 million allocation of anticipated federal economic recovery funds, currently distributed as $8 million to King County for transit facilities and $80 million to the City of Seattle for portions of the Mercer and Spokane Street projects, which will be ready for construction by the summer of 2009.

Eight years ago the Nisqually earthquake warned us of the dangers posed by the existing viaduct. After years of extensive review and discussion, today we join together calling for action. We are confident that a bored tunnel replacement, with improvements to transit and city streets, is the best solution for Seattle, the region and the state.

Sincerely,

Christine Gregoire

Ron Sims

Governor Christine O. Gregoire
State of Washington

Executive Ron Sims
King County

Mayor Gregory J. Nickels
City of Seattle