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.

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.

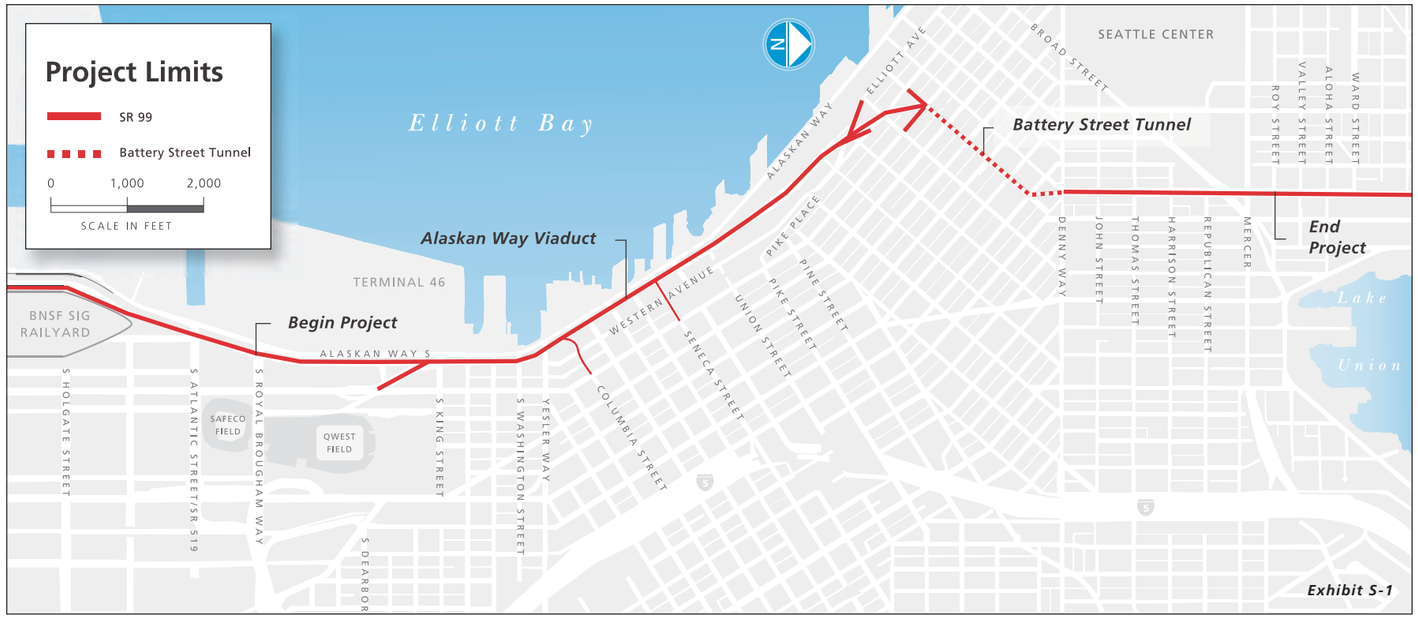


Exhibit S-1

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:

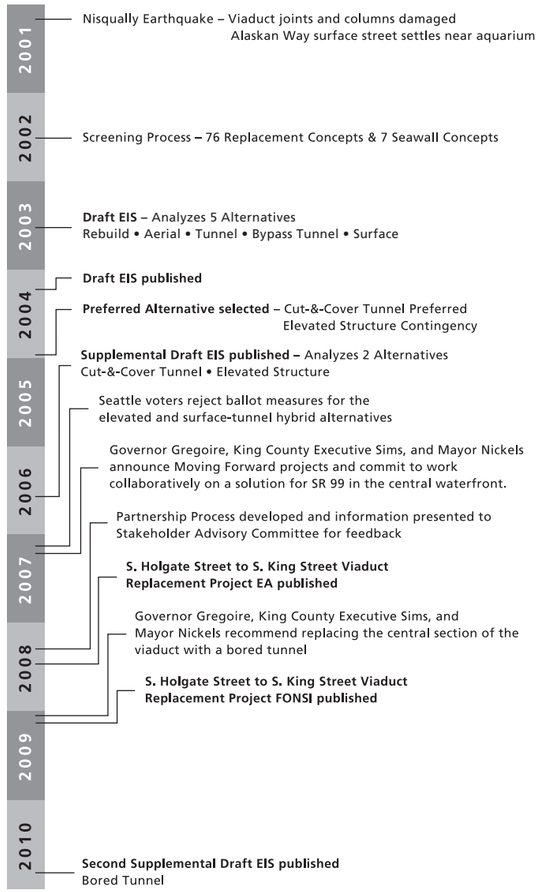
- I-5, Surface, and Transit Hybrid – SR 99 would be replaced with a pair of north- and southbound one-way streets near Seattle's central waterfront. This scenario included a high level of transit investment and extensive I-5 improvements.

- 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.

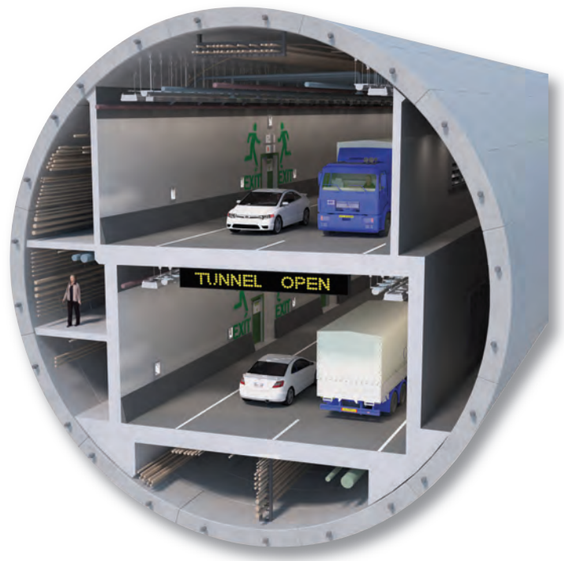
- Twin Bored Tunnel Hybrid (later refined to a single bored tunnel) – SR 99 would be replaced with two 2-lane bored tunnels between approximately S. Royal Brougham Way and Harrison Street. Evaluation of this hybrid led to the development of a single large-diameter bored tunnel. This scenario included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



Bored Tunnel Cross-Section



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:

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

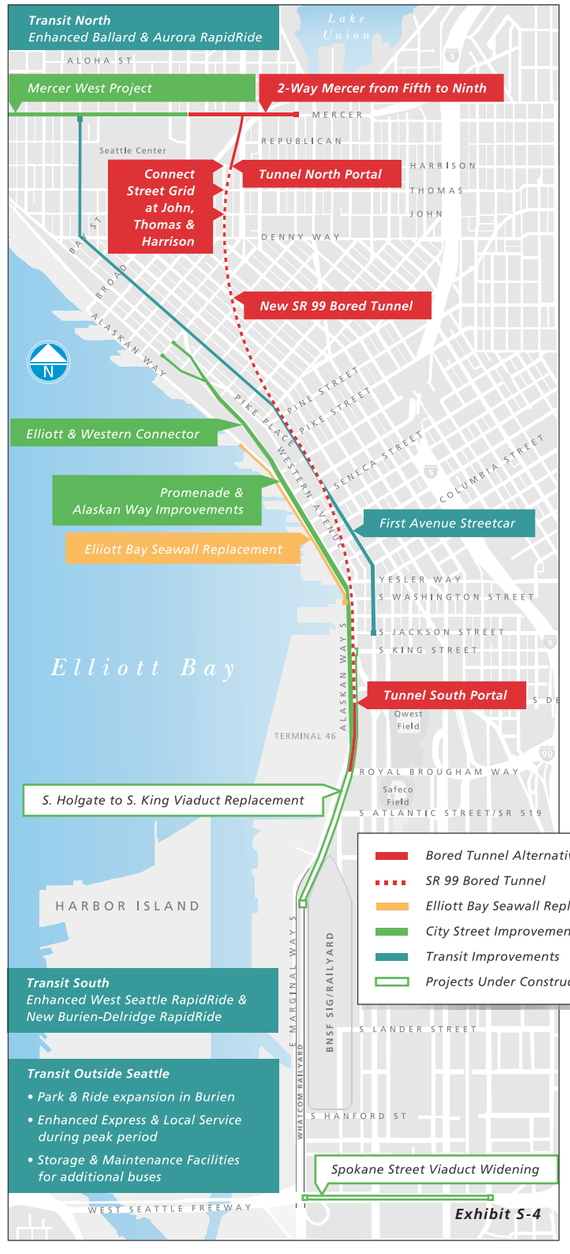


Exhibit S-4

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

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

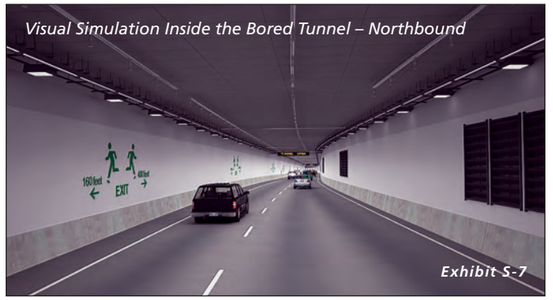
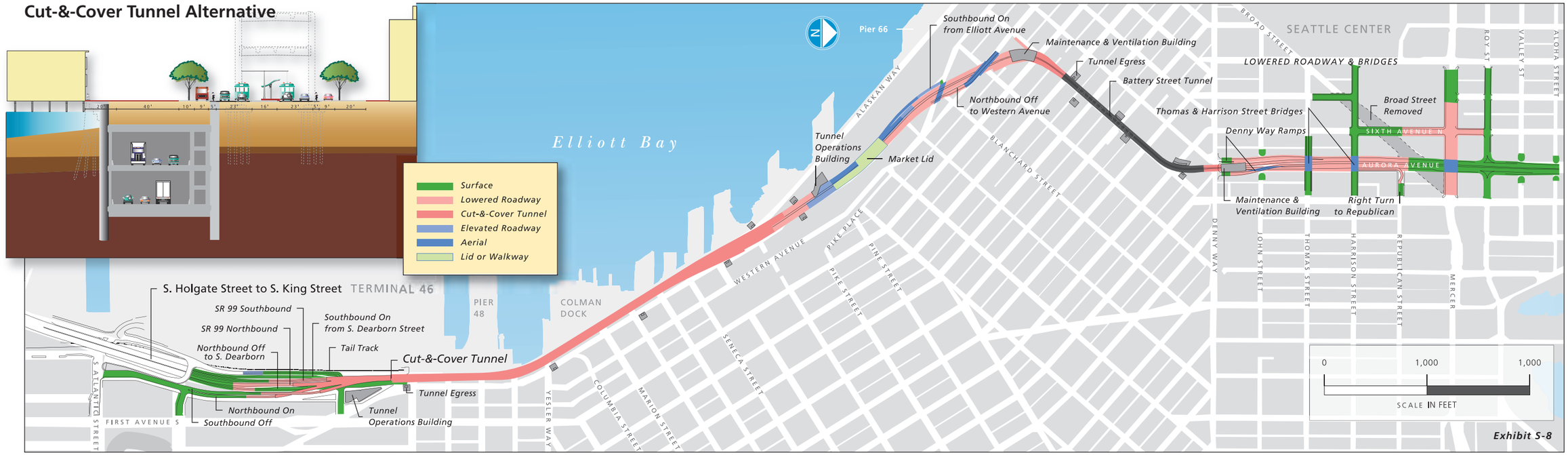


Exhibit S-7

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***.



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?

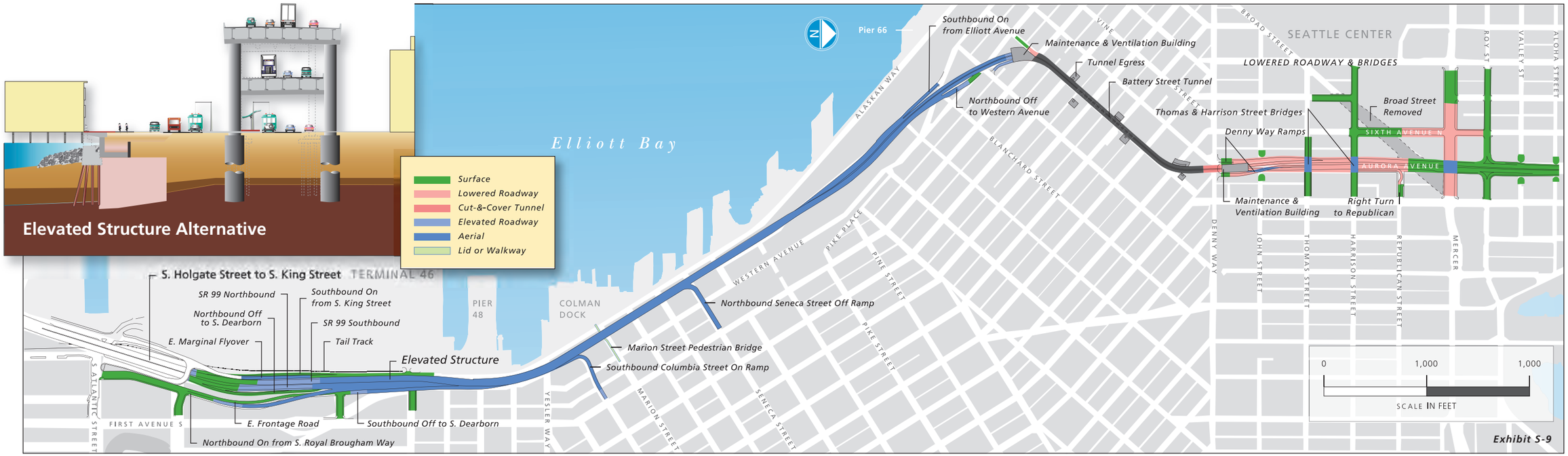
The Elevated Structure Alternative would replace SR 99 from S. Royal Brougham Way to Aloha Street, as shown in Exhibit S-9.

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

	ALTERNATIVE		
Item	**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		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

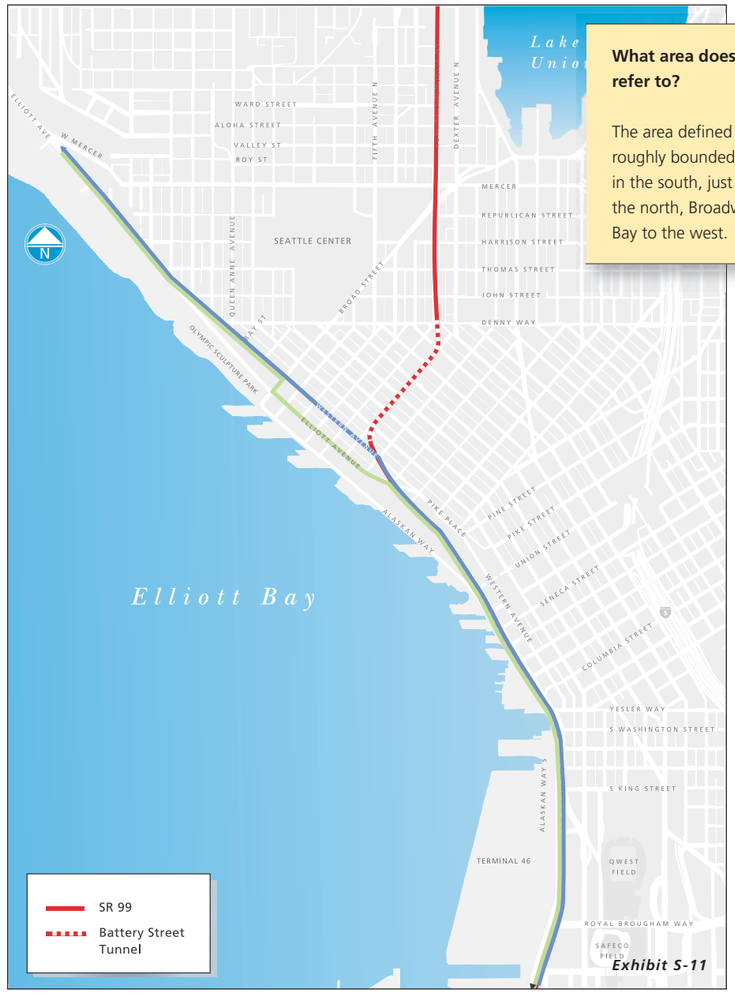
Exhibit S-13 shows that person throughput would be substantially lower across all three screenlines with the Viaduct Closed. Person throughput would decrease with the Viaduct Closed because SR 99 would be closed for safety reasons, which would reduce total person throughput through Seattle's transportation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



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.

Exhibit S-11

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.

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		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						
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		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**

Exhibit S-18
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.*

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		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	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		Cut-&-Cover Tunnel		Elevated Structure	
	NON-TOLLED	TOLLED	NON-TOLLED	TOLLED	NON-TOLLED	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

Tolled Bored Tunnel

Non-Tolled Cut-&-Cover Tunnel

Tolled Cut-&-Cover Tunnel

Non-Tolled Elevated Structure

Tolled Elevated Structure

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.

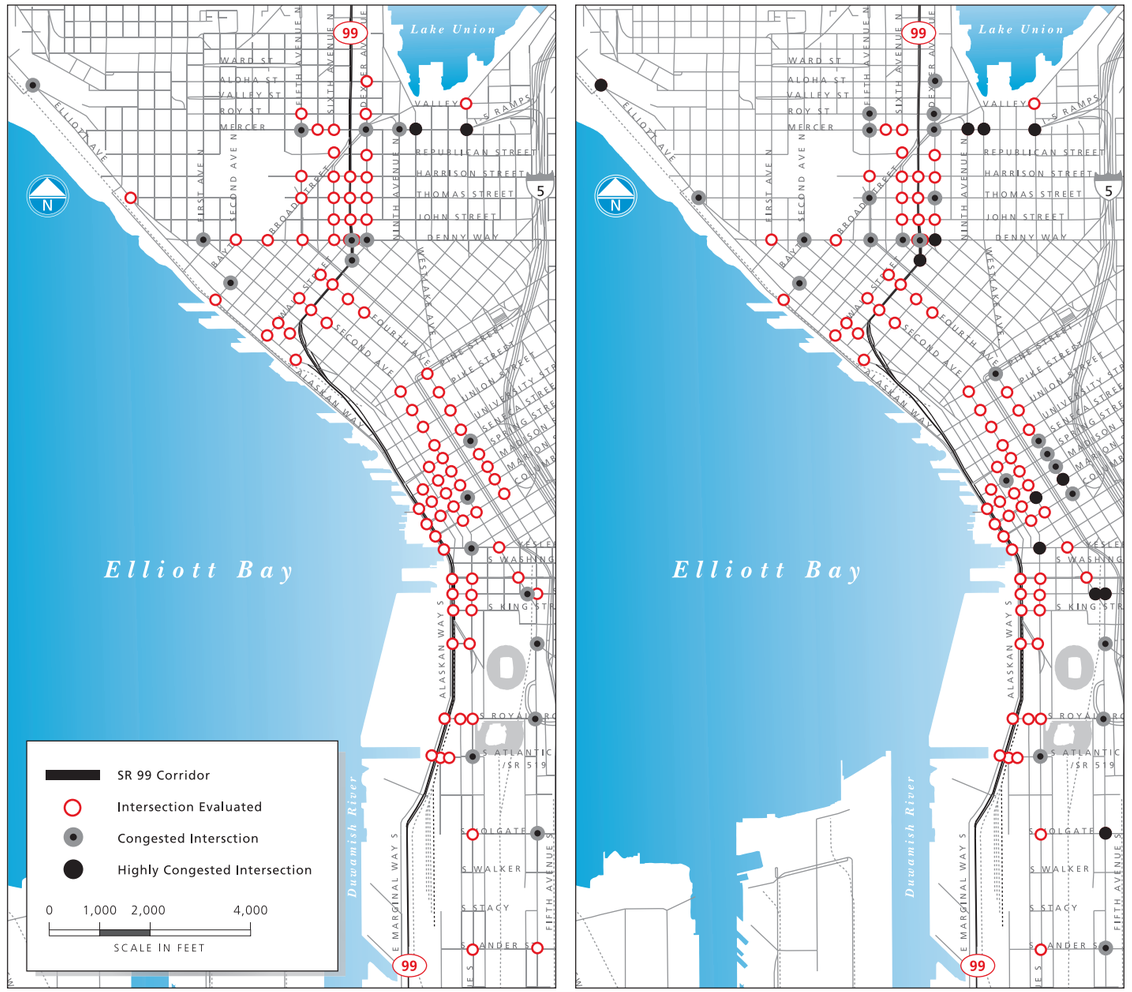
I-5 Trips

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

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 S-16

2030 Travel Time Comparison[1]

NON-TOLLED/TOLLED

West Seattle Trips to and from Downtown

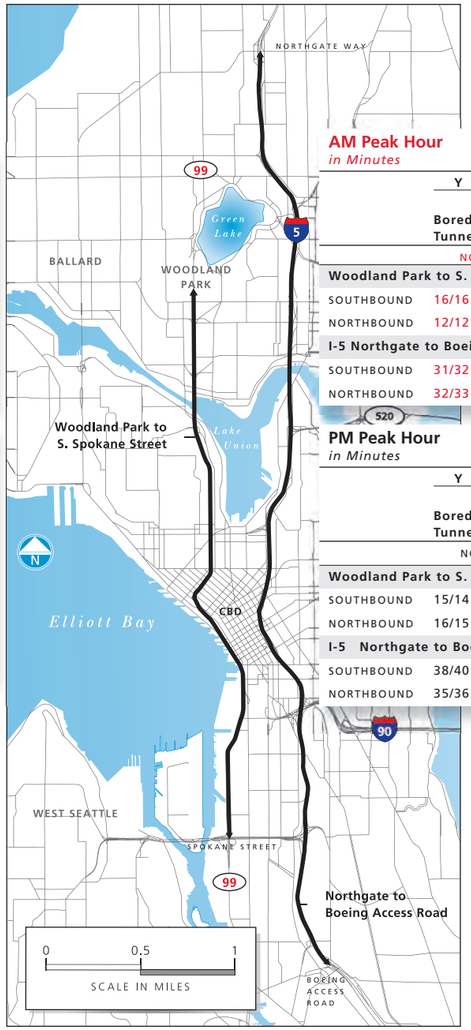
AM Peak Hour
in Minutes

	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



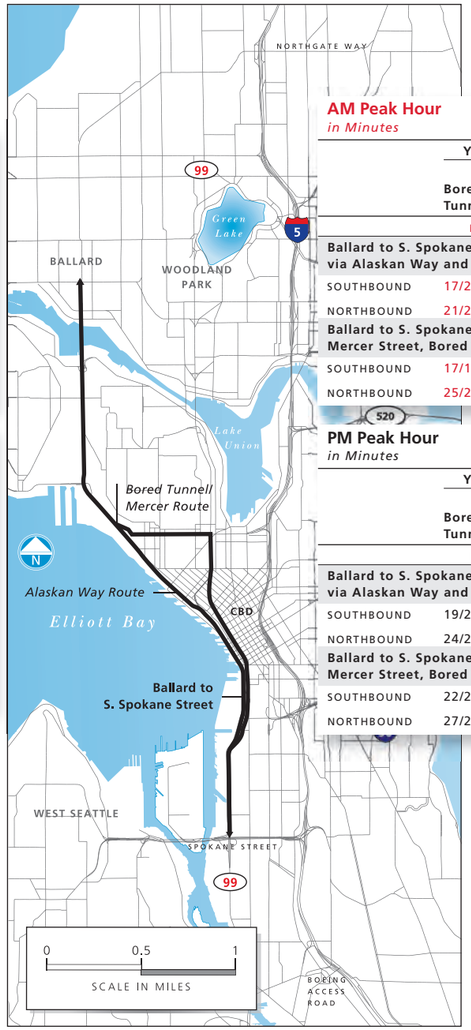
AM Peak Hour
in Minutes

	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	**12**	**40**	**35**
in approximate acres	*7.8*	*9.1*	*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.

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.

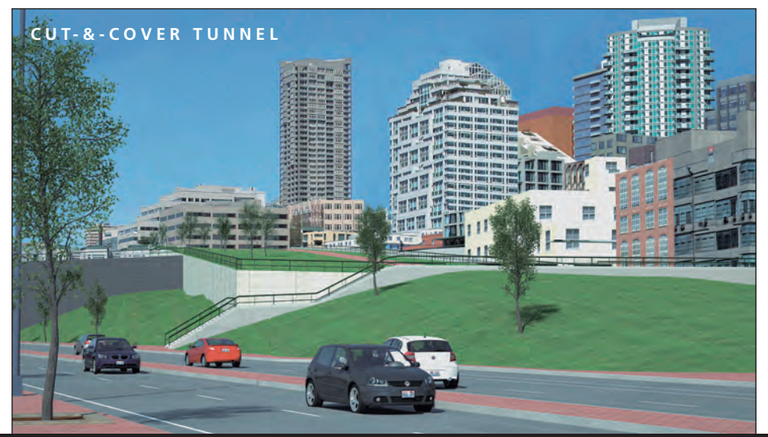
All of the alternatives would also require modifying a manhole shaft connecting to the NRHP-eligible Lake Union sewer tunnel to construct the northbound off-ramp at Republican Street.

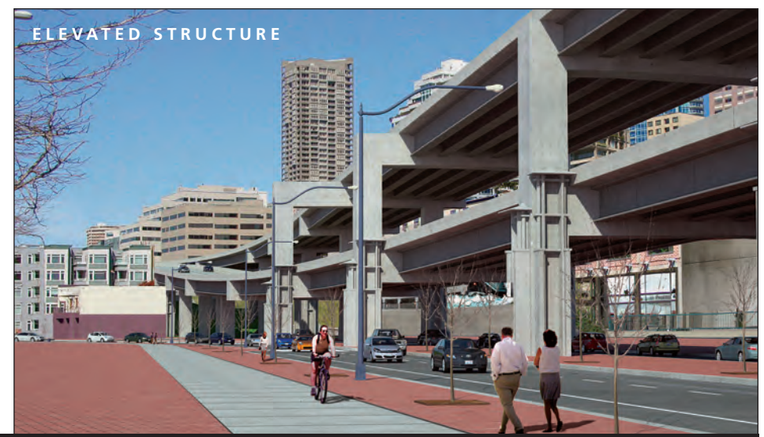
Tolled and Non-Tolled Bored Tunnel Alternative
Effects to the Western Building and Polson Building (located within the NRHP-listed Pioneer Square Historic District) would occur during construction of the Bored Tunnel Alternative and are discussed in Question 36 in this summary.

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

Bored Tunnel

In Months

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 northbound 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

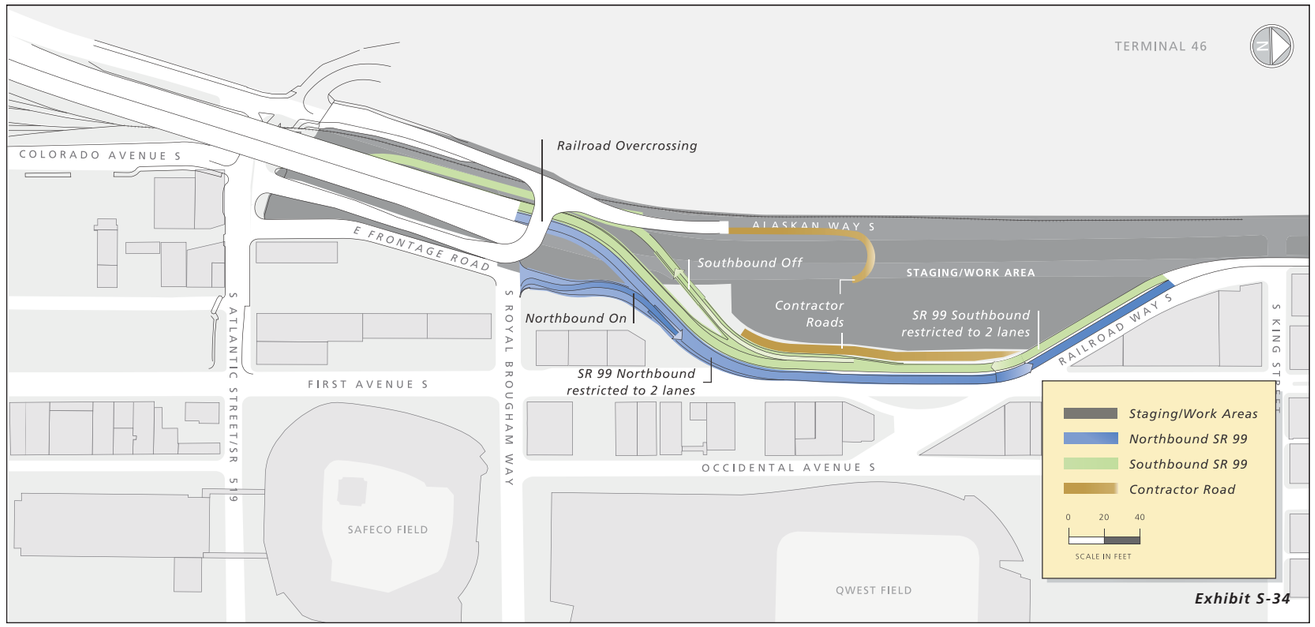


Exhibit S-34

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

	PARKING SPACES				
	On-Street			Off-Street	Total
Alternative	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.

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	**381,341**	**351,046**	**348,362**
Over Duration of Construction			

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 Supplemental Draft EISs	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.