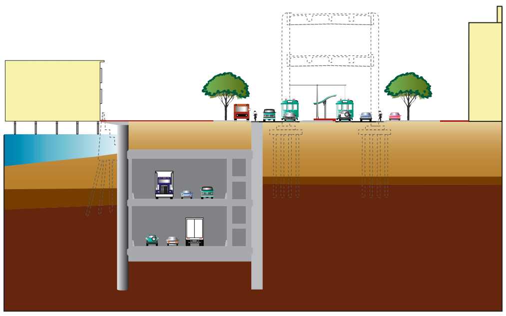
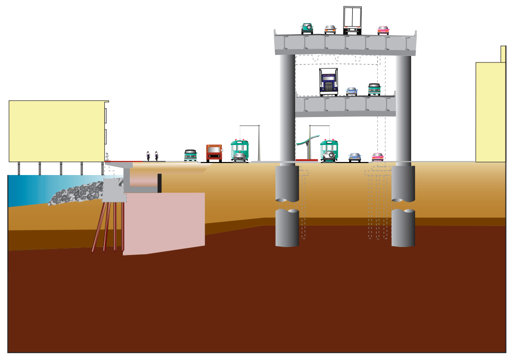
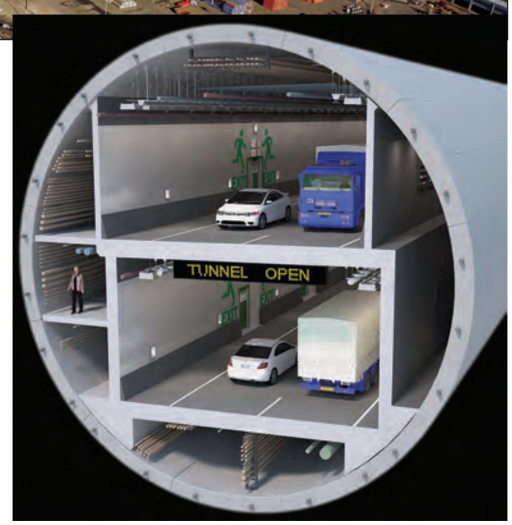
ALASKAN WAY VIADUCT REPLACEMENT PROJECT
Final Environmental Impact Statement

APPENDIX C Transportation Discipline Report







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U.S. Department of Transportation
Federal Highway Administration

Washington State
Department of Transportation

City of Seattle

JULY 2011

Alaskan Way Viaduct Replacement Project

Final EIS
Transportation Discipline Report

The Alaskan Way Viaduct Replacement Project is a joint effort between the Federal Highway Administration (FHWA), the Washington State Department of Transportation (WSDOT), and the City of Seattle. To conduct this project, WSDOT contracted with:

Parsons Brinckerhoff
999 Third Avenue, Suite 3200
Seattle, WA 98104

In association with:
Coughlin Porter Lundeen, Inc.
EnviroIssues, Inc.
GHD, Inc.
HDR Engineering, Inc.
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EXHIBITS

ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
BAT	business access and transit
BINMIC	Ballard Interbay Northend Manufacturing and Industrial Center
BRT	bus rapid transit
CBD	Central Business District
City	City of Seattle
DSTT	Downtown Seattle Transit Tunnel
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
HCM	Highway Capacity Manual
HOV	high-occupancy vehicle
I-5	Interstate 5
I-90	Interstate 90
LOS	level of service
LRT	light rail transit
mph	miles per hour
MOT	maintenance of traffic
MTP	Metropolitan Transportation Plan
MVMT	million vehicle miles of travel
NEPA	National Environmental Policy Act
PSRC	Puget Sound Regional Council
Program	Alaskan Way Viaduct and Seawall Replacement Program
project	Alaskan Way Viaduct Replacement Project
RDP	Route Development Plan
SDOT	Seattle Department of Transportation
Sea-Tac	Seattle-Tacoma International (Airport)
SIG	Seattle International Gateway
SODO	South of Downtown
SOV	single-occupant vehicle
SR	state route
ST2	Sound Transit Phase 2
UPRR	Union Pacific Railroad
VHD	vehicle hours of delay
VHT	vehicle hours of travel
VMT	vehicle miles of travel
WOSCA	Washington-Oregon Shippers Cooperative Association
WSDOT	Washington State Department of Transportation

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Chapter 1 INTRODUCTION AND SUMMARY

1.1 Introduction

This discipline report was prepared in support of the Final Environmental Impact Statement (EIS) for the Alaskan Way Viaduct Replacement Project. The Final EIS and all of the supporting discipline reports evaluate the Viaduct Closed (No Build Alternative) in addition to the three build alternatives: the Bored Tunnel Alternative (preferred), the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. The designs for both the Cut-and-Cover Tunnel and the Elevated Structure Alternatives have been updated since the 2006 Supplemental Draft EIS (WSDOT et al. 2006), to reflect that the section of the viaduct between S. Holgate Street and S. King Street is being replaced by a separate project and the alignment at S. Washington Street no longer intrudes into Elliott Bay. All three build alternatives are evaluated with tolls and without tolls.

The Federal Highway Administration (FHWA) is the lead federal agency for this project, primarily responsible for compliance with the National Environmental Policy Act (NEPA) and other federal regulations, as well as distributing federal funding. Per the NEPA process, FHWA was responsible for selecting the preferred alternative. FHWA has based its decision on the information evaluated during the environmental review process, including information contained in the 2010 Supplemental Draft EIS (WSDOT et al. 2010) and previous evaluations in 2004 and 2006. After issuance of the Final EIS, FHWA will issue its NEPA decision, called the Record of Decision (ROD).

The 2004 Draft EIS (WSDOT et al. 2004) evaluated five Build Alternatives and a No Build Alternative. In December 2004, the project proponents identified the Cut-and-Cover Tunnel Alternative as the preferred alternative and carried the Rebuild Alternative forward for analysis as well. The 2006 Supplemental Draft EIS (WSDOT et al. 2006) analyzed two alternatives—a refined Cut-and-Cover Tunnel Alternative and a modified rebuild alternative called the Elevated Structure Alternative. After continued public and agency debate, Governor Gregoire called for an advisory vote to be held in Seattle. The March 2007 ballot included an elevated structure alternative (differing in design from the current Elevated Structure Alternative) and a surface tunnel hybrid alternative. The citizens voted down both alternatives.

After the 2007 election, the lead agencies committed to a collaborative process (referred to as the Partnership Process) to find a solution to replace the viaduct along Seattle's central waterfront. In January 2009, Governor Gregoire, King County Executive Sims, and Seattle Mayor Nickels announced that the agencies had reached a consensus and recommended replacing the aging viaduct with a bored tunnel, which is being evaluated in this Final EIS as the preferred alternative.

1.2 Report Overview

This Transportation Discipline Report, Appendix C of the Final EIS for the Alaskan Way Viaduct Replacement Project, describes transportation conditions associated with the State Route (SR) 99 corridor through downtown Seattle and predicts the transportation performance and effects of the project, which is part of the larger Alaskan Way Viaduct and Seawall Replacement Program.

This Transportation Discipline Report comprises the following chapters:

- Chapter 2, Methodology, describes the methods used to assess the alternatives in this report.
- Chapter 3, Studies and Coordination, provides information regarding agency participation in the refinement of the build alternatives.
- Chapter 4, Affected Environment, discusses current transportation conditions, which assumes that the S. Holgate to S. King Street Viaduct Replacement Project has been completed.
- Chapter 5, Operational Effects, Mitigation, and Benefits, describes changes in travel patterns and traffic volumes under the following conditions, which were modeled for the horizon year (2030) by means of a travel demand model:
  - 2030 Viaduct Closed (No Build Alternative)
  - 2030 Bored Tunnel Alternative (non-tolled)
  - 2030 Cut-and-Cover Tunnel Alternative (non-tolled)
  - 2030 Elevated Structure Alternative (non-tolled)

  Also in Chapter 5, a brief discussion of 2040 conditions provides a basis for describing further changes in travel conditions beyond the horizon year.
- Chapter 6, Construction Effects and Mitigation, reviews the construction plans for the build alternatives, traffic management approaches (detours), and expected performance associated with major construction stages. The following conditions were modeled:
  - 2015 Construction Stage for Bored Tunnel Alternative
  - 2018 Construction Stage for Cut-and-Cover Tunnel Alternative
  - 2017 Construction Stage for Elevated Structure Alternative

- Chapter 7, Operational Effects, Mitigation, and Benefits With Tolling, describes changes in travel patterns and traffic volumes under the following scenarios:
  - 2030 Bored Tunnel Alternative (tolled)
  - 2030 Cut-and-Cover Tunnel Alternative (tolled)
  - 2030 Elevated Structure Alternative (tolled)
- Chapter 8, Cumulative Effects, describes the secondary and cumulative effects of the combined effects of the Bored Tunnel Alternative, other elements of the Alaskan Way Viaduct and Sewall Replacement Program, and other projects that are anticipated to affect transportation in the study area. It also describes the cumulative effects of the Cut-and-Cover Tunnel Alternative and other projects that are anticipated to affect transportation in the study area, as well as the cumulative effects of the Elevated Structure Alternative and other projects that are anticipated to affect transportation in the study area.
- Chapter 9, References, includes the information sources used in the preparation of this report.

1.3 Alternatives Studied

The transportation analysis included the Viaduct Closed (No Build Alternative) and the three build alternatives, which are described in the following subsections.

1.3.1 Viaduct Closed (No Build Alternative)

Both federal and Washington State environmental regulations require agencies to evaluate a No Build Alternative to provide baseline information about existing conditions in the project area. For this project, the No Build Alternative is not a viable alternative because the existing viaduct is vulnerable to earthquakes and structural failure due to ongoing deterioration. Multiple studies of the viaduct's current structural conditions, including its foundations in liquefiable soils, have determined that retrofitting or rebuilding the existing viaduct is not a reasonable alternative. At some point in the future, the roadway will need to be closed.

The Viaduct Closed (No Build Alternative) describes what would happen if the Bored Tunnel Alternative or one of the other build alternatives is not implemented. If the existing viaduct is not replaced, it will be closed, but it is unknown when that would happen. However, it is highly unlikely that the existing structure could still be in use in 2030.

The Viaduct Closed (No Build Alternative) describes the consequences of suddenly losing the function of SR 99 along the central waterfront based on the two scenarios described below. These consequences would last until the Washington State Department of Transportation (WSDOT) and other agencies could develop and implement a new, permanent solution. The planning and development of the new solution would have its own environmental review.

Given the unpredictability associated with the long-term structural viability of the viaduct, the following two scenarios are considered as part of the Viaduct Closed (No Build Alternative):

- Scenario 1 – Sudden unplanned closure of the SR 99 viaduct due to structural damage from a smaller earthquake or other reasons for partial structural failures that render the viaduct unsafe or unusable.
- Scenario 2 – Catastrophic failure and collapse of the viaduct. Under this scenario, a seismic event of similar or greater magnitude than the February 2001 Nisqually earthquake could trigger failure of portions of the viaduct. This scenario would have the greatest effect on people and the surrounding environment. Failure of the viaduct could cause injuries and death to people traveling on or near the structure at the time of the seismic event. Severe travel delays would occur. The environmental effects and length of time it would take to repair the SR 99 corridor are unknown, but the effects would be substantial.

In this report, Scenario 1 is referred to as the Viaduct Closed (No Build Alternative). Scenario 2 is discussed qualitatively but is not quantitatively analyzed in this report. This report also analyzes traffic and transportation conditions for continued operation of the existing Alaskan Way Viaduct and Elliott Bay Seawall, which are referred to as the 2015 Existing Viaduct. Although a comparison to conditions represented by the 2015 Existing Viaduct is useful for assessing the performance and effects of the Bored Tunnel Alternative relative to the facility that is in place today, it should be recognized that the current facility is reaching the end of its service life, is unlikely to remain in satisfactory condition for long-term use, and is at risk of catastrophic failure in an earthquake.

1.3.2 Bored Tunnel Alternative

The Bored Tunnel Alternative would remove the existing Alaskan Way Viaduct, as well as close and fill the Battery Street Tunnel after the new bored tunnel is completed.

Under the Bored Tunnel Alternative, SR 99 would be replaced between S. Royal Brougham Way and Roy Street. The bored tunnel would have two lanes in each direction. It would be approximately 1.7 miles long, with an inside diameter of 52 feet and an outside diameter of approximately 56 feet.

Beginning at S. Royal Brougham Way, SR 99 would be a side-by-side surface roadway that would transition to a cut-and-cover tunnel. At approximately S. King Street, SR 99 would become a stacked bored tunnel, with two southbound travel lanes on the top and two northbound travel lanes on the bottom.

Passing under Alaskan Way S. to approximately S. Washington Street, the bored tunnel would curve slightly away from the waterfront, travel under First Avenue, and continue diagonally under Seattle's Central Business District (CBD) to First Avenue at approximately University Street. Near Stewart Street, the alignment would extend north under Belltown. The bored tunnel would end at Thomas Street. Between Thomas Street and Harrison Street, the roadway would transition from a stacked configuration to a side-by-side roadway in a cut-and-cover tunnel. From the tunnel portal at Harrison Street, the roadway would continue in a retained cut section until it matches the existing grade at Mercer Street.

Three primary elements of the Bored Tunnel Alternative are described in this overview: the south portal area, the bored tunnel alignment (central area), and the north portal area.

1.3.2.1 South Portal Area

Full northbound and southbound access to and from SR 99 would be provided in the south portal area between S. Royal Brougham Way and S. King Street. The northbound on-ramp to and southbound off-ramp from SR 99 would be built near S. Royal Brougham Way and would intersect with the East Frontage Road.

The southbound on-ramp to and northbound off-ramp from SR 99 would feed directly into a reconfigured Alaskan Way S., with three lanes in each direction. Alaskan Way S. would also have a new intersection constructed at S. Dearborn Street, with sidewalks on both sides.

The Port Side Pedestrian/Bike Trail (to be constructed as an element of the S. Holgate Street to S. King Street Viaduct Replacement Project) will run along the west side of the reconfigured Alaskan Way S. The City Side Trail would extend from S. Atlantic Street up to S. King Street. This multi-use path would replace the existing Waterfront Bicycle/Pedestrian Facility that currently runs along the east side of Alaskan Way S.

Under the Bored Tunnel Alternative, the frontage road east of SR 99 would be widened slightly at S. Atlantic Street to accommodate truck turning movements. Railroad Way S. would be replaced by a new one-lane roadway on which traffic could travel northbound between S. Dearborn Street and Alaskan Way S.

Amenities such as landscaping, pedestrian facility improvements, and transit priority features would be incorporated into the reconstructed surface streets in the area of Alaskan Way S. between S. Royal Brougham Way and S. King Street.

1.3.2.2 Bored Tunnel Alignment – Central Area

Beginning in the south end of the project area, the bored tunnel would connect to SR 99 just south of S. King Street. The bored tunnel would continue under Alaskan Way S. to approximately S. Washington Street, where it would curve slightly away from the waterfront and then travel under First Avenue beginning at approximately University Street. At Stewart Street, it would extend north under Belltown.

1.3.2.3 North Portal Area

Full northbound and southbound access to and from SR 99 would be provided near Harrison and Republican Streets. The existing on- and off-ramps at Denny Way would be closed and replaced with downtown access ramps to and from SR 99 that drivers would access via a new surface connection between Denny Way and Harrison Street.

Northbound access from SR 99 and southbound access to SR 99 would be provided via new ramps at Republican Street. The northbound off-ramp to Republican Street would be provided on the east side of SR 99 and routed to an intersection at Dexter Avenue N. Drivers would access the southbound on-ramp via a new connection with Sixth Avenue N. between Harrison Street and Mercer Street on the west side of SR 99.

The surface streets in the north portal area would be reconfigured and improved. The street grid between Denny Way and Harrison Street would be connected by restoring a section of Aurora Avenue just north of the existing Battery Street Tunnel portal. John, Thomas, and Harrison Streets would be connected as cross streets. The Aurora Avenue surface roadway would have two general-purpose lanes in each direction, a transit-only lane, and turn pockets between Denny Way and Harrison Street. Signalized intersections would be located 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. The rebuilt Mercer Street would have three lanes in each direction, with left-turn pockets. Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N.

A new Sixth Avenue N. roadway would be built in a curved formation between Harrison and Mercer Streets and would connect to the southbound on-ramp to the tunnel. The new roadway would have one to two lanes in each direction and a signalized intersection at the ramp terminal intersection.

1.3.2.4 Battery Street Tunnel Decommissioning

The Battery Street Tunnel would be closed after the bored tunnel is opened to traffic. During or after the demolition of the Alaskan Way Viaduct, the Battery Street Tunnel would be filled in, likely using the concrete rubble from the demolished viaduct structure. The cross streets above the tunnel and the utilities would be maintained.

1.3.2.5 Alaskan Way Viaduct and Seawall Replacement Program

For the Bored Tunnel Alternative analysis only, the Alaskan Way Viaduct Replacement Project is considered one of several independent projects intended to improve safety and mobility along SR 99 and the Seattle waterfront from the South of Downtown (SODO) area to Seattle Center. Collectively, these individual projects are referred to as the Alaskan Way Viaduct and Seawall Replacement Program (Program). For the Bored Tunnel Alternative, the cumulative effects of all projects in the Program were evaluated; however, the direct and indirect environmental effects of these independent projects will be considered separately in independent environmental documents. This collection of independent projects is categorized into four groups: roadway elements, non-roadway elements, projects under construction, and completed projects. Exhibit 1-1 lists the major components of the Bored Tunnel Alternative as well as the additional elements associated with the overall Program.

Exhibit 1-1. Other Projects Included in the Alaskan Way Viaduct and Seawall Replacement Program

Project	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Independent Projects That Complement the Bored Tunnel Alternative			
Elliott Bay Seawall Project	X	Included in alternative	Included in alternative
Alaskan Way Surface Street Improvements	X	Included in alternative	Included in alternative
Alaskan Way Promenade/Public Space	X	Included in alternative	Included in alternative
First Avenue Streetcar Evaluation	X	Included in alternative	Included in alternative
Elliott/Western Connector	X	Function provided[1]	Function provided[1]
Transit enhancements	X	Not proposed[2]	Not proposed[2]
Projects That Complement All Build Alternatives			
S. Holgate Street to S. King Street Viaduct Replacement Project	X	X	X
Mercer West Project	X	X	X
Transportation Improvements to Minimize Traffic Effects During Construction	X	X	X
SR 99 Yesler Way Vicinity Foundation Stabilization	X	X	X
S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project	X	X	X

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.*

1.3.2.5.1 Roadway Elements

Alaskan Way Surface Street Improvements

The Alaskan Way surface street would be rebuilt and improved between S. King Street and Pike Street. The new surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), transitioning to four lanes between Marion and Pike Streets. Generally, the new street would be located east of the existing street where the viaduct is located today. The new street would include sidewalks, parking/loading zones, and signalized pedestrian crossings at cross streets. The new surface street would provide a regional truck route for freight traveling to and from the Duwamish/Harbor Island/SR 519 area and the Ballard Interbay Northend Manufacturing and Industrial Center

(BINMIC). The City of Seattle (City) is currently involved in an intensive design study for the use of the central waterfront area.

Elliott/Western Connector

The Elliott/Western Connector would provide a connection from the Alaskan Way surface street to the Elliott/Western corridor that provides access to and from BINMIC and neighborhoods north of downtown Seattle (including Ballard and Magnolia). The connector would be four lanes wide and would provide a grade-separated crossing of the BNSF Railway mainline tracks. Additionally, it would provide local street access to Lenora Street and reintegrate with the street grid at Bell Street, which would improve local street connections in Belltown. The new roadway would include bicycle and pedestrian facilities.

Mercer West Project

The Mercer West Project improvements include reconfiguring Mercer Street between Fifth Avenue N. and Elliott Avenue to accommodate two-way traffic. Mercer Street would be restriped and signalized between Fifth Avenue N. and Second Avenue W. to create a two-way street with two lanes in each direction and left-turn pockets. The route would provide an alternative freight and general traffic connection from Interstate 5 (I-5) and SR 99 to Ballard/Interbay. These improvements also include the restriping and resignalization necessary to convert Roy Street to two-way operations from Fifth Avenue N. to Queen Anne Avenue N.

1.3.2.5.2 Non-Roadway Elements

Elliott Bay Seawall Project

The Elliott Bay Seawall needs to be replaced to protect the shoreline along Elliott Bay, including Alaskan Way. It is at risk of failure due to seismic and storm events. The seawall currently extends from S. Washington Street in the south to Bay Street in the north, a distance of about 8,000 feet. The Elliott Bay Seawall Project limits extend from S. Jackson Street in the south to Broad Street in the north (also known as the central seawall).

Alaskan Way Promenade/Public Space

A new, expanded promenade and public space would be provided to the west of the new Alaskan Way surface street between S. King Street and Pike Street. The promenade would vary in width and would serve Piers 48 through 59, which have varying uses, including ferry terminals, restaurants, retail shops, hotels, and regional entertainment such as the Seattle Aquarium. Access to the piers would be provided by service driveways.

Between Marion and Pike Streets, the promenade would be approximately 70 to 80 feet wide. This public space will be designed at a later date. Other potential open space sites include a triangular space north of Pike Street and east of

Alaskan Way, and parcels created by the removal of the viaduct between Lenora and Battery Streets.

First Avenue Streetcar Evaluation

Functioning as a local connector, the First Avenue streetcar would circulate between S. Jackson Street and Republican Street. This alignment would travel within several of Seattle's densest neighborhoods, including Pioneer Square, the Commercial Core and CBD, Belltown, and Uptown (Lower Queen Anne). Additionally, it would serve many tourist and regional attractions, such as Pike Place Market, the Seattle waterfront piers, the Seattle Art Museum, the Seattle Aquarium, Seattle Center, and the Olympic Sculpture Park.

Transit Enhancements

A variety of transit enhancements would be provided to support planned transportation improvements associated with the Program and accommodate future demand. These include (1) the Delridge RapidRide line, (2) additional service hours on the West Seattle and Ballard RapidRide lines, (3) peak hour express routes added to South Lake Union and Uptown, (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes, (5) transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue, and (6) simplification of the electric trolley system.

1.3.2.5.3 Projects Under Construction

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

The S. Holgate Street to S. King Street Viaduct Replacement Project will replace this seismically vulnerable portion of SR 99 with a seismically sound structure that is designed to meet current roadway and safety standards. An Environmental Assessment for this project was completed in June 2008, and the Finding of No Significant Impact (FONSI) was published in February 2009. Construction and early utility relocations began in mid-2009, and the project is expected to be completed by 2015.

Transit Enhancements and Other Improvements

Several transportation improvements are underway to help offset traffic effects during construction of projects included in the Program. Construction or implementation of the following improvements is underway:

- Adding variable speed signs and travel time signs on I-5 to help maximize safety and traffic flow
- Providing funding for the S. Spokane Street Viaduct Widening Project, which includes a new Fourth Avenue S. off-ramp for West Seattle commuters

- Adding buses and bus service in the West Seattle, Ballard/Uptown, and Aurora Avenue corridors during construction, as well as a monitoring system for bus travel times
- Upgrading traffic signals and driver information signs for the Denny Way, Elliott Avenue W./15th Avenue W., SODO, and West Seattle corridors to support transit and traffic flow
- Providing information about travel alternatives and incentives to encourage use of transit, carpool, and vanpool programs

1.3.2.5.4 Completed Projects

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

Construction to strengthen four Alaskan Way Viaduct column footings between Columbia Street and Yesler Way was completed in April 2008. To prevent the columns from sinking farther, crews drilled a series of steel rods surrounded by concrete into stable soil and then added a layer of reinforced concrete to tie the new supports to the existing column footings.

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

Construction to relocate electrical lines along the south end of the Alaskan Way Viaduct began in September 2008 and was completed in Fall 2009. WSDOT and Seattle City Light relocated electrical lines from the viaduct to underground locations east of the viaduct between S. Massachusetts Street and Railroad Way S.

1.3.3 Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would replace the existing Alaskan Way Viaduct and Elliott Bay Seawall structures. The project limits would extend from S. Royal Brougham Way in the south to Aloha Street in the north.

1.3.3.1 South Area

Similar to the Bored Tunnel Alternative, full northbound and southbound access to and from SR 99 would be provided in the south area between S. Royal Brougham Way and S. King Street. The northbound on-ramp to and southbound off-ramp from SR 99 would be built near S. Royal Brougham Way and would intersect with the East Frontage Road.

The southbound on-ramp to and northbound off-ramp from SR 99 would feed directly into a reconfigured Alaskan Way S., with three lanes in each direction. Alaskan Way S. would also have a new intersection constructed at S. Dearborn Street with sidewalks on both sides.

The Port Side Pedestrian/Bike Trail (built as an element of the S. Holgate Street to S. King Street Viaduct Replacement Project) will run along the west side of the reconfigured Alaskan Way S. The City Side Trail would extend from S. Atlantic Street up to S. King Street. This multi-use path would replace the existing facility that currently runs along the east side of Alaskan Way S.

Under the Cut-and-Cover Tunnel Alternative, the frontage road east of SR 99 would be widened slightly at S. Atlantic Street to accommodate truck turning movements. Railroad Way S. would be replaced by a new one-lane roadway on which traffic could travel northbound between S. Dearborn Street and Alaskan Way S.

Amenities such as landscaping, pedestrian facility improvements, and transit priority features would be incorporated into the reconstructed surface streets in the area of Alaskan Way S. between S. Royal Brougham Way and S. King Street.

1.3.3.2 Central Area

A six-lane stacked cut-and-cover tunnel would replace the existing viaduct and extend just over a mile from S. Jackson Street to Pine Street, with the west side of the tunnel wall replacing the existing seawall. At Pine Street, SR 99 would transition out of the cut-and-cover tunnel near the Pike Street Hillclimb and cross over the BNSF Railway tracks on a side-by-side aerial roadway covered by a walkway lid structure. Near Lenora Street, SR 99 would transition to a retained cut extending up to the south portal of the Battery Street Tunnel. SR 99 would travel under Elliott and Western Avenues. The on- and off-ramps at Elliott and Western Avenues would be reconstructed. The existing Battery Street Tunnel southbound off-ramp and northbound on-ramp would be rebuilt. These Battery Street Tunnel ramps would be closed to general-purpose traffic and used for emergency access only.

Under the Cut-and-Cover Tunnel Alternative, SR 99 would extend above grade between Union and Pike Streets. At Pike Street, the northbound tunnel lanes would travel above the Alaskan Way surface street. This configuration would allow public space on top of the building on a flat or stepped roof surface. At Pike Street, the walkway lid would be over the southbound tunnel lanes, which would allow a two-tier stairway from the Pike Street Hillclimb on the east to the Alaskan Way surface street on the west. The top of the walkway lid would connect to the Pike Street Hillclimb at Western Avenue on a pedestrian bridge.

1.3.3.3 Alaskan Way Surface Street

The Alaskan Way surface street in the central waterfront area would be located above the tunnel up to Pike Street. This large, open right-of-way between the seawall and the east side of the existing viaduct structure would become available for a variety of uses beyond the Alaskan Way surface street. The City is currently involved in an intensive design study for the use of this area.

1.3.3.4 Battery Street Tunnel

The Battery Street Tunnel would be retrofitted for improved seismic safety. The existing tunnel safety systems would be updated. Improvements would include a fire suppression system, ventilation, and new emergency egress structures near Second, Fourth, and Sixth Avenues. The vertical clearance would be increased to at least 16.5 feet throughout the length of the tunnel. The south portal would be widened to accommodate the connection from the new SR 99 roadway. At the south end of the tunnel, near Western Avenue, a new open space would be built on top of the tunnel's south portal ventilation building that would house the mechanical, electrical, and communications systems, as well as maintenance facilities.

1.3.3.5 North Area

From the north portal of the Battery Street Tunnel, SR 99 would be lowered in a retained cut to about Mercer Street, with improvements and widening north to Aloha Street. Broad Street would be closed between Fifth and Ninth Avenues N., allowing the street grid to be connected. Mercer Street from Dexter Avenue N. to Firth Avenue N. would be widened and converted from a one-way street to a two-way street with three lanes in each direction and left-turn pockets. The two-way conversion of Mercer with two lanes in each direction and left-turn pockets would extend west from Fifth Avenue N. to Second Avenue W.

Access to and from SR 99 would be provided at Denny Way and Roy Street. In the northbound direction, drivers could also exit at Republican Street. To improve safety for traffic on SR 99, access to SR 99 would be restricted by building cul-de-sacs at John, Valley, and Aloha Streets. Surface streets would be connected over the top of SR 99 by building two new bridges at Thomas and Harrison Streets.

1.3.4 Elevated Structure Alternative

The Elevated Structure Alternative would replace the existing Alaskan Way Viaduct generally within the existing right-of-way. The Elliott Bay Seawall would be rebuilt from S. Jackson Street to Broad Street. The project limits would extend from S. Royal Brougham Way in the south to Aloha Street in the north.

1.3.4.1 South Area

Similar to the Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative, full northbound and southbound access to and from SR 99 would be provided in the south area between S. Royal Brougham Way and S. King Street. Access would be in slightly different locations from the other two build alternatives.

At S. Royal Brougham Way, SR 99 would carry three lanes in each direction, with wider lanes and shoulders than the existing viaduct. The elevated structure would rise and cross over S. Dearborn Street and remain an aerial structure through the downtown core. The northbound on-ramp and southbound off-ramp connections could be made from S. Royal Brougham Way and S. Dearborn Street, respectively, to complete the full access interchange in the stadium area. Other roadway improvements would include a new Alaskan Way aerial overpass of the BNSF tail track, a new East Frontage Road between First Avenue S. and Alaskan Way S, a S. Dearborn Street connection between First Avenue S. and Alaskan Way S., and multi-use bicycle and pedestrian paths on both the east and west sides of SR 99. The Port Side Pedestrian/Bike Trail on the west side would be built as an element of the separate S. Holgate Street to S. King Street Viaduct Replacement Project.

1.3.4.2 Central Area

In the central section of Seattle's downtown, the Elevated Structure Alternative would replace the existing viaduct with a stacked aerial structure along the central waterfront. The SR 99 roadway would have three lanes in each direction, with wider lanes and shoulders than the existing viaduct.

The existing ramps at Columbia and Seneca Streets would be rebuilt and connected to a fourth lane. This extra lane would improve safety for drivers accessing downtown Seattle on the midtown ramps. Drivers could access downtown Seattle using these reconstructed ramps in either direction:

- Northbound off-ramp to Seneca Street
- Southbound on-ramp from Columbia Street

The existing SR 99 roadway would be retrofitted, starting between Virginia and Lenora Streets up to the south portal of the Battery Street Tunnel.

SR 99 would travel over Elliott and Western Avenues to connect to the Battery Street Tunnel. This aerial structure would transition to four lanes as it enters the Battery Street Tunnel by dropping lanes to Elliott and Western Avenues. The Elliott and Western Avenue ramps would be rebuilt, and the existing southbound off-ramp at Battery Street and Western Avenue and the northbound on-ramp from Bell Street would be closed to traffic, but maintained for emergency and maintenance access.

1.3.4.3 Elliott Bay Seawall and Alaskan Way Surface Street

The Elevated Structure Alternative would replace the Elliott Bay Seawall between S. Jackson and Broad Streets.

The Alaskan Way surface street would be reconstructed with two lanes in each direction and left-turn pockets at key intersections in the waterfront section. Instead of following the northwesterly curve of the waterfront as it currently does, the surface street would continue straight, to the east of the public open space at the foot of the Pike Street Hillclimb, turning back toward the waterfront between Pike and Pine Streets. The new public open space on the west side of the reconfigured surface would consist of a wedge-shaped plaza adjacent to the Seattle Aquarium, approximately 90 feet wide at its broadest point.

Two streetcar tracks would be located along the centerline of the surface street, separated by a median that would vary in width between 6 and 15 feet. On-street parking would be located on both sides of Alaskan Way.

1.3.4.4 Battery Street Tunnel

The Battery Street Tunnel would be upgraded with fire/life safety improvements, including a fire suppression system, seismic retrofitting, and access and egress structures. The vertical clearance would be increased to about 16.5 feet throughout the length of the tunnel.

1.3.4.5 North Area

The improvements to the surface streets north of Denny Way would be the same as those described for the Cut-and-Cover Tunnel Alternative.

1.4 Summary of Findings

The key findings of the transportation analysis are presented in the following subsections.

1.4.1 Operational Characteristics

The operational characteristics of the transportation network in the project area are greatly affected by the underlying travel demand patterns, the design and connectivity of the build alternatives, the level and implementation strategies for tolling, and the interplay between all of these elements. The characteristic of each build alternative is measured in a variety of ways from an operational standpoint. The three primary types of metrics presented in this Transportation Discipline Report are system-wide metrics that measure the movement of people and vehicles, intersection-level metrics that measure the differences between the alternatives at specific locations in the transportation network, and travel time metrics that provide a way to compare performance along specified routes that represent standard travel patterns.

Comparing the build alternatives to each another and to the Viaduct Closed (No Build Alternative) under tolled and non-tolled conditions can lead to a large number of permutations. In order to avoid over complication of the comparisons, one time period (2030), one design configuration for each alternative, and one tolling level are presented.

1.4.1.1 System-Level Findings

1.4.1.1.1 Non-Tolled Conditions

The system-level findings under non-tolled conditions are the following:

- Increased congestion as measured by vehicle miles of travel (VMT), vehicle hours of travel (VHT), and vehicle hours of delay (VHD) would be highest for the Viaduct Closed (No Build Alternative) because of diversion, redistribution, and longer trips resulting from the roughly 110,000 daily trips that currently use SR 99.
- For the three build alternatives with non-tolled conditions, the transportation network would carry roughly the same number of person trips through the project area. Due to design differences between the alternatives and the underlying travel patterns, the distribution of these trips would vary by alternative.
- The Bored Tunnel Alternative (non-tolled) is expected to result in the highest number of vehicle through-trips along the corridor of the three build alternatives and a noticeable increase in vehicles along arterials near the waterfront due to the lack of ramps at Elliott and Western Avenues.
- The Cut-and-Cover Tunnel Alternative (non-tolled) is expected to result in an overall increase in vehicle volumes on SR 99downtown and southward, relative to the Bored Tunnel Alternative (non-tolled), due to connections at Elliott and Western Avenues and an additional lane on SR 99 along the waterfront.
- The Elevated Structure Alternative (non-tolled) is forecasted to carry the highest vehicle volumes on SR 99 downtown and southward among the three build alternatives, because of additional capacity on SR 99 in Pioneer Square and its connections in the midtown area and at Elliott and Western Avenues.

1.4.1.1.2 Tolled Conditions

A background assumption for tolled conditions is that toll rates would vary by time of day, direction, and vehicle type.

The system-level findings under tolled conditions are the following:

- Under tolled conditions, SR 99 mainline volumes would decrease for all of the build alternatives.
- Vehicles would divert from SR 99 when tolling is implemented. For example, diversion from SR 99 under the Bored Tunnel Alternative with tolling is forecasted to be approximately 39 percent of daily vehicles compared to the Bored Tunnel Alternative without tolling. These diverted

vehicle trips would instead be distributed across Alaskan Way, parallel arterials, and I-5.

- Diversion percentages would vary greatly between peak and off-peak time periods, with off-peak diversion being higher. The daily diversion rate represents the average of several time periods.
- Regardless of the build alternative, diversion to city streets due to tolling on SR 99 would be much less than the diversion associated with the Viaduct Closed (No Build Alternative).
- The Bored Tunnel Alternative would experience less diversion associated with tolling than either the Cut-and-Cover Tunnel Alternative or the Elevated Structure Alternative.
- Under the Bored Tunnel Alternative, person trips across all screenlines are similar regardless of tolling, demonstrating that both the non-tolled and tolled alternative meet a similar person-trip demand.
- For each of the build alternatives, the analysis of travel patterns under tolled and non-tolled conditions indicated diversion from the SR 99 facility in the Center City. For each of the build alternatives, patterns north and south of the Center City were less affected by diversion due to tolling.
- For the transportation analyses, tolling was assumed to be implemented just north of Seneca Street for all three build alternatives. The differing connectivity associated with the alternatives (i.e., connections to the midtown ramps at Seneca and Columbia Streets and Elliott and Western Avenues) resulted in significantly different diversion patterns for each of the alternatives.
- Because the Elevated Structure Alternative would include ramps at Seneca and Columbia Streets, which were not tolled for this analysis because of their location, this alternative resulted in much higher diversion rates as drivers took advantage of those ramps to bypass tolls for part of the trip through downtown.

1.4.1.2 SR 99 Mainline

1.4.1.2.1 Non-Tolled Conditions

The findings for the SR 99 mainline under non-tolled conditions are the following:

- SR 99 volumes showed peak-period directionality, with higher volumes traveling to downtown during the morning (AM) peak hour and the reverse during the evening (PM) peak hour.
- Compared to the other build alternatives, the Bored Tunnel Alternative generally resulted in higher speeds through the central section of the

project area because of the lack of ramps that cause merging activity and a disruption of traffic flow.

1.4.1.2.2 Tolled Conditions

The findings for the SR 99 mainline under tolled conditions are the following:

- SR 99 mainline volumes forecasted for all three build alternatives with tolling were generally lower than volumes without tolling in both directions during the AM and PM peak hours. Under all three alternatives, vehicles are expected to divert from the tolled facility to the arterial street system and I-5.
- For all three build alternatives with tolling, SR 99 mainline operations through midtown are projected to improve in both directions during the AM and PM peak hours, compared to the same alternatives without tolling. This is expected to occur as a result of significant decreases in traffic volumes through the midtown section as vehicles are diverted away from the tolled facility onto the arterial street system and I-5.

1.4.1.3 Key Intersections

The findings for key intersections under non-tolled conditions are the following:

1.4.1.3.1 Non-Tolled Conditions

- The Viaduct Closed (No Build Alternative) would displace a large number of trips from SR 99 to other routes, leading to high levels of traffic congestion on city streets and I-5 throughout the day.
- The difference in access between the three build alternatives (i.e., whether or not connections are provided to the midtown ramps or Elliott and Western Avenues) is a major factor in the performance characteristics of individual intersections throughout the project area because traffic patterns would vary depending on the ramp connections to the SR 99 mainline.
- Compared to the Bored Tunnel Alternative (non-tolled), traffic operations on major through routes in downtown (e.g., Second and Fourth Avenues) are expected to be better under the Cut-and-Cover Tunnel Alternative (non-tolled) and the Elevated Structure Alternative (non-tolled) because less traffic would use surface streets to access destinations that can be reached instead via SR 99 and the Elliott/Western ramps.
- Under the Bored Tunnel Alternative, the new east-west surface street connectivity in the north area would result in a number of new intersections, all of which are expected to operate well.

- In the north area, many of the same intersections that would operate with congested conditions under the Bored Tunnel Alternative would also operate with congested conditions under the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative.

1.4.1.3.2 Tolled Conditions

The findings for key intersections under tolled conditions are the following:

- Under all three build alternatives, tolling would affect the level of service (LOS) at selected intersections in the project area. Some ramp volumes are expected to increase. As a result, key intersections along alternate routes are expected to experience increased delay. Traffic volumes on alternate routes, including Alaskan Way, Second Avenue, and Fourth Avenue, are expected to experience the greatest increase, although the increase would vary with the alternative.
- Intersections that would experience the greatest increase in delay in the south area are located along the alternate routes, including First Avenue at Yesler Way, Second Avenue S. at S. Jackson Street, Fourth Avenue S. at S. Jackson Street, Fourth Avenue S. at Airport Way S., and Fourth Avenue S. at S. Holgate Street.
- The Bored Tunnel Alternative (tolled) is expected to result in increased delay at more intersections in the north area than the central or south areas. Of the 34 intersections reported, 19 would experience a change in delay; 15 intersections would experience increased delays due to tolling.
- The north area is expected to experience greater impacts on intersection LOS due to diversion associated with tolling because most of the traffic diversion from SR 99 would be in a relatively concentrated area.

1.4.1.4 Travel Times

1.4.1.4.1 Non-Tolled Conditions

The findings for travel times under non-tolled conditions are the following:

- Projected travel times for most of the routes investigated are not expected to vary dramatically from one build alternative to another. The majority of travel times during the AM and PM peak hours are expected to be within 2 to 3 minutes of each other, with the exception of travel times on routes that take advantage of the Elliott/Western ramps for which the Bored Tunnel Alternative would be 5 to 6 minutes longer.
- Based on the routes targeted and summarized, travel times for the Bored Tunnel Alternative (non-tolled) would generally be higher than those for the Cut-and-Cover Tunnel Alternative (non-tolled) and the Elevated Structure Alternative (non-tolled).

- The Viaduct Closed (No Build Alternative) would likely result in much slower travel times than any of the build alternatives. As an example, travel times for the Woodland Park to S. Spokane Street route under the Viaduct Closed (No Build Alternative) could be up to three times longer than travel times for the Bored Tunnel Alternative (non-tolled).

1.4.1.4.2 Tolled Conditions

The findings for travel times under tolled conditions are the following:

- Projected travel times for most routes with tolls are generally expected to be longer than those for the same routes without tolls. This is mainly due to traffic diversion to surface streets and resulting conditions at the ramp diversion points and on alternate routes such as downtown arterials.
- Routes showing the greatest difference between non-tolled and tolled conditions are Second Avenue (southbound), Fourth Avenue (northbound), and Ballard to S. Spokane Street via Alaskan Way.

1.4.2 Construction Effects

The constructions effects of the three build alternatives would be the following:

- Construction effects would be greatest for the Cut-and-Cover Tunnel Alternative, followed by the Elevated Structure Alternative. Construction of the Bored Tunnel Alternative would result in far less disruption to the existing transportation system than the other two build alternatives because it could leave the existing viaduct in operation for most of the construction period.
- Total construction duration for each of the three build alternatives is as follows:
  - Bored Tunnel Alternative: 65 months
  - Cut-and-Cover Tunnel Alternative: 105 months
  - Elevated Structure Alternative: 120 months
- Total duration of SR 99 closure for each of the three build alternatives is as follows:
  - Bored Tunnel Alternative: 3 weeks
  - Cut-and-Cover Tunnel Alternative: 27 months for both northbound and southbound travel. In addition, the southbound lanes would be closed for an additional 15 months (between Virginia and Blanchard Streets), and the northbound lanes would be closed for an additional 12 months after the main closure.
  - Elevated Structure Alternative: 4 months

- Construction of all three build alternatives would take many years. The analysis presented in this report provides detailed data only for the construction stage that was determined to be the most severe (a combination of impact on street operations and the duration of impact).

1.4.3 Travel Patterns and Design

The findings for travel patterns and design are the following:

- Connecting east-west streets across Aurora Avenue would greatly improve local circulation and mobility for both motorized vehicles and nonmotorized modes in the South Lake Union area and between the South Lake Union area, Uptown, and surrounding areas. This is an especially key benefit for pedestrians and bicycles because the next nearest crossings (Mercer Street, Broad Street, and Denny Way) carry high volumes of motor vehicles and have relatively narrow sidewalks, contributing to a non-friendly environment for nonmotorized travel. The Bored Tunnel Alternative would connect John, Thomas, and Harrison Streets over SR 99. Under the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative, Thomas and Harrison Streets would connect over SR 99 on two new bridges.
- Under the Bored Tunnel Alternative, Alaskan Way is expected to carry more vehicles than it would under the other alternatives because it would be the primary access route from SR 99 into downtown from the south, and it would accommodate traffic to 15th Avenue via Elliott and Western Avenues. Direct access to Elliott and Western Avenues would not be provided under the Bored Tunnel Alternative, which is expected to result in congestion along the roadway, particularly near the Seattle Ferry Terminal at Colman Dock, without further improvements to Alaskan Way.
- The ability of Alaskan Way to serve as a primary travel corridor for Elliott/Western traffic is limited by the rail crossing at Broad Street and multiple cross streets. The Elliott/Western Connector, proposed as part of the Program, would address this issue.

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Chapter 2 METHODOLOGY

This chapter details the data collection process for the transportation analysis, specifies the methods used for the travel forecasting and traffic analysis, and describes the types of transportation effects investigated and how those effects were evaluated.

2.1 Study Area

The primary study area for the transportation analysis encompasses the project area and nearby transportation facilities that are related to or affected by the SR 99 corridor. The study area is very similar to that used in the previous EIS studies, such as the 2006 and the 2010 Supplemental Draft EISs (WSDOT et al. 2006, 2010). It is generally bounded by S. Spokane Street to the south, Elliott Bay to the west, Aloha Street (three blocks north of Mercer Street) to the north, and I-5 to the east (Exhibit 2-1). The study area is divided primarily unto three areas: south, central, and north. In places, additional divisions may be added to the discussion for clarity. In Chapter 5, the operational effects were evaluated for the four-county region.

Changes in travel patterns and transportation-related effects outside the study area were considered and found to be minimal. In addition, the potential for cumulative effects was evaluated for the broader region and is discussed in Chapter 8.

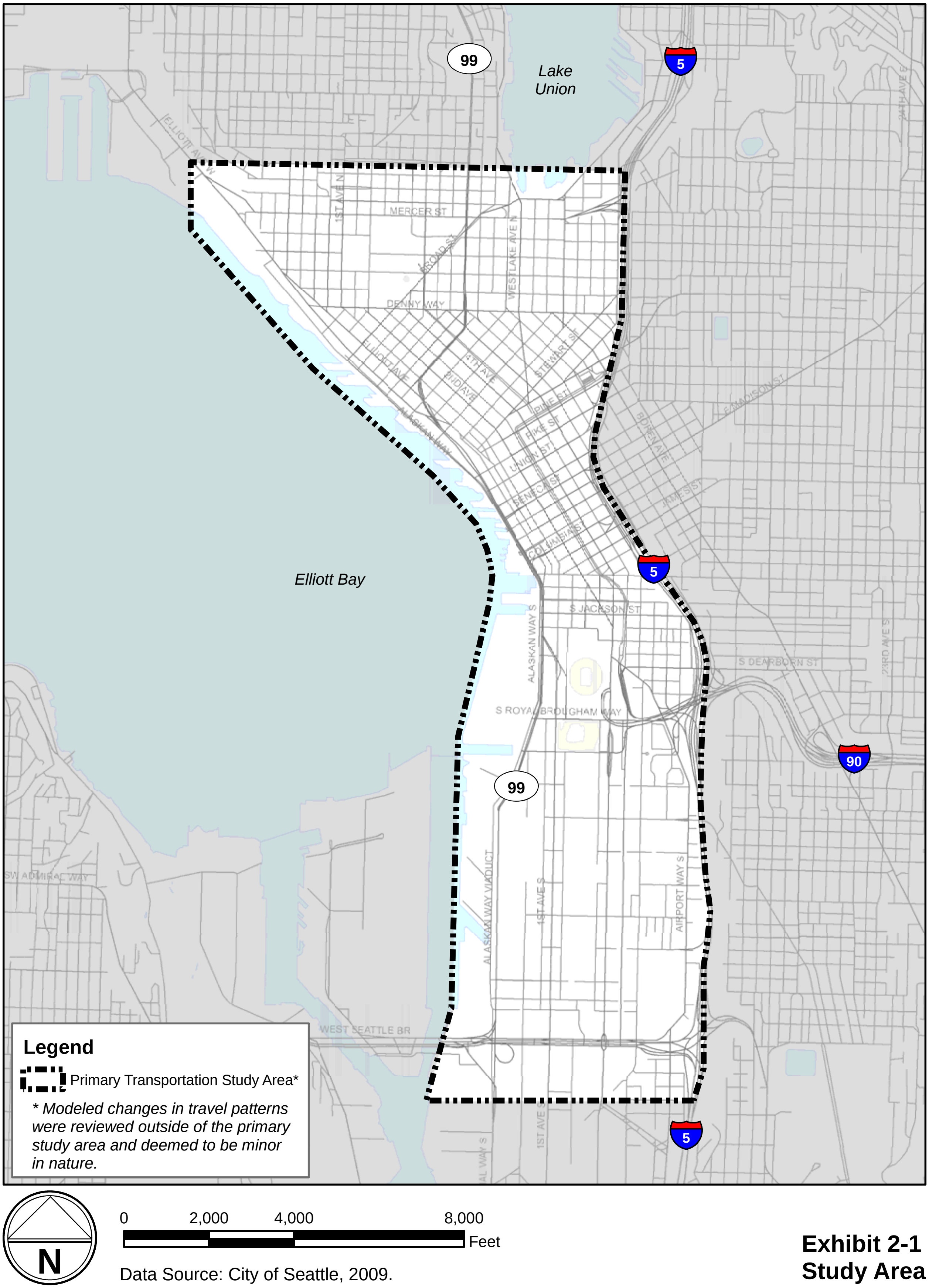
2.2 Data Collection and Sources

The Transportation Research Board's 2000 *Highway Capacity Manual* (HCM) provides guidance for assessing traffic operating conditions for the range of roadway types found within the study area, including limited-access segments and ramps on SR 99, as well as signalized and unsignalized intersections on study area arterials (TRB 2000).

The *National Cooperative Highway Research Report #255, Highway Traffic Data for Urbanized Area Project Planning and Design* outlines recommended practices for preparation of transportation data, including travel forecasts (TRB 1982).

In addition, design guidelines that are relevant to the study of transportation conditions include the following:

- *A Policy on Geometric Design of Highways and Streets* (AASHTO 2004a)
- *A Guide for Achieving Flexibility in Highway Design* (AASHTO 2004b)
- *Guide for the Development of Bicycle Facilities* (AASHTO 1999)
- *Manual on Uniform Traffic Control Devices* (FHWA 2003)
- *Design Manual*, M 22-01 (WSDOT 2009a)
- Any relevant City design guidelines or standards



Data Source: City of Seattle, 2009.

Exhibit 2-1
Study Area

2.3 Travel Demand Estimates and Forecasts

The assessment of future travel conditions is based in part on travel forecasts generated by the application of a regional travel demand model. The project model is based on the current (2008) Seattle Department of Transportation (SDOT) enhanced version of the Puget Sound Regional Council (PSRC) regional planning model, which operates in the EMME software environment. The model reflects assumptions for regional population and employment growth as defined in PSRC's adopted regional plan, *Destination 2030: Metropolitan Transportation Plan for the Central Puget Sound Region* (PSRC 2001). These data were most recently updated in 2006.

Documentation of the model development and validation is detailed in three documents:

- *PSRC Travel Model Documentation (for Version 1.0), Updated for Congestion Relief Analysis* (PSRC 2007b)
- *Alaskan Way Viaduct (AWV) Central Waterfront Travel Demand Model Documentation* (Fehr and Peers 2008)
- *Alaskan Way Viaduct & Seawall Replacement Program Travel Demand Model Refinement and Validation Report* (Parsons Brinckerhoff 2009)

The travel demand model was used to establish baseline traffic estimates for future years that reflect forecasted population and employment changes, as well as planned transportation system improvements. Forecasts for the affected environment were developed for 2015. Horizon year forecasts were developed for 2030 conditions. Construction period forecasts were derived from model runs for 2015, 2017, and 2018.

Previous editions of the Transportation Discipline Report for the Supplemental Draft EISs (WSDOT et al. 2006, 2010) used year 2005 conditions for the affected environment, which describes the context, or setting, of the project. For the Final EIS, the year 2015 was chosen to reflect the affected environment based on projects recently completed or currently underway. The S. Holgate Street to S. King Street Viaduct Replacement Project will affect access to the Alaskan Way Viaduct. The project is funded, under construction, and will be complete by 2015. Recent modification to SR 519, as part of the SR 519 Intermodal Access Project, resulted in new traffic patterns in the south portal area that also need to be captured as part of the affected environment. Based primarily on these two projects, it was determined that 2015 conditions would provide a better description of the project setting for the Final EIS than 2005 conditions.

Previous editions of the Transportation Discipline Report for the Supplemental Draft EISs (WSDOT et al. 2006, 2010) used year 2015 conditions to represent the horizon (design) year. For the Final EIS, 2030 was used for the horizon year forecasts, rather than 2015, for several reasons. Because the opening year of the

SR 99 mainline for Cut-and-Cover Tunnel Alternative would be 2019 and the opening year for the Elevated Structure Alternative would be 2021, analysis of the build alternatives for 2015 was not performed. The Bored Tunnel Alternative would be expected to open to traffic in 2015, and the results from the analysis of the Bored Tunnel Alternative for 2015 were included in the 2010 Supplemental Draft EIS (WSDOT et al. 2010).

2.3.1 Model Assumptions

The future year model conditions include a unique set of baseline assumptions for the horizon year (2030). These assumptions include population and employment forecasts for the specific horizon year and transportation network elements, including today's highway, street, and transit system components as well as other transportation improvements that are currently identified in adopted regional plans and have a funding commitment toward implementation in place.

In addition to using the PSRC four-county EMME travel demand forecasting model assumptions for population and employment to develop future year forecasts, the project team compiled a list of transportation projects that are included in the baseline and build networks and have worked with the lead agencies to finalize and reach consensus on these assumptions. The current list of major new transportation system components within the study area for 2030 is as follows:

- New ramps to and from Alaskan Way S. south of S. King Street and reconfiguration of Alaskan Way S. and S. Atlantic Street as proposed in the S. Holgate Street to S. King Street Viaduct Replacement Project.
- Sound Transit Phases 1 and 2, which consists of Sounder commuter rail; ST Express bus; First Hill Streetcar; and South Link, University Link, North Link, and East Link light rail. Buses currently operating in the Downtown Seattle Transit Tunnel (DSTT) are assumed to operate on surface streets upon completion of University Link.
- Existing transit services and new services proposed in the agencies' 6-year plans.
- Third Avenue transit exclusivity (Stewart Street to Yesler Way) and the Fourth Avenue S. bus island north of S. Jackson Street (continuation of improvements put in place for the Sound Transit Tunnel Conversion).
- King County Transit Now service changes and bus rapid transit (BRT) corridors (called RapidRide) approved through the Transit Now initiative (2006).
- SR 519 Intermodal Access Project, Phase 2.

- The Mercer East Project, which would widen Mercer Street between I-5 and Dexter Avenue N. to accommodate three lanes of travel in each direction, parking, sidewalks, and a median with left-turn lanes.
- S. Spokane Street Viaduct Widening Project, including widening between Sixth Avenue S. and SR 99, relocation of the westbound off-ramp from Fourth Avenue S. to First Avenue S., and a new eastbound off-ramp at Fourth Avenue S.

The 2015, 2017, and 2018 models have similar components as the 2030 model, but they do not include Sound Transit Phase 2 (ST2) elements, except for the First Hill Streetcar. A few minor highway projects outside the study area that are included in the 2030 model are also not included in these earlier horizon years.

Based on input from King County Metro, the model assumes Fall 2009 service levels as a year 2015 baseline for transit due to the national recession and sales tax revenues being substantially less than predicted in the 2009 budget.

The assumptions for Port of Seattle container terminal/rail terminal trips (Terminal 46, Terminal 30, and the North Seattle International Gateway [SIG], in particular) in the S. Holgate Street to S. King Street Viaduct Replacement Project are included in the analysis in the post-processing portion of volume development (i.e., they were incorporated into the volumes after the travel demand model runs, but before any operational analyses). The PSRC 2040 freight element is not incorporated in the travel demand model at this point.

2.3.2 Model Conditions

Transportation planners prepared a model for the 2015 Existing Viaduct that included the baseline elements described previously. The 2015 Existing Viaduct assumes that the existing viaduct would remain in place in its current configuration except for new ramps to and from Alaskan Way S. south of S. King Street and reconfiguration of Alaskan Way S. and S. Atlantic Street as proposed in the S. Holgate Street to S. King Street Viaduct Replacement Project.

The 2030 Viaduct Closed (No Build Alternative) assumes that the existing viaduct would be removed from S. Royal Brougham Way to the south portal of the Battery Street Tunnel, with SR 99 instead connecting to the existing street grid at these locations. The existing linkage from the central waterfront to the Battery Street Tunnel provided by the Alaskan Way Viaduct would not be replicated. The Alaskan Way surface street would be maintained in its current alignment but restriped to provide four travel lanes.

The build alternatives are reflected in the 2030 results that gauge conditions that include network changes associated with each of the build alternatives. Each of the build alternatives was analyzed with and without tolling.

In addition, a "construction" condition was modeled for each build alternative to reflect conditions during the most disruptive construction stage. The construction analysis is based on model runs for 2015, 2017, and 2018, and it was adjusted accordingly.

A "high-level" year 2040 assessment was conducted by analyzing projected population and employment growth in the region and in the Center City area. This assessment did not require travel demand model runs.

In total, 13 model runs were conducted, representing the following conditions:

- 2015 Existing Viaduct
- 2015 Construction Stage for the Bored Tunnel Alternative
- 2018 Construction Stage for the Cut-and-Cover Tunnel Alternative
- 2017 Construction Stage for the Elevated Structure Alternative
- 2030 Viaduct Closed (No Build Alternative)
- 2030 Non-Tolled Bored Tunnel Alternative
- 2030 Tolled Bored Tunnel Alternative
- 2030 Non-Tolled Cut-and-Cover Tunnel Alternative
- 2030 Tolled Cut-and-Cover Tunnel Alternative
- 2030 Non-Tolled Elevated Structure Alternative
- 2030 Tolled Elevated Structure Alternative
- 2030 Non-Tolled Program
- 2030 Tolled Program

The 2015 Existing Viaduct is described in Chapter 4, while the 2030 Viaduct Closed (No Build Alternative), non-tolled 2030 Bored Tunnel Alternative, non-tolled 2030 Cut-and-Cover Tunnel Alternative, and non-tolled 2030 Elevated Structure Alternative are discussed in Chapter 5. Construction conditions are discussed in Chapter 6. Chapter 7 provides a discussion of tolling, which includes the tolled 2030 Bored Tunnel Alternative, the tolled 2030 Cut-and-Cover Tunnel Alternative, and the tolled 2030 Elevated Structure Alternative. Finally, the 2030 Program (non-tolled and tolled) is discussed in Chapter 8, along with qualitative discussions of the cumulative effects of all of the build alternatives.

2.4 Traffic Operations Analysis

2.4.1 Highway Simulation

SR 99 traffic operations were assessed for the AM and PM peak hours using a traffic simulation model developed in the VISSIM modeling environment (version 5.1). The VISSIM model includes mainline SR 99 segments, ramps, and ramp terminal intersections. The model replicates traffic flow by simulating discrete vehicle movements to produce estimates of travel speeds and traffic density, which can be used to assess highway LOS consistent with HCM definitions.

2.4.2 Arterial Intersection Analysis

Intersection traffic operations were evaluated for key locations on the arterial network using VISSIM, described above, and Trafficware Corporation's Synchro software (version 7.0 or later). Synchro is a traffic modeling program designed for the analysis of intersection traffic operations and the optimization of traffic signal timings. Synchro reports average vehicle delay, allowing calculation of LOS consistent with HCM definitions. Synchro also estimates average and maximum queue lengths.

Intersections were selected for analysis based primarily on their relation to the Alaskan Way Viaduct corridor and changes in traffic patterns predicted by the travel forecasting model. VISSIM was used to evaluate intersections located at ramp terminals and on the following segments:

- Alaskan Way from S. Royal Brougham Way to Broad Street
- Elliott and Western Avenues from Blanchard Street to Mercer Place W.
- New Elliott/Western Connector arterial between Elliott and Western Avenues and the Alaskan Way surface street (where applicable)
- Mercer Street from I-5 to Elliott Avenue W.

Other intersections were evaluated using Synchro. Exhibit 2-2 shows the intersections that were analyzed, and Exhibit 2-3 shows the intersections that are specifically addressed in this report.

2.5 Transportation Data and Performance Measures

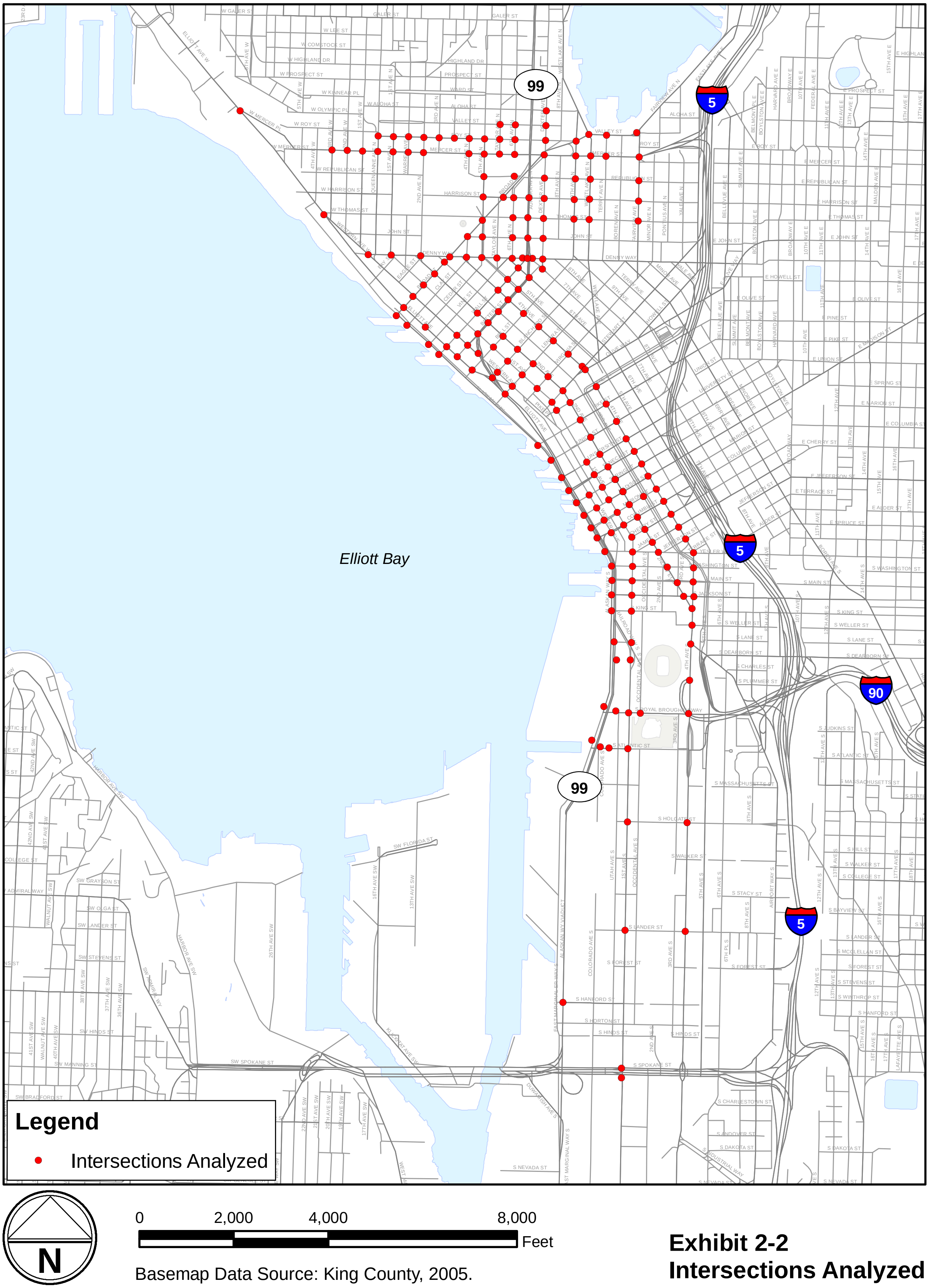
2.5.1 Sources of Existing Geometric Data and Traffic Control Information

Transportation analysts have previously compiled data related to roadway geometry, channelization, and traffic control (including signal timing) for the Program. These data were reviewed for consistency with existing field conditions and updated as necessary.

2.5.2 Traffic Volume Information

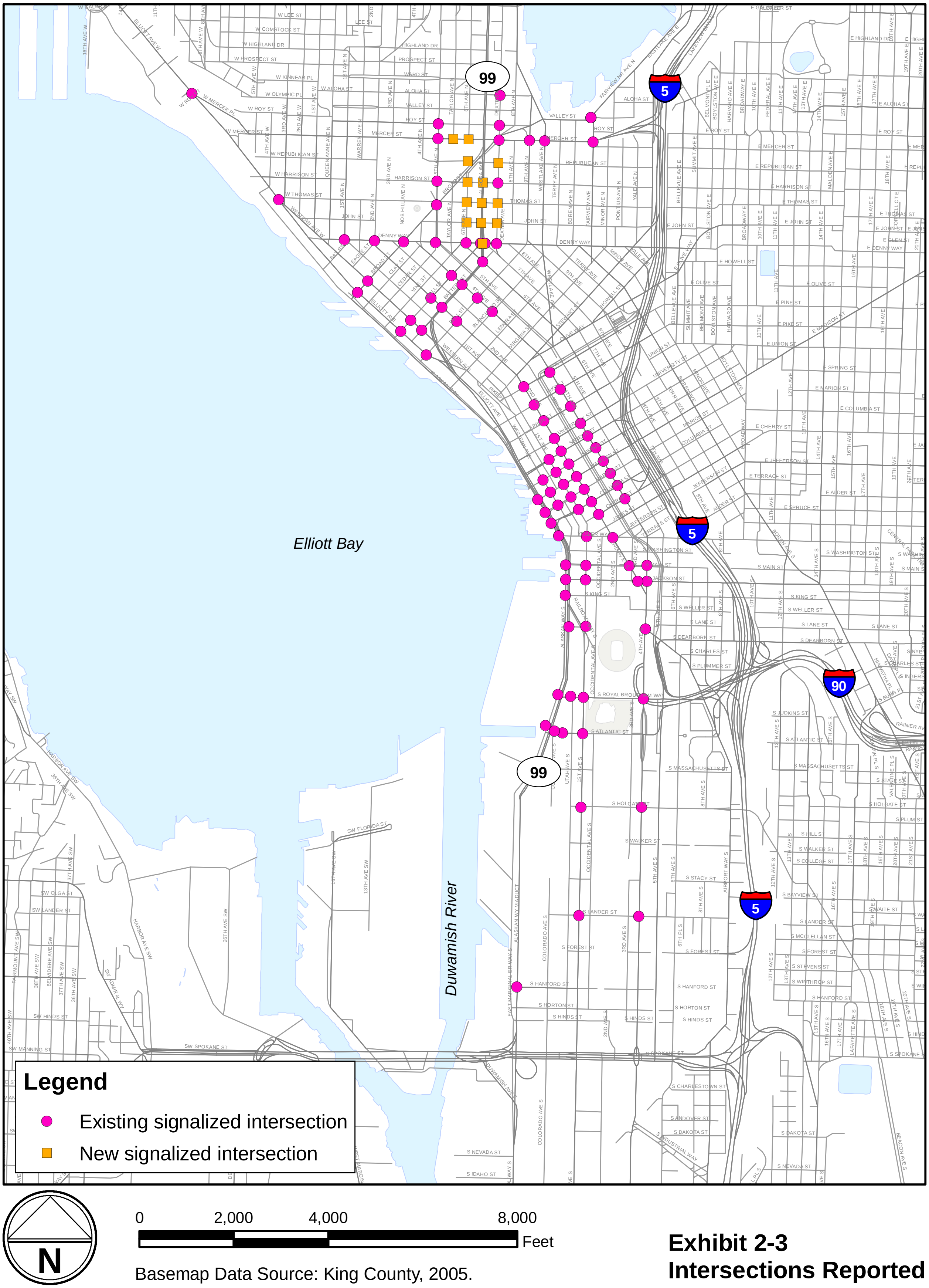
2.5.2.1 Mainline SR 99 Traffic Counts

Transportation analysts have previously prepared estimates of AM peak hour, PM peak hour, and daily traffic volumes for SR 99 mainline segments and ramps under 2005 conditions. These volume estimates were derived from traffic counts conducted by WSDOT and the City from 2004 through 2006. Traffic volumes on SR 99 within the study area have generally remained stable in recent



Basemap Data Source: King County, 2005.

Exhibit 2-2
Intersections Analyzed



0 2,000 4,000 8,000
Feet

Basemap Data Source: King County, 2005.

Exhibit 2-3
Intersections Reported

years, so these volume estimates are still considered current. Some additional on-corridor traffic count data were collected in 2007 and 2008 by the City. These data were evaluated, and existing traffic volume estimates were updated as necessary to reflect changes evident in these latest counts.

2.5.2.2 Intersection Traffic Counts and Related Data

Previous work associated with the Program led to the development of a database of turning movement counts for intersections throughout the study area. The data include AM and PM peak hour vehicle turning movements, percentages of heavy vehicles, peak hour factors, and pedestrian crossings for each intersection leg. Counts have been collected for most traffic-signal-controlled intersections within the primary study area. Traffic volumes at minor intersections for which counts are unavailable have been estimated based on counts at adjacent intersections.

Turning movement counts were originally conducted between 2003 and 2005, although the database has been updated as more recent data have become available. The intersections selected for detailed traffic analysis were evaluated to determine whether new traffic counts were needed. This process involved considering whether new development in the area is likely to have altered traffic patterns since the date of the last traffic count, and comparing turning movement volume counts to newer automated traffic counter data available from the City (2007–2008). New peak-hour turning movement counts were conducted for locations where the last estimates were determined to be out of date. Newer counts were compared to prior counts to identify any anomalies.

2.5.2.3 High-Occupancy Vehicles

Vehicle occupancy data were collected for the existing Seneca Street off-ramp and the Columbia Street on-ramp during the AM and PM peak hours. The purpose of focusing on the midtown ramps was to assess high-occupancy vehicle (HOV) use of the ramps to and from downtown to support decisions related to providing transit and/or HOV priority into the CBD from the south. The SR 99 corridor within the study area does not currently include any HOV facilities.

2.5.2.4 Nonmotorized Users

Pedestrian volumes at intersections were collected with the arterial turning movement counts described previously. Generally, bicycle traffic was counted as part of the vehicle stream. Discrete counts of bicycle traffic were not conducted.

2.5.2.5 Trucks

Volumes of heavy trucks were collected during the arterial turning movement counts described previously. Heavy trucks include single- and double-trailer units, dump trucks, and similar large trucks. Medium- and light-duty trucks and delivery vans were not included in these totals. These data were supplemented by video reconnaissance of freight traffic on SR 99 conducted in June 2006. Additional information on the use of the SR 99 corridor by heavy trucks is summarized in the project memorandum *Updated SR 99 Truck Volumes* (Parsons Brinckerhoff 2006a). After the Nisqually earthquake of February 2001, weight restrictions were established to prohibit vehicles weighing over 10,000 pounds from using the two left lanes on each level of the viaduct. These restrictions remain in place today.

2.5.3 Parking Inventory

On-street parking in the Seattle CBD and along the waterfront was counted in 2001, with additional counts in 2002 and 2003 and an updated count in 2006. Location and types of parking were rechecked in 2009 and 2010. On-street parking spaces surrounding the north project area were counted in the summer of 2009 and rechecked in early 2010. Also obtained were City data for on-street parking spaces in 2009 and off-street parking data collected from 2004 to 2006 (PSRC 2007a).

2.5.4 Transit Service Routes and Frequencies

Transit information related to service coverage, frequency, and travel times for buses that currently use SR 99 and other nearby street segments was obtained from published schedules and maps provided by King County Metro, Community Transit, Pierce Transit, and Sound Transit. Available transit ridership data were obtained from King County Metro, and modeled transit ridership statistics from the project's travel demand model (see Section 2.3) were used to compare relative levels of ridership.

2.5.5 Ferry Service Characteristics at Colman Dock

Washington State Ferries representatives have provided data relating to current ferry vessel capacities, ferry operating schedules, Seattle Ferry Terminal vehicle holding capacity, and typical loading and unloading procedures. Information on street-level pedestrian activity and actual traffic counts near Colman Dock also has been collected (see discussion in Section 2.5.2.2).

2.5.6 Collision Data for SR 99

A comprehensive evaluation of collision history on the SR 99 corridor was conducted in 2007, reviewing collision data from 2000 through 2003. Additional collision data for the Battery Street Tunnel area were assessed for 2004. Collision data gathered for the corridor for years 2005 through 2007 were also assessed.

2.6 Analysis of the Affected Environment

The affected environment was analyzed for a base year of 2015, unless otherwise noted. The elements of the analysis are described in the following subsections. The findings are typically reported for daily conditions corresponding to average daily totals for weekday (Monday through Friday) conditions or for the AM or PM peak hours. These peak hours correspond to the hour-long periods in the morning and evening when overall traffic volumes and travel demand are at their highest levels. For SR 99, the peak hours that were assessed correspond to 8:00 to 9:00 a.m. and 5:00 to 6:00 p.m. Generally, traffic volumes are at similar levels at other times during the morning and evening commuting periods as well. Therefore, peak hour results are largely representative of travel conditions anytime from 7:00 to 9:00 a.m. and from 4:00 to 6:00 p.m.

2.6.1 Regional Context and Travel Patterns

The project's travel forecasting model was used to estimate travel patterns on regional transportation corridors, including I-5, SR 99, and major arterials in central Seattle at screenline locations south of, within, and north of downtown Seattle. Estimates of transit ridership and total person throughput for all travel modes were prepared at the screenline level. Projected region-wide AM peak hour, PM peak hour, and daily VMT, VHT, and VHD are reported from the travel demand forecasting model, as well as daily transit mode shares to and from the Center City area.

2.6.2 Traffic Operations on SR 99

AM and PM peak hour travel speed and LOS are reported for all mainline segments and ramps on SR 99. These data were estimated from traffic simulation modeling as described previously. Notable areas of congestion are identified and described.

LOS is a measure that characterizes the operating conditions, as perceived by a driver or facility user, of a highway, street, or other transportation facility. Although LOS is a qualitative measure, it is based on quantitative measures, such as traffic density, average speed, or average vehicle delay. A range of six LOS designations, "A" to "F," is defined in the HCM. LOS A represents ideal, uncongested operating conditions, while LOS F designates congested, breakdown conditions. Generally, LOS A, B, and C conditions are considered relatively uncongested for the peak period of traffic in the urban environment. LOS D conditions reflect heavier traffic volumes and noticeable slowing, while LOS E represents congested conditions at the point of maximum vehicle throughput (i.e., facility operation at full capacity).

LOS for either freeway segments or multilane highway segments is derived from traffic density and classified according to the ranges shown in Exhibit 2-4. SR 99 is best classified as a multilane highway north of Denny Way. South of Denny

Way, it most closely functions as a freeway, although its posted speed is lower than that of a typical freeway. Both the multilane highway classification and the freeway classification use the same density range to estimate LOS. These traffic density ranges were used to classify LOS for all SR 99 mainline and ramp segments. However, because posted speeds on SR 99 are less than those on a typical freeway, the LOS as based on the HCM density ranges for freeways is likely to be lower than the actual LOS experienced on the facility. Note that LOS for intersections at ramp termini is also categorized using intersection-based LOS measurements, as described in Section 2.6.3.

Exhibit 2-4. Level of Service Designations for Freeways or Multilane Highways

LOS for Freeway/Highway Segments	Density Range (pcpmpl)
A	0 to 11
B	>11 to 18
C	>18 to 26
D	>26 to 35
E	>35 to 45
F	>45

Source: TRB 2000.
Notes: LOS = level of service
pcpmpl = passenger car equivalents per mile per lane

2.6.3 Traffic Operations at Key Arterial Intersections

Average vehicle delay and LOS are reported for AM and PM peak hour conditions for key study area intersections on adjacent and nearby arterials. Average vehicle delay is reported from either Synchro's HCM Signals report or from the simulation runs in the VISSIM model (see Section 2.4.2 for more information). Intersection LOS is based on the average delay per vehicle and is categorized as shown in Exhibit 2-5.

Exhibit 2-5. Level of Service Designations for Signalized Intersections

LOS for Signalized Intersections	Average Vehicle Delay (seconds)
A	0 to 10
B	>10 to 20
C	>20 to 35
D	>35 to 55
E	>55 to 80
F	>80

Source: TRB 2000.
Note: LOS = level of service

2.6.4 Roadway Connectivity and Access

SR 99 connections were identified by movement (e.g., southbound SR 99 to Denny Way) and evaluated qualitatively as providing "good access," "partial or substandard access," or "no access." These designations reflect the degree of connectivity provided (full access, partial access, or no access); the quality of the connections (high-speed/high-capacity ramp connections, low-speed/low-capacity ramp connections, or arterial connections); and the type of connection provided (direct connection, short indirect connection, or longer indirect connection requiring extended arterial travel). Although the terms "access," "full access," and "partial access" have very specific meanings to WSDOT with regard to access control, these terms are used more generally in this report.

2.6.5 Transit Services

Public transportation services in the study area are described. Bus routes that could be affected directly by the proposed changes to SR 99 under the build alternatives were identified and are described in terms of routing, frequency of service, and scheduled travel times. Transit enhancements included in the Program are not proposed for the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

2.6.6 Truck Traffic and Freight

Truck volumes on SR 99 were mapped. Major freight generators and destinations were identified, and truck use of SR 99 is described (including current weight and flammable/hazardous materials restrictions). Truck and freight volumes were included in the traffic operations analysis for SR 99 and key arterial intersections.

2.6.7 Parking

The location and type of parking for areas that may be affected by the build alternatives are described. Parking utilization is also described in a general sense as allowed by existing data.

2.6.8 Pedestrians

Pedestrian facilities proximate to the corridor are described. Major pedestrian generators and their characteristics are also identified, such as the stadiums, the Seattle Ferry Terminal at Colman Dock, and attractions along the waterfront. Pedestrian activity was quantified for areas where activity is known to be high, with particular emphasis on the waterfront. Pedestrian interactions with vehicle traffic are discussed as they relate to Alaskan Way, Aurora Avenue, and ramps from the Alaskan Way Viaduct.

2.6.9 Bicycles

Bicycle routes and facilities were identified, and bicycle activity in the study area is generally described.

2.6.10 Ferries

Current ferry operations at the Seattle Ferry Terminal, with emphasis on both pedestrian and vehicle access and egress from the terminal, are described. To capture traffic operating characteristics for the intersections that provide egress from Colman Dock, delay and LOS were calculated separately for periods during which ferry traffic is actively exiting the dock (and extension of the egress green time is ongoing) and periods during which no ferry traffic is exiting the dock.

2.6.11 Collision History

Current high-accident locations and high-accident corridors were identified, and the factors that contribute to the high incidence of collisions at those locations were determined. A detailed discussion of collision history is presented, updating the prior Program analysis conducted for 2001–2003 to reflect more recent collision data (2005–2007). The collision history includes following elements:

- **Collision rates.** To allow comparison of collision rates between corridor segments and to average rates on similar facilities, collisions per million vehicle miles of travel (MVMT) were calculated for each corridor segment.
- **Collision types.** The share of collisions for major collision types (e.g., fixed-object collisions and rear-end collisions) relative to total collisions, and collision rates by type (per MVMT) were calculated. Comparing the proportion of accident types by segment can help identify possible factors contributing to collisions.
- **Collision severity.** The share of injury collisions (per MVMT) relative to total collisions was calculated.

2.7 Analysis of Future Conditions and Environmental Effects

As discussed in Section 2.3.2, the project's travel demand forecasting model was used to estimate changes in travel patterns and traffic volumes for the future years of 2015 and 2030. The construction analysis is based on model runs for 2015, 2017, and 2018 and adjusted accordingly. The year of analysis for construction of the Bored Tunnel Alternative is 2015; the year of analysis for construction of the Cut-and-Cover Tunnel Alternative is 2018, and the year of analysis for construction of the Elevated Structure Alternative is 2017. The construction analyses are based on the construction stage for each alternative that is deemed the most disruptive. Detailed analysis was conducted for the 2015 Existing Viaduct and horizon year (2030) conditions for the Viaduct Closed (No Build Alternative) and the build alternatives.

2.7.1 Conditions in 2015 and 2030

2.7.1.1 Changes in Travel Patterns and System-Wide Performance Measures

The travel demand forecasting model was used to estimate how travel patterns might change with the construction conditions as well as the conditions in the 2030 horizon year for each build alternative. Traffic volumes on regional transportation corridors, including I-5, SR 99, and major arterials in central Seattle, were compared at screenline locations in the study area south of, within, and north of downtown Seattle.

Estimates of transit ridership and total person throughput (for total vehicles and transit modes) were prepared at the screenline level. In addition, forecasted region-wide AM peak hour, PM peak hour, and daily VMT, VHT, and VHD are reported, as well as daily transit mode shares to and from the Center City area.

2.7.1.2 Traffic Operations on SR 99

AM and PM peak hour travel speeds and LOS for all mainline segments and ramps on SR 99 were developed for 2015 and 2030 modeled conditions. These data were estimated from VISSIM traffic simulation modeling. One exception is the 2030 Viaduct Closed (No Build Alternative). VISSIM modeling was not conducted for the 2030 Viaduct Closed (No Build Alternative). Notable areas of congestion and any substantial difference in operating conditions are identified and described.

Travel characteristics on Alaskan Way for the build alternatives in 2030 were compared to SR 99 trips that use the Elliott/Western ramps under the 2015 Existing Viaduct.

2.7.1.2.1 Traffic Operations at Key Arterial Intersections

Average vehicle delay and LOS were estimated for AM and PM peak hour conditions for the build alternatives at key study area intersections, consistent with locations evaluated for the affected environment (2015 Existing Viaduct). In addition, any intersections that would be newly created or reconfigured under the build alternatives were included in the evaluation.

Vehicle delays at select locations were also extracted for the Viaduct Closed (No Build Alternative) and the Program as needed to provide input to the travel time analyses, although full analysis of intersection LOS was not conducted.

Peak hour volume estimates used for these intersection analyses were developed based on changes in traffic volumes projected by the project's travel demand model. For each intersection location, existing counts were adjusted by the modeled change in traffic volumes to derive the appropriate volume under future conditions. This "post-processing" of model volumes helps ensure that forecasts derived from the model are calibrated to observed field conditions. In cases of new intersections, estimates are based on modeled volumes adjusted to balance with those at nearby intersections.

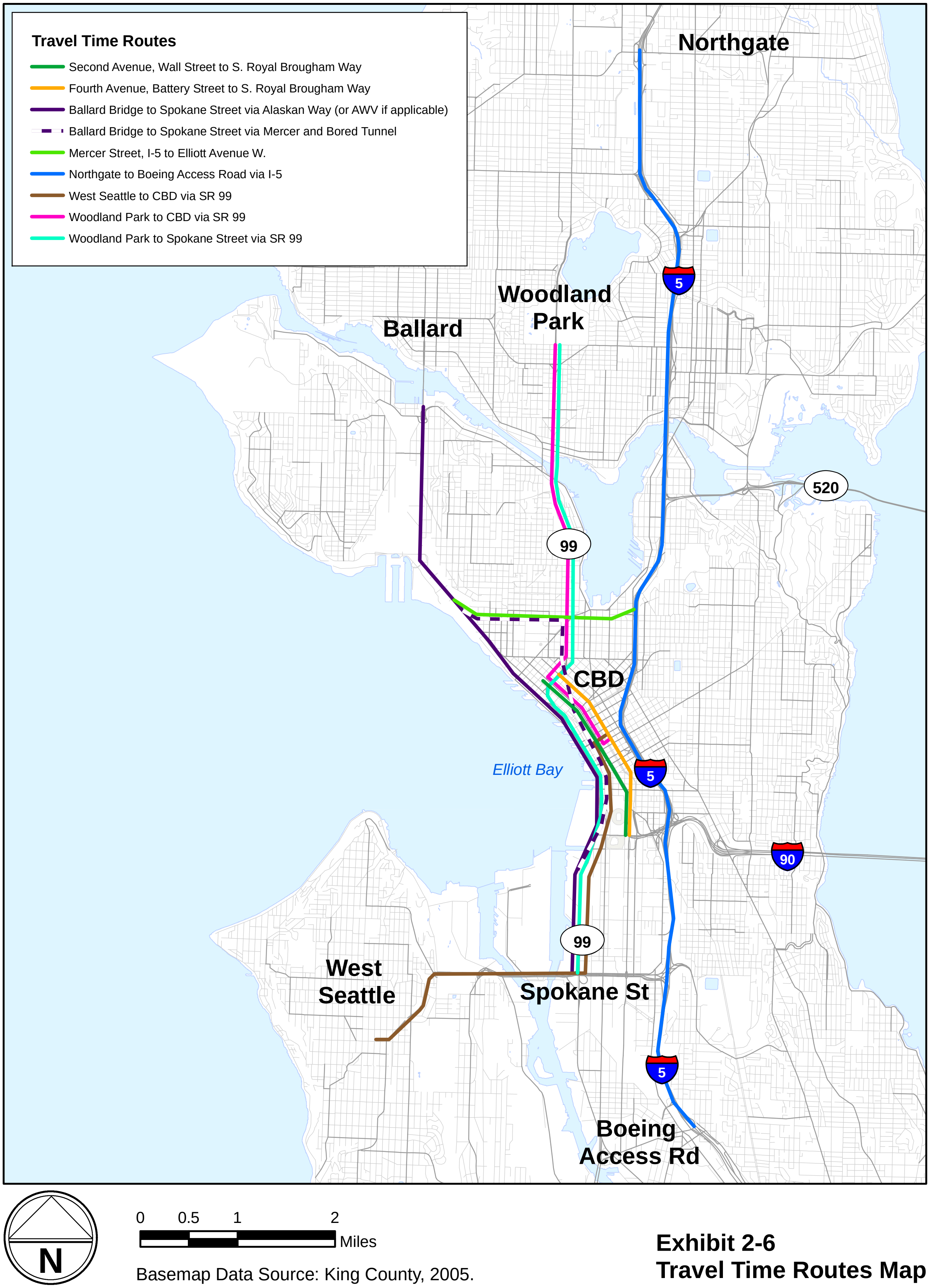
2.7.1.2.2 Travel Times

AM and PM peak hour travel time estimates for the 2015 Existing Viaduct and the 2030 build alternatives were developed for routes that represent major traffic movements accommodated by the SR 99 corridor. The selected routes extend beyond the boundary of the study area to better represent the total travel times that actual trips might take. This allows the relative difference in travel times to be considered in context with the total travel times for longer-distance trips (i.e., those originating in or destined for locations outside the study area).

Travel time estimates were generated from models. Within the study area, travel time estimates for SR 99 segments and ramps were derived from VISSIM simulation model results. For arterial segments, travel time estimates were based on free-flow speeds, and intersection delays were estimated from VISSIM simulation model results and/or Synchro operations analysis results as available. Finally, the travel demand model travel speeds were used as a basis for calculating travel times along route segments outside the study area (e.g., SR 99 north of Aloha Street, 15th Avenue W. north of Elliott Avenue, and the West Seattle Bridge west of Harbor Island). In addition, travel time contours were estimated from the travel demand model and presented graphically for each alternative.

Travel times are reported for routes that correspond to a range of trips that typically use the corridor (the routes are shown in Exhibit 2-6):

- South to and from downtown, represented by West Seattle to CBD via SR 99 and Alaskan Way surface street
- North to and from downtown via SR 99, represented by Woodland Park (SR 99 and N. 50th Street) to CBD
- Through-trips on SR 99, represented by Woodland Park (SR 99 and N. 50th Street) to S. Spokane Street
- Through-trips on the Elliott/Western corridor, represented by Ballard Bridge to S. Spokane Street via two routes:
  - Via Alaskan Way (or Alaskan Way Viaduct if applicable)
  - Via Mercer Street and the bored tunnel (for the Bored Tunnel Alternative only)
- Mercer Street from I-5 to Elliott Avenue
- Northgate to Boeing Access Road via I-5
- Fourth Avenue from S. Royal Brougham Way to Battery Street
- Second Avenue from Wall Street to S. Royal Brougham Way



Basemap Data Source: King County, 2005.

Exhibit 2-6
Travel Time Routes Map

Travel times to downtown are reported for the peak direction only, while other routes—which do not have strong differences in directional traffic volumes during commute times—were assessed for both directions of travel during each peak hour. All routes were assessed for the 2015 Existing Viaduct and the 2030 build alternatives. Exhibit 2-7 identifies the travel time estimates that were developed for each of the modeled conditions analyzed.

Exhibit 2-7. Modeled Conditions and Routes for Estimated Travel Times

	2015 Existing Viaduct	2030 Build Alternatives
West Seattle Junction to CBD (Seneca Street and Fourth Avenue) via SR 99 and Alaskan Way surface street	Peak direction only	Peak direction only
Woodland Park (SR 99 and N. 50th Street) to CBD	Peak direction only	Peak direction only
Woodland Park (SR 99 and N. 50th Street) to S. Spokane Street	AM and PM	AM and PM
Ballard Bridge/Elliott Avenue to S. Spokane Street		
a) Via Alaskan Way (or Alaskan Way Viaduct if applicable)	AM and PM	AM and PM
b) Via Mercer Street, bored tunnel	N/A	AM and PM
Northgate to Boeing Access Road via I-5	AM and PM	AM and PM
Mercer Street from I-5 to Elliott Avenue	AM and PM	AM and PM
Second Avenue from Wall Street to S. Royal Brougham Way	AM and PM	AM and PM
Fourth Avenue from S. Royal Brougham Way to Battery Street	AM and PM	AM and PM

Notes: CBD = Central Business District
N/A = not applicable

2.7.1.3 Roadway Connectivity and Access

The connections for the build alternatives were identified by movement (e.g., southbound SR 99 to Denny Way) and evaluated qualitatively as providing "good access," "partial or substandard access," or "no access." These designations reflect the degree of connectivity provided (full access, partial access, or no access); the quality of the connections (high-speed/high-capacity ramp connections, low-speed/low-capacity ramp connections, or arterial connections); and the type of connection provided (direct connection, short indirect connection, or longer indirect connection requiring extended arterial travel).

2.7.1.4 Transit

The expected effects on transit services were assessed using both qualitative and quantitative information. Expected changes in transit routing for the build alternatives were identified and compared to routing for the Bored Tunnel Alternative. The comparison focused on changes in coverage area and potential effects on speed and reliability (based on traffic operations results). The results of the traffic analysis were used to gauge potential effects on travel times on routes operating on SR 99 (Aurora Avenue and SODO). Modeled changes in mode share are reported as well.

2.7.1.5 Truck Traffic and Freight

The effects of the build alternatives on the movement of freight and goods, including a comparison of routing alternatives for trips that currently use the Elliott/Western Avenue corridor, were evaluated, along with potential changes in vehicle restrictions (in terms of weight and/or flammable or hazardous materials).

2.7.1.6 Parking

Potential effects on parking were quantified for the area that would be directly affected by the build alternatives. The location and proximity to dependent uses and the availability of alternative parking also were qualitatively examined.

2.7.1.7 Pedestrians

Pedestrian components of the build alternatives are described in addition to other project-related changes that could affect the quality and/or safety of pedestrian facilities. In particular, potential effects associated with changes to Alaskan Way, Aurora Avenue, and SR 99 ramp locations were examined to gauge pedestrian exposure to vehicle traffic, effects on pedestrian connectivity, and means for providing safe and convenient crossings of streets and highways.

2.7.1.8 Bicycles

Bicycle facility components of the build alternatives were characterized, as well as other project-related changes that could affect the quality and/or safety of bicycle travel. The assessment considered how changes in the roadway configuration and traffic volumes on Alaskan Way might affect bicycling on Alaskan Way.

2.7.1.9 Ferry Traffic

Changes in vehicle access and egress from the Seattle Ferry Terminal at Colman Dock are described.

2.7.1.10 Event Traffic

Traffic conditions and access to major events in the stadium area and at Seattle Center were assessed qualitatively, taking into consideration normal peak hour traffic conditions, changes in traffic patterns and volumes associated with events, and event-related pedestrian activity.

2.7.1.11 Safety

Potential changes in conditions that could affect motorist, pedestrian, and bicyclist safety were assessed on the basis of a review of the major design elements associated with each build alternative, including facility type, lane widths, geometric configuration, and potential locations of vehicle, bicyclist, and pedestrian conflicts. The assessment also included the potential effects of the design features on existing locations that experience a relatively greater share of accidents, or how the design features could potentially introduce new or different safety issues.

2.7.2 Conditions in 2040

A "high-level" year 2040 assessment was conducted by analyzing projected population and employment growth both in the region and in the Center City area. Based on this assessment, a qualitative discussion of the potential effect of year 2040 conditions on the operational performance of the build alternatives is included.

2.7.3 Travel Conditions During Construction

Traffic management approaches (detours) associated with major construction stages of the build alternatives are described. Travel forecasts were prepared for one construction stage associated with each build alternative, corresponding to the stage that is expected to be most disruptive. SR 99 mainline speeds and travel times were estimated. Travel disruption during other construction stages is described qualitatively relative to this modeled stage. Transportation measures to help maintain mobility and access during construction are suggested based on the degree, location, and extent of the forecasted disruption. Impacts on access and egress for stadium and Seattle Center events were assessed and are discussed qualitatively.

2.8 Cumulative Effects

Cumulative effects are effects that result from the incremental impact of the build alternatives when added to other past, present, and reasonably foreseeable future actions. The quantitative focus of the cumulative effects analysis, which is described in Chapter 8, is on the combined effect of the Bored Tunnel Alternative plus the Program elements. A qualitative assessment is also presented for each of the build alternatives combined with other past, present, and reasonably foreseeable future projects that are anticipated to add to the transportation effects in the study area. Two levels of cumulative effects were assessed. The first level includes the Bored Tunnel Alternative and the other Program elements. This level was assessed quantitatively. The second level of cumulative effects includes each of the build alternatives and other regional transportation projects. This analysis was qualitative in nature and relied on other previously conducted studies.

2.8.1 Other Projects

Other major projects included in the cumulative effects analysis are the following:

- Other Program elements, which consist of roadway and non-roadway elements:
  - Roadway elements

    Alaskan Way Surface Street Improvements – S. King Street to Pike Street

    Elliott/Western Connector – Pike Street to Battery Street

    Mercer West Project – Fifth Avenue N. to Elliott Avenue (Note: the City refers to this project as Mercer West, Two-Way Conversion, to distinguish it from the underpass, which is part of the Bored Tunnel Alternative.)
  - Non-roadway elements

    First Avenue Streetcar Evaluation

    Transit Enhancements

    Elliott Bay Seawall Project

    Alaskan Way Promenade/Public Space
  - Projects under construction

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

    Transportation Improvements to Minimize Traffic Effects During Construction
- Other planned projects with potential cumulative effects (some of these are already included in the 2015 Existing Viaduct):
  - Seattle planned urban development

    Gull Industries on First Avenue S.

    North Parking Lot Development at Qwest Field

    Seattle Center Master Plan (EIS) (Century 21 Master Plan)

    Bill and Melinda Gates Foundation Campus Master Plan

    South Lake Union Redevelopment

    U.S. Coast Guard Integrated Support Command

    Seattle Aquarium and Waterfront Park
  - Local roadway improvements

    Bridging the Gap Projects

    SR 99/East Marginal Way S. Grade Separation

- Regional roadway improvements
  - I-5 Improvements
  - SR 520 Bridge Replacement and HOV Program
  - I-405 Corridor Program
  - Interstate 90 (I-90) Two-Way Transit and HOV Operations, Stages 1, 2, and 3
  - SR 518 Widening
- Transit improvements
  - First Hill Streetcar
  - Sound Transit University Link Light Rail Project
  - RapidRide
  - Sound Transit North Link Light Rail Project
  - Sound Transit East Link Light Rail Project
- Transportation network assumptions
  - HOV Definition Changes to 3+ Throughout the Puget Sound Region
  - Sound Transit Phases 1 and 2
  - Other Transit Improvements

Potential changes in travel effects associated with the combined or cumulative implementation of the identified projects are qualitatively described for both the construction and operational timeframes.

2.8.2 Changes in Travel Patterns and System-Wide Performance Measures

The travel demand forecasting model was used to estimate how travel patterns might change with the 2030 Program. The same performance measures outlined in Section 2.7.1 were assessed for cumulative effects.

2.8.3 Traffic Operations on SR 99

AM and PM peak hour travel speeds and LOS were calculated for all mainline segments and ramps on SR 99 for the 2030 Program. These data were estimated from VISSIM traffic simulation modeling. Notable areas of congestion and any substantial difference in operating conditions were identified and are described. Travel characteristics on the Alaskan Way surface street with the Program are specifically compared to existing SR 99 trips that use the Elliott/Western ramps.

2.8.4 Traffic Operations at Key Arterial Intersections

AM and PM peak hour vehicle delay by approach was developed for key arterial intersections in the study area for the 2030 Program, as needed, to provide input to the travel time analyses.

Intersection analyses were conducted using the Synchro modeling software, version 7.0. In addition, the VISSIM model, version 5.1, was used to analyze intersections on the following arterials:

- Alaskan Way from S. Royal Brougham Way to Broad Street
- Elliott and Western Avenues from Blanchard Street to Mercer Place W.
- New Elliott/Western Connector arterial between Elliott and Western Avenues and the Alaskan Way surface street (where applicable)
- Mercer Street from I-5 to Elliott Avenue

2.8.5 Travel Times

AM and PM peak hour travel time estimates for the routes indicated in Exhibit 2-7 were developed for the modeled conditions included in the cumulative effects analysis, consistent with the method identified previously. The routes are shown in Exhibit 2-6.

2.9 Determination of Transportation Mitigation Measures

2.9.1 Mitigation of Operational Effects

Because the operational effects of each of the build alternatives would be substantially better than those of the Viaduct Closed (No Build Alternative), long-term (after construction) transportation mitigation measures would not be necessary because all of the build alternatives would result in better long-term operations on SR 99 and adjacent city streets. Under the build alternatives, both travel times and intersection LOS in the study area would improve compared to the Viaduct Closed (No Build Alternative), and each of the build alternatives would result in lower daily traffic volumes on the Center City street grid than those of the Viaduct Closed (No Build Alternative).

Although tolling the build alternatives would likely result in additional volumes on streets in the north and south areas due to some drivers avoiding the toll, the daily volumes and resulting travel speeds and nonmotorized mobility would remain consistent with the classification of these streets and would be similar to those found on other arterials and streets in the Center City. Even with the diverted traffic, the transportation network would operate more effectively under the build alternatives than under the Viaduct Closed (No Build Alternative).

Despite the expected operations under the build alternatives, WSDOT has acknowledged that an acceptable long-term solution should be sought to minimize the amount of diverted traffic due to tolling in order to optimize the operation of the transportation network. Strategies for optimization are being developed by the Tolling Advisory Committee, which is not a decision-making body. Therefore, when the committee completes its work in 2012, additional action may be required by Washington State, the City of Seattle, the Port of

Seattle, and King County to implement the strategies developed by the committee or other tolling mitigation strategies developed before project completion. If necessary, additional environmental analysis may be performed to evaluate the potential effects of the proposed strategies before implementation.

2.9.2 Mitigation of Adverse Effects on Travel During Construction

A program of measures to help maintain mobility and access during construction is recommended based on the proposed detour routes and the forecasted degree of travel disruption, including changes in existing pedestrian or vehicle circulation patterns, parking, and access.

WSDOT, King County, and the City have developed transportation improvements to minimize traffic effects during construction to keep people and goods moving during construction associated with the Program. Although the specific locations of construction mitigation actions would be different from those for the Bored Tunnel Alternative and Program elements, all three build alternatives could use similar mitigation strategies. These strategies are discussed in Section 6.15, Mitigation of Construction Effects.

Preparation of a traffic management plan will be required. This plan will need to be accepted by the City and will ensure that construction effects on local streets, property owners, and businesses are minimized. Localized mitigation measures will be developed as the construction details are refined.

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Chapter 3 STUDIES AND COORDINATION

This chapter provides a summary of the studies and adopted plans undertaken in the region that have relevance to the project. Also included is a summary of coordination activities undertaken to guide the development of traffic and transportation components of the project.

3.1 Relevant Studies and Plans

3.1.1 City of Seattle Comprehensive Plan (2005)

The *City of Seattle's Comprehensive Plan: Toward a Sustainable Seattle* (City of Seattle 2005a), articulates a vision of how Seattle will grow in ways that sustain its citizens' values. The City first adopted the Comprehensive Plan in 1994 in response to the state Growth Management Act of 1990. Multimodal transportation policies discussed in the Comprehensive Plan were used to define the project's system elements. In particular, transportation demand policies and system management strategies were used to guide development of the project's mitigation plans.

3.1.2 City of Seattle Transportation Strategic Plan (2005)

The *Transportation Strategic Plan* (City of Seattle 2005b) describes SDOT's vision, goals, and policies for achieving the City's long-range objectives. It describes the actions, projects, and programs that SDOT will implement to promote economic growth in Seattle and the region, support livable neighborhoods, improve the environment, and address the complex demands of the traveling public. Information from this plan was used to help refine the project's travel demand models.

3.1.3 City of Seattle Bicycle Master Plan (2007)

The *Seattle Bicycle Master Plan* (City of Seattle 2007a) is a planning document used to guide future improvements to Seattle's bicycle network. This master plan focuses on evaluating arterial streets to implement bicycle lanes and encourage more bicycling throughout Seattle.

3.1.4 Seattle Pedestrian Master Plan (2009)

The mission of the Seattle *Pedestrian Master Plan* (City of Seattle 2009b) is to make Seattle the most walkable city in the country by meeting four primary supporting goals:

- Safety – reduce the number and severity of collisions involving pedestrians.

- Equity – make Seattle a more walkable city for all through equity in public engagement, service delivery, accessibility, and capital investments.
- Vibrancy – develop a pedestrian environment that sustains healthy communities and supports a vibrant economy.
- Health – raise awareness of the important role of walking in promoting health and preventing disease.

The plan defines walkable streets by outlining the elements of a walkable street and potential destinations that generate pedestrian traffic.

3.1.5 City of Seattle Center City Circulation Report (2003)

The City conducted a study of transit and nonmotorized circulation and service options in the downtown area (City of Seattle 2003a). This study is an effort to better integrate numerous independent transportation components and plans in the downtown area.

3.1.6 City of Seattle Center City Access Strategy (2007)

In preparation for construction and growth, including the project and Program, SDOT is planning, building, and monitoring the implementation of projects in the city center. This strategy involves creating a livable and walkable city center, integrating and simplifying the transit system, accommodating anticipated growth, maintaining access into downtown during major construction projects, and continuing mobility into the future (City of Seattle 2007b).

3.1.7 City of Seattle Freight Mobility Strategic Action Plan (2005 Plan Update)

The *Freight Mobility Strategic Action Plan* (City of Seattle 2005c) presents a list of actions that SDOT will implement. These actions or tasks address administrative and functional actions that SDOT will carry out to benefit freight, in accordance with Seattle's Comprehensive Plan and its *Transportation Strategic Plan*. Actions include railroad grade separations, truck guide signing, street improvements, and ongoing communication with the Seattle freight community via the Seattle Freight Mobility Advisory Board.

3.1.8 Seattle Intermediate Capacity Transit Study (2001)

The *Intermediate Capacity Transit Study* (City of Seattle 2001) examined a wide range of transit technologies and services that offer higher passenger carrying capacity and greater reliability than buses operating in mixed traffic. It included an assessment of the following transit services:

- BRT – buses that move quickly and reliably because of improvements such as transit-only lanes or transit priority technology, which gives buses a green light at intersections

- Streetcars and trams – electric vehicles running on rails in the streets
- Elevated transit (like monorail) – electric vehicles that are grade-separated or operate in exclusive rights-of-way, allowing them to avoid traffic congestion and other barriers

This transit study examined transit system performance for various types of transit service that may operate in the Alaskan Way Viaduct corridor.

3.1.9 City of Seattle Transit Plan (2005)

The City adopted a Transit Plan (City of Seattle 2005d) to define its transit strategies for its *Transportation Strategic Plan*. The purpose of the Transit Plan is to provide sound direction on how Seattle can achieve the transit system it needs to meet long-term growth, economic, and transportation objectives for connecting downtown and the emerging set of urban villages. Information from the plan was used to help refine travel networks within the Program's travel demand models.

3.1.10 Seattle Streetcar Network Development Report (2008)

The Seattle City Council approved a Seattle Streetcar Network Concept in early 2008 and authorized SDOT to evaluate the concept and identify the most promising routes for early implementation. The report evaluated a number of potential corridors and routes, including the First Avenue streetcar line that is part of the Program (City of Seattle 2008a).

3.1.11 Center City Parking Program Work Plan (2008)

The Center City Parking Program is SDOT's effort to address anticipated changes to on-street parking in the Center City over the next several years (City of Seattle 2008b). This would be accomplished with new marketing, way-finding, and technology measures in place by 2012. This program's goal is to provide easy-to-access off-street short-term parking with easy-to-understand pricing that keeps the Center City moving and contributes to a sustainable transportation system.

3.1.12 Waterfront Parking Strategy (2002)

The *Waterfront Parking Strategy* was developed through a partnership between the City of Seattle Strategic Planning Office, the Seattle Aquarium, the Metropolitan Improvement District, the Pike Place Market Preservation and Development Authority, and the Port of Seattle (City of Seattle 2002). It was commissioned to develop a parking strategy to meet changing needs brought about by new and emerging land uses along the Seattle central waterfront area. The purpose of the strategy was to help the City balance the access and parking needs of a revitalized waterfront with the preservation of neighborhood character and businesses.

3.1.13 South Lake Union Transportation Study (2004)

The main objective of the *South Lake Union Transportation Study* (City of Seattle 2004) is to form a set of transportation strategies to address existing problems and to support and shape the development of the South Lake Union Urban Village.

3.1.14 Mercer Corridor Improvements Project NEPA Environmental Assessment (December 2008) and Finding of No Significant Impact (May 2009)

The Mercer Corridor Improvements Project will replace the existing Mercer/Valley couplet in the South Lake Union neighborhood with a widened two-way Mercer Street and a narrowed two-way Valley Street. The widened Mercer Street will have three lanes in each direction, with widened sidewalks, on-street parking, and a landscaped median. On May 12, 2009, FHWA issued a FONSI (City of Seattle 2009c) based on the analysis presented in the Environmental Assessment (City of Seattle 2008c).

3.1.15 Seattle Center Century 21 Master Plan (2008)

The *Seattle Center Century 21 Master Plan* calls for substantial, long-term investment in Seattle Center over the next 20 years (Seattle Center Century 21 Committee and City of Seattle 2008). It allows for a mix of commercial and community spaces. In terms of transportation, the master plan calls for increasing the mode and frequency of transit, improving pedestrian connections to and through the campus, and making it easier and safer to access Seattle Center by vehicle, by bicycle, or on foot.

3.1.16 Destination 2030: Metropolitan Transportation Plan (2001)

The *Destination 2030: Metropolitan Transportation Plan for the Central Puget Sound Region* (PSRC 2001) is the adopted regional long-range transportation plan for the central Puget Sound region. The Metropolitan Transportation Plan (MTP) comprises all transportation projects and programs planned for implementation by 2030 (funded and unfunded). It also describes land use and socioeconomic conditions forecasted for 2030, which form the basis for PSRC's travel demand models (the project's travel demand model, as described in Chapter 2, is an enhanced version of the PSRC model).

The MTP describes the performance of the regional transportation system, given implementation of the full complement of projects identified in the plan. It illustrates the cumulative effects of implementing all of the transportation projects and programs planned throughout the region.

3.1.17 Transportation 2040

PSRC prepared *Transportation 2040*, a new transportation plan to address critical issues such as congestion and mobility, the environment, and transportation finance in the central Puget Sound region (PSRC 2010). This plan is an update of the central Puget Sound region's MTP. *Transportation 2040* was adopted by the General Assembly on May 20, 2010.

3.1.18 Sound Transit 2 Plan (2008)

In 2008, voters approved funding for the ST2 plan (Sound Transit 2008), which identified a major expansion of regional transit services. This program includes extensions of the Link light rail transit (LRT) system by 36 miles, a new streetcar line connecting Capitol Hill and First Hill to downtown Seattle, and significant expansion of Sounder commuter rail and ST Express bus service.

Currently operating between downtown Seattle and the Seattle-Tacoma International (Sea-Tac) Airport, Link LRT will make the connection between downtown Seattle and the University of Washington in 2016. Under ST2, Link LRT will be extended to Lynnwood in the north, Overlake in the east, and Federal Way in the south. A new streetcar line will connect Pioneer Square in the south end of downtown Seattle with First Hill and Capitol Hill. Sounder commuter rail serving downtown Seattle will be enhanced by expanded operations, extended platforms at stations, and improved access at south King County and Pierce County stations. ST Express bus service will be expanded. Potential improvements along the SR 520 corridor were also identified for study under ST2.

ST2 builds on the initial program of regional service development known as Sound Move. One of the major elements of Sound Move is construction of LRT to serve the University District. This element, which is currently under construction, is scheduled for completion in 2016. Once completed, LRT service will be provided between Westlake Station in downtown Seattle and the University of Washington campus (near Husky Stadium) via Capitol Hill.

The transit investments approved in ST2 are included as part of future conditions.

3.1.19 King County Comprehensive Plan for Public Transportation (2007)

The *Comprehensive Plan for Public Transportation* is the guiding policy document for King County Metro Transit (King County Department of Transportation 2007). It identifies goals, objectives, and policies to fulfill Metro's mission and progress toward an efficient, reliable, and convenient public transportation system of the future. It also lays the foundation for Metro's 10-year *Strategic Plan for Public Transportation (2007–2016)* (King County Metro 2007). The plan supports the growth management principles and is consistent with the regional vision identified in *VISION 2040* (PSRC 2009b). This plan was replaced by King County Metro's *Strategic Plan for Public Transportation 2011–2021*, described in Section 3.1.21.

3.1.20 King County Metro Strategic Plan for Public Transportation 2007–2016

The King County *Strategic Plan for Public Transportation 2007–2016* (King County Metro 2009) outlines strategies to achieve the goals and objectives in Metro's long-range *Comprehensive Plan for Public Transportation* (King County Department of Transportation 2007). It builds on previous 6-year transit development plans guiding service and capital investments for Metro's transit, paratransit, and rideshare services. It also guides planning and management efforts.

The Transit Now initiative to expand King County Metro bus transit service by 15 to 20 percent over the next 10 years was approved by King County voters in the general election on November 7, 2006 (King County Ordinance 2006-0285). This initiative is a major component of the current strategic plan.

Elements of Transit Now are expected to supplement the strategies identified through the project's construction transportation planning process. Travelers to downtown Seattle will benefit from Transit Now both during and after project construction. RapidRide is a key feature of Transit Now that will consist of several BRT lines that will be implemented over the next few years. RapidRide is a branded service that will have unique low-floor buses with wider aisles, three doors, and faster fare collection for shorter dwell times and travel times. Service will be frequent, with trips every 10 minutes or less in the peak periods and every 15 minutes or less in the off-peak periods. The A, Boulevard, and F Lines are in south and east King County. The C Line, serving West Seattle, is scheduled to be completed in 2012, although some of the new service will be implemented in 2011. The D Line, serving Ballard-Uptown, is scheduled to be implemented in 2012. The E Line, serving Aurora Avenue N. is scheduled to be implemented in 2013. The C, D, and E Lines will all serve downtown Seattle via the Third Avenue transit spine.

Although BRT corridors and targeted implementation timelines have been identified, the extent and phasing of the program will depend on available funding. This plan was replaced by King County Metro's *Strategic Plan for Public Transportation 2011–2021*, described in Section 3.1.21.

3.1.21 King County Metro Strategic Plan for Public Transportation 2011–2021

King County Metro's *Strategic Plan for Public Transportation 2011–2021* describes a vision for the future of the county's public transportation system and sets objectives, goals, and strategies for attaining that vision. It focuses on the results Metro intends to achieve, which include outstanding performance, financial sustainability, transparency and accountability to the public, and excellent service.

3.1.22 King County Metro Transit Development Plans

The King County Metro *Looking to the Future, Six-Year Transit Development Plan for 2002 to 2007*, provided the framework for transit service and capital investments

(King County Metro 2004). This plan guided transit development for 2002 through 2007. The 6-year transit plan was used to determine annual transit service growth for the regional travel demand models, including Metro bus service and transportation demand management strategies provided by King County Metro. In November 2007, the *Strategic Plan for Public Transportation (2007–2016)* (King County Metro 2007) replaced and updated the *Six-Year Transit Development Plan for 2002 to 2007*.

3.1.23 King County Ferry District – Technical Studies (2009)

The King County Ferry District assessed the feasibility of adding new routes to its system. The *King County Ferry District Demonstration Project, Technical Studies Implementation, Refined Route Analysis* (King County 2009) documented the assessment of several potential new ferry routes, including those connecting to downtown Seattle. However, in late 2009, due to lack of funding, the King County Ferry District voted to limit the district to the two existing passenger ferry routes: the Vashon Island passenger ferry and the downtown Seattle to West Seattle water taxi.

3.1.24 Evaluation of Joint Operations in the Downtown Seattle Transit Tunnel (2001)

This joint Sound Transit and King County study issued in August 2001 examined the impact of removing buses from the DSTT during the planned conversion of the DSTT to joint bus and light rail operations (Sound Transit and King County 2001). Of particular note was the impact on downtown streets of distributing tunnel buses to the downtown Seattle arterials for 2 years.

3.1.25 King County Metro Transit Tunnel Conversion Project Performance Reports (2005–2007)

King County Metro, under the "Agreement Regarding the Design, Construction and Operation of the Downtown Seattle Transit Tunnel and Related Facilities," was mandated to provide periodic reports on the performance of the downtown transportation system during the DSTT closure for the Downtown Transit Tunnel Conversion Project. These reports have provided updates on a number of performance measures during the closure of the DSTT (King County Metro 2005-2007). The information in these studies has been helpful in the documentation of potential traffic impacts during construction.

3.1.26 Alaskan Way Viaduct Project: Task 1 Report (December 1996)

The Task 1 Report (WSDOT 1996a) provides insight to the travel characteristics of trips made on the Alaskan Way Viaduct. The report led to four distinct approaches (framework policies) for seeking a course of action. The report provided comparison information for the development of travel forecasts and traffic analysis activities.

3.1.27 Route Development Plan: State Route 99 North/Aurora Avenue North (2003)

The Route Development Plan (RDP) was prepared by WSDOT for the segment of SR 99 (Aurora Avenue N.) between the north end of the Battery Street Tunnel and N. 145th Street (WSDOT 2003). The RDP is a 25-year plan developed to assist WSDOT, the City, and King County Metro in making informed decisions on future improvements to the SR 99 north corridor.

3.1.28 Washington State Transportation Plan 2007–2026 (November 2006)

The Washington State Transportation Plan 2007–2026 (Washington State Transportation Commission and WSDOT 2006) identifies needs and deficiencies of the state's transportation system, including designated state highways. The plan was the result of a continuous, comprehensive, and coordinated planning and outreach effort with other agencies and the public to identify potential transportation improvements.

3.2 Coordination

FHWA, WSDOT, and the City are lead agencies for this transportation study. Cooperating agencies include the U.S. Army Corps of Engineers, the Federal Transit Administration, King County, and the Port of Seattle.

Ongoing coordination has been conducted as needed with agencies that manage operations or have a stake in particular transportation modes. These include the following agencies:

- City planning, design, and operations staff for multimodal design and operations input
- King County Metro staff for transit service and transit capital planning
- The Port of Seattle and BNSF Railway for freight and rail operations
- Washington State Ferries for vehicle and pedestrian access issues to and from the Seattle Ferry Terminal

In addition, there has been coordination with major stakeholders, including the stadiums, Seattle Center, the freight community, and Union Pacific Railroad (UPRR).

Chapter 4 AFFECTED ENVIRONMENT

This chapter describes the affected environment for transportation systems within the study area. Information is presented regarding transportation facilities, their use, and their performance. The discussion of the affected environment assumes that the existing viaduct would remain in place in its current configuration except for new ramps to and from Alaskan Way S. south of S. King Street and reconfiguration of Alaskan Way S. and S. Atlantic Street as proposed in the S. Holgate Street to S. King Street Viaduct Replacement Project. These conditions are referred to as the 2015 Existing Viaduct. Compared to today's conditions, the 2015 Existing Viaduct includes improved access between SR 99 and the local street system in the south end as a result of new and improved connections provided by the S. Holgate Street to S. King Street Viaduct Replacement Project. The assumptions for 2015 also include population and employment growth for 2015 and funded transportation system improvements that are scheduled to be completed by 2015.

The affected environment describes the context, or setting, of the project. Previous editions of the Transportation Discipline report for the Supplemental Draft EIS (WSDOT et al. 2010) used year 2005 conditions for the affected environment. For the Final EIS, the year 2015 was chosen to reflect the affected environment based on projects recently completed or currently underway. The S. Holgate Street to S. King Street Viaduct Replacement Project affects access to the Alaskan Way Viaduct. The project is funded, under construction, and will be complete by 2015. SR 519 has also been recently modified resulting in new traffic patterns in the south portal area and needs to be captured as part of the affected environment. Based primarily on these two projects, it was determined that 2015 would serve as a better description of the project setting in the Final EIS than 2005 conditions.

The S. Holgate Street to S. King Street Viaduct Replacement Project will be completed before 2015 and is included in the 2015 Existing Viaduct. The primary difference in the transportation network between the facility before the construction of the S. Holgate Street to S. King Street Viaduct Replacement Project and the 2015 Existing Viaduct is that new ramps to southbound SR 99 and from northbound SR 99 will be provided to Alaskan Way S. near S. Dearborn Street. Furthermore, the connection between East Marginal Way S. and First Avenue S. on S. Atlantic Street will be improved by a new grade-separated facility (i.e., an h-shaped overcrossing) that will operate while the rail crossing is blocked by train movements, improving access to the First Avenue S. ramps for traffic traveling on East Marginal Way S. In addition, by 2015, the Mercer East Project will have converted Mercer Street to two-way traffic flow between I-5 and Dexter Avenue N. and will have disconnected Broad Street from Ninth Avenue N. and connected it to Mercer Street at Eighth Avenue N.

Note that while 2015 is listed as the analysis year, in some cases, such as for the safety discussion, data from previous years were all that were available for the analysis. Such exceptions are indicated in the applicable sections.

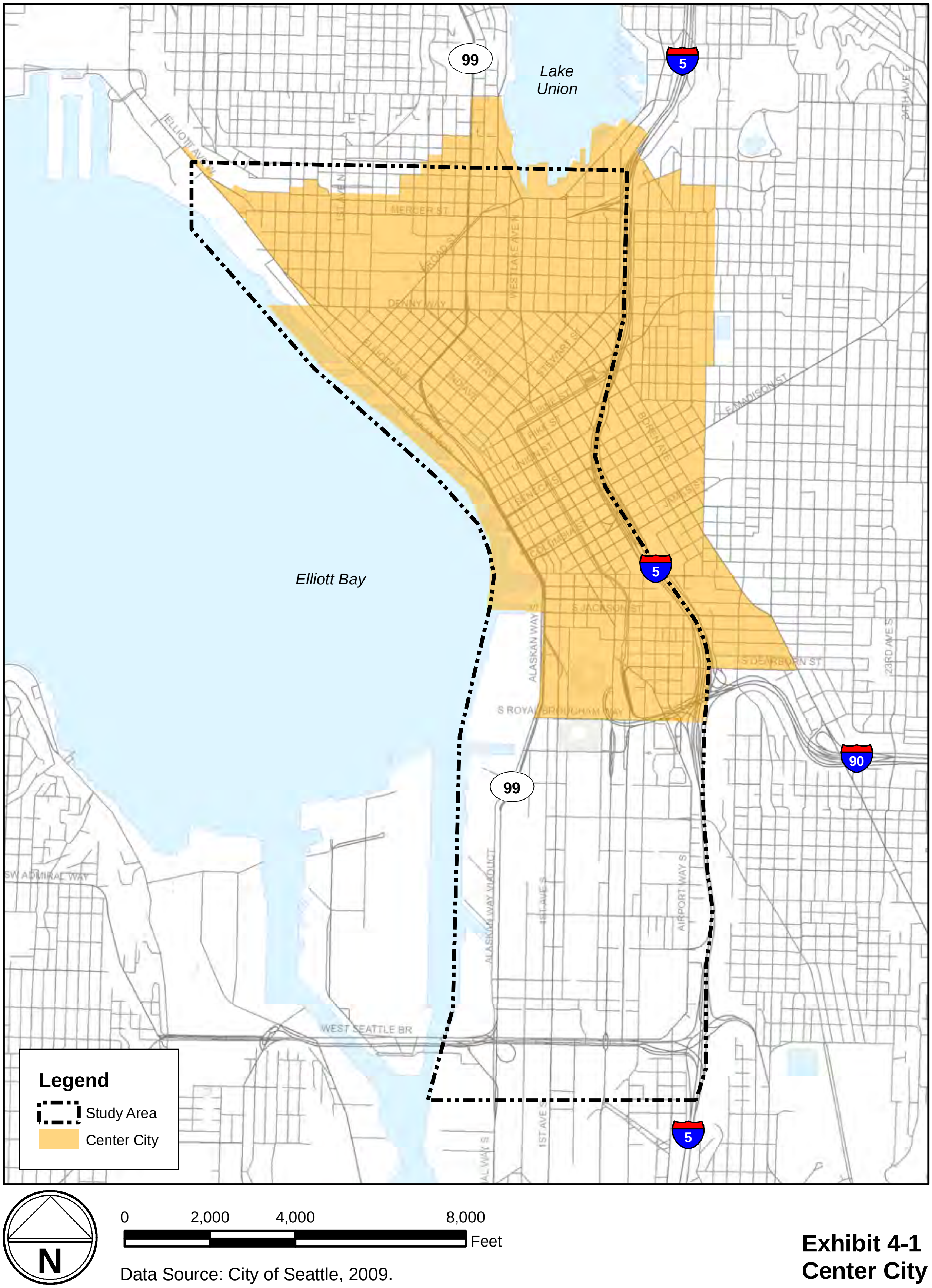
4.1 Regional Context and Travel Patterns

This section analyzes the transportation conditions associated with the SR 99 corridor through downtown Seattle and presents the transportation performance and effects of the three build alternatives under consideration for replacing the Alaskan Way Viaduct: the Bored Tunnel (preferred), the Cut-and-Cover Tunnel, and the Elevated Structure Alternatives. The project limits extend from S. Royal Brougham Way in the south to approximately Aloha Street in the north, with slight variations in project area for each alternative.

The transportation study area, which encompasses the project limits on SR 99, as well as nearby transportation facilities that are closely related to or affected by the SR 99 corridor, is shown in Exhibit 2-1. The primary study area (smaller than the full transportation study area) is roughly bordered by I-5 to the east, Elliott Bay to the west, Aloha Street to the north, and S. Spokane Street to the south. The transportation study area includes a range of multimodal transportation facilities and service types, including limited-access highways, arterial streets, HOV facilities, transit services and facilities, ferry services and facilities, nonmotorized facilities and routes, and important freight corridors. Modeled changes in travel patterns outside the primary study area were reviewed and deemed to be minor in nature.

The study area is located in a dense urban area that contains a major interstate freeway (I-5), two state routes (SR 99 and SR 519), five interchanges on I-5 (including the I-5 and I-90 interchange), arterial streets (primary, minor, and collector), and local streets. I-5 is a major state and regional facility and carries the majority of regional traffic through the study area, as well as considerable local traffic. Seattle's Center City is also a useful area for reference. Center City represents the core of Seattle, in terms of geography and density of jobs and housing. Center City is shown in relation to the study area in Exhibit 4-1.

The study area represents the area for which the transportation performance and effects of the build alternatives were assessed. The changes in traffic volumes and patterns were reviewed for a broader area, although the detailed analysis is limited to areas where there would be notable changes. The most intensive evaluation of transportation performance and impacts was performed on SR 99 itself. Elsewhere in the study area, the assessment focused on capturing the important impacts and primary operational differences associated with the different analysis conditions. On occasion, information beyond the study area boundaries is brought into the discussion to provide context for the data presented.



Data Source: City of Seattle, 2009.

Exhibit 4-1
Center City

4.1.1 State Route 99

SR 99 serves important local and regional transportation functions. Within the project area, it provides access to downtown from many parts of the western neighborhoods of Seattle and provides freight access between the SODO and the Duwamish and Ballard/Interbay industrial areas. It is an important alternate route to I-5, the most heavily used highway in the Pacific Northwest. SR 99 also provides an important link to major league sports stadiums at the south end of downtown and access to I-90 for trips coming from northwest Seattle.

Within the study area, the Alaskan Way Viaduct is classified as an "Other Urban Expressway" and is part of the National Highway System within Washington State. The roadway was designed in the 1940s and was open for traffic in 1953. SR 99 is an at-grade facility as it enters downtown Seattle from both the north and south. However, between approximately S. Dearborn Street and the Battery Street Tunnel, SR 99 is a double-level viaduct facility with two to four lanes available in each direction and no shoulders. Access between SR 99 and the surface street system is provided by several ramps along the length of the corridor, as well as side-street connections to Aurora Avenue that allow right-on and right-off maneuvers in the South Lake Union area. Access to downtown Seattle is provided at Denny Way and Battery Street to and from the north, and at Seneca and Columbia Streets to and from the south. The S. Holgate Street to S. King Street Viaduct Replacement Project will provide ramps to southbound SR 99 and from northbound SR 99 to Alaskan Way S. near S. Dearborn Street.

4.1.2 Other Freeways, Highways, and Expressways

I-5 is a major Urban Interstate freeway that runs the length of the west coast from the Mexican border south of San Diego, California, to the Canadian border north of Bellingham, Washington. I-5 is the most used and most important highway corridor in the region. Within the study area, I-5 runs north-south just east of downtown. The corridor serves a number of roles, including freight transport, commuting, and longer-distance regional trips.

The roadway varies from two to five travel lanes in each direction, with additional collector-distributor lanes providing access to downtown ramps and accommodating merging traffic from I-90. Only two continuous lanes are provided through downtown in each direction, as other lanes are added or dropped to provide access to downtown.

In addition to the I-5 mainline, a reversible set of express lanes provides general-purpose and HOV access to and from downtown and additional capacity for general-purpose through-traffic. This facility operates southbound during the morning commute and northbound at other times.

There are five interchanges on I-5 within the study area. The I-5/I-90 interchange is by far the largest and most complicated of the interchanges, providing access to a number of arterials in south downtown, as well as to the two interstate freeways. A number of entrance and exit points are located between James and Stewart Streets that directly access downtown Seattle. The interchange at Mercer Street provides the main access point to the northern portion of the study area and South Lake Union.

Exhibit 4-2 shows average congestion by location and time of day on the general-purpose lanes of I-5 on weekdays in 2005. The general congestion pattern reflects the typical commute pattern, with higher congestion occurring for those traveling into Seattle during the AM peak period and for those traveling out of Seattle during the PM peak period. The southbound direction additionally experiences restricted movement and minor congestion north of Seattle, which becomes very severe south of Northgate Way and continues into downtown Seattle. In the Center City area, traffic on I-5 experiences restricted movement or congestion throughout most of the day, from 6 a.m. to 7 p.m. in both directions. In the southbound direction, congestion during the AM peak period is not as severe due to the additional capacity provided by the reversible lanes. Without the additional capacity of the reversible lanes in the afternoon, southbound traffic experiences more severe congestion in the PM peak period as compared to the AM peak period.

The northbound direction also experiences severe congestion during the AM peak period. In contrast to the southbound direction, the additional capacity of the reversible lanes in the northbound direction during the PM peak period hour does not prevent the general-purpose lanes from experiencing severe congestion and unstable flow.

Although traffic volumes on I-5 would be expected to be higher in 2015, the overall pattern of congestion would be expected to be similar. Since the facility operates at or near capacity during and between the peak periods, it is anticipated that congestion may spread outward both temporally and spatially to some degree.

4.1.3 Arterial and Local Streets

Nearly all of the streets in the downtown area are designated as either a principal or minor arterial. Principal arterials make up the majority of the central downtown area between Yesler Way and Denny Way. Principal arterials provide major north-south travel ways, with a mixture of minor and collector arterials providing travel opportunities in the east and west directions. In the South Lake Union area, the street classifications are a mix of principal, minor, and collector arterials, with access streets (i.e., non-arterials) filling in the remainder of the grid, particularly east-west streets between Fifth Avenue N. and Fairview Avenue N.

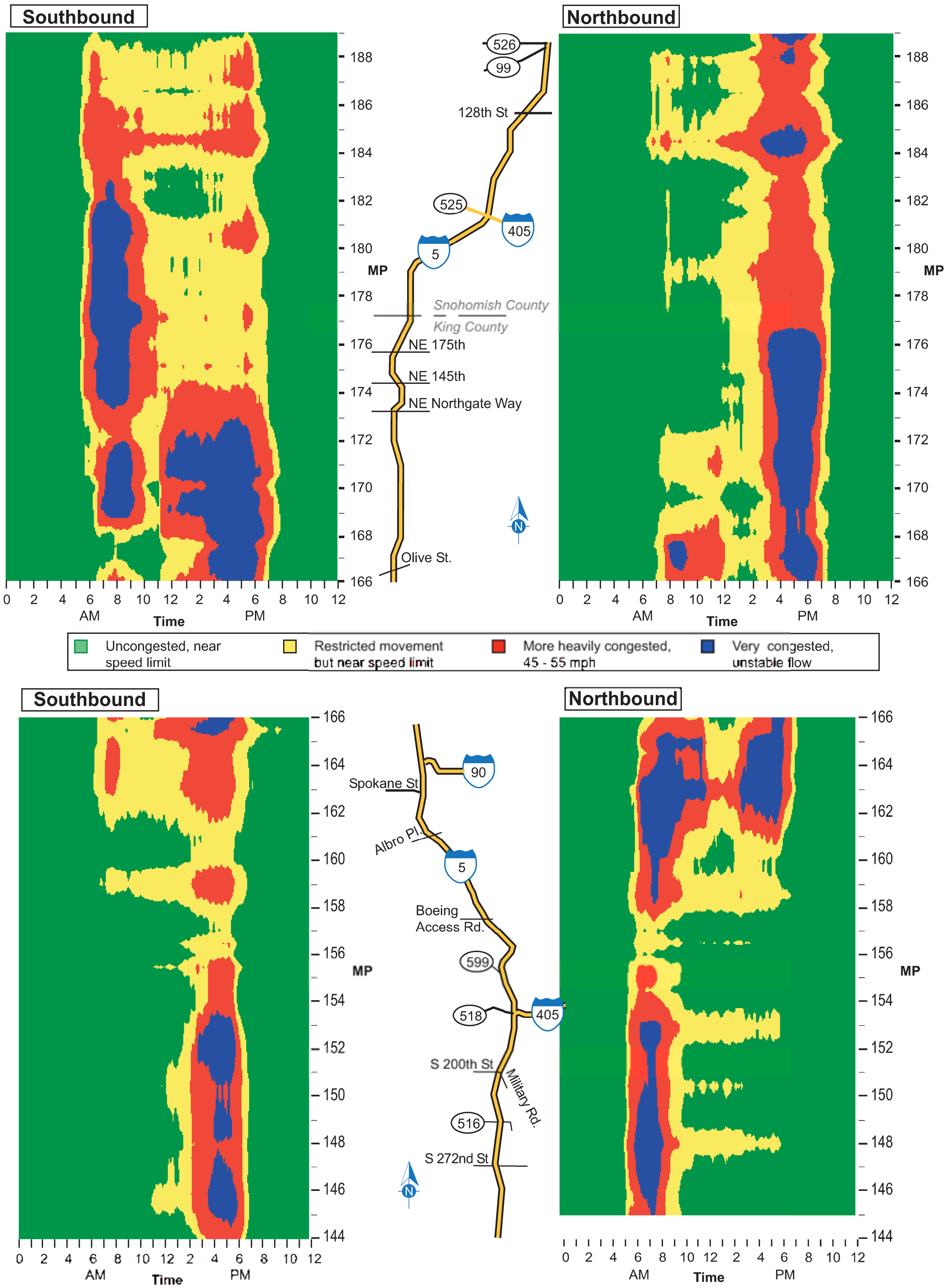


Exhibit 4-2
Average Congestion on I-5

While SR 99 is designated as an "Other Urban Expressway," approximately 44 percent of all users (vehicle and transit) on the viaduct on a daily basis have one trip end in downtown Seattle. Therefore, connections to the downtown street network are of considerable importance.

With construction of the S. Holgate to S. King Street Viaduct Replacement Project, the connection between East Marginal Way S. and First Avenue S. on S. Atlantic Street will include a grade-separated facility (i.e., the h-shaped overcrossing) that will provide additional access across SR 99, which is particularly needed when the rail crossing is blocked by train movements. In addition, by 2015, the Mercer East Project will have converted Mercer Street to two-way traffic flow between I-5 and Dexter Avenue N. and will have disconnected Broad Street from Ninth Avenue N. and connected it to Mercer Street at Eighth Avenue N.

4.1.4 Travel Demand and Traffic Patterns

4.1.4.1 Vehicle Miles of Travel

VMT, derived from the project's travel demand model, provides a measure of vehicle demand on the four-county regional roadway network. VMT is defined as the sum for each roadway segment of the product of number of vehicles traveling over each segment times the length of each segment. The 2015 Existing Viaduct conditions total for regional daily VMT is estimated to be approximately 97,141,400. During the AM peak period, regional VMT is estimated to be 18,003,800, and PM peak period regional VMT is estimated to be 21,210,200. VMT is shown in Exhibit 4-3.

4.1.4.2 Vehicle Hours of Travel

VHT provides an estimate of how long travelers spend on the roadway system. Regional daily VHT for 2015 Existing Viaduct conditions is estimated to be 3,310,000. During the AM peak period, the VHT is estimated to be 746,800, while for the PM peak period, the estimate is 857,400. VHT is shown in Exhibit 4-3.

4.1.4.3 Vehicle Hours of Delay

VHD measures the number of hours of travel on a transportation network that are considered to be operating at less than optimum speeds. VHD is often considered as an indicator of congestion levels. Regional daily VHD for 2015 Existing Viaduct conditions is estimated to be 678,300. Regional VHD for the AM peak period is 253,600, while the PM peak period is estimated to be 271,400. VHD is shown in Exhibit 4-3.

Exhibit 4-3. VMT, VHT, and VHD for Center City and Region

Performance Measure	Vehicle Miles of Travel	Vehicle Hours of Travel	Vehicle Hours of Delay
Seattle's Center City			
AM peak hour	431,900	16,900	5,300
PM peak hour	536,600	23,800	9,100
Daily	2,425,200	87,200	23,000
Four-County Region			
AM peak hour	18,003,800	746,800	253,600
PM peak hour	21,210,200	857,400	271,400
Daily	97,141,400	3,310,100	678,300

4.1.4.4 Person Throughput

Analysts use person-trips to measure the number of people, rather than vehicles, who travel on the transportation system. Increased use of transit or carpools can increase the overall number of people conveyed, even if vehicle traffic does not increase.

Exhibit 4-4 summarizes model-estimated person-trips at three screenline locations for the 2015 Existing Viaduct:

- A south screenline south of S. King Street, representing persons entering and exiting the study area at the south end of downtown
- A central screenline north of Seneca Street, capturing north-south person movement in the center of the study area
- A north screenline located north of Thomas Street, representing persons entering and exiting the study area to the north

Exhibit 4-4. Model-Estimated Person Throughput (Person-Trips)

	2015 Existing Viaduct
South Screenline (South of S. King Street)	
AM peak hour	55,230
PM peak hour	67,850
Daily	787,900
Central Screenline (North of Seneca Street)	
AM peak hour	52,780
PM peak hour	61,970
Daily	728,700
North Screenline (North of Thomas Street)	
AM peak hour	59,560
PM peak hour	69,040
Daily	791,200

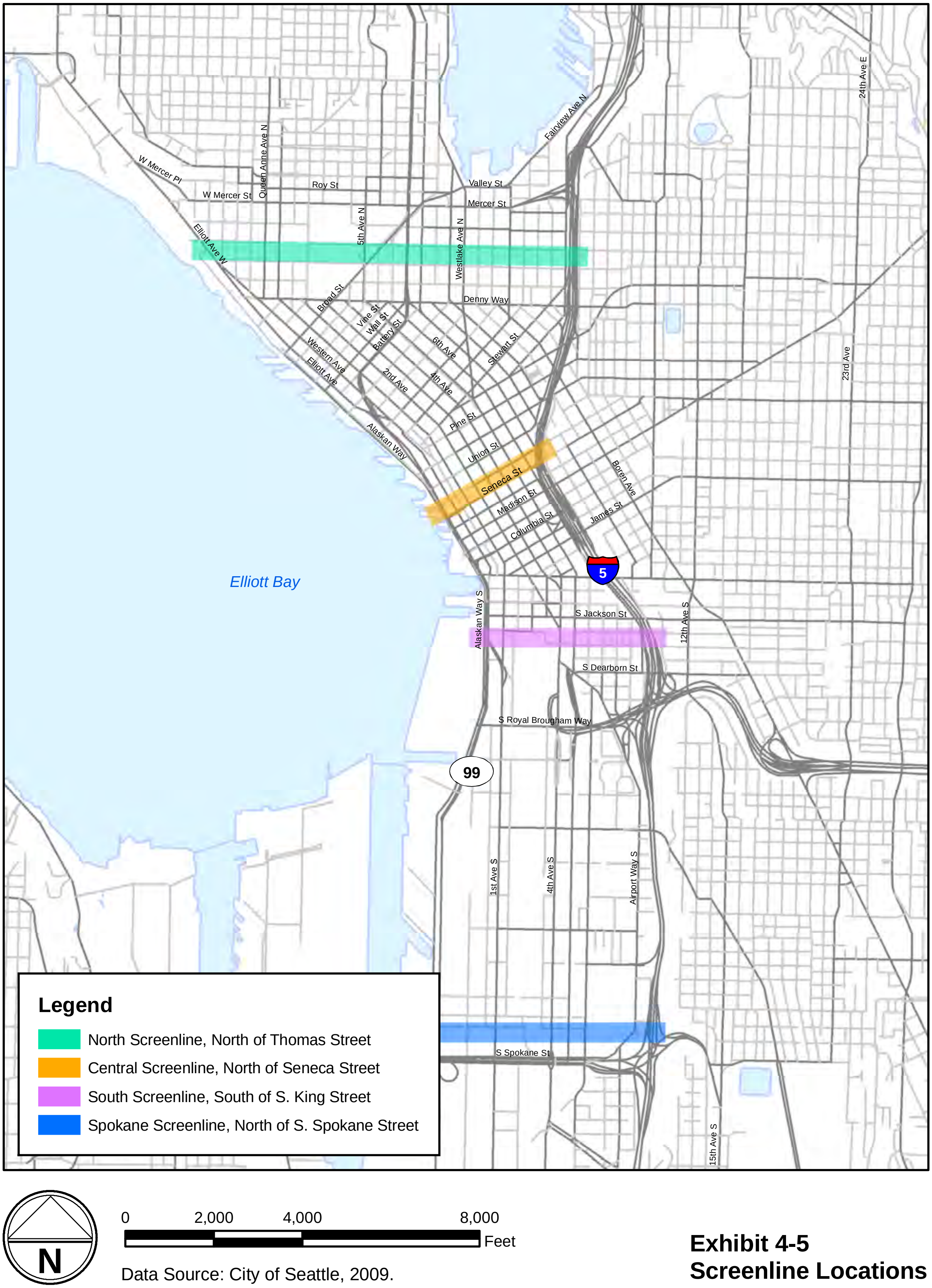
The screenline locations are shown in Exhibit 4-5 (note that person-trips are not estimated at the Spokane screenline). At the south screenline, AM peak hour person-trips are estimated to be over 55,000, while nearly 68,000 person-trips are expected to occur during the PM peak hour. Daily trips over the screenline are estimated to be slightly fewer than 788,000. The central screenline shows slightly lower trips for all time periods, with an expected 53,000 trips during the AM peak hour and nearly 62,000 during the PM peak hour. Daily trips over the central screenline are estimated to approach 729,000. Over the north screenline, an anticipated 60,000 trips are to occur during the AM peak hour, and over 69,000 trips are estimated during the PM peak hour. Total daily trips over the north screenline are expected to exceed 791,000.

4.1.4.5 Vehicle Volumes on Screenlines

After gaining an understanding of person-trips in the study area, it is necessary to estimate vehicle volumes on screenlines in order to gauge the effects such volumes may have on nearby parallel facilities. Traffic volumes were accordingly estimated for the same screenlines described in Section 4.1.4.4, with the addition of a screenline farther to the south just north of S. Spokane Street. This screenline, referred to as the Spokane screenline, represents traffic entering and exiting the study area to and from the south.

The screenline vehicle volumes are presented in Exhibit 4-6. At the Spokane screenline, AM peak hour volumes are estimated to exceed 33,000 vehicles during the AM peak hour, while PM peak hour trips are estimated to number over 37,000 vehicles. The daily volume over this screenline is estimated to approach 469,000 vehicles. AM and PM peak hour volumes over the south screenline are estimated to approach 37,000 vehicles and 43,000 vehicles, respectively. An estimated 535,000 vehicles would pass over the south screenline daily.

At the central screenline, 33,000 vehicles are expected to cross the screenline during the AM peak hour, while nearly 37,000 vehicles are estimated to cross during the PM peak hour. Nearly 475,000 vehicles are anticipated to cross the central screenline daily. The north screenline shows the highest volumes for all time periods, with nearly 40,000 vehicles estimated to cross during the AM peak hour and over 43,000 vehicles during the PM peak hour. Nearly 549,000 vehicles are estimated to cross the north screenline daily.



Data Source: City of Seattle, 2009.

Exhibit 4-5
Screenline Locations

Exhibit 4-6. Model-Estimated Vehicle Volumes at Screenlines

	2015 Existing Viaduct
Spokane Screenline (North of S. Spokane Street)	
AM peak hour	33,280
PM peak hour	37,200
Daily	468,500
South Screenline (South of S. King Street)	
AM peak hour	36,600
PM peak hour	42,650
Daily	535,200
Central Screenline (North of Seneca Street)	
AM peak hour	33,010
PM peak hour	36,980
Daily	474,900
North Screenline (North of Thomas Street)	
AM peak hour	39,680
PM peak hour	43,100
Daily	548,800

4.1.4.6 Vehicle Volumes on Key Facilities and Arterial Screenlines

Exhibit 4-7 depicts the modeled distribution of daily traffic on north-south-oriented highways and streets entering the study area from the north and south, as well as in the central downtown Seattle area for the 2015 Existing Viaduct. I-5 would carry the majority of traffic in the study area, with over half of the traffic in the south (53 percent), central (57 percent), and north (53 percent) regions of the downtown area. SR 99 would carry a quarter of all traffic in the south region in 2015. Daily SR 99 vehicle volume north of the midtown ramps would be 98,500, which represents a 20 percent share of all north-south traffic. The share of traffic on SR 99 would decrease to 16 percent in the north area, as other local streets would carry an increasing share of traffic in this area. With the exception of I-5, SR 99 would carry more traffic than any single facility in the study area.

4.1.4.6.1 Origins and Destinations of Alaskan Way Viaduct Trips

The origins and destinations of trips using the viaduct were estimated from travel demand model assignments. During the morning commute, the highest concentration of Alaskan Way Viaduct trip origins would be in the downtown, Queen Anne, Fremont, Ballard, and West Seattle neighborhoods. There are trips that begin as far south as Pierce County and as far north as Snohomish County that would also use SR 99. These trips would primarily originate from west-side communities (e.g., Burien, Shoreline, and White Center). Destinations would be more concentrated, with most trips accessing work and commercial sites downtown, the Ballard/Fremont/Interbay areas northwest of downtown, and to the south, in the SODO and Duwamish industrial areas. West Seattle, the University of Washington, and Sea-Tac Airport would be other primary destinations during the AM peak hour.

Exhibit 4-7. Model-Estimated Daily Traffic Distributions

	2015 Existing Viaduct
Alaskan Way	
South (south of S. King Street)	26,400
Central (north of Seneca Street)	12,400
North (north of Pine Street)	12,400
North-South Arterials West of I-5 (Except SR 99)	
South (south of S. King Street)	80,400
Central (north of Seneca Street)	112,900
North (north of Thomas Street)	170,300
SR 99 (Alaskan Way Viaduct)	
Spokane (north of S. Spokane Street)	105,400
South (north of Stadium Area ramps)	116,900
Central (south of Denny Way)	70,000
North (south of Dexter Ramp)	95,600
I-5 (Main and Reversible/HOV)	
South (south of I-90)	251,400
Central (north of Seneca Street)	262,300
North (south of SR 520)	318,400

Note: HOV = high-occupancy vehicle

Daily trips along the viaduct were also estimated using travel demand model assignments. Approximately 44 percent of trips (including transit) on SR 99 would be going to or coming from the Seattle CBD. Approximately 23 percent of all users would travel along SR 99 through the study area but would be originating from or destined to nearby locations just north or south of downtown, such as South Lake Union, Uptown, Capitol Hill, or SODO. The remaining trips that would use SR 99 are longer-distance through-trips, such as trips from Ballard to Burien. Exhibit 4-8 lists the modeled percentage of daily trips using SR 99 to travel through Seattle's Center City by end location. Trips originating from or destined to areas near downtown do not include trips with a trip end in downtown since those trips are already counted in the downtown Seattle trip total.

Exhibit 4-8. Model-Estimated Daily Person-Trips Using SR 99 Through Seattle's Center City by Trip End Location

	Downtown Seattle	Areas Near Downtown[1]	Longer-Distance Trips
Automobiles	42%	23%	35%
Automobiles + transit	44%	23%	33%

Note: 1. South Lake Union, Uptown, Capitol Hill, or SODO.

4.1.5 Alaskan Way Viaduct (SR 99) Users

SR 99 travels north-south, passing through downtown Seattle on the Alaskan Way Viaduct. I-5 parallels SR 99 through downtown, and together they are the primary north-south corridors in Seattle. SR 99 connects west-side communities such as West Seattle, Burien, Ballard, and Greenwood with each other and downtown. The following subsections present data that describe users of SR 99 within the study area.

4.1.5.1 Daily Traffic Patterns on SR 99

Exhibit 4-9 shows the daily traffic patterns on SR 99 within the study area for the 2015 Existing Viaduct. Green lines indicate trips that use the viaduct (SR 99 between the stadium area and Battery Street Tunnel), while red lines show trips that use SR 99 (Aurora Avenue), but enter or exit north of the viaduct. Arrows indicate locations where traffic enters or exits the corridor, with each arrow representing a major access and egress movement. Because access in the South Lake Union area is provided by many closely spaced cross streets, these movements are grouped.

At S. Spokane Street, a combined 39,000 vehicles would either enter SR 99 northbound from the West Seattle high bridge or exit the corridor southbound to either the West Seattle high bridge or the low bridge to Harbor Island. Approximately 66,400 trips combined would continue northbound or southbound on SR 99 south of the Spokane Street Viaduct. South of midtown, a total of 20,500 vehicles would exit from or enter to the south at the stadium area ramps, while 32,000 vehicles would exit from or enter to the north on the First Avenue ramps. These would be the first connections in the greater downtown area, as no other connections are provided between S. Spokane Street and the stadium area.

In downtown, 18,400 vehicles would either join southbound SR 99 from the Columbia Street on-ramp or exit northbound via the Seneca Street off-ramp. South of these ramps, the viaduct would carry its highest level of traffic: 116,900 vehicles on a typical weekday.

Exhibit 4-9
Daily SR 99 Traffic Patterns – 2015 Existing Viaduct

The Elliott/Western ramps would also be significant access points to the corridor. About 35,800 vehicles would either enter SR 99 southbound on the Elliott Avenue on-ramp or exit northbound on the Western Avenue off-ramp. These connections provide access to Belltown, Uptown, and points farther north, including Magnolia and the Ballard/Interbay area via 15th Avenue W.

Some 70,000 vehicles would use the Battery Street Tunnel on a typical weekday. They would include the remainder of the Aurora Avenue trips, as well as 18,100 additional trips entering or exiting the corridor from the south in the South Lake Union area. A relatively small number of trips would enter or exit at the Battery Street Tunnel ramps in the Belltown area. About 7,300 vehicles exit southbound or enter northbound at this location at the south portal of the Battery Street Tunnel.

At the north end of the study area (on Aurora Avenue), almost half of trips using SR 99 north of Mercer Street would enter or exit the corridor north of the Battery Street Tunnel. Of the 95,600 daily vehicle trips on Aurora Avenue, 43,700 trips would enter to or exit from the north in the South Lake Union area.

4.1.5.2 Traffic Peaking Characteristics

The following subsections present data that describe the use of SR 99 within the study area; the descriptions are based on existing data from 2009 because data for the 2015 Existing Viaduct are not available. However, the general patterns in congestion and peaking characteristics of traffic volume are not expected to be significantly different in 2015 because these trends have been similar for some time. The differences most likely to occur by 2015 include potential spreading of the peak periods and perhaps a moderately higher volume between the peaks; nonetheless, the overall patterns would remain intact.

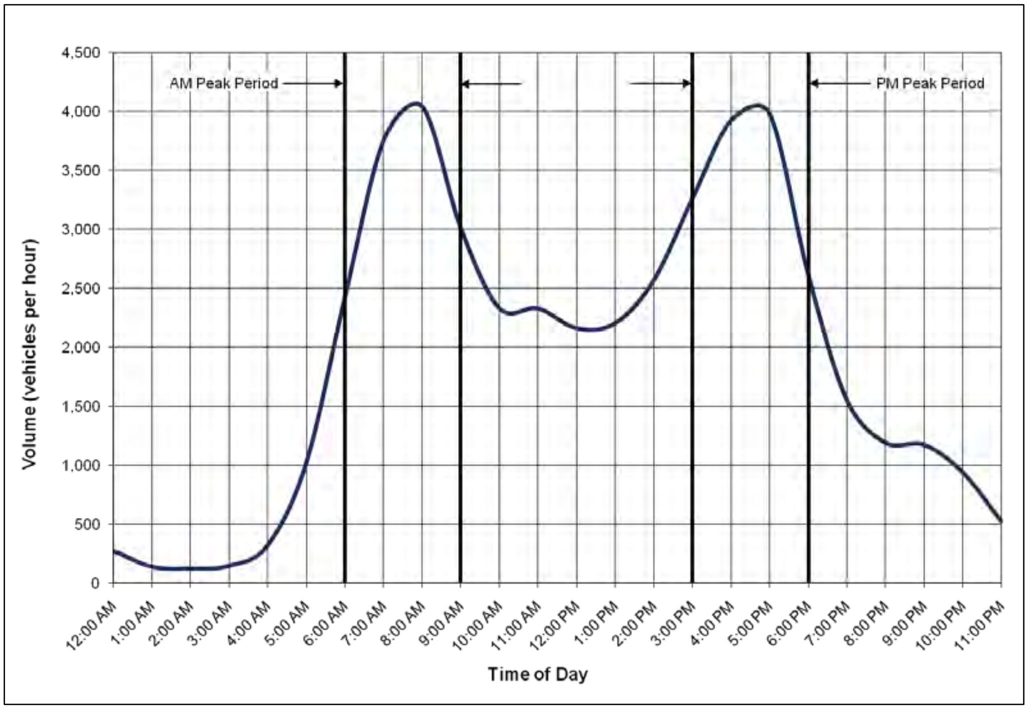
4.1.5.2.1 Weekday Traffic Peaking Characteristics

The current 24-hour volume distribution for weekday SR 99 traffic exhibits sharp peaking characteristics. As shown in Exhibits 4-10 and 4-11, traffic volumes in the SR 99 corridor are highest during AM and PM peak commuting hours, at nearly twice the midday volumes in both the northbound and southbound directions.

4.1.5.2.2 Weekend Traffic Peaking Characteristics

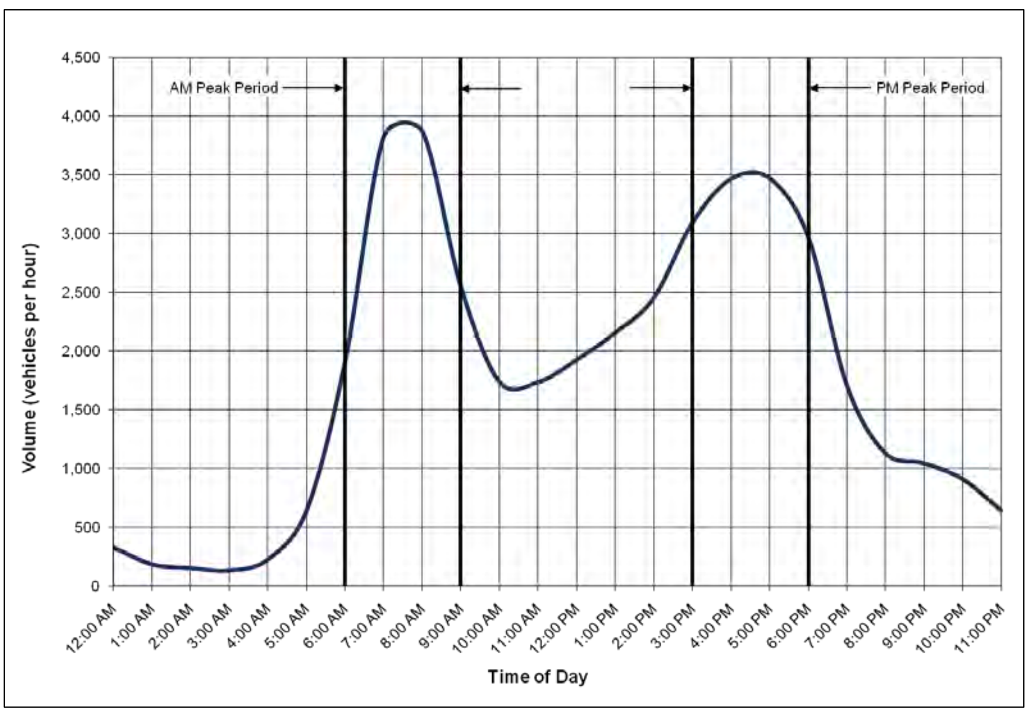
As shown in Exhibits 4-12 and 4-13, weekend traffic patterns differ from weekday patterns in that there are no sharp peaks in hourly distribution, instead there is one relatively flat peak that runs from midmorning to early evening. The peak volumes on the weekends are slightly higher than the midday peak volumes during the week.

Exhibit 4-10. Peaking Characteristics of Northbound SR 99 Weekday Traffic – 2009



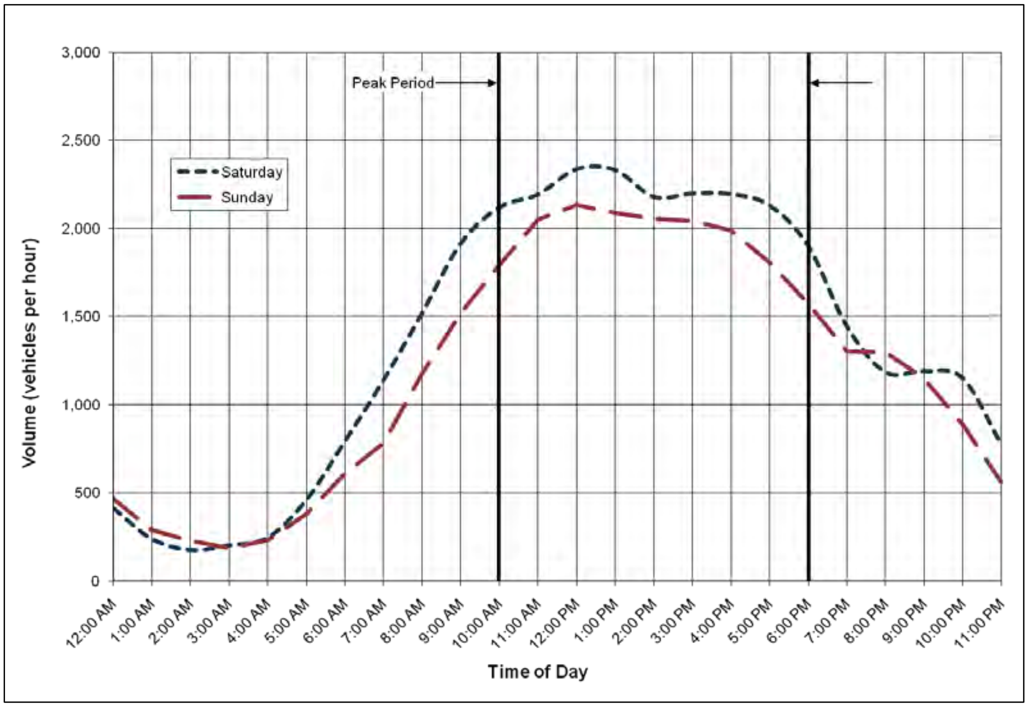
Note: Between midtown and Elliott/Western ramps.

Exhibit 4-11. Peaking Characteristics of Southbound SR 99 Weekday Traffic – 2009



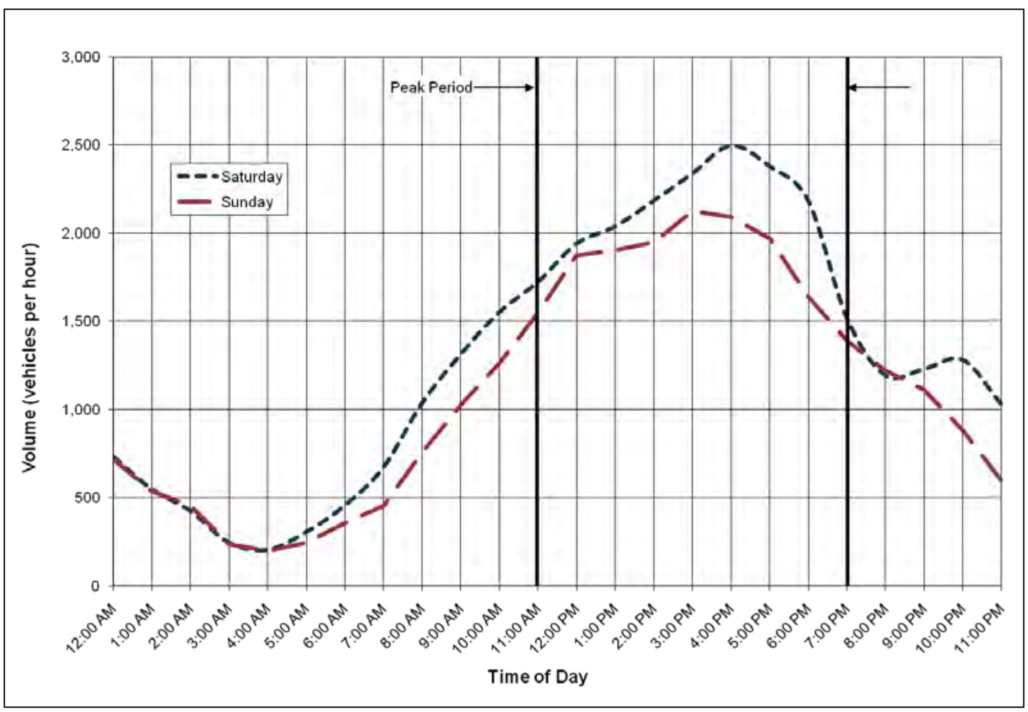
Note: Between midtown and Elliott/Western ramps.

Exhibit 4-12. Peaking Characteristics of Northbound SR 99 Weekend Traffic – 2009



Note: Between midtown and Elliott/Western ramps.

Exhibit 4-13. Peaking Characteristics of Southbound SR 99 Weekend Traffic – 2009



Note: Between midtown and Elliott/Western ramps.

4.2 Traffic Operations on SR 99

4.2.1 Alaskan Way Viaduct Mainline and Ramp Volumes

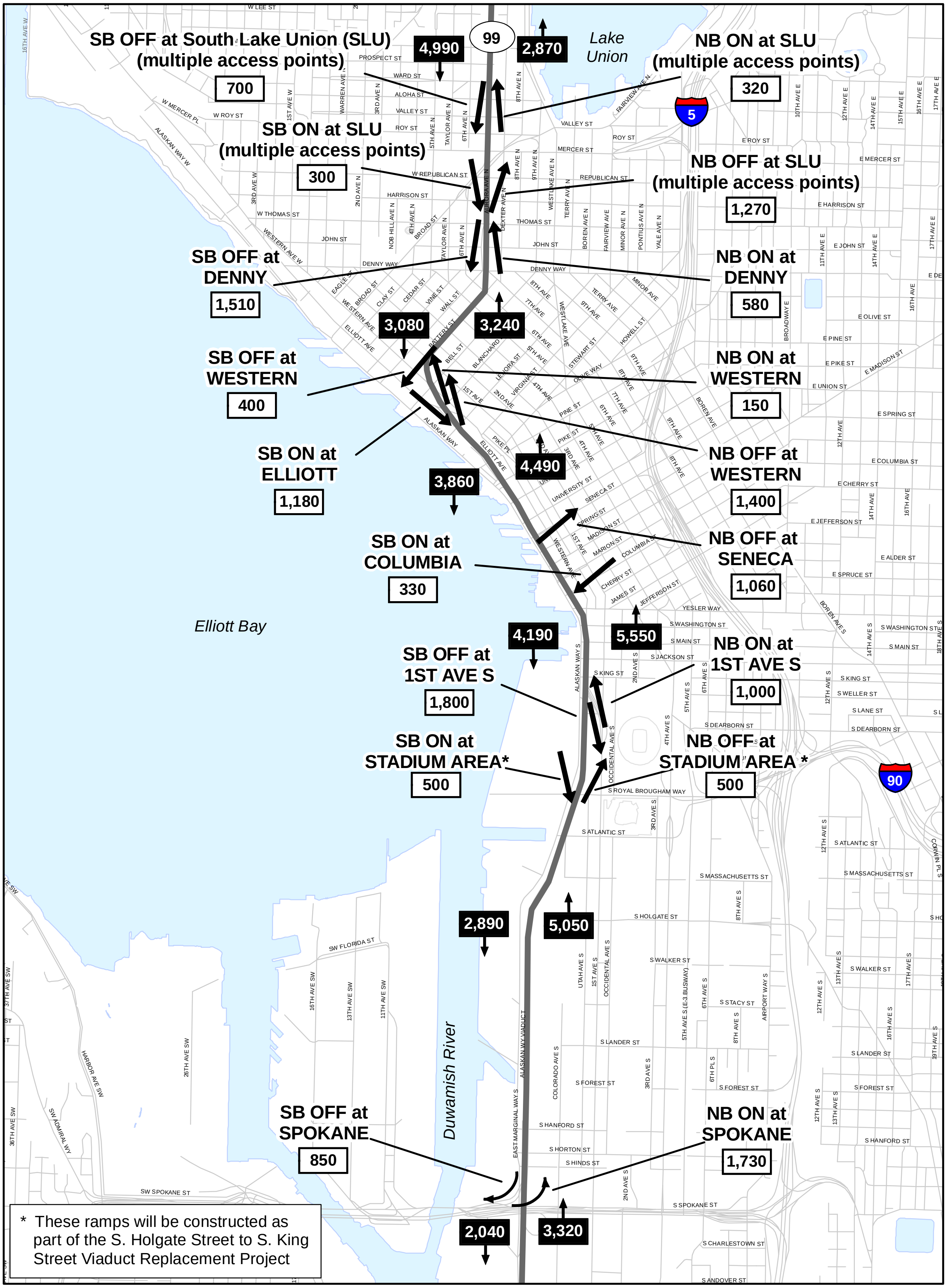
This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the SR 99 mainline and ramps under the 2015 Existing Viaduct.

4.2.1.1 AM Peak Hour

As with most urban transportation facilities, traffic volumes on the SR 99 corridor are generally the most pronounced during weekday commuting hours. In the morning, peak hour traffic volumes on SR 99 are fairly directional, with heavier volumes entering the central downtown area from all directions. AM peak hour mainline ramp volumes forecasted for the 2015 Existing Viaduct are shown in Exhibit 4-14. At S. Spokane Street, volumes entering northbound SR 99 from West Seattle (1,730 vehicles) are more than double those exiting southbound SR 99 to West Seattle (850 vehicles). South of downtown and the stadium area, mainline SR 99 volumes are considerably higher in the northbound direction (5,050 vehicles) than in the southbound direction (2,890 vehicles).

The First Avenue S. ramps show some directional difference, with 1,800 vehicles exiting southbound SR 99 in the morning but only 1,000 vehicles entering northbound. The downtown ramps providing access to and from the south show more vehicles exiting northbound SR 99 at Seneca Street (1,060 vehicles) than entering southbound at Columbia Street (330 vehicles). The volumes on the Seneca and Columbia ramps are projected to be generally lower than under existing conditions because of the new ramps to Alaskan Way S., which would serve a similar function.

The Elliott/Western ramps to and from the south do not show the same level of directionality, with 1,180 vehicles entering southbound SR 99 and 1,400 vehicles exiting northbound SR 99. The ramps at the south end of the Battery Street Tunnel that provide access to and from the north show directionality, with 400 vehicles exiting southbound SR 99 and only 150 vehicles entering northbound SR 99. In the Battery Street Tunnel, the northbound volume (3,240 vehicles) is higher than the volume of southbound vehicles (3,080 vehicles). Southbound SR 99 off-ramp volumes at Denny Way (1,510 vehicles) exceed those on the northbound on-ramp (580 vehicles). At the north end of the study area, AM peak hour mainline volumes are projected to be higher in the southbound direction (4,990 vehicles) than in the northbound direction (2,870 vehicles), as more vehicles are entering the South Lake Union and downtown areas.



N

0 2,500
Feet

XXX Ramp Volumes
XXX SR 99 Mainline Volumes

Exhibit 4-14
AM Peak Hour Mainline and Ramp Volumes - 2015 Existing Viaduct

4.2.1.2 PM Peak Hour

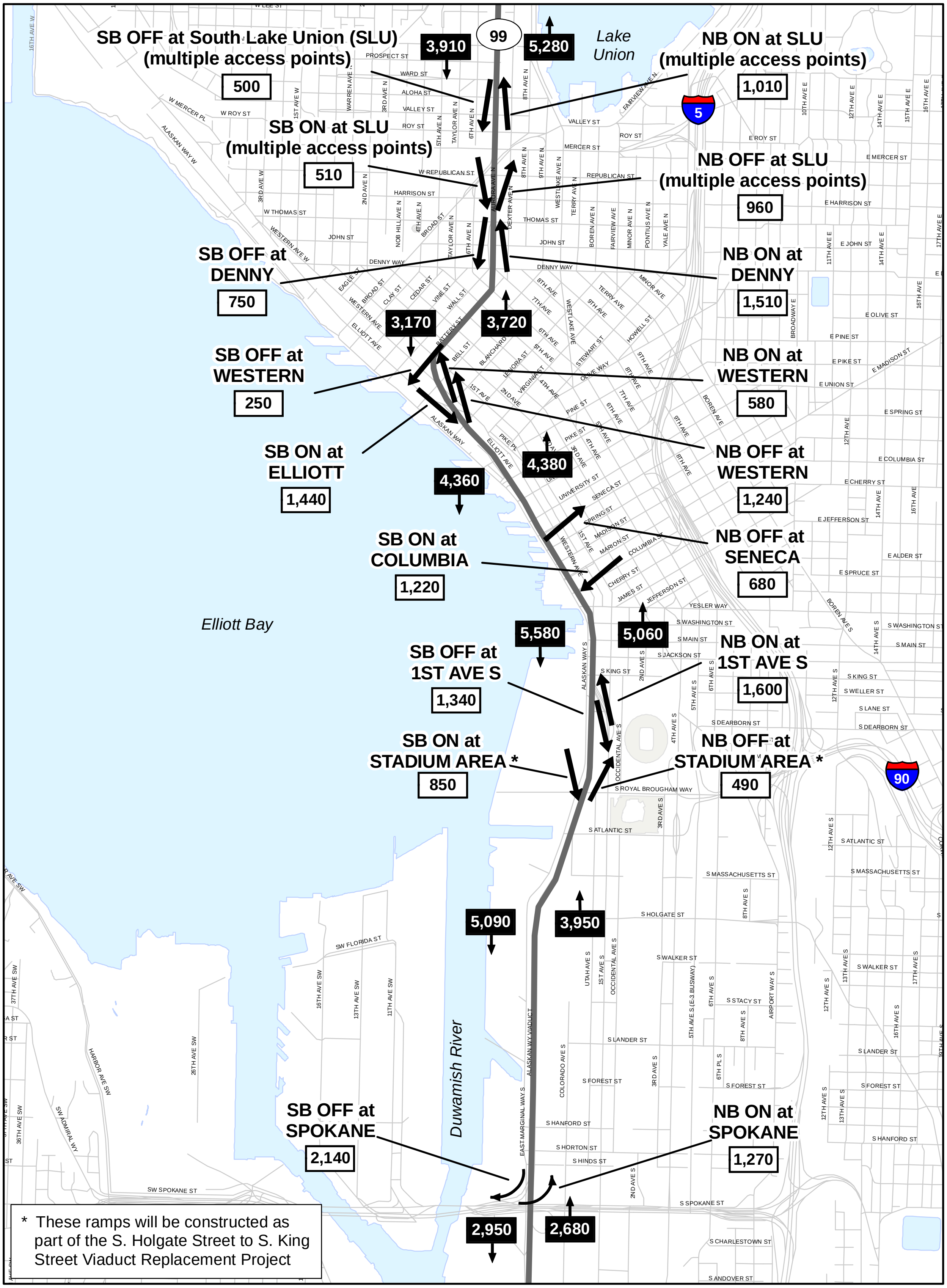
Similar to the AM peak, the PM peak hour traffic volumes along SR 99 are directional (though generally not as pronounced as AM peak volumes), with heavier volumes leaving the central downtown. PM peak hour mainline ramp volumes forecasted for the 2015 Existing Viaduct are shown in Exhibit 4-15.

At S. Spokane Street, volumes exiting southbound to West Seattle (2,140 vehicles) are higher than those entering northbound from West Seattle (1,270 vehicles). South of downtown and the stadium area, mainline volumes are noticeably higher in the southbound direction (5,090 vehicles) than in the northbound direction (3,950 vehicles). The First Avenue S. ramps show different directionality, with 1,600 vehicles entering northbound SR 99 but only 1,340 vehicles exiting southbound. The downtown ramps to and from the south show more vehicles entering southbound SR 99 at Columbia Street (1,220 vehicles) than exiting northbound at Seneca Street (680 vehicles). As in the AM peak hour, the volumes on the Seneca/Columbia Street ramps are lower than under existing conditions because of the new ramps to Alaskan Way S., which serve a similar function.

The Elliott/Western ramps to and from the south show little directional difference, with 1,440 vehicles entering southbound and 1,240 vehicles exiting northbound. The ramps at the south end of the Battery Street Tunnel that provide access to and from the north show directionality, with 580 vehicles entering northbound but only 250 vehicles exiting southbound. In the Battery Street Tunnel, the volume of northbound vehicles (3,720 vehicles) again exceeds the volume of southbound vehicles (3,170 vehicles). Northbound on-ramp volumes at Denny Way (1,510 vehicles) exceed those of the southbound off-ramp (750 vehicles). At the north end of the study area, PM peak hour mainline volumes are higher in the northbound direction (5,280 vehicles) than in the southbound direction (3,910 vehicles), as more vehicles are leaving the downtown area than are entering.

4.2.1.3 Daily

Daily mainline and ramp volumes are shown in Exhibit 4-16. Similar to existing conditions, projected daily traffic volumes along SR 99 for the 2015 Existing Viaduct are generally balanced by direction, with similar volumes leaving and entering the central downtown area. At S. Spokane Street, volumes exiting southbound to West Seattle (19,800 vehicles) are similar to those entering northbound from West Seattle (19,200 vehicles). South of downtown and the stadium area, mainline volumes are generally balanced by direction. The new ramps at Alaskan Way S. are somewhat unbalanced, with more vehicles entering



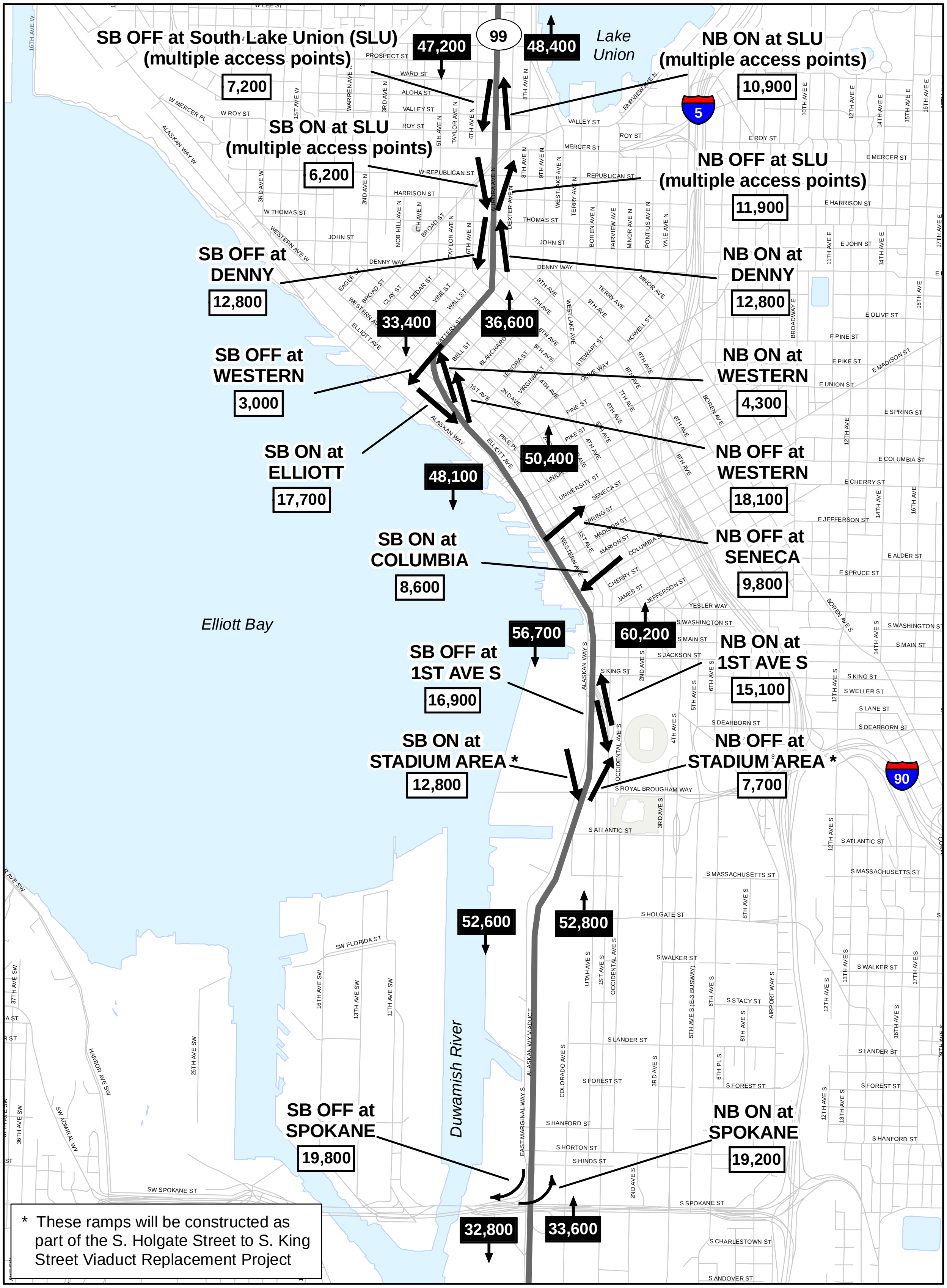
N

0 2,500 Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 4-15
PM Peak Hour Mainline and Ramp Volumes - 2015 Existing Viaduct



N

0 2,500

Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 4-16
Daily Mainline and Ramp Volumes - 2015 Existing Viaduct

southbound (12,800 vehicles) than exiting northbound (7,700 vehicles). The volumes on the First Avenue S. ramps are somewhat balanced, with 15,100 vehicles entering northbound and 16,900 vehicles exiting southbound.

The downtown ramps providing access to and from the south are also relatively balanced, with 8,600 vehicles entering southbound at Columbia Street and 9,800 vehicles exiting northbound at Seneca Street. As in the AM and PM peak hours, the volumes on the ramps at Seneca and Columbia Streets are lower than existing conditions because of the new ramps at Alaskan Way S., which serve a similar function.

Traffic volumes at the Elliott/Western ramps to and from the south are relatively balanced, with 17,700 vehicles entering southbound and 18,100 vehicles exiting northbound. Similar to existing conditions, the ramps at the south end of the Battery Street Tunnel providing access to and from the north are not as balanced as other ramps in the study area on a daily basis, with 4,300 vehicles entering northbound but only 3,000 vehicles exiting southbound. In the Battery Street Tunnel, the volume of northbound vehicles (36,600 vehicles) is higher than the volume of southbound vehicles (33,400 vehicles). At the north end of the study area, about 12,800 northbound vehicles enter SR 99 at Denny Way, with 10,900 entering at other South Lake Union access points. Similarly, the majority of southbound vehicles leaving SR 99 exit at Denny Way (12,800 vehicles), with a little more than half that many (7,200 vehicles) exiting at the multiple access points in South Lake Union.

4.2.2 SR 99 Mainline Level of Service

Mainline traffic conditions and ramp interactions for the SR 99 corridor in terms of AM and PM peak hour volumes, travel speeds, and LOS are presented in this section for key mainline segments and related on- and off-ramps.

For limited-access facilities such as SR 99, the LOS ranges published in the HCM are measured by traffic density and scaled to reflect conditions where free-flow (uncongested) speeds are 55 miles per hour (mph) or higher. Because free-flow (and posted) travel speeds on SR 99 are generally slower than 55 mph, vehicles tend to travel closer together, resulting in higher traffic densities and poorer LOS when measured against the most-applicable published standards. The LOS results reported for SR 99 segments are therefore likely to overstate the level of congestion on SR 99 to a modest degree.

Mainline traffic performance was modeled using VISSIM simulation software. The 2015 Existing Viaduct AM and PM peak hour LOS estimates for mainline segments were calculated based on simulation results for the SR 99 mainline and are presented in Exhibits 4-17 and 4-18.

Exhibit 4-17. Peak Hour Northbound SR 99 Segment Level of Service – 2015 Existing Viaduct

Northbound	2015 Existing Viaduct	
	AM Peak Hour	PM Peak Hour
South Corridor		
S. Spokane on-ramp to stadium off-ramp	F	D
Stadium off-ramp to First Avenue S. on-ramp	F	E
Midtown		
First Avenue S. on-ramp to Seneca off-ramp	F	F
Seneca off-ramp to Western off-ramp	F	F
Battery Street Tunnel	E	F
North Corridor		
North of Battery Street Tunnel	C	F

Exhibit 4-18. Peak Hour Southbound SR 99 Segment Level of Service – 2015 Existing Viaduct

Southbound	2015 Existing Viaduct	
	AM Peak Hour	PM Peak Hour
South Corridor		
Stadium on-ramp to S. Spokane off-ramp	C	F
First Avenue S. off-ramp to stadium on-ramp	B	E
Midtown		
Columbia on-ramp to First Avenue S. off-ramp	F	F
Elliott on-ramp to Columbia on-ramp	E	D
Battery Street Tunnel	E	F
North Corridor		
North of Battery Street Tunnel	F	E

The majority of the evaluated corridor is expected to operate at LOS E or LOS F conditions for the 2015 Existing Viaduct during the AM and PM peak hours, with some exceptions at the north and south ends of the corridor.

The high levels of congestion identified for the 2015 Existing Viaduct are primarily due to merging and weaving friction associated with on-ramp and off-ramp areas within the SR 99 study segment, as well as geometric constraints such as narrow lanes and limited sight distance. Current traffic flow conditions in the downtown area show similarly high levels of congestion during peak commute periods. Key friction areas related to northbound ramp merging and weaving include the on-ramp from First Avenue S. in the south end, the

Seneca Street off-ramp in midtown, and the off-ramp to Western Avenue. The northbound on-ramp from Denny Way also causes some congestion north of the Battery Street Tunnel.

For the southbound direction, queues on the off-ramp to Denny Way would spill back to the SR 99 mainline, while downstream friction from the Elliott Avenue on-ramp, left-side Columbia Street on-ramp, and left-side off-ramp to First Avenue S. also create pockets of congestion that would affect peak period mainline flow. These merging and weaving areas are expected to collectively affect SR 99 corridor operations and are reflected in the LOS estimates shown in Exhibits 4-17 and 4-18.

4.2.3 SR 99 Mainline Speeds

The 2015 Existing Viaduct AM and PM peak hour segment speed results are shown in Exhibits 4-19 and 4-20. These may be compared with the posted speed limits to gauge the level of delay experienced on the mainline during the AM and PM peak hours. The posted speed on the northbound mainline is 50 mph between S. Spokane Street and Virginia Street. Between Virginia Street and Bell Street, the posted speed drops to 45 mph. North of Bell Street, the posted speed drops again to 40 mph and remains 40 mph to the north end of the project area. The southbound posted speed limit is 40 mph from the north end of the project area to Bell Street and 45 mph from Bell Street to Virginia Street, where it increases to 50 mph.

Exhibit 4-19. Peak Hour Northbound SR 99 Segment Speeds – 2015 Existing Viaduct

Northbound	Posted Speed (miles per hour)	2015 Existing Viaduct Speed (miles per hour)	
		AM Peak Hour	PM Peak Hour
South Corridor			
S. Spokane on to stadium off-ramp	50	37	46
Stadium off-ramp to First Avenue S. on-ramp	50	27	35
Midtown			
First Avenue S. on-ramp to Seneca off-ramp	50	22	21
Seneca off-ramp to Western off-ramp	50	17	14
Battery Street Tunnel	40	33	33
North Corridor			
North of Battery Street Tunnel	40	35	33

Exhibit 4-20. Peak Hour Southbound SR 99 Segment Speeds – 2015 Existing Viaduct

Southbound	Posted Speed (miles per hour)	2015 Existing Viaduct Speed (miles per hour)	
		AM Peak Hour	PM Peak Hour
South Corridor			
Stadium on-ramp to S. Spokane off-ramp	50	48	32
First Avenue S. off-ramp to stadium on-ramp	50	49	42
Midtown			
Columbia on to First Avenue S. off-ramp	50	24	31
Elliott on-ramp to Columbia on-ramp	50	36	43
Battery Street Tunnel	40	33	33
North Corridor			
North of Battery Street Tunnel	40	25	33

The 2015 Existing Viaduct estimated speeds on SR 99 in the AM peak hour range from 24 to 49 mph in the southbound direction and 17 to 37 mph in the northbound direction. In the PM peak hour, speeds range from 31 to 43 mph in the southbound direction and 14 to 46 mph in the northbound direction. The segments with the slowest speeds generally correspond to the locations with lower LOS, i.e., the Battery Street Tunnel and midtown sections.

4.3 Traffic Operations at Key Arterial Intersections

Traffic operations at signalized intersections in the study area were assessed to determine intersection LOS and average vehicle delay. The intersection analysis results are presented for three geographic areas:

- South area
- Central area
- North area

Intersections included in the tables below represent those intersections that meet one or more of the following criteria:

- Intersection was evaluated in the 2004 Draft EIS, 2006 Supplemental Draft EIS, or 2010 Supplemental Draft EIS.
- Intersection operates at LOS E or worse in either peak period.
- Intersection is new for 2015 Existing Viaduct or the Bored Tunnel Alternative.

4.3.1 South Area

Exhibit 4-21 presents traffic operations for intersections in the south area. The S. Holgate Street to S. King Street Viaduct Replacement Project improvements to SR 99 will be in place by 2015 and are considered part of the 2015 Existing Viaduct. That project includes revisions to the street system west of First Avenue S. near S. Atlantic Street and S. Royal Brougham Way. Additionally, new ramp connections to SR 99 will be provided to Alaskan Way S. south of S. King Street. These ramps will provide an entrance to southbound SR 99 and an exit from northbound SR 99, complementing the existing Columbia and Seneca ramps and providing new access into the central waterfront, Pioneer Square, and stadium areas. While these new ramps are expected to draw additional traffic onto Alaskan Way S., intersections on Alaskan Way S. are generally expected to operate at LOS D or better conditions in the south area with a few exceptions. One exception is the new intersection at Alaskan Way S./Alaskan Way S. ramps/ferry holding. This intersection is expected to operate at LOS F and LOS E during the AM and PM peak hours, respectively, although this is largely a result of the operational approach of holding ferry traffic for a period of time and releasing it in platoons and is not reflective of congestion or over-capacity conditions. Traffic on Alaskan Way S. would not experience particularly long delays at this location.

The h-shaped overcrossing will be used when the tail track crossing S. Atlantic Street is blocked by trains. When the tail track is clear, traffic will travel along S. Atlantic Street between the intersections of East Marginal Way S./Terminal 46 and Colorado Avenue S. It was estimated that the tail track is blocked on average with three 10-minute blockages per hour, or approximately 50 percent of the day. Therefore, the h-shaped overcrossing will also be used as a bypass about half of the day. The intersection of East Marginal Way S./Terminal 46 at S. Atlantic Street is projected to operate at LOS F and LOS E during the AM and PM peak hours. The intersection of Colorado Avenue S. at S. Atlantic Street is projected to operate at LOS E during the AM peak hour. Operations at these two intersections reflects the need for a relatively long cycle length to accommodate all movements associated with the h-shaped overcrossing and disruption caused by changing between timing plans when the overcrossing cycles in or out of use. In addition, the signal system for the intersection of East Marginal Way S./Terminal 46 at S. Atlantic Street must also provide for movements at the adjacent Colorado Avenue S./S. Atlantic Street intersection, further adding to potential delays in the general area.

The high-volume intersection of First Avenue S. at S. Atlantic Street is expected to operate at LOS E conditions for the PM peak hour. During the PM peak hour, congestion levels are affected by heavy northbound through-movements and southbound left-turns, which require considerable portions of the available signal cycle lengths to accommodate.

Exhibit 4-21. AM and PM Peak Hour Detailed Traffic Operations, South – 2015 Existing Viaduct

Street	Cross Street	AM Peak Hour LOS	AM Peak Hour Avg. Vehicle Delay (seconds)	PM Peak Hour LOS	PM Peak Hour Avg. Vehicle Delay (seconds)
Alaskan Way	Yesler Way	C	30	C	31
Alaskan Way S.	S. Main Street	B	19	B	11
Alaskan Way S.	S. Jackson Street	A	5	A	5
Alaskan Way S.	S. King Street	A	6	B	15
Alaskan Way S.	Ferry holding	F	103	E	56
East Frontage Road	S. Royal Brougham Way/SR 99 ramps	C	31	B	17
East Frontage Road	S. Atlantic Street	B	16	B	10
East Marginal Way S.	h-shaped overcrossing	B	11	B	14
East Marginal Way S./Terminal 46	S. Atlantic Street	F	102	E	63
East Marginal Way S.	S. Hanford Street	D	37	C	31
Colorado Avenue	S. Atlantic Street	E	68	C	28
First Avenue	Yesler Way	C	23	E	57
First Avenue S.	S. Main Street	A	6	A	9
First Avenue S.	S. Jackson Street	B	12	B	12
First Avenue S	S. King Street	B	13	D	37
First Avenue S.	S. Royal Brougham Way	D	35	D	52
First Avenue S.	S. Atlantic Street	D	47	E	58
First Avenue S.	S. Holgate Street	D	41	C	29
First Avenue S.	S. Lander Street	B	19	C	31
Second Avenue.	Yesler Way	B	16	B	16
Second Avenue S.	S. Main Street	B	18	C	23
Second Avenue S.	S. Jackson Street	C	33	D	53
Fourth Avenue S.	S. Main Street	A	7	A	8
Fourth Avenue S.	S. Jackson Street	A	28	C	26
Fourth Avenue S.	Airport Way S.	C	34	C	33
Fourth Avenue S.	S. Royal Brougham	B	17	E	56
Fourth Avenue S.	S. Holgate Street	C	21	D	40
Fourth Avenue S.	S. Lander Street	C	23	C	22

Note: LOS = level of service

The heavily traveled intersection of S. Royal Brougham Way at Fourth Avenue S. is expected to continue to operate at LOS E during the PM peak hour, as it does today.

In Pioneer Square, the intersection of First Avenue S. at Yesler Way is expected to operate at LOS E during the PM peak hour. Delays at this location are primarily due to increased traffic volumes on First Avenue S. compared to pre-2015 Existing Viaduct (no S. Holgate Street to S. King Street Viaduct Replacement Project) conditions coupled with the availability of only one travel lane in each direction during the afternoon.

4.3.2 Central Area

Exhibit 4-22 shows AM and PM peak hour signalized intersection LOS and delay for selected signalized intersections in the waterfront, downtown, and Belltown areas.

Exhibit 4-22. AM and PM Peak Hour Detailed Traffic Operations, Central – 2015 Existing Viaduct

		AM Peak Hour		PM Peak Hour	
Street	Cross Street	LOS	Avg. Vehicle Delay (seconds)	LOS	Avg. Vehicle Delay (seconds)
Alaskan Way	Madison Street	A	10	B	15
Alaskan Way	Marion Street	C	25	C	26
Alaskan Way	Columbia Street	A	7	B	15
Elliott Avenue	Broad Street	C	28	D	41
Elliott Avenue	Wall Street	B	16	C	32
Elliott Avenue	Bell Street	A	5	A	7
Western Avenue	Broad Street	B	14	B	13
Western Avenue	Wall Street	B	17	C	31
Western Avenue	Battery Street/SR 99 off-ramp	B	16	A	10
Western Avenue	Spring Street	A	8	B	12
Western Avenue	Madison Street	B	17	C	27
Western Avenue	Marion Street	C	21	B	14
First Avenue	Seneca Street	C	24	C	23
First Avenue	Spring Street	A	7	B	12
First Avenue	Madison Street	A	8	B	13
First Avenue	Marion Street	B	13	B	11
First Avenue	Columbia Street	B	14	F	146
Second Avenue	Wall Street	B	15	B	15
Second Avenue	Battery Street	A	5	A	5
Second Avenue	Bell Street	A	5	B	14
Second Avenue	Pine Street	A	10	B	16
Second Avenue	Pike Street	A	10	B	12
Second Avenue	Union Street	B	11	B	17
Second Avenue	University Street	A	10	B	17
Second Avenue	Seneca Street	C	24	C	28

Exhibit 4-22. AM and PM Peak Hour Detailed Traffic Operations, Central – 2015 Existing Viaduct (continued)

Street	Cross Street	AM Peak Hour LOS	AM Peak Hour Avg. Vehicle Delay (seconds)	PM Peak Hour LOS	PM Peak Hour Avg. Vehicle Delay (seconds)
Second Avenue	Spring Street	B	12	B	13
Second Avenue	Madison Street	B	19	B	16
Second Avenue	Marion Street	D	43	D	36
Second Avenue	Columbia Street	B	13	C	21
Second Avenue	Cherry Street	A	6	B	10
Fourth Avenue	Wall Street	A	6	A	8
Fourth Avenue	Battery Street	A	10	B	18
Fourth Avenue	Bell Street	A	8	A	10
Fourth Avenue	Blanchard Street	A	8	A	8
Fourth Avenue	Pine Street	C	21	C	22
Fourth Avenue	Pike Street	B	19	D	42
Fourth Avenue	Union Street	B	12	B	13
Fourth Avenue	University Street	A	10	C	25
Fourth Avenue	Seneca Street	B	12	D	46
Fourth Avenue	Spring Street	B	19	B	18
Fourth Avenue	Madison Street	D	37	C	28
Fourth Avenue	Marion Street	C	25	B	12
Fourth Avenue	Columbia Street	D	46	D	46
Fourth Avenue	Cherry Street	A	9	A	9

Note: LOS = level of service

With the 2015 Existing Viaduct, one intersection during the PM peak hour is forecasted to operate at LOS E or F conditions, while all other intersections studied are expected to operate at LOS D or better during the AM and PM peak hours. However, during the AM peak hour the intersection of First Avenue at Seneca Street is anticipated to experience queuing on the SR 99 off-ramp due to heavy traffic volumes destined to downtown and conflicts with pedestrian circulation and local traffic movements at the ramp terminal.

With the 2015 Existing Viaduct, the intersection of First Avenue at Columbia Street is expected to operate at LOS F during the PM peak hour. The intersection of First Avenue at Columbia Street serves as the access point to southbound SR 99 from downtown, and therefore serves relatively high concentrations of traffic. Queues from the Columbia Street southbound on-ramp frequently spill back to First Avenue, causing additional delays at this intersection.

With the 2015 Existing Viaduct, a number of intersections are anticipated to operate at acceptable levels of service but with queues expected to spill back and affect SR 99 mainline traffic. As described above, traffic on the northbound SR 99 off-ramp to Seneca Street is anticipated to spill back from the intersection of Seneca Street at First Avenue onto SR 99, causing delays along SR 99. Also, the intersection of Western Avenue at Battery Street is expected to experience queues that spill back onto both the southbound SR 99 Battery Street Tunnel off-ramp and northbound Western Avenue off-ramp, resulting in some queues and delay on SR 99.

Though the intersection of Alaskan Way at Marion Street operates at LOS C overall during both peaks, short durations with higher levels of congestion occur while traffic exits Colman Dock.

4.3.3 North Area

Exhibit 4-23 shows AM and PM peak hour signalized intersection LOS and delay for selected signalized intersections in the north area.

Exhibit 4-23. AM and PM Peak Hour Detailed Traffic Operations, North – 2015 Existing Viaduct

Street	Cross Street	AM Peak Hour		PM Peak Hour	
		LOS	Avg. Vehicle Delay (seconds)	LOS	Avg. Vehicle Delay (seconds)
Western Avenue W.	Elliott Avenue W.	B	16	C	21
W. Mercer Place	Elliott Avenue W.	E	60	F	130
First Avenue	Denny Way	C	26	D	37
Second Avenue	Denny Way	A	7	A	7
Broad Street	Denny Way	C	25	C	24
Fifth Avenue	Denny Way	B	20	B	18
Fifth Avenue N.	Broad Street	C	27	C	28
Fifth Avenue N.	Harrison Street	B	12	B	18
Fifth Avenue N.	Mercer Street	B	15	C	23
Fifth Avenue N.	Roy Street	B	17	C	21
Sixth Avenue	Battery Street	A	9	B	18
Sixth Avenue	Denny Way	A	8	C	21
Aurora Avenue SB	Denny Way	B	18	D	48
Aurora Avenue NB	Denny Way	C	28	F	98
Dexter Avenue N.	Denny Way	C	27	E	61
Dexter Avenue N.	Harrison Street	B	18	B	13
Dexter Avenue N.	Mercer Street	D	46	E	78
Dexter Avenue N.	Roy Street	A	7	A	9
Dexter Avenue N.	Aloha Street	C	28	B	15
Ninth Avenue N.	Mercer Street	E	63	E	60
Westlake Avenue N.	Mercer Street	C	32	F	129
Fairview Avenue N.	Valley Street	E	65	D	41
Fairview Avenue N./ I-5 ramp	Mercer Street	E	56	F	182

Notes: LOS = level of service
NB =northbound
SB = southbound

It is assumed that by 2015, the Mercer East Project would be completed, converting the segment of Mercer Street from Fairview Avenue N. to Dexter Avenue N. into a two-way facility by widening it from four lanes (currently one-way eastbound) to three lanes in each direction. As part of these area improvements, Valley Street would be reduced to a two-lane roadway (one lane each direction). The conversion to a two-way roadway would also necessitate a new signalized intersection on Mercer Street to provide access to Broad Street.

Heavy traffic flow to and from I-5 would continue to affect a number of intersections along the Mercer Street corridor. The intersection of Fairview Avenue N. and Mercer Street is projected to operate at LOS E during the AM Peak hour and LOS F during the PM peak hour, though forecasted delays are considerably reduced due to the Mercer corridor improvements. The Mercer Street/Westlake Avenue N. intersection is projected to operate at LOS F during the PM peak hour, when northbound traffic on Westlake Avenue N. peaks, while the Mercer Street intersection at Dexter Avenue N. would operate at LOS E during the PM peak hour, when eastbound traffic peaks. The intersection of Mercer Street at Ninth Avenue N. is forecasted to operate at LOS E during both the AM and PM peak hours, due to high volumes on Mercer and high southbound volumes on Ninth Avenue N.

The intersection of Fairview Avenue N. and Valley Street is projected to operate at LOS E conditions during the AM peak hour when it accommodates heavy southbound movements from Eastlake Avenue and is also affected by nearby congestion at the I-5/Mercer Street ramps.

The intersections of Denny Way at southbound and northbound Aurora Avenue are projected to operate at LOS C or better during the AM peak hour. The intersection of Denny Way at southbound Aurora Avenue is projected to operate at LOS D during the PM Peak hour. This relatively good LOS reflects the long green time given to the high volume east-west movement. However, the north and south approaches at these intersections operate at a worse LOS than the overall intersection LOS. The southbound approach at the intersection of Denny Way and southbound Aurora Avenue is forecasted to operate at LOS E during the AM peak hour and LOS F during the PM peak hour. This is a result of the southbound left-turn lane traffic spilling back into the southbound through-lanes, causing this intersection to essentially operate with one southbound through-lane, instead of two lanes, for much of the AM and PM peak hours. The northbound approach at the intersection of Denny Way and northbound Aurora Avenue is forecasted to operate at LOS D during the AM peak. The intersection of Denny Way and northbound Aurora Avenue is projected to operate at LOS F during the PM peak hour, with all intersection approaches operating at LOS E or worse.

To the west, the intersection of W. Mercer Place at Elliott Avenue is projected to operate at LOS E during the AM peak hour and LOS F during the PM peak hour.

During peak hours, business access and transit (BAT) lanes are provided along Elliott Avenue W., reducing the number of through-lanes for general-purpose traffic. The reduction in the number of through-lanes, coupled with heavy north-south volumes on Elliott Avenue and increased southbound traffic turning left from Elliott Avenue to W. Mercer Place, results in degraded LOS at this intersection.

4.4 AM and PM Peak Hour Travel Times

AM and PM peak hour travel times for routes using the SR 99 corridor are presented for the 2015 Existing Viaduct as a metric for mobility during periods of high use, measured during the AM and PM peak hours. The travel time routes analyzed are shown in Exhibit 2-6. Travel times are described below for the key regional and downtown routes that were deemed appropriate for representing the primary travel patterns experienced on or adjacent to the corridor:

- South end to and from downtown, represented by West Seattle to CBD (Fourth Avenue and Seneca Street) via SR 99
- North end to and from downtown via SR 99, represented by Woodland Park (SR 99 and N. 50th Street) to CBD (Fourth Avenue and Seneca Street)
- Through-trips on SR 99, represented by Woodland Park to S. Spokane Street
- West-side through-trips on the Elliott/Western corridor, represented by Ballard Bridge to S. Spokane Street via Alaskan Way or the Alaskan Way Viaduct
- Northgate to Boeing Access Road via I-5
- Mercer Street from I-5 to Elliott Avenue
- Second Avenue from Wall Street to S. Royal Brougham Way
- Fourth Avenue from S. Royal Brougham Way to Battery Street

Exhibit 4-24 summarizes AM and PM peak hour corridor travel times by route and direction as estimated from simulation software, and each of the corridors are discussed in the following sections.

Exhibit 4-24. Corridor Travel Times

	2015 Existing Viaduct	
	AM Peak Hour (minutes)	PM Peak Hour (minutes)
West Seattle to CBD (Fourth Avenue and Seneca Street)		
Northbound	20	-
Southbound	-	25
Woodland Park to CBD (Fourth Avenue and Seneca Street)		
Southbound	20	-
Northbound	-	15
Woodland Park to S. Spokane Street		
Southbound	16	15
Northbound	16	18
Ballard Bridge to S. Spokane Street (via Alaskan Way Viaduct)		
Southbound	16	16
Northbound	19	21
Northgate to Boeing Access Road (via I-5)		
Southbound	28	32
Northbound	28	30
Mercer Street (I-5 to Elliott Avenue W.)		
Westbound	9	11
Eastbound	6	12
Second Avenue (Wall Street to S. Royal Brougham Way)		
Southbound	11	12
Fourth Avenue (S. Royal Brougham Way to Battery Street)		
Northbound	11	12

Note: CBD = Central Business District

4.4.1 West Seattle to CBD

This route represents trips between West Seattle (specifically the intersection of California Avenue and S.W. Alaska Street) and the CBD (specifically at Fourth Avenue and Seneca Street) and is presented for the peak traffic flow direction only (i.e., northbound in the AM and southbound in the PM peak period).

For the northbound direction during the AM peak hour, the travel time from West Seattle to the CBD would be 20 minutes for the 2015 Existing Viaduct. The return travel time during the PM peak hour would be 25 minutes.

4.4.2 Woodland Park to CBD

This route covers trips between N. 50th Street/SR 99 and downtown Seattle and is again presented for the peak direction trip only (i.e., southbound in the AM peak and northbound in the PM peak).

For the southbound direction for the AM peak hour, the 2015 Existing Viaduct travel time would be 20 minutes. The return trip during the PM peak hour would be 15 minutes.

4.4.3 Woodland Park to S. Spokane Street

This route represents one of the longer travel time paths identified for measurement. The path is aligned directly through the study area along the SR 99 corridor and captures trips not originating or destined to the Seattle CBD. Travel times for both peak and off-peak directions are provided to gauge a wide range of peak period users.

During the AM peak hour, travel times for both the northbound and southbound directions would be 16 minutes for the 2015 Existing Viaduct. During the PM peak hour, the southbound travel time would be 15 minutes, while the northbound travel time would be 18 minutes. The relative consistency between these times for the AM and PM peak periods demonstrate that this route is not subject to heavy directional demand.

4.4.4 Ballard Bridge to S. Spokane Street – Via Alaskan Way Viaduct

This route reflects the travel times for longer distance through-trips between Ballard and S. Spokane Street (using the Elliott/Western ramps and SR 99 corridor) connecting two neighborhoods on the fringe of the study area.

In the southbound direction, travel times for both the AM and PM peak hours would be 16 minutes. In the northbound direction, the AM peak hour travel time would be 19 minutes, while the PM peak hour travel time would be 21 minutes.

4.4.5 Northgate to Boeing Access Road – Via I-5

This route defines the I-5 path between Northgate and the area near Boeing Field and reflects longer distance trips outside of, but parallel to, the SR 99 corridor. Travel times along this corridor are generally the highest of any route examined, primarily due to the physical distance covered along the route.

The travel times for the northbound and southbound directions would both be 28 minutes during the AM peak hour for the 2015 Existing Viaduct. During the PM peak hour, the southbound travel time would be 32 minutes, while the northbound direction would be 30 minutes.

4.4.6 Mercer Street – I-5 to Elliott Avenue

The Mercer Street travel time route is defined by trips along Mercer Street between Elliott Avenue and I-5 and captures west-side traffic to/from the SR 99 and I-5 corridors.

In the westbound direction, the travel time along Mercer Street would be 9 minutes during the AM peak hour, while the travel time during the PM peak hour would be 11 minutes. In the eastbound direction, the travel time during the AM peak hour would be 6 minutes. However, during the PM peak hour, the travel time would increase to 12 minutes, representing a doubling of the comparable AM peak hour travel time.

4.4.7 Second Avenue – Wall Street to S. Royal Brougham Way

The Second Avenue route represents trips made in the southbound direction within the Seattle CBD. Travel times for this route help to describe how surface street traffic is accommodated relative to the volumes served on the SR 99 corridor. During the AM peak hour, the travel time along this path would be 11 minutes, while the PM peak hour travel time would be 12 minutes.

4.4.8 Fourth Avenue – S. Royal Brougham Way Street to Battery Street

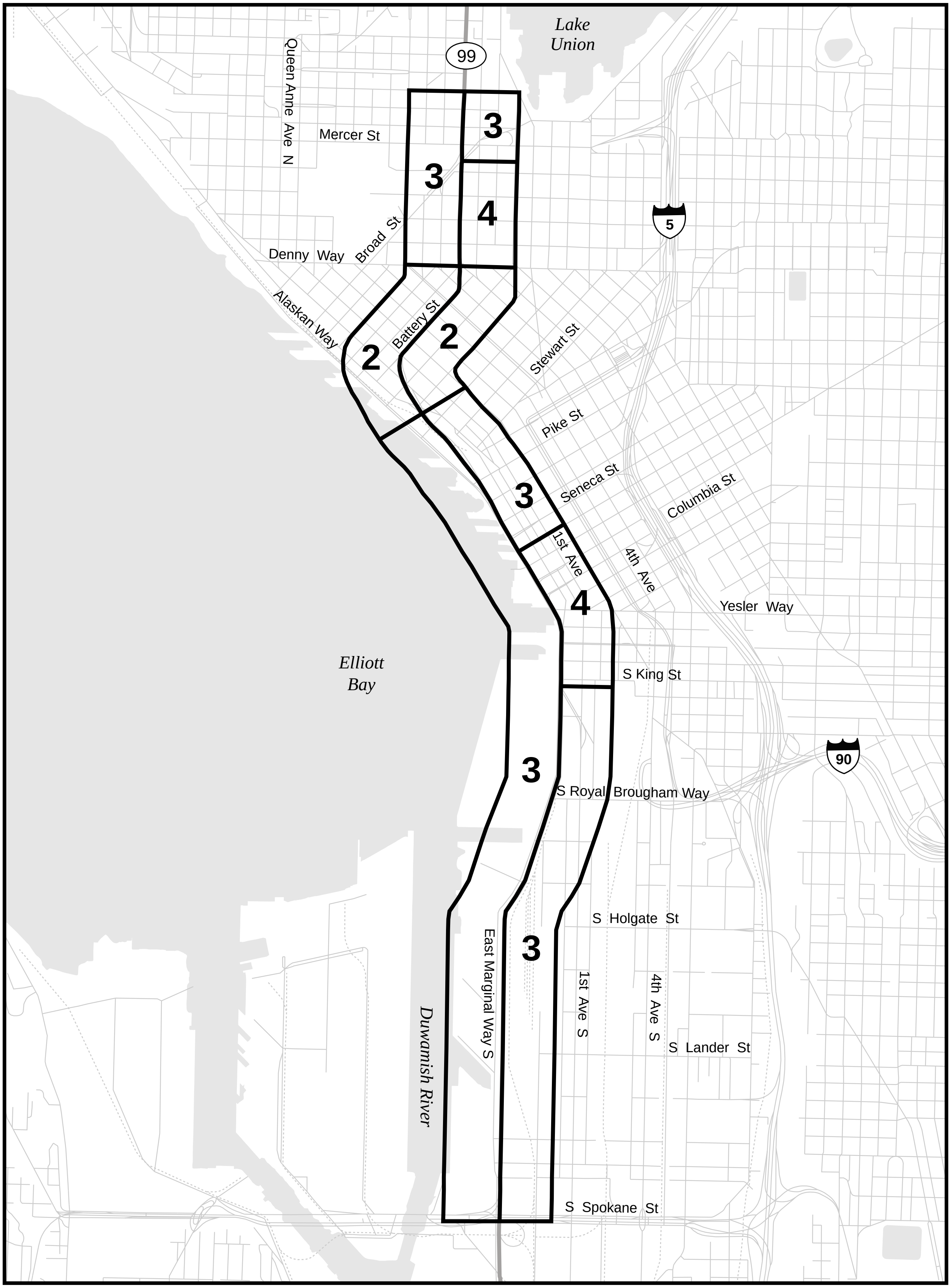
Similar to the Second Avenue route, the Fourth Avenue route represents trips made in the northbound direction within the Seattle CBD. Travel times on Fourth Avenue also help to describe how surface street traffic is accommodated relative to the volumes served on the SR 99 corridor. The travel time during the AM peak hour would be 11 minutes, while the travel time during the PM peak hour would be 12 minutes.

4.5 Roadway Connectivity and Access

SR 99 is a regional highway facility, though it primarily serves shorter regional trips and intracity trips, whereas parallel route I-5 carries a higher share of longer-distance trips. Between S. Spokane Street and Denny Way, SR 99 is fully access controlled, with traffic able to enter or exit the roadway only at ramps. North of the Battery Street Tunnel, access is provided by right turn on/right turn off movements to side streets.

4.5.1 Travel Lanes

Two or more general-purpose travel lanes are provided on SR 99 in each direction through the study area, as shown in Exhibit 4-25. Northbound, the SR 99 corridor carries three lanes from S. Spokane Street past the northbound off-ramp to S. Royal Brougham Way to the First Avenue S. ramps, which join the corridor as a fourth, outside (right) lane. This add-drop lane continues until just north of the Seneca Street off-ramp (which essentially functions as a drop lane), and helps accommodate traffic entering and exiting SR 99 at these two ramps. Three lanes continue northbound, with the outside (right) lane dropping to the Western Avenue off-ramp. Just before entering the tunnel, the Battery Street Tunnel on-ramp (from Western Avenue) merges into the outside (right) mainline lane. Two lanes continue northbound through the Battery Street Tunnel.



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SCALE IN FEET

N

Note:
Numbers represent number of lanes on SR 99.

Exhibit 4-25
SR 99 Lane Configuration

Emerging from the Battery Street Tunnel as Aurora Avenue, an arterial with a center median barrier, SR 99's two primary travel lanes are joined by two additional lanes from the Denny Way on-ramp. The outside lane operates essentially as an auxiliary lane, which accommodates slower-moving traffic entering and exiting Aurora Avenue via right-hand turns to connecting cross streets. Thomas Street, Harrison Street, and Republican Street intersect northbound SR 99, and an off-ramp is provided to the Mercer Street/Dexter Avenue N. intersection. Additional arterial connections (right-turns only) occur at Roy, Valley, and Aloha Streets. The outermost northbound lane of Aurora Avenue is regulated by a stop sign at Valley Street, which provides an opportunity for traffic from Valley Street to enter the northbound mainline. Aurora Avenue traffic tends to move out of the right-hand lane to avoid stopping at this location. North of Aloha Street, the outside lane ends and merges on the right side of the roadway to form a three-lane section that continues north to the Aurora Bridge and beyond.

In the southbound direction, three lanes are provided on Aurora Avenue, with one option-lane and one drop-lane accessing the two-lane Denny Way off-ramp just north of the Battery Street Tunnel. As with the northbound direction, the outside lane serves to collect and distribute right-turning vehicles to side streets, and it also provides access to the Denny Way off-ramp. Southbound side-street connections are provided at Aloha, Valley, Roy, Republican, Harrison, and Thomas Streets, while an off-ramp to Broad Street exits the roadway south of Roy Street. Through-movements are primarily accommodated in the inside two lanes. Two lanes continue through the Battery Street Tunnel, with the diverging Battery Street Tunnel off-ramp providing a connection to Western Avenue near the south tunnel portal.

The two mainline lanes are joined by a third lane entering from the Elliott Avenue on-ramp, and the three southbound lanes are carried through the corridor. Unlike in the northbound direction, the segment between downtown (the Columbia Street on-ramp) and the stadium area (First Avenue S. off-ramp) does not have an additional lane to accommodate entering and exiting traffic. Instead, the Columbia on-ramp enters the corridor as a left-side merge, while the First Avenue S. off-ramp exits as a diverging left-side ramp. Three mainline lanes continue southbound with a right-side merge from the new on-ramp from S. Royal Brougham Way and continue past S. Spokane Street (following the off-ramp to the West Seattle Bridge), where they merge into two lanes before transitioning into East Marginal Way S., a surface arterial.

4.5.2 Access to SR 99

Exhibit 4-26 summarizes connections currently provided between SR 99 and other roadways. Transit connections are addressed separately in Section 4.6.

Exhibit 4-26. Connections Provided To and From SR 99

	SR 99 Facility Including the S. Holgate Street to S. King Street Viaduct Replacement Project
Stadium Area (South of S. King Street)	
SB SR 99 to stadium area	S. Royal Brougham off-ramp
Stadium area to NB SR 99	S. Royal Brougham on-ramp
Stadium area to SB SR 99	Alaskan Way S. on-ramp near King Street
NB SR 99 to stadium area	Atlantic Street off-ramp
Downtown Seattle (S. King Street to Stewart Street)	
Downtown to SB SR 99	Columbia Street on-ramp
NB SR 99 to downtown	Seneca Street off-ramp
Elliott and Western Corridor (Stewart Street to Denny Way)	
SB SR 99 to Belltown	Denny Way off-ramp or Battery Street Tunnel off-ramp
Belltown to NB SR 99	Denny Way on-ramp or Battery Street Tunnel on-ramp
Belltown to SB SR 99	Elliott Avenue on-ramp
NB SR 99 to Belltown	Western Avenue off-ramp
South Lake Union Area (North of Denny Way)	
SB SR 99 to Uptown	Denny Way off-ramp or Broad Street off-ramp or arterial connections
SB SR 99 to South Lake Union	Denny Way off-ramp or Broad Street off-ramp
Uptown to SB SR 99	Arterial connections
South Lake Union to SB SR 99	Arterial connections
NB SR 99 to Uptown	Mercer Street/Dexter Avenue off-ramp or arterial connections
NB SR 99 to South Lake Union	Mercer Street/Dexter Avenue off-ramp or arterial connections
Uptown to NB SR 99	Arterial connections
South Lake Union to NB SR 99	Denny Way on-ramp or arterial connections

Notes: NB = northbound
SB = southbound

4.5.2.1 To and From West Seattle

At S. Spokane Street, an eastbound to northbound on-ramp provides access from West Seattle, while in the opposing direction a southbound to westbound off-ramp provides for the reciprocal movement to the West Seattle high bridge. The southbound off-ramp also provides access to Harbor Island and the West Seattle low bridge. (These movements are not shown in Exhibit 4-26 because no changes are proposed here.)

4.5.2.2 To and From Stadium Area

The S. Holgate Street to S. King Street Viaduct Replacement Project improvements to SR 99 will be in place by 2015 and are considered part of the 2015 Existing Viaduct. That project includes revisions to the ramp and street system. New ramp connections to and from SR 99 at the following locations:

- SR 99 Southbound off-ramp to S. Royal Brougham Way
- SR 99 Southbound on-ramp from Alaskan Way S. near King Street

- SR 99 Northbound off-ramp to S. Atlantic Street
- SR 99 Northbound on-ramp from S. Royal Brougham Way

These ramps will complement the existing Columbia and Seneca ramps and providing new access into the central waterfront, Pioneer Square, and stadium areas.

4.5.2.3 To and From Downtown

In downtown Seattle, a northbound off-ramp connects to Seneca Street, while an on-ramp from Columbia Street provides access from downtown to southbound SR 99. These midtown ramps provide access to the CBD, including the retail and financial districts, and are also the downtown transit access point for routes traveling to and from the south. No direct access to or from the north is provided in the downtown area.

4.5.2.4 To and From Elliott and Western Avenues

In the Belltown area, an interchange at Western Avenue and Elliott Avenue provides access to north downtown, Belltown, Pike Place Market, and the north waterfront, as well as access to arterials connecting to Interbay, Uptown, Magnolia, and Ballard. To accommodate substantial traffic flows, the northbound off-ramp to Western Avenue and southbound on-ramp from Elliott Avenue exit and enter the mainline as their own, additional lanes. The Battery Street Tunnel ramps, which comprise the southbound off-ramp and northbound on-ramp at the south tunnel portal, carry a small share of corridor traffic.

4.5.2.5 To and From the South Lake Union and Uptown Area

The Denny Way ramps provide access to north downtown and a variety of locations to the east and west of SR 99 (South Lake Union, Uptown, Seattle Center, Queen Anne, the north waterfront, and Port of Seattle facilities). These ramps are also the transit access point for all routes traveling on the corridor between downtown and points north.

In the South Lake Union/Uptown area, an off-ramp to Mercer Street at Dexter Avenue provides direct access to the South Lake Union neighborhood for northbound traffic, while an exit to Broad Street provides access to Uptown, Seattle Center, and Queen Anne for southbound traffic. Other access in the South Lake Union/Uptown area is provided by a number of right-on and right-off access points connecting to the local street grid. No left turns or at-grade crossings of SR 99 are allowed. Access at these locations is somewhat limited because the side streets enter at right angles, requiring drivers to accelerate from a stopped position when entering or decelerate considerably before exiting SR 99. In addition, connections from northbound SR 99 to Uptown and from South Lake Union to southbound SR 99 are poor due to the limited number of streets crossing SR 99 in this area.

4.5.3 Effects of Design and Operational Constraints

SR 99 was constructed in the 1950s and was designed to conform to different standards than those found on more contemporary facilities. Certain physical and operational characteristics associated with the corridor affect the quality of connections provided in some locations.

The transport of hazardous materials through the Battery Street Tunnel is prohibited at all times and is also prohibited on the viaduct during peak commuting hours. The adjacent Battery Street Tunnel ramps have limited ability to efficiently accommodate traffic due to the location of their connections to the street-grid and geometric limitations.

In the northbound direction, the off-ramp to Seneca Street includes a 90-degree corner requiring deceleration for traffic leaving the mainline, as well as an abrupt transition to the downtown street-grid at the ramp terminal (First Avenue at Seneca Street). These factors contribute to congestion that slows traffic on the off-ramp and the viaduct itself during peak periods. Southbound, connections from downtown (Columbia Street) and to the stadium area (First Avenue S. off-ramp) are affected by congestion and vehicle weaving conflicts associated with the proximity and left-side location of these ramps.

North of the Battery Street Tunnel, access to and from side-street connections can be difficult, especially during peak periods when mainline traffic flows are heavy.

4.5.4 Speed Limits

Posted speed limits on the SR 99 mainline are shown in Exhibit 4-27.

Exhibit 4-27. Posted Speed Limits on SR 99

Mainline Segment	Posted Speed Limit, Northbound and Southbound (miles per hour)
South of S. Spokane Street	45
S. Spokane Street to First Avenue S. ramps	50 (40 trucks north of S. Holgate Street)
First Avenue S. ramps to Seneca/Columbia ramps	50 (40 trucks)
Seneca/Columbia ramps to Elliott/Western ramps	50 (40 trucks)
Battery Street Tunnel	40 (35 advisory)
North of Denny Way	40

4.6 Transit Services and Facilities

Downtown Seattle is served by a network of bus and rail services as well as vanpool programs. Complementing these services are HOV and transit facilities, including the DSTT and arterial treatments for bus services. Transit services and facilities are further described in the following sections.

4.6.1 Transit Services

Transit service to downtown Seattle is provided by six cooperating agencies using several modes, supplemented by large vanpool programs. Sound Transit, Community Transit, Pierce Transit, and King County Metro operate transit service to downtown Seattle. In addition, the Washington State Ferries and the King County Ferry District serve Colman Dock with several routes on Puget Sound, providing service to Kitsap County and Vashon Island. Below is a description of transit services within the study area.

4.6.1.1 Bus Service

King County Metro operates a network of bus routes, over half of which are oriented to downtown Seattle. It uses electric trolleybus, hybrid, and diesel buses in downtown Seattle. Under a contract with Sound Transit, King County Metro operates bus routes serving downtown Seattle from Eastside locations such as Bellevue Redmond, and Woodinville. Other Metro routes serve north, south and east King County locations.

Community Transit operates a network of routes between Snohomish County and downtown Seattle; some of the routes, including all-day two-way routes, are funded by Sound Transit. Pierce Transit operates Sound Transit bus service between Pierce County and downtown Seattle via I-5.

4.6.1.2 Monorail Service

The Seattle Monorail would continue to connect Westlake Center and Seattle Center via an elevated guideway on Fifth Avenue. It would continue to be operated by a private contractor for the City.

4.6.1.3 Sound Transit Central Link Light Rail Service

Service on the Central Link LRT line would continue to serve the 15.6-mile segment between Westlake Station and Sea-Tac Airport. By 2016 the LRT line is scheduled to serve the University of Washington[1]. This line serves downtown Seattle, the SODO industrial area, the Beacon Hill and Rainier Valley neighborhoods, Tukwila, and Sea-Tac Airport. Along the SODO Busway and inside the DSTT, joint bus and rail operations are provided.

LRT trains provide two-way service for 20 hours each day, operating every 7.5 minutes during peak periods and every 10 to 15 minutes during midday and evening hours. Each two-car train has the capacity for 400 riders (148 seats and standing room). Until Link is extended farther north, trains would continue to use a stub-end tunnel track under Pine Street to turn back.

[1] Although the Link extension to the University of Washington is scheduled for 2016, the travel forecasting assumptions include it as part of 2015 transit service conditions.

4.6.1.4 Sounder Commuter Rail Service

Sound Transit's commuter rail line, Sounder, would continue to serve riders north and south of Seattle. By 2015, the south line would operate between Lakewood and King Street Station in downtown Seattle and would serve Lakewood, Tacoma, Puyallup, Sumner, Auburn, Kent, and Tukwila. The north Sounder line would continue to travel between Everett and the King Street Station, with stations in Edmonds and Mukilteo. Park-and-ride facilities in these communities further extend the effective reach of the service.

As of November 2010, Sounder operates seven commuter trips between Tacoma and Seattle during the morning (into Seattle) and evening (out of Seattle) commute periods on weekdays. Also, two reverse commute trips operate in the morning (out of Seattle) and evening (into Seattle). By 2015 additional Sounder trips would be provided consistent with the ST2 Plan. Four Sounder trains would operate between Everett and Seattle each day as well, traveling to Seattle in the morning, and returning to Everett in the evening. Occasional weekend or extra trips for special events such as Mariners, Seahawks, and Sounders games would also operate.

Commuter rail service at the King Street Station would continue to connect with several other forms of transportation, including stations in the DSTT. The Weller Street pedestrian bridge would provide a direct connection between Sounder service at the King Street Station and the DSTT at the International District Station.

4.6.1.5 South Lake Union Streetcar

The South Lake Union streetcar began operation in 2007. It provides access to businesses, residences, and activities in South Lake Union and the northern part of the CBD. The streetcar line runs from Fairview Avenue N. and Yale Avenue N. to Westlake Avenue and Olive Way and includes 11 stops. The streetcars would continue to operate every 15 minutes 7 days a week. The service would continue to connect with several other public transportation modes, including King County Metro and Sound Transit buses, Link LRT (Westlake Station), and the Monorail.

4.6.1.6 Waterfront Streetcar

Construction of the Olympic Sculpture Park and the resulting displacement of the vehicle storage and maintenance facility led to the indefinite suspension of the George Benson Line Waterfront Streetcar service in 2008. King County Metro would continue to provide replacement service with fare-free bus service on the Route 99 Waterfront Streetcar Line. The routing and stop locations for this line would not exactly duplicate those of the waterfront streetcar; however, Route 99 would serve the same neighborhoods—the waterfront, Pioneer Square, and Chinatown/International District.

4.6.1.7 Vanpools

Transit agencies in the region all operate vanpool programs. The programs provide the vans, maintain the vehicles, and offer ride-matching service and support. In turn, fees are collected from vanpool users to cover expenses. A substantial volume of vanpools would continue to access downtown Seattle via Washington State Ferry routes serving Bainbridge Island and Bremerton. Vanpools would continue to depend on the regional highway system for mobility, including HOV facilities where available, as well as local streets. Community Transit and Pierce Transit also operate vanpools.

4.6.2 HOV and Transit Facilities

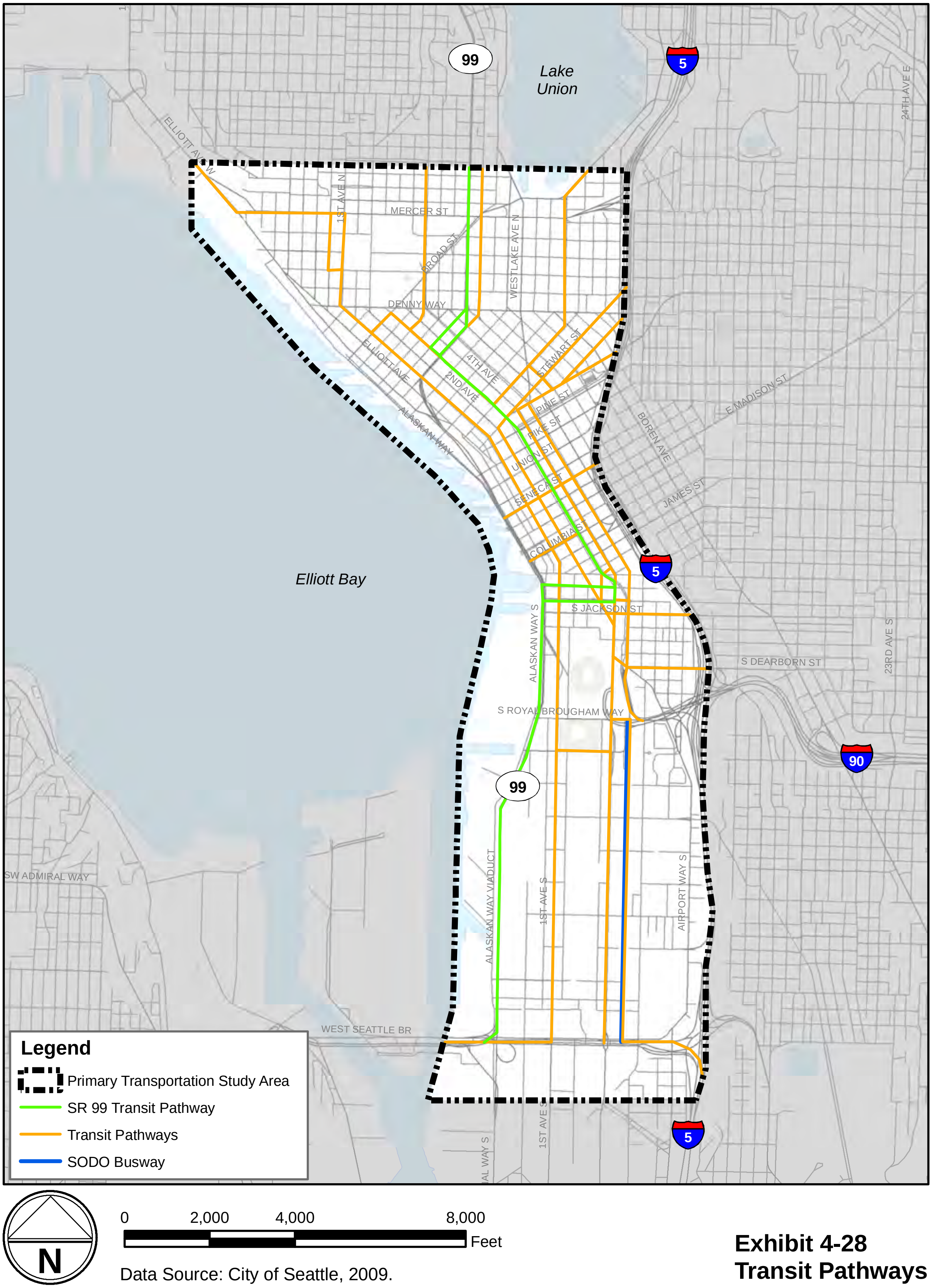
The 2015 Existing Viaduct assumes the completion of the S. Holgate Street to S. King Street Viaduct Replacement Project. The 2015 Existing Viaduct does not necessitate a change in transit routing or service coverage because the existing viaduct and midtown ramps north of S. King Street would still exist. Transit access to and from the SODO and Pioneer Square areas would continue to be provided on First and Fourth Avenues S. and the SODO Busway while transit access to downtown from West Seattle, Burien, and other points south would be principally provided via SR 99 using the Columbia and Seneca Streets midtown ramps.

Under the 2015 Existing Viaduct, bus routes would continue to use the Denny Way ramps resulting in no change to existing transit operations.

Most of the transit service to downtown Seattle would continue to be assigned to pathways that are broadly defined corridors consisting of transit routes serving common markets. This would allow transit priority measures to be implemented and is more easily understood by riders. It also improves the effective service frequency of bus routes.

King County Metro collaborated with the City and other transit agencies to develop a *Draft Transit Blueprint* (King Country Metro 2006) in order to coordinate transit pathways in downtown Seattle. The Transit Blueprint is an evolving document, adjusted to various changes of the roadway network configuration. Implementation of the transit priority treatments in the Transit Blueprint has been incremental and would continue to evolve as needs arise. The transit pathways within the study area are shown in Exhibit 4-28.

Transit vehicles use several facilities that give priority to transit and/or HOVs in the study area. Exhibit 4-29 summarizes the 2015 Existing Viaduct transit priority facilities in the study area.



Data Source: City of Seattle, 2009.

Exhibit 4-28
Transit Pathways

Exhibit 4-29. Transit and HOV Facilities and Treatments in the Study Area – 2015 Existing Viaduct

Arterial	Limits		Description
I-5 express lanes	Northgate	South downtown	Reversible lanes
Restricted reversible ramps	Pike Street, Columbia Street, and Cherry Street	I-5 reversible lanes	HOV-only ramps from and to the I-5 reversible lanes
D2 Ramps	Rainier Avenue	International District	Transit-only connection to the I-90 HOV lanes
Downtown Seattle Transit Tunnel and ramps	I-5 and Olive Way	I-90 and SODO Busway	Transit tunnel and five stations
E3/SODO Busway	S. Spokane Street	International District Station	Busway with four bus stations and two rail stations
Second Avenue and Second Avenue Extension S.	Stewart Street	S. Jackson Street	Peak period transit lane
Second Avenue Extension S.	North of S. Jackson Street	S. Jackson Street	Transit signal queue bypass
Fourth Avenue	Jefferson Street	Olive Way	Peak period transit lane
Fourth Avenue S.	S. Jackson Street	S. Main Street	Transit lane and passenger waiting island
Fifth Avenue	S. Jackson Street	S. Washington Street	Contraflow transit lane
Fifth Avenue	Terrace Street	Cherry Street	Contraflow transit lane
S. Jackson Street	Maynard Avenue S.	Eighth Avenue S.	Bus Bulbs
Third Avenue	Stewart Street	Yesler Way	Transit priority corridor: restricted to buses and bicycles in peak periods
Prefontaine Place S.	S. Washington Street	Yesler Way	Restricted to buses and bicycles when Third Avenue traffic restrictions are in effect
Seneca Street	Second Avenue	Third Avenue	Transit-only lane
Pine Street	Fourth Avenue	Third Avenue	Transit lane and passenger waiting island
S.W. Spokane Street	West of Chelan ramp	Chelan West Seattle Freeway ramp	Bus-only lane
Fairview Avenue N.	North of Valley Street	Valley Street	Southbound left-turn lane for transit
15th and Elliott Avenues W.	W. Armor Street	W. Harrison Street	Peak period BAT lanes
First Avenue	North of Broad Street	Denny Way	Peak period transit lane

Exhibit 4-29. Transit and HOV Facilities and Treatments in the Study Area – 2015 Existing Viaduct (continued)

Arterial	Limits		Description
Wall Street	Fifth Avenue	Fifth Avenue	Bus bulb
Third Avenue	Stewart Street	Yesler Way	Bus bulbs (1990)
Third Avenue	Stewart Street	Cedar Street	Bus bulbs (2010)
Alaskan Way	North of Yesler Way	Yesler Way	Southbound left-turn lane for transit
Olive Way	Fifth Avenue	Fifth Avenue	Bus bulb
Howell Street	Ninth Avenue	Ninth Avenue	Transit queue jump
Stewart Street	Eastlake Avenue	Third Avenue	Peak period transit lane
Stewart Street	Seventh Avenue	Seventh Avenue	Transit queue jump
Olive Way	Fourth Avenue	Eighth Avenue	Peak period transit lane
I-5	S. 356th Street	I-90	Inside HOV lanes
I-5	Stewart Street	I-90	Southbound inside HOV lane
I-5	Mercer Street	I-90	Southbound reversible HOV lane

Notes: BAT = business access and transit
HOV = high-occupancy vehicle
SODO = South of Downtown

All transit pathways in downtown Seattle could be affected by changes in traffic volumes and congestion caused by the Alaskan Way Viaduct Replacement Project. The key north-south facilities in 2015 in central downtown Seattle that could be affected by this project are as follows:

- Aurora Avenue (SR 99) with ramps at Denny Way, serves north-central Seattle. See Exhibit 4-30 for transit routes directly using SR 99.
- SR 99 between Spokane Street and the Seneca/Columbia ramps serves West Seattle, Delridge, Vashon, White Center, and Burien. See Exhibit 4-30 for transit routes directly using SR 99.
- Dexter Avenue N. and First Avenue S. are transit corridors parallel to SR 99.
- Second and Fourth Avenues operate as a couplet used by routes serving Pierce County, south King County, Snohomish County, and east King County.
- Third Avenue is the downtown Seattle transit spine and is used by many bus lines, including Aurora Avenue N. routes and the electric trolleybus routes serving southeast Seattle, Queen Anne, and Eastlake. Transit volumes on Third Avenue increased in 2005 when the DSTT was closed while it was being retrofitted for joint bus-rail operation. Transit flow on downtown streets was given higher priority. The City allowed the increased priority to continue after the DSTT was reopened in 2007. Metro

RapidRide BRT C, D, and E Lines are expected to use Third Avenue as they are implemented in the next few years.

- Fifth Avenue is used by routes serving east King County and Snohomish County.
- 15th Avenue W. and Elliott Avenue are used by transit to serve Magnolia and Ballard to downtown Seattle.

Exhibit 4-30. King County Metro Routes Using SR 99 or Adjacent Arterials

Routes	Market Areas	SR 99 Ramp	North-South Avenues in CBD
South			
21X, 54, 54X, 55, 56X, 57X	West Seattle	Midtown	Third
113, 120, 125	White Center, Delridge	Midtown	Third
121, 122	Burien and SR 509	Midtown	Third
37	Alki	Columbia Street	Second/Third
21, 22, 56, 57	West Seattle and Ballard via First Avenue S. in SODO	None	Third
116, 118, 119	Vashon Island and Fauntleroy Terminal via First Avenue S. in SODO	None	Third
132	Burien and Des Moines via First Avenue S. in SODO	None	Second/Fourth
North			
5, 5X, 26X, 28X, 358X	North Seattle, Shoreline	Denny Way	Third
26, 28	North Seattle via Dexter Avenue N. in South Lake Union	Denny Way	Third
3, 4	E. Queen Anne via Fifth Avenue N. in Uptown	None	Third
15, 18	Ballard via First Avenue S. in SODO	None	Third
16	Wallingford via Fifth Avenue N. in Uptown	Valley and John Streets	Third

Notes: CBD = Central Business District
SODO = South of Downtown

4.6.2.1 Limited Access Highway HOV Facilities

Within the study area, HOV lanes would continue to be provided on the southbound I-5 reversible express lanes, and on the southbound I-5 mainline starting at the Mercer Street on-ramp. The reversible lane ramps to Columbia, Cherry and Pike Streets would be restricted to HOV vehicles. The reversible lanes carry both general-purpose and HOV traffic separately from the I-5 mainline and operate southbound on mornings and northbound on afternoons. The D2 ramps on I-90 would provide direct access for transit vehicles from the International District to the new inside HOV lanes.

Outside the study area, HOV lanes would be provided on I-5 north of Northgate and south of I-90, SR 509 south of S. Michigan Street, I-90 east of Rainier Avenue, and SR 520 east of I-5.

4.6.2.2 Arterial Transit Facilities

Several transit facilities are provided on arterials in the study area. As listed in Exhibit 4-29, most of these facilities aid transit movement in downtown Seattle. The Seneca Street transit lane would continue to connect SR 99 bus service to Third Avenue from the Seneca Street ramp. The Third Avenue priority measures and bus bulbs discussed below would both continue to aid bus routes serving Aurora Avenue.

South of the study area, there would continue be HOV lanes on SR 99 on the First Avenue S. Bridge. And north of the study area, segments of Aurora Avenue in North Seattle would have BAT lanes during peak periods.

4.6.2.3 New Arterial Transit Facilities

Several new arterial HOV and transit-only facilities have been added to the local street system since 2006, when the initial King County Metro *Draft Transit Blueprint* was published. These facilities were associated with the closure of the DSTT while it was being retrofitted for joint bus-rail operation between September 2005 and September 2007. In 2009 and 2010, transit lanes were provided on Olive Way and Stewart Street, and bus bulbs were constructed on Third Avenue in Belltown. All these facilities would continue to be in place under the 2015 Existing Viaduct.

4.6.2.4 SODO Busway

In addition to on-street arterial transit facilities, the transit-only SODO Busway on Fifth Avenue S., between S. Spokane Street and the south portal of the DSTT near S. Dearborn Street, carries Link LRT trains as well as bus routes serving south King and Pierce Counties. There are two Link stations and four bus stations on the SODO Busway.

4.6.2.5 Third Avenue Transit Spine

Third Avenue, between Yesler Way and Stewart Street, operates as a transit priority corridor during peak periods (6 to 9 a.m. and 3 to 6:30 p.m.). During those periods, other vehicles have limited circulation and business access. General-purpose vehicles have unlimited access to Third Avenue between the hours of 9:00 a.m. and 3:00 p.m. and during evenings and weekends. The restrictions during weekday peak periods allow increased transit capacity through skip-stop operation and more curb space devoted to bus stops.

4.6.2.6 Business Access and Transit Lanes

King County Metro and the City have been working together on roadway and traffic signal improvements to improve the speed and reliability of buses, including bus bulbs, BAT lanes, transit signal priority, and queue jumps. In 2008, curb lanes along 15th and Elliott Avenues W. in both directions between W. Harrison and W. Armour Streets were converted to BAT lanes. These BAT lanes would be used by the RapidRide D Line (scheduled to be implemented in 2012). BAT lanes already have been provided on segments of Aurora Avenue N. (SR 99) in Shoreline and Seattle.

4.6.3 Transit Connectivity and Coverage

In general, conditions under the 2015 Existing Viaduct assume the same transit connectivity and coverage as existing conditions. The exception involves access from SR 99 to the central part of downtown Seattle. This access would continue to be provided at the Columbia Street on-ramp and Seneca Street off-ramp, in addition to access provided at the stadium area ramps. For buses accessing downtown Seattle from the north end, existing access locations would be maintained. No additional access locations would be provided for buses, and additional transit-only lanes would not be provided on Aurora Avenue.

As described in Section 4.6.2, several transit pathways in the *Draft Transit Blueprint* include SR 99 or adjacent arterials. These pathways would be directly affected by the project. In 2012, transit service in West Seattle, Uptown, and Ballard may be restructured due to implementation of RapidRide BRT. The extent of route restructuring would be highly dependent on the availability of funding and a public review process that will begin in mid-2011.

Exhibit 4-30 shows various King County Metro routes in the study area as well as the associated market areas they serve. Also shown are the associated SR 99 access ramps and north-south corridors on which the routes operate. Further information about access to the Alaskan Way Viaduct and Aurora Avenue N. is provided in the following subsections.

4.6.3.1 Alaskan Way Viaduct Access

Several King County Metro routes use the Alaskan Way Viaduct to and from destinations in West Seattle and communities south of Seattle via the midtown ramps at Columbia and Seneca Streets. Most trips and passengers are on all-day two-way routes 54, 55, 120, and 125. These ramps are also used by one-way peak-only routes 21X, 54X, 56X, 113, 121, and 122. The majority of routes traveling into Seattle (e.g., routes 21X, 54, 55, 54x, 56X, and 120) access Third Avenue from the Alaskan Way Viaduct via Seneca Street. About half as many these routes (e.g., routes 113, 121, 122, and 125) turn left onto First Avenue instead of Third Avenue. Most routes traveling out of Seattle approach the Columbia Street ramp from Third Avenue via Columbia Street, and others approach from First Avenue. In 2012, the RapidRide C Line is expected to replace routes 54 and 55. There may be other routes revised at that time.

4.6.3.2 Aurora Avenue Access

Several King County Metro routes use Aurora Avenue N. (SR 99) via the Denny Way ramps to and from the north. Most trips and passengers are on all-day two-way routes 5 and 358X; the ramps are also used by one-way peak-only routes 5X, 26X, and 28X. Northbound routes 5, 5X, and 358X were recently revised to use Battery Street instead of Dexter Avenue N. and John Street to reach SR 99. Two-way all-day routes 26 and 28 serve Dexter Avenue N. adjacent to SR 99. Those routes are through-routed with routes 23 and 124, extending to south Seattle via Fourth Avenue S. in SODO. In 2013, the RapidRide E Line is expected to replace Route 358X. There may be other routes revised in 2012 and 2013 when the RapidRide D and E Lines are implemented.

4.6.4 Modeled Transit Ridership

Exhibit 4-31 summarizes projected 2015 AM peak period and daily transit ridership at three screenline locations. Daily and peak period transit demand reflect population and employment growth as well as transit improvements expected to be implemented by 2015, including King County Metro's RapidRide BRT service to downtown Seattle from West Seattle, Ballard, and Shoreline. These ridership estimates also reflect Link LRT service operating between the University of Washington and Sea-Tac Airport, even though the University Link project is not expected to be complete until one year later; buses currently operating in the DSTT are modeled as operating on surface streets upon completion of University Link.

Exhibit 4-31. Model-Estimated AM Peak Period and Daily Transit Ridership (Person-Trips) at Selected Screenlines

Screenline	AM Peak Period	Daily
South (south of S. King Street)	31,950	101,100
Central (north of Seneca Street)	36,890	126,700
North (north of Thomas Street)	36,330	118,400

4.6.5 Transit Mode Share

The transit shares for 2015 Existing Viaduct are identified in Exhibit 4-32. The projected transit ridership for the 2015 Existing Viaduct indicates that the transit share of total demand would be at 9 percent and at 34 percent for home-based work trips. Expanded bus and rail service, particularly Link LRT service in place by 2015, would contribute to these transit mode shares, along with assumed automobile operating costs and parking costs.

Exhibit 4-32. Model-Estimated 2015 Daily Transit Mode Shares: To, From, and Within Seattle's Center City

	2015 Existing Viaduct
Home-based work	34.3%
Non-work	9.0%

4.6.6 Peak Hour Travel Times for Transit Corridors

The following sections identify estimated travel times under 2015 Existing Viaduct for several transit corridors serving downtown Seattle. For the Ballard to CBD (Denny Way) corridor, transit travel times are available for the bus lanes on Elliott Avenue. For the Aurora Avenue and West Seattle/CBD corridors, the travel demand information for the 2015 Existing Viaduct does not identify transit-specific travel times. However, the information for general traffic does allow comparisons between the modeled conditions for major transit corridors.

Travel times for AM and PM peak hours under 2015 Existing Viaduct are shown in Exhibit 4-33. The travel times are presented for three major transit corridors. Affected transit travel for a fourth corridor, S. King Street to downtown Seattle, is reflected in the West Seattle/downtown Seattle times.

Exhibit 4-33. Travel Times Along Major Transit Travel Corridors

	2015 Existing Viaduct	
	AM Peak Hour (minutes)	PM Peak Hour (minutes)
Ballard to Denny Way[1]		
Southbound	8	8
Northbound	8	7
Aurora Avenue (Woodland Park to CBD)[2]		
Southbound	20	18
Northbound	11	15
West Seattle to CBD[2]		
Southbound	20	15
Northbound	12	25

Notes: CBD = Central Business District
1. Represented by transit travel on Elliott Avenue between the Ballard Bridge and Denny Way.
2. CBD location for the Aurora Avenue and West Seattle corridors is Fourth Avenue and Seneca Street.

4.6.6.1 Peak Hour Travel Times – South King County (Burien)/Downtown Seattle Corridor

Since the Burien to CBD routes would have the same alignments as West Seattle to CBD service, the travel times for the 2015 Existing Viaduct would be comparable.

4.6.7 Intersection Level of Service Changes Affecting Transit

While travel time changes provide information about the flow of traffic through an area, intersection LOS data provide more detailed information about how operations at specific intersections could affect transit service.

At the south end of downtown Seattle, several intersections with transit service would operate at LOS E or LOS F during peak hours. These locations include First Avenue S. at S. Atlantic Streets and Fourth Avenue S. at S. Royal Brougham Way. With the 2015 Existing Viaduct, a number of intersections are anticipated to operate at acceptable levels of service but with queues expected to spill back and affect SR 99 mainline traffic. For example, traffic on the northbound SR 99 off-ramp to Seneca Street, which includes substantial bus volumes from West Seattle, is anticipated to spill back from the intersection of Seneca Street at First Avenue onto SR 99, causing delays along SR 99.

In the central section of downtown Seattle, First Avenue at Columbia Street in the PM peak would operate at LOS F. This location would have extensive bus volumes accessing the on-ramp to SR 99. In the north end of the project corridor several locations with bus service would operate at LOS E or LOS F. Examples include West Mercer Street at Elliott Avenue N. (LOS E in AM peak and LOS F in PM peak), Aurora Avenue northbound at Denny Way (LOS F in PM peak), and Westlake Avenue N. at Mercer Street (LOS F in PM peak). However, the intersection of W. Mercer Street at Elliott Avenue N. includes northbound and southbound BAT lanes on Elliott Avenue; therefore, the intersection LOS for transit operations may not be as severe as for general-purpose travel.

4.7 Freight

The state of Washington classifies freight routes according to the number of tons of cargo carried on them. Truck freight tonnage on interstate highways, state routes, and Seattle streets is shown in Exhibit 4-34.

The City designates all arterials as truck streets. Certain arterials are classified as Major Truck Streets. By policy, the City will "monitor these streets and make operating, design, access and/or service changes, as well as capital investments, to accommodate trucks and to preserve and improve commercial transportation mobility and access on these major truck streets." Seattle's Major Truck Streets within the study area are shown on Exhibit 4-35. SR 99 is designated as a Major Truck Street, as are all or portions of 15th Avenue W., Elliott Avenue, Western Avenue, Broad Street, Mercer Street, Valley Street, Westlake Avenue N., East Marginal Way S., First Avenue S., Fourth Avenue S., Sixth Avenue S., Airport Way S., S. Spokane Street, S. Lander Street, S. Royal Brougham Way, and Alaskan Way.

Exhibit 4-34. Freight Tonnage Designations for State and City Routes

Route Name	Segment	Classification
I-5	Oregon border to Canadian border	T-1
I-5	Express lanes	T-1
I-90	Fourth Avenue to Idaho border	T-1
SR 99	East Marginal Way S. to Elliott Avenue (includes Alaskan Way Viaduct)	T-1
SR 99	Elliott Avenue to Green Lake Way (includes Battery Street Tunnel)	T-2
SR 519	I-90 to Seattle Ferry Terminal	T-2
West Seattle Bridge	Delridge Way S.W. to I-5/Columbian Way	T-1
First Avenue S.	East Marginal Way S. to Alaskan Way Viaduct ramps	T-2
Fourth Avenue	Yesler Way to Denny Way	T-2
Fourth Avenue S.	East Marginal Way S. to Airport Way S.	T-1
Fourth Avenue S.	Airport Way S. to Yesler Way	T-2
Alaskan Way S.	East Marginal Way S. to S. Royal Brougham Way	T-2
Alaskan Way S.	Columbia Street to Broad Street	T-2
Elliott Avenue W.	W. Denny Way to W. Galer Street	T-2

Source: WSDOT 2008.
Note: Classification: T-1 = more than 10 million tons per year; T-2 = 4 million to 10 million tons per year.

4.7.1 Weight and Height Restrictions

Following the Nisqually earthquake of February 2001, weight restrictions were established to prohibit vehicles over 10,000 pounds from using the two left lanes on each level of the viaduct. In addition, vehicles with a gross weight of more than 105,500 pounds are prohibited. These restrictions remain in place today. These restrictions also limit the use of the southbound exit to First Avenue S., which is located on the left side of the roadway. Further deterioration of the viaduct structure could lead to further restrictions.

There is a height restriction of 14 feet 6 inches for the Battery Street Tunnel.

4.7.2 Alternate Truck Routes in the Alaskan Way Viaduct Corridor

In case of congestion, incidents, or lack of access to the Alaskan Way Viaduct, different types of trucks have different alternate route options. Oversized or overweight trucks are limited to the designated over-legal route along Alaskan Way and Broad Street, or I-5. For the downtown traffic control zone, trucks 30 feet or taller are precluded from using city streets in the downtown area north of S. King Street from 7:00 a.m. to 7:00 p.m. daily, and therefore have the same options to use Alaskan Way and Broad Street or I-5 instead of the viaduct. The downtown traffic control zone is shown on Exhibit 4-35. Trucks shorter than 30 feet have the option to divert to city streets to get through the downtown area.

The Alaskan Way surface street presents some challenges as a truck route. Alaskan Way contains a number of unsignalized intersections along the central waterfront, where pedestrians can cross at random, rather than be controlled by traffic signals. This can increase the unpredictability of pedestrian crossings, and increase delay for all vehicles. The at-grade rail crossing at Alaskan Way and Broad Street also increases delay for trucks when they must wait for crossing trains.

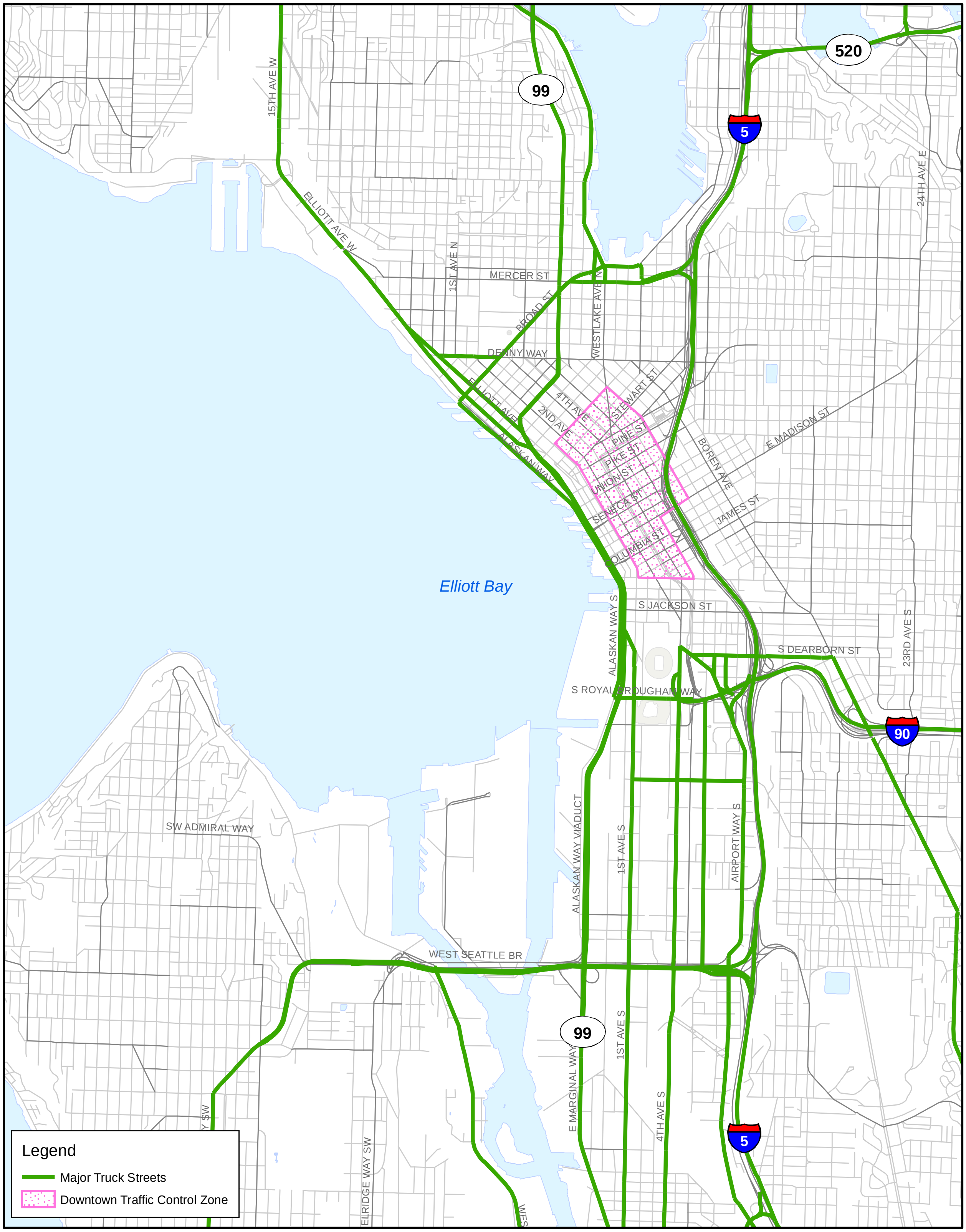
I-5 also has some drawbacks as a truck route for truckers passing through downtown Seattle. Heavy congestion persists for much of the day. Frequent on- and off-ramps and heavy entering and exiting volumes make truck travel particularly difficult and require trucks to change lanes frequently to make a through-movement. The Port of Seattle has identified access to and from the north on I-5 as an important issue resulting from congestion and poor operations on I-5 through downtown Seattle.

4.7.3 Freight and Commercial Traffic

Truck volume and classification counts were collected by video along the SR 99 corridor in downtown Seattle in June 2006. As shown in Exhibit 4-36, an estimated 3,720 trucks use the Alaskan Way Viaduct through central Seattle on a typical weekday. This includes single-unit trucks, combination trucks, and tanker (liquid transport) trucks. Garbage trucks and concrete trucks were classified as single-unit trucks.

4.7.3.1 Travel Patterns

South of downtown, 10 percent of southbound trucks (180 trucks) exit the corridor, and 17 percent of northbound trucks (310 trucks) enter the corridor at the First Avenue S. ramps. The lower southbound ramp volumes may be partially due to weight restrictions currently in place for the southbound outside lane, which limits access to the left-side off-ramp. Note, however, that mainline truck volumes are balanced (1,870 northbound and 1,850 southbound), which could indicate that trips displaced from the southbound off-ramp by these weight restrictions may be continuing to use the corridor, but exiting farther to the south. The majority of truck trips south of downtown continue south to East Marginal Way S. or West Seattle/Harbor Island.



N

1 0.5 0 1 Miles

Basemap Data Source: City of Seattle, 2006.

Exhibit 4-35
City of Seattle Designated Major Truck Streets

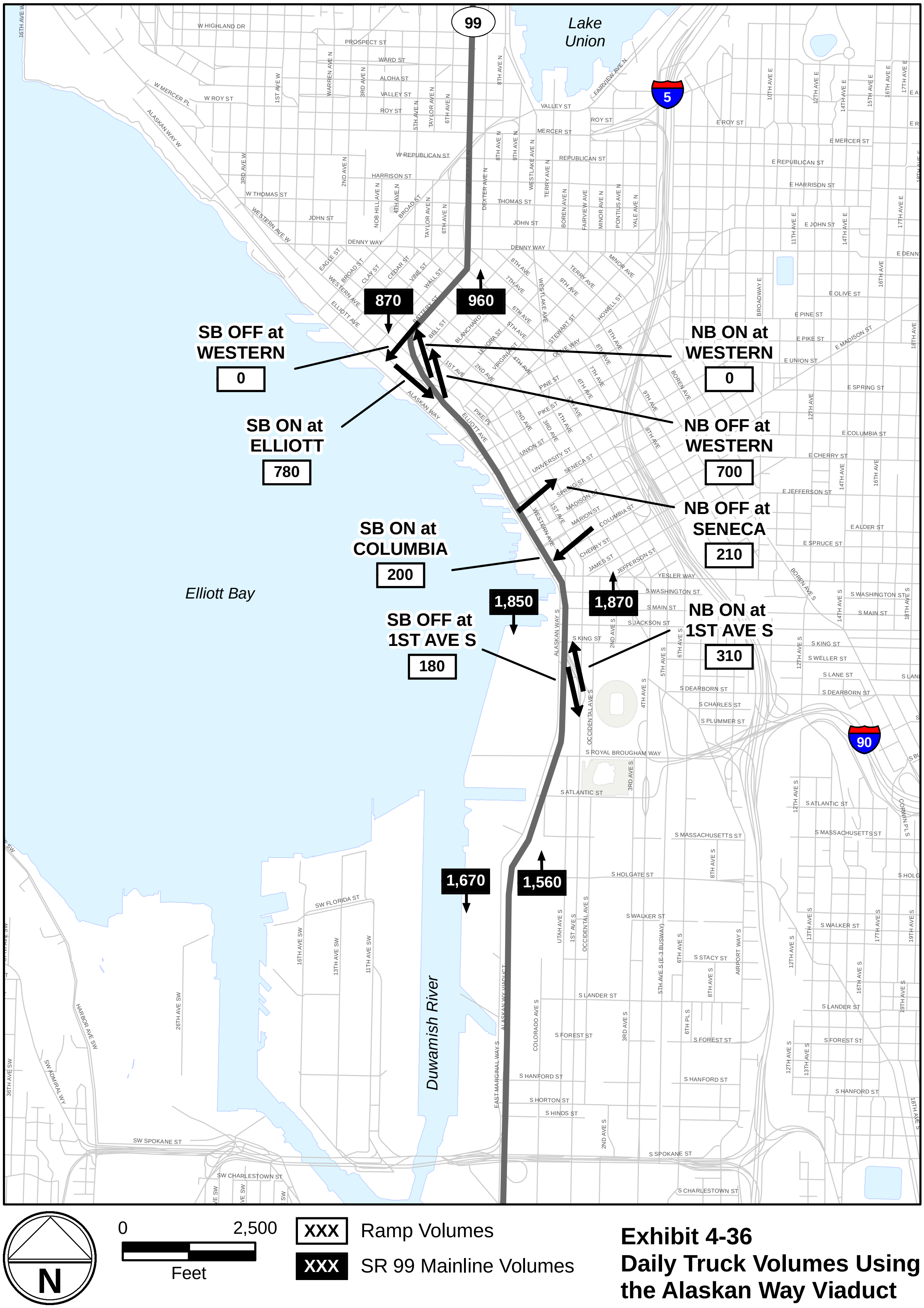


Exhibit 4-36
Daily Truck Volumes Using the Alaskan Way Viaduct

North of downtown, the Elliott/Western ramps provide access to the Ballard/ Interbay industrial area (via 15th Avenue N.W.), as well as other areas northwest of downtown. A large share of truck traffic uses the Elliott/Western ramps, though a majority of trucks continue north on SR 99 through the Battery Street Tunnel. A smaller share of traffic accesses downtown directly using the Columbia/Seneca Street ramps. Northbound, 11 percent of trucks (210 trucks) exit SR 99 at Seneca Street, 37 percent (700 trucks) exit to Western Avenue, and 51 percent (960 trucks) continue through the Battery Street Tunnel. Southbound, 47 percent of trucks (870 trucks) access the viaduct through the Battery Street Tunnel, 42 percent (780 trucks) via the Elliott Avenue on-ramp, and 11 percent (200 trucks) use the Columbia Street on-ramp.

4.7.3.2 Classification of Truck Types

The composition of trucks on the viaduct along the central waterfront is approximately 88 percent single-unit trucks, 9 percent combination trucks, and 3 percent tanker trucks (single and combination units). A higher share of combination and tanker trucks use the Elliott/Western corridor, hence the composition in the Battery Street Tunnel is 93 percent single units, 6 percent combination trucks, and 1 percent tankers.

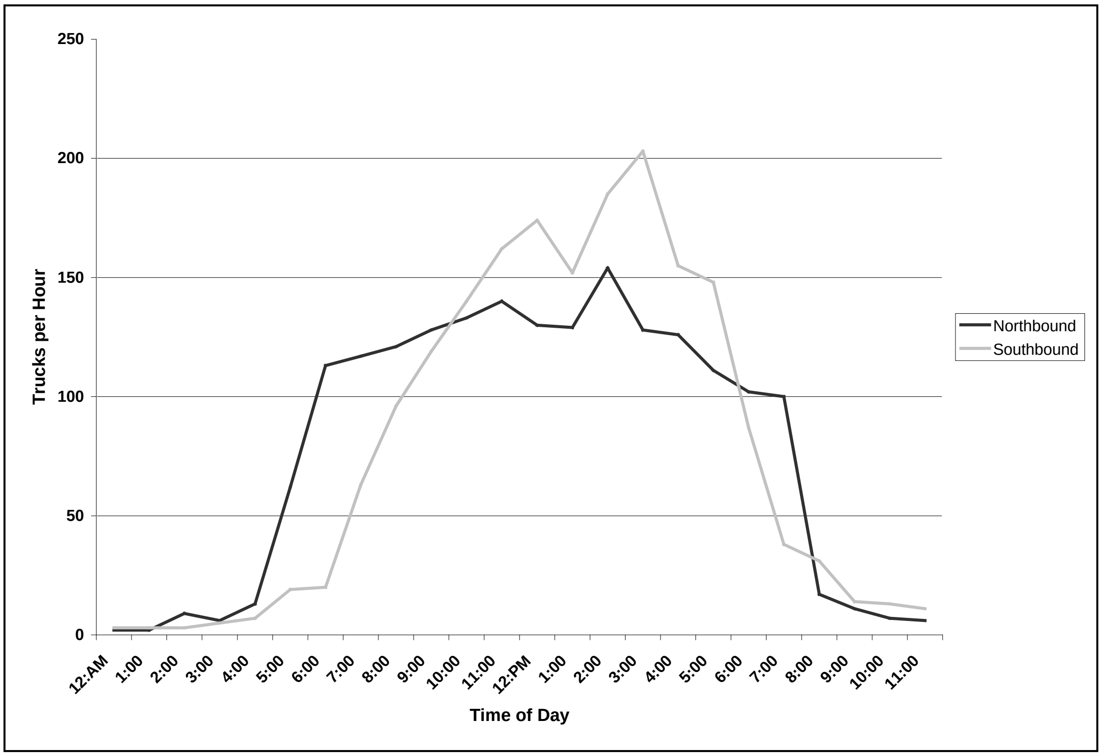
4.7.3.3 Tanker/Liquid Transport Trucks

Between 80 and 100 tanker trucks are estimated to use the SR 99 corridor each day (40 to 50 per direction). The share of these trucks that are hauling hazardous, combustible, or flammable materials is unknown. However, approximately 15 percent of tankers on the viaduct were observed using the Battery Street Tunnel, where hazardous materials are prohibited. An additional 15 percent of tanker trucks, some of which may carry hazardous cargo, use the viaduct during times when hazardous cargos are prohibited anywhere on the viaduct between 7:00 and 9:00 a.m. and between 4:00 and 6:00 p.m. Up to 70 percent of the observed tanker truck volumes—55 to 70 tankers per day—could therefore be legally carrying hazardous loads on the viaduct.

4.7.3.4 Hourly Truck Volumes

Unlike overall traffic volumes, which peak during the morning and evening commutes, truck volumes peak during the midday and afternoon. Exhibit 4-37 shows hourly truck volumes on the viaduct between the First Avenue S. ramps and Columbia/Seneca Street ramps (this is the busiest segment of the corridor). Northbound truck volumes are quite steady, generally ranging between 100 and 150 trucks per hour between 6:00 a.m. and 8:00 p.m. They peak at 155 trucks per hour between 2:00 p.m. and 3:00 p.m. Southbound truck traffic peaks more sharply, meaning higher volumes, but for fewer hours. Southbound truck volumes don't reach 100 trucks per hour until 9:00 a.m., and fall below that threshold by 6:00 p.m. Peak volumes do, however, range from 150 to 200 trucks per hour between 11:00 a.m. and 5:00 p.m., peaking at 205 trucks between 3:00 p.m. and 4:00 p.m. Use of the viaduct by trucks at other times is low.

Exhibit 4-37. Hourly Truck Volumes on the Alaskan Way Viaduct (Midtown)



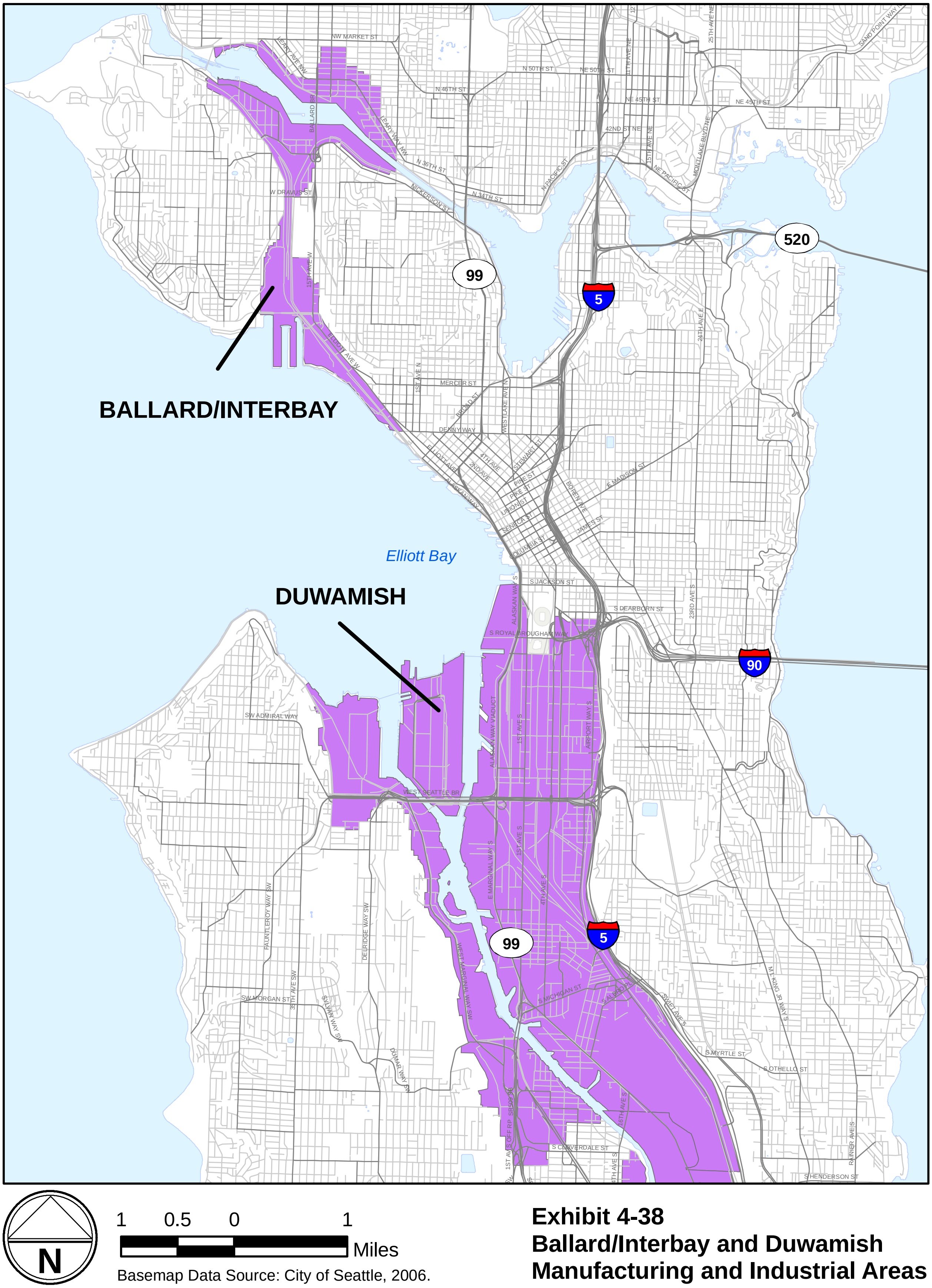
4.7.3.5 Freight Access

Within the project area, SR 99 serves areas that generate substantial freight and truck traffic. Exhibit 4-38 shows the boundaries of the Duwamish/SODO manufacturing and industrial area and the BINMIC, as determined by the City. In addition to the industrial areas, trucks using this portion of the SR 99 corridor are destined to consumer markets throughout Seattle and the region.

The southern portion of the study area falls within the Duwamish/SODO manufacturing and industrial area. In addition, freight using the viaduct is often destined for the BINMIC area. Light industrial and warehouse uses north and south of downtown Seattle also generate substantial truck traffic. Historically, freight-related businesses have clustered north and south of downtown Seattle to be near both marine and railroad access.

4.7.3.5.1 Duwamish Industrial Area

The Duwamish Manufacturing and Industrial Center stretches over 3,981 acres from the area south of downtown Seattle, following the Duwamish River to unincorporated King County south of the Seattle city limits. It includes Boeing's



Basemap Data Source: City of Seattle, 2006.

Exhibit 4-38
Ballard/Interbay and Duwamish Manufacturing and Industrial Areas

Plant 2, much of the Port of Seattle, and almost 1,900 businesses just within the Seattle city limits. In 2008, approximately 65,300 employees worked in the Duwamish Manufacturing and Industrial Center (City of Seattle 2009a).

Marine access to the Duwamish industrial area is provided through the Port of Seattle and along the Duwamish Waterway. Railroad access is provided at the BNSF SIG and North SIG and UPRR Argo Railyards.

Highway access from this area to I-5 is provided by SR 519 from Fourth Avenue S., at S. Spokane Street from Sixth Avenue S. and the S. Spokane Street surface route, and at S. Industrial Way. Alternate access routes to I-5 south include SR 99 to SR 599, SR 99 to SR 509 and SR 518, and Airport Road S. Access to I-90 is provided from Fourth Avenue S. at SR 519 or from S. Spokane Street and from I-5 to I-90.

Freight trips in the North Duwamish area, including port-related trips, must share the street system with other uses, including stadium event and ferry access traffic—both of which can overwhelm the street network at times. Roads and rail lines intersect at many locations, and rail traffic preempts use of the roadway when train activity is present. Because trains are assembled at rail switching yards in the area, some train activity consists of switching movements that can block intersections for an extended time. This causes truckers to rely heavily on existing grade-separated facilities to avoid conflicts with rail or heavy traffic conflicts. These facilities include the Alaskan Way Viaduct, the S. Spokane Street Viaduct, and overpasses on Airport Way S., First Avenue S., and Fourth Avenue S. Phase 1 of the SR 519 Intermodal Access Project added a new grade separation at S. Atlantic Street to provide grade-separated access in the eastbound direction between First Avenue S. and Fourth Avenue S., I-90, and I-5. Phase 2 of the SR 519 Intermodal Access Project, completed in Spring 2010, added a corresponding westbound connection.

4.7.3.5.2 Ballard Interbay Northend Manufacturing and Industrial Center

The BINMIC comprises 866 acres, with over 650 businesses employing approximately 14,500 employees in 2008 (City of Seattle 2009a). Many of these businesses are located in this area due to its marine access. Commercial fishing and marine-related businesses such as ship repair are located here. In 2005, 31 percent of employment in the BINMIC was in manufacturing; 14 percent in wholesale trade (including warehousing), transportation, and utilities; and 13 percent in construction/resources (including fishing). Most BINMIC businesses are small businesses employing 40 or fewer employees. Railcar storage and switching is provided at the BNSF Balmer Yard. Access to BINMIC businesses is provided at the Ballard Terminal Railroad Company, via the railcar distribution and interchange operations located along Shilshole Avenue N.W. on the north side of the Lake Washington Ship Canal. The Port of Seattle also has facilities in the area at Terminals 86 and 91 and Fishermen's Terminal.

The BINMIC is not served directly by the regional highway system. The primary access to regional freeways and industrial areas south of Seattle is via 15th Avenue W., connecting to SR 99 via the Elliott/Western ramps. Alternate routes include 15th Avenue W. or Nickerson Street and Westlake Avenue N. to N. Mercer Street and I-5; however, Mercer Street and I-5 provide a less direct and more congested route during most workdays. Freight generators in Ballard also use arterial east-west streets in Ballard and Fremont to access SR 99, including Leary Way and N. 39th Street, which is not designated as a Major Truck Street by the City. Trucks traveling to the north that begin their trip in the Ballard/Interbay area use 15th Avenue N.W. to Holman Road, then east to I-5. N.E. 85th Street also provides a connection to I-5 for freight.

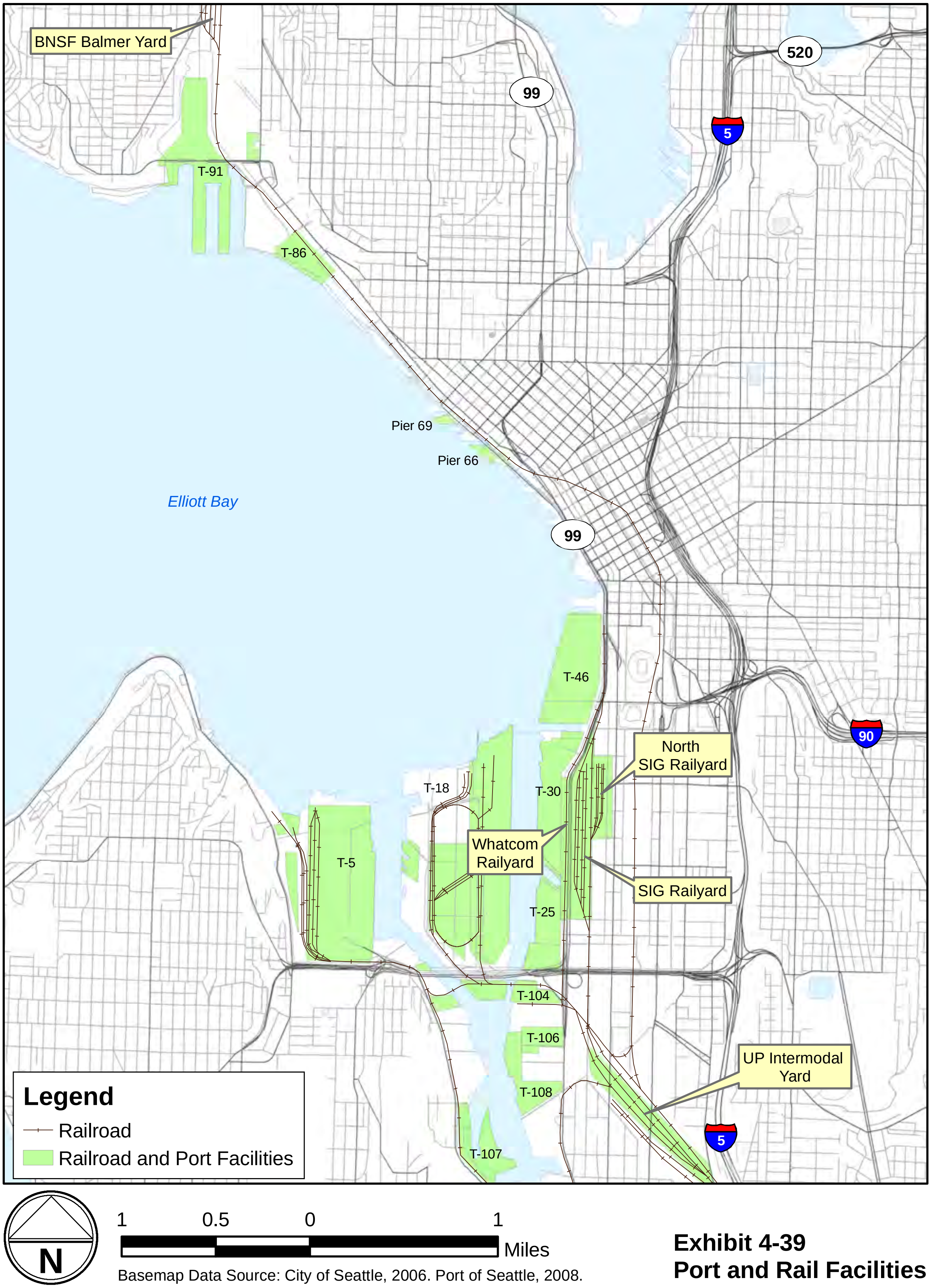
4.7.3.5.3 Port of Seattle and Intermodal Railyards

The Port of Seattle is one of the largest west coast cargo centers, serving as the entry and exit point for marine cargo to and from the Pacific Rim and Alaska. Exhibit 4-39 shows Port of Seattle facilities, including marine cargo terminals at Harbor Island and the Southwest Harbor (Terminals 5 and 18), along Alaskan Way in the Southeast Harbor (Terminals 25, 30, 37, and 46), and in the Interbay area north of the study area (Terminals 86 and 91). Terminal 91 is used for processing cargo as well as for staging cruise ships. The BNSF and UPRR Argo railyards are also shown in Exhibit 4-39.

Most of the freight shipped through the port is in intermodal containers that are transferred to or from railcars or trucks on the dock. The Port of Seattle's container terminals are Terminals 5, 18, 25, 30, and 46. Terminals 25, 30, and 46 are all accessed from East Marginal Way S. between S. Atlantic Street and S. Hanford Street. Terminal 18 on Harbor Island and Terminal 5 in West Seattle are accessed from S. Spokane Street. Terminals 5 and 18 have been upgraded over the past decade to include on-dock rail facilities. Some of the containers are shuttled (called “drayed”) by truck to or from the BNSF or UPRR Argo railyards accessed from East Marginal Way S. to be transferred to or from railcars remotely.

Trucks entering or leaving Terminals 5 and 18 use the S. Spokane Street Viaduct to reach I-5, but use surface-level S. Spokane Street to get to and from Duwamish locations since there are no connections from the S. Spokane Street Viaduct to the south on SR 99.

Terminals located along the Southeast Harbor do not have on-dock rail facilities, and when ships are unloaded at these terminals, those containers bound inland by rail must be drayed between the terminal and the railyard. The primary dray route is along East Marginal Way S. to S. Atlantic Street, under the Alaskan Way Viaduct to the north entrance of the BNSF SIG Railyard. Other key truck arterials in the north Duwamish area include West Marginal Way, Alaskan Way, and S. Michigan and S. Hanford Streets.



Basemap Data Source: City of Seattle, 2006. Port of Seattle, 2008.

Exhibit 4-39
Port and Rail Facilities

Bulk (non-containerized) grain shipments are made through Terminal 86, and generally these loads arrive and leave via rail rather than by truck. Bulk cargo also passes through Terminal 91, often as over-legal (oversized) vehicle loads that must use designated over-legal routes to reach their landside destinations. Alaskan Way surface street, Broad Street, and 15th Avenue W. are the streets used for over-legal truck travel to and from the Interbay area.

The Port of Seattle gates are typically open between 7:00 a.m. and 5:00 p.m. Arrival times at the gate are determined by businesses that ship through the port and are affected by travel distance as well as the delivery schedule to regional warehouse and distribution centers. Peak truck volumes usually occur between 7:00 and 9:00 a.m. as trucks arrive for their first morning trip, and then again midday (12:30 to 2:30 p.m.). Most of the port gates are closed or partially closed during the noon lunch hour, but trucks continue to arrive in the gate queue areas.

Freeway access to and from I-5 and I-90 are provided at SR 519 and at S. Spokane Street from both the viaduct level and the surface roadway. Access to I-90 from S. Spokane Street requires entering and exiting from I-5 in a bottleneck location. Since I-5 is congested during much of the work day, alternate access to and from I-5 is provided using SR 509 and SR 518, SR 99 and SR 599, or Airport Way S.

4.7.4 Peak Hour Travel Times for Freight Corridors

The following sections identify estimated travel times under 2015 Existing Viaduct conditions for several popular freight corridors serving the study area. These include the Ballard to S. Spokane Street (via Alaskan Way/Alaskan Way Viaduct) corridor, the Northgate to Boeing Access Road (via I-5) and the Mercer Street (I-5 to Elliott Avenue W.) corridors. Travel times are provided for the AM and PM peak hours for the 2015 Existing Viaduct conditions as shown below in Exhibit 4-40.

For the 2015 Existing Viaduct, data are provided for general-purpose traffic. While trucks operate slightly slower than automobile traffic, particularly on streets with signalized intersections, over a long corridor, the times are generally close to those of general-purpose traffic.

4.7.4.1 Peak Hour Travel Times – Ballard to Spokane Street Corridor

This corridor serves truck traffic that may operate in the BINMIC, Interbay, and SODO areas. During the AM peak hour, general-purpose travel times in this corridor are estimated to be 16 minutes in the northbound direction and 19 minutes in the southbound direction. Travel times in the PM peak hour are similar to the AM peak hour, except in the northbound direction, where travel times increase to 21 minutes on this corridor. This reflects the trend of higher congestion levels due to higher vehicle demand in the afternoon peak over the morning peak.

Exhibit 4-40. Travel Times Along Major Freight Travel Corridors

	2015 Existing Viaduct	
	AM Peak Hour (minutes)	PM Peak Hour (minutes)
Ballard to Spokane Street (via Alaskan Way/Alaskan Way Viaduct)		
Southbound	16	16
Northbound	19	21
Northgate to Boeing Access Road (via I-5)		
Southbound	28	32
Northbound	28	30
Mercer Street (I-5 to Elliott Avenue W.)		
Westbound	9	11
Eastbound	6	12

4.7.4.2 Peak Hour Travel Times – Northgate to Boeing Access Road Corridor

This corridor serves truck traffic that may be long-haul interstate traffic or trucks making much shorter hauls but find it more advantageous to use I-5 over the SR 99 corridor. During the AM peak hour, general-purpose travel times in this corridor are estimated to be about 28 minutes in both directions. Travel times are slightly higher in the PM peak hour.

4.7.4.3 Peak Hour Travel Times – Mercer Street Corridor

This corridor serves I-5 truck traffic that may use Mercer Street to access the Seattle waterfront connecting to industrial areas in the Ballard and Interbay areas or along the Seattle waterfront and points south via Alaskan Way and East Marginal Way S. Travel times reflect the time it takes general-purpose traffic to travel on Mercer Street from I-5 to Elliott Avenue W. and vice versa. During the AM peak hour, general-purpose travel times in this corridor are estimated to be about 9 minutes for the westbound direction and 6 minutes in the eastbound direction. Travel times in the PM peak hour are higher, with westbound traffic taking 11 minutes and eastbound traffic taking 12 minutes. The predominant travel patterns in this corridor are westbound (I-5 to Elliott) in the morning and eastbound (Elliott to I-5) in the afternoon and this is reflected in the travel time data.

4.7.5 Railroads

BNSF Railway maintains two mainline tracks through the study area, paralleling I-5 to the south and running between First and Fourth Avenues S., crossing S. Spokane Street, S. Lander Street, S. Holgate Street, and S. Royal Brougham Way (SR 519) at-grade. North of S. Royal Brougham Way is King Street Station and a tunnel under the downtown area that emerges north of the Pike Place Market and follows the waterfront to points north. This route serves the Interbay switching and engine maintenance and refueling yard, as well as the grain elevator at Terminal 86. The BNSF mainline serves the I-5 corridor south to Long Beach, California, and north to British Columbia, connecting to east-west tracks crossing the Cascades at Everett, Auburn, and along the Columbia River. BNSF Railway has agreements with the state, Amtrak, and Sound Transit to carry intercity and regional commuter rail passenger trips that are accessed at King Street Station. Passenger train switching and staging occur on switching tracks north and south of SR 519.

UPRR maintains a single mainline track heading south from Seattle, using a shared alignment with BNSF Railway until Tukwila. UPRR also serves the I-5 corridor and connects to east-west tracks at the Columbia River. The UPRR Argo intermodal switching yard is south of S. Spokane Street. The capacity of the combined UPRR and BNSF tracks is reduced due to operational conflicts caused by the need for UPRR trains to cross the BNSF mainline to access the Argo Railyard. Both the UPRR and BNSF tracks serving Terminals 5 and 18 cross East Marginal Way S. at-grade, resulting in delays for heavy truck traffic in that area.

The BNSF SIG and North SIG Railyards are located on the east side of SR 99, south of S. Atlantic Street. These intermodal railyards are used to load cargo containers (most of which arrive by sea at the port facilities on the west side of SR 99) onto railcars and switch railcars to build freight trains. A switching track, referred to as the *tail track*, extends north from the SIG Railyard, crossing S. Atlantic Street and S. Royal Brougham Way. Switching operations at the SIG Railyard have frequently blocked these streets near their intersections with Alaskan Way S.

To help remedy these conflicts, as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, a grade separation from the BNSF tail track will provide an h-shaped overcrossing that will extend from the S. Atlantic Street/Colorado Avenue S. intersection to the S. Atlantic Street/East Marginal Way S. intersection. This h-shaped overcrossing will provide a bypass for traffic traveling along S. Atlantic Street when the tail track is blocked. The structure will include an aerial connection with East Marginal Way S., providing increased north-south mobility through the project area. In this new configuration, Alaskan Way S. will connect to the structure and will include a southbound connection from the central waterfront to East Marginal Way S. and eastbound S. Atlantic Street east of the tail track. The facility will also provide other east-west traffic connections (e.g., to I-90) for freight traveling between the container terminals, railyards, and freeways. Two additional BNSF tracks pass through the Whatcom Railyard on the west side of SR 99. One track that is used for train assembly continues from the SIG Railyard north across S. Royal Brougham Way just west of the viaduct, causing backups for trucks accessing port terminals along the waterfront. To eliminate conflicts for trucks at this location, the connection between the Whatcom Railyard and the SIG Railyard will be removed by the S. Holgate Street to S. King Street Viaduct Replacement Project. In addition, traffic signals, intelligent transportation systems, train crossing gates, illumination, and signage will be added to help facilitate freight travel through the area.

4.8 Parking

4.8.1 Parking Space Definitions

This assessment quantifies "public parking," unless otherwise noted.
Public parking is defined as (1) parking spaces regulated by the City and (2) pay parking lots from which money is collected by a private entity but parking spaces are available to the public. Parking was grouped and summarized into three main categories: short-term on-street parking, long-term on-street parking, and off-street parking. Viaduct demolition poses a special case for which restricted parking spaces are discussed.

4.8.1.1 On-Street Short-Term Parking

Existing short-term parking includes metered spaces (including pay stations) with up to a 2-hour limit; passenger and commercial loading zones; and taxi, bus, and police parking.

4.8.1.2 On-Street Long-Term Parking

On-street long-term parking includes 10-hour metered spaces plus unmetered, unrestricted, on-street public parking. These types of spaces are found in the primarily in the north area.

4.8.1.3 Off-Street Parking

Off-street parking includes privately owned parking lots at which the public can park for a fee. In most cases, public parking does not include customer or employee parking for private businesses. The exception is some parking under the viaduct that is restricted during daytime hours on weekdays but used as public parking at other times.

4.8.1.4 Restricted Parking

As noted previously, this assessment quantifies "public parking." However, viaduct demolition would affect some restricted parking spaces under the viaduct, along the west side of buildings and loading docks. These spaces can generally be categorized as restricted or reserved for private business use, including customer and employee parking, but some of the spaces can be used by the public during non-business hours. The effect of viaduct demolition on restricted spaces is noted in Chapter 6, Construction Effects and Mitigation, Section 6.9, Parking.

4.8.2 Parking Study Boundaries

The parking study was generally limited to the areas in and adjacent to the project area where parking spaces could be affected. The parking assessment areas are organized according to the following subareas, which are shown in Exhibit 4-41:

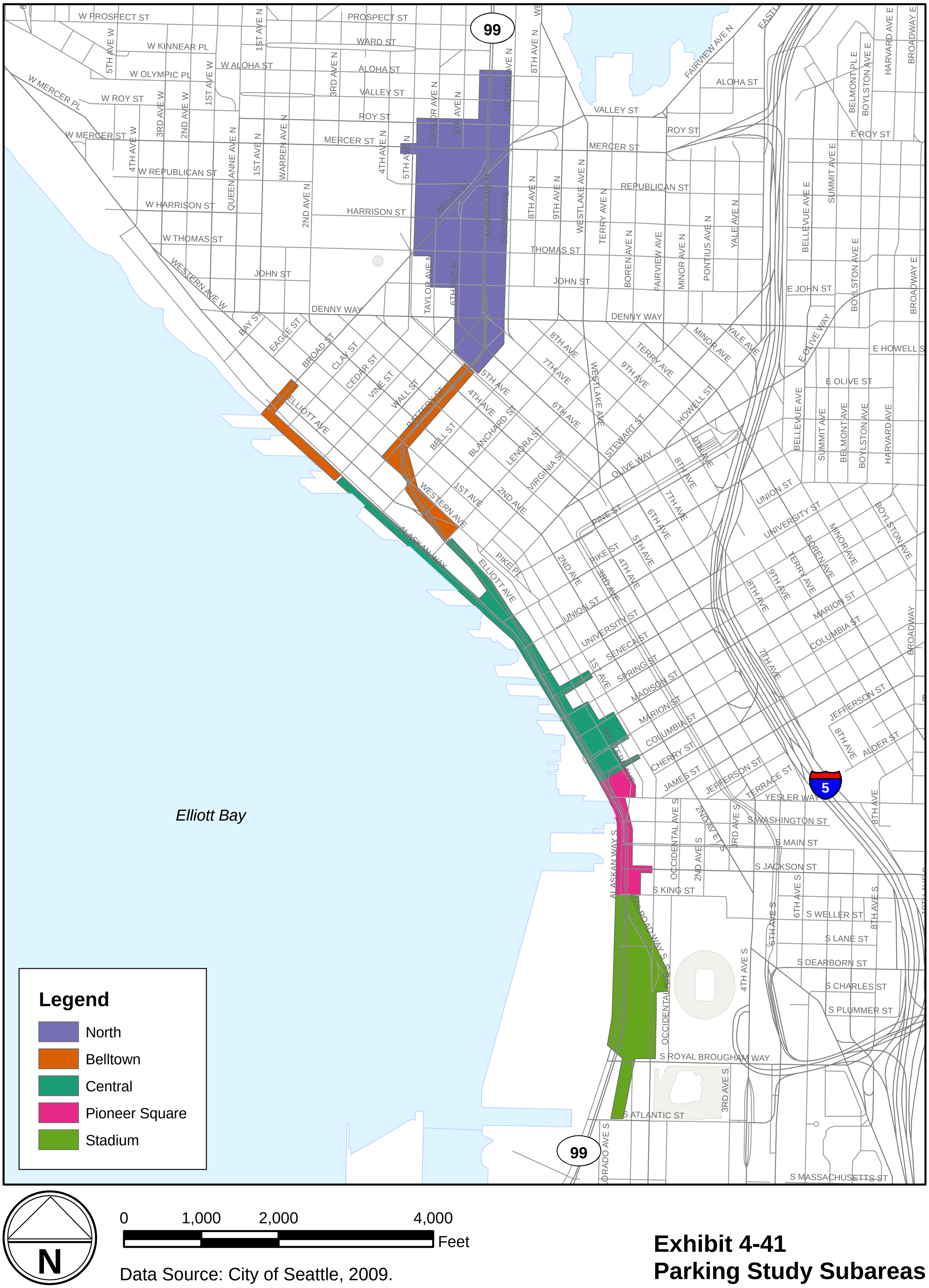
1. Stadium subarea – S. Atlantic Street to S. King Street
2. Pioneer Square subarea – S. King Street to Columbia Street
3. Central subarea – Columbia Street to Lenora Street (and Wall Street along the waterfront)
4. Belltown subarea – Lenora Street to Denny Way
5. North subarea – Denny Way to Aloha Street

4.8.3 Existing Parking Spaces

Exhibit 4-42 summarizes the existing parking in the study area. By definition, the parking study area was delineated to quantify parking in the vicinity of SR 99 and Alaskan Way that could be affected by one or more of the build alternatives. There may be a small number of additional parking spaces, not captured in Exhibit 4-42, that are affected for short durations during construction that would be identified as the construction approach is refined.

Most of the on-street parking in the study area is short-term parking. The off-street parking in the study area consists of a number of privately managed public pay lots that are adjacent to or under the viaduct or ramps, or adjacent to or within the surface street improvement areas.

Changes to parking due to the S. Holgate Street to S. King Street Viaduct Replacement Project have been previously accounted for, so they are incorporated into the existing conditions. About 200 off-street spaces are located on the Washington-Oregon Shippers Cooperative Association (WOSCA) property and are currently unavailable due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project; however, they could be replaced after completion of that project. These 200 spaces are therefore included in the summary of existing parking spaces in the stadium subarea. Near the stadiums, about 230 on-street spaces and 250 off-street spaces are within the study area. In this subarea, on-street parking in the study area predominantly consists of short-term parking, much of which is under the viaduct and Railroad Way ramp. Off-street parking, which represents privately managed paid parking lots, represents about 250 stalls.



Data Source: City of Seattle, 2009.

Exhibit 4-41
Parking Study Subareas

Exhibit 4-42. Summary of Existing Parking Spaces Within the Study Area

	On-Street Parking			Off-Street Parking	Total
	Short-Term	Long-Term	Subtotal		
Stadium subarea	180	50	230	250	480
Pioneer Square subarea	220	10	230	130	360
Central subarea	560	0	560	110	670
Belltown subarea	150	0	150	200	350
North subarea	170	300	470	140	610
Total	1,280	360	1,640	830	2,470

In the Pioneer Square, central, and Belltown subareas, most of the on-street parking is short-term. In these subareas, approximately 230, 560, and 150 on-street spaces, respectively, are in the parking study area. Within these three subareas, only about 10 of the on-street spaces are long-term unrestricted spaces. In the Pioneer Square and central subareas, most of the on-street parking supply under the viaduct, along Alaskan Way, and along Western Avenue is short-term metered parking serving waterfront visitors and access to nearby businesses.

In the north subarea, about 470 on-street spaces are within the area investigated, and about 300 of these are 10-hour metered or unrestricted spaces.

4.9 Pedestrians

The study area includes several noteworthy pedestrian generators/attractors:

- Two stadiums
- Major employment centers
- Major tourist attractions
- Green space/recreational areas

Sidewalks are found on the majority of streets in the study area and are the primary source of pedestrian access and mobility. Other pedestrian facilities in the study area include the Waterfront Bicycle/Pedestrian Facility and pedestrian facilities to or across Alaskan Way at Marion Street, Pike Street, Lenora Street, and Bell Street that link the downtown and Belltown areas with the waterfront. The following discussion provides information on existing pedestrian facilities for the following portions of the project area:

- South area
- Waterfront area
- North area

4.9.1 South Area

The south area includes the area immediately to the west of the sports stadiums and adjacent to the Port of Seattle and other industrial land uses. Pedestrian activity is highly variable in the south area due to the mix of land uses in the area and the stadiums.

First Avenue S. and Occidental Avenue S. provide the main north-south pedestrian facilities in the area. First Avenue S. has sidewalks on both sides of the street, whereas Occidental Avenue S. has a large sidewalk area adjacent to Qwest Field, but no sidewalk facilities on the western side of the roadway.

While First Avenue S. has sidewalks on both sides of the roadway, the sidewalks are relatively narrow, there are limited pedestrian-oriented attractors or amenities, traffic volumes on First Avenue S. are relatively high, and overall pedestrian flow is interrupted by the ramps to SR 99, where pedestrians are diverted to a narrow, hidden sidewalks behind the ramps.

Conversely, Occidental Avenue S. has very low traffic volumes, virtually no traffic channelization markings, and a broad sidewalk and pedestrian area on the east side of the roadway, which generally leads to the intermingling of pedestrian and vehicle traffic on Occidental Avenue S.

The S. Holgate Street to S. King Street Viaduct Replacement Project includes the Port Side Trail and City Side Trail. The Port Side Trail will be a combined pedestrian and bicycle facility adjacent to Terminal 46 and on the west side of East Marginal Way S. from S Atlantic Street to S. King Street.

The City Side Trail will also be a combined pedestrian and bicycle facility, located on the east side of SR 99. This trail will run adjacent to the East Frontage Road south of S. Royal Brougham Way and will continue northward on the east side of the SR 99 ramps/Alaskan Way to S. King Street. The S. Holgate to S. King Street Viaduct Replacement Project will also improve sidewalk and crosswalk facilities on S. Atlantic Street.

East-west pedestrian facilities are provided on S. Atlantic Street, S. Royal Brougham Way, Railroad Way S., and S. King Street. Sidewalks exist on both S. Atlantic Street and S. Royal Brougham Way, but they are discontinuous due to entrances to parking facilities and the railroad facilities under the Alaskan Way Viaduct. The Railroad Way S. has a sidewalk only on the north side of the street. These two factors, in addition to a confusing roadway configuration under the viaduct, contribute to a generally unfriendly pedestrian environment. As a result, more pedestrians are likely to use S. King Street because it has sidewalks on both sides of the roadway, has more pedestrian-oriented amenities, and is less affected by the viaduct.

During non-event times, pedestrian traffic is relatively light in the south area. However, these pedestrian and roadway facilities, particularly Occidental and First Avenues S., experience significant pedestrian volumes during events at either Safeco or Qwest Field. During larger events, such as a Mariners baseball game, Sounders soccer match, or a Seahawks football game, thousands of pedestrians crowd the sidewalks and alleys in the stadium and Pioneer Square areas. During these times, Occidental Avenue S. functions as the main pedestrian corridor, and while traffic is maintained on First Avenue S. and Alaskan Way S., there is virtually no vehicle traffic on Occidental Avenue S. Intersections throughout the area become saturated with pedestrian activity, and both the pedestrian and vehicle traffic LOS are considerably degraded. During such events, police officers typically provide traffic control to manage the very high vehicle and pedestrian volumes.

4.9.2 Waterfront Area

The waterfront area includes the Alaskan Way surface street from S. King Street to Broad Street and the SR 99 Alaskan Way Viaduct. In this area, the viaduct is an elevated, double-level structure that runs roughly parallel and to the east of Alaskan Way.

Primary pedestrian traffic generators along the waterfront include tourist activities, businesses, recreational uses, and ferry service. Sidewalks adjacent to east-west streets in this area make up the primary pedestrian access between downtown and the waterfront. However, between University Street and Wall Street, steep grades limit east-west connections under the viaduct, and east-west pedestrian access is challenging. As a result, a number of grade-separated pedestrian facilities have been constructed over the years to provide access between the downtown and Belltown areas and the waterfront.

Five major pedestrian facilities in the central waterfront area provide connections to the waterfront:

- Marion Street pedestrian bridge, which extends from First Avenue S., over Alaskan Way S., and connects to the Seattle Ferry Terminal at Colman Dock and the west side of Alaskan Way S.
- Harbor Steps, a wide, multilevel pedestrian plaza with stairs that provides access between First and Western Avenues located at University Street
- Pike Street Hillclimb, which provides access to the east side of Alaskan Way from Pike Place Market, First Avenue, and Western Avenue
- Lenora Street pedestrian bridge, which provides access from Elliott Avenue to the east side of Alaskan Way
- Bell Street Skybridge, which extends over Alaskan Way and the BNSF Railway tracks and connects to the Bell Street Pier

4.9.2.1 Pedestrian Facilities Along Alaskan Way

A widened sidewalk on the west side of Alaskan Way fronts waterfront businesses and attractions, acting as a pedestrian promenade. The promenade varies from 16 to 20 feet wide in the central waterfront area. The east side of

Alaskan Way is only periodically fronted by sidewalks between S. King Street and Pike Street, primarily at stops for the waterfront streetcar. Farther north, a sidewalk is provided between Pike Street and Clay Street on the east side of Alaskan Way. The Waterfront Bicycle/Pedestrian Facility is a multipurpose asphalt pathway along the east side of Alaskan Way (east of the streetcar tracks) that is used by both pedestrians and cyclists. This facility provides access along the eastern right-of-way from S. Royal Brougham Way to Broad Street, where it connects with the Elliott Bay Trail in Myrtle Edwards Park.

Pedestrians can cross Alaskan Way both at-grade and at two pedestrian bridges within the waterfront area. The Marion Street pedestrian bridge connects the Seattle Ferry Terminal to First Avenue, allowing commuters and other ferry users to access downtown without having to cross Alaskan Way S. at-grade. To the north, the Bell Street Skybridge connects to Elliott and Western Avenues. In addition, the Pike Street Hillclimb and the Lenora Street pedestrian bridge link downtown and the south end of Belltown to the waterfront by providing facilities on the east side of Alaskan Way, where pedestrians can then cross Alaskan Way at-grade.

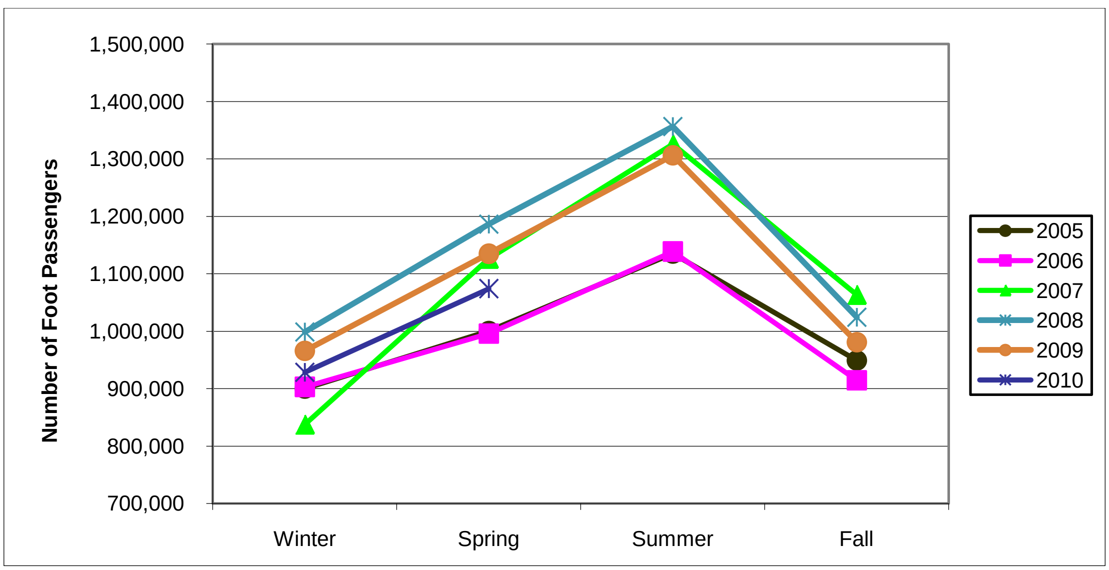
Surface crossings of Alaskan Way are provided at fairly regular intervals along the roadway. However, not all crossings are at a signalized intersection, which may be difficult for some pedestrians. Signalized intersection crossings are mainly in the southern portion of the waterfront area. In the south end, signalized intersections are located at Yesler Way and Columbia, Marion, and Madison Streets; near the middle at University and Pike Streets; and Wall and Clay Streets to the north. Pedestrians wishing to cross Alaskan Way only at a signalized intersection would face longer travel distances (or out of direction travel), particularly if they are unaware that there are only two signalized crossings between Madison and Wall Streets, a stretch of nearly 1 mile.

Pedestrian traffic along the waterfront experiences substantial variability—both day-to-day and seasonally—due to ferry, tourist, and cruise ship activities. Data from Washington State Ferries show that overall foot passenger volumes are typically higher during the summer months than during the fall and winter months (Exhibit 4-43). Unlike overall pedestrian volumes in the downtown area, which are generally associated with typical workday activities and tend to peak during the weekday PM peak hour, pedestrian volumes along the downtown waterfront tend to peak during the weekend PM peak hour in the summertime.

Pedestrian volumes were collected by video along Alaskan Way in the waterfront area in August 2006 during the PM peak hour for both weekday and weekend conditions. These volumes also serve to reinforce the variability of pedestrian traffic in the area, and include the following:

- The western legs of the following streets at Alaskan Way saw fairly substantial increases in pedestrian traffic during the weekend PM peak hour over the weekday PM peak hour:
  - Pike Street: from 897 to one-and-a-half times that at 1,446
  - Madison Street: from 848 to over twice as many at 2,173
  - Marion Street: from 415 to over three times as many at 1,408
- The Marion Street pedestrian bridge had 915 users during the weekday PM peak hour but less than half as many during the weekend PM peak hour count (387); this was the only location to see a decrease in pedestrian volumes during the weekend PM peak hour.
- The western leg of Bell Street at Alaskan Way saw 305 pedestrians during the weekday PM peak hour but more than five times that amount during the weekend PM peak hour count (1,582).
- The Bell Street Skybridge was used by 199 pedestrians during the weekday PM peak hour and more than twice as many during the weekend PM peak hour count (422).

Exhibit 4-43. Washington State Ferries Seasonal Foot Passenger Traffic at Colman Dock



Source: Washington State Ferries 2010.

4.9.3 North Area

The north area consists of the western portion of the South Lake Union neighborhood and the Uptown neighborhood, which contains Seattle Center. North of Denny Way, SR 99 divides the grid system and separates the South Lake Union area from Uptown and the Seattle Center area. This segment of SR 99 is at-grade, and the only pedestrian crossings provided are at Denny Way, Mercer Street, and Broad Street.

Denny Way and Dexter Avenue serve as the primary east-west and north-south pedestrian routes, respectively. Mercer and Broad Streets also serve as east-west pedestrian routes, but these streets pass under SR 99, have quite narrow sidewalks, and do not provide a comfortable or attractive environment for most pedestrians.

Pedestrian activity in the South Lake Union area continues to increase as residential, commercial, and retail development continues. The Seattle Center area also has a relatively high volume of pedestrian traffic, and similar to the stadiums in the south area, pedestrian activity increases rather dramatically during the numerous sporting, art, and cultural events that take place at Seattle Center.

By 2015, the City will have completed the construction of a new bicycle/pedestrian overpass connecting Uptown to the waterfront at Thomas Street.

4.9.4 Interaction Between Pedestrians and Vehicle Traffic

Pedestrians may encounter heavy traffic and fast-moving vehicles at locations where traffic enters or exits SR 99. The Denny Way ramps are one location where vehicles encounter pedestrians immediately as they exit the highway. These ramps have sidewalks and buses along their outside lanes. This location is an area for potential conflict, because it is an active pedestrian environment that also accommodates high vehicle volumes at potentially higher rates of travel as vehicles transition from a limited-access environment to an arterial environment.

The Battery Street Tunnel and Elliott/Western ramps also introduce highway traffic into a pedestrian environment with little transition. At the southbound on-ramp at Elliott Avenue and the northbound Battery Street Tunnel on-ramp, accelerating traffic entering the highway crosses pedestrian traffic traveling along Western and Elliott Avenues. The northbound off-ramp to Western Avenue accommodates high traffic volumes, which encounter an active pedestrian environment immediately at the base of the ramp. An unsignalized crosswalk at Bell Street crosses the ramp immediately as it joins the street grid. Both Western and Elliott Avenues experience moderate to high levels of pedestrian activity.

The Columbia/Seneca Street ramps are signal-controlled, and due to the sharp exiting curve from SR 99 to the Seneca Street off-ramp, traffic is slowed to arterial speeds before reaching the intersection with First Avenue. Conflicts between pedestrians and vehicles are limited at the southbound SR 99 off-ramp to First Avenue and the northbound SR 99 on-ramp from First Avenue because pedestrians on First Avenue are routed behind the ramp structures to narrow, hidden walkways. While this reduces the conflicts between pedestrians and ramp traffic, the environment behind the ramp structures is not an appealing one for most pedestrians, with this sidewalk section largely hidden from view.

4.10 Bicycle Facilities

Bicycles are used in the study area for both recreation and commuting. This section describes existing bicycle facilities and routes, planned facilities and routes, and how these facilities and routes relate to the existing SR 99 facility. The discussion provides information on bicycle facilities in the following portions of the project area:

- South area
- Waterfront area
- North area

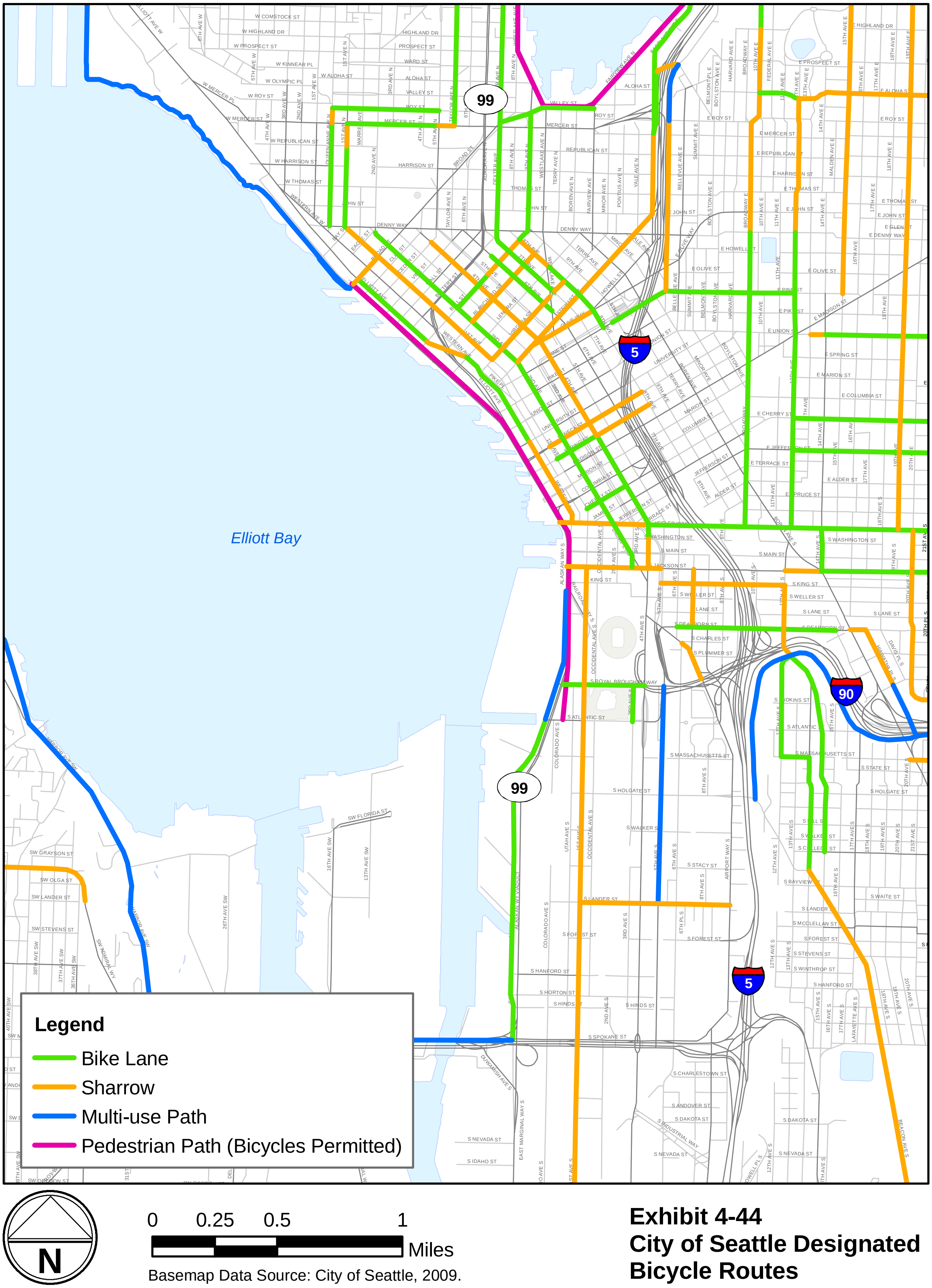
4.10.1 Bicycle Facilities and Designated Bicycle Routes

Seattle features an extensive network of bicycle facilities and routes. Bicycle facilities consist of separate, off-street trails or paths, on-street bicycle lanes, and designated routes on both arterials and local streets, some of which are designated by a sharrow. A sharrow is a bicycle symbol that is placed in the roadway lane, indicating that motorists should expect to see and share the lane with bicycles. Unlike bicycle lanes, they do not designate a particular part of the roadway for the use of bicyclists. A substantial number of commuters travel to jobs in the downtown area via these facilities and designated routes. City delineated bicycle facilities and routes in the downtown area are shown in Exhibit 4-44. These facilities are either existing or scheduled for construction as of late 2010, and include projects that are funded as part of the S. Holgate Street to S. King Street Viaduct Replacement Project and the First Hill Streetcar project.

The City adopted a Bicycle Master Plan (City of Seattle 2007a) that was approved May 22, 2007, by the Seattle Bicycle Advisory Board. The plan has proposed the development of approximately 450 miles of marked or separated bicycle routes, to be completed over the next 10 years, including sharrows, bicycle lanes, and multi-use trails. Some of these facilities will be in place by 2015 but are not shown in Exhibit 4-44.

4.10.2 South Area

East Marginal Way S. contains an on-street bicycle lane in the south area and is considered a regional connection that serves as the main route into and out of downtown for West Seattle residents. The SR 99/East Marginal Way S. corridor is considered the primary connection for bicyclists from the West Seattle, White Center, Arbor Heights, and Burien areas to the Seattle CBD. The corridor also allows bicyclists access to other neighborhoods and communities in the region.



Basemap Data Source: City of Seattle, 2009.

Exhibit 4-44
City of Seattle Designated Bicycle Routes

The Port Side Pedestrian/Bike Trail and City Side Trail are included as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. The Port Side Pedestrian/Bike Trail will be located on the western side of SR 99 adjacent to the Port of Seattle property between S. Atlantic and S. King Streets.

The City Side Trail will run adjacent to the East Frontage Road south of S. Royal Brougham Way and continue north on the east side of the SR 99 ramps. The Bicycle Master Plan calls for a new multi-use path for S. Royal Brougham Way from Fourth Avenue S. east to Beacon Hill, where it would connect with the existing Mountains to Sound/I-90 Trail and a new trail that would continue south along the west side of Beacon Hill. This path is not currently in place or under construction, but it is reasonable to anticipate that it may be by 2015.

4.10.3 Waterfront Area

Major facilities along the waterfront include the Waterfront Bicycle/Pedestrian Facility, which runs from the stadium area to Myrtle Edwards Park, and to the multi-use trail that starts in Myrtle Edwards Park and runs northward through the Interbay area to Magnolia and Ballard. On-street bicycle facilities are not presently provided on Alaskan Way, though cyclists ride either in the street or on the Waterfront Bicycle/Pedestrian Facility. There is an additional bicycle lane on Western Avenue from Yesler Way to Blanchard Street. In the north waterfront, Elliott and Western Avenues already include bike lanes and/or sharrows; First Avenue is anticipated to include a sharrow.

4.10.4 North Area

Dexter Avenue N. serves as the main northbound and southbound route for bicyclists traveling between downtown and areas north of the Lake Washington Ship Canal. Second Avenue serves as the main route for bicyclists heading southbound through downtown, while First, Third, and Fourth Avenues are used for northbound travel. There are no grade-separated or designated in-street bicycle lanes for east-west crossings of SR 99 in the north area. To cross SR 99 in an east-west manner, cyclists must ride in a travel lane on Denny Way, Mercer Street, or Broad Street, all of which are high traffic volume streets with minimal room for error due to curbs, parked cars, and other barriers.

Lake to Bay Trail bicycle lanes will be constructed by 2015 on Valley and Roy Streets between Fairview and Dexter Avenues N. and on Ninth Avenue N. between Valley and Mercer Streets that would be completed as part of the Mercer East Project. In the north area, the Lake Union to Elliott Bay Trail project, which connects the South Lake Union area with the Seattle Center and waterfront areas through a series of bicycle lanes and shared-use facilities is being completed by the City.

Trail facilities in the South Lake Union and north area are being completed by the City as part of the Mercer Corridor project.

Planned bicycle improvements in the north area also include a new bicycle corral planned at Seattle Center as part of redevelopment of Memorial Stadium. The addition of the bicycle corral may have some effect on the amount of bicycle use to and from the area.

4.10.5 Regional Connections

Near the north area, the bicycle lane on Dexter Avenue N. connects to the Fremont Bridge and the Burke-Gilman Trail, which provides regional connections to Ballard, the University District, and points beyond located along the western and northern shores of Lake Washington. As mentioned previously, the trail in Myrtle Edwards Park leads to a trail through the Interbay area to Magnolia, Ballard, and a trail along the south side of the Fremont cut.

To the south, East Marginal Way S. connects to S. Spokane Street, along which bicyclists can travel to reach the low West Seattle Bridge and a multi-use trail along the water around Alki Point. Near the stadiums, S. Dearborn Street connects to the I-90 Trail, which provides connections to Mercer Island and areas east of Lake Washington. The Port Side Pedestrian/Bike Trail is being constructed on the west side of Alaskan Way as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. The City Side Trail will be adjacent to the SR 99 ramps between S. Atlantic Street and S. King Street. This multi-use path would replace the existing 15-foot-wide Waterfront Bicycle/Pedestrian Facility currently located on the east side of Alaskan Way S. Both trails are expected to improve bicyclist mobility and access in the south area.

4.11 Ferry Services

Ferry service to downtown Seattle is provided by Washington State Ferries and King County. Washington State Ferries provides direct ferry service between downtown Seattle and both Bainbridge and Bremerton. Alternate transportation connections between Seattle and these communities are by highway through Tacoma (via the Tacoma Narrows Bridge), or by ferry to Edmonds. The King County Ferry District provides service to downtown Seattle from West Seattle and Vashon Island. Alternative transportation connections for the West Seattle route involve the West Seattle Freeway and either SR 99 or surface streets. Alternatives for the Vashon Island service involve Washington State Ferries service to Fauntleroy and surface streets to the West Seattle Bridge and either SR 99 or surface streets to downtown Seattle.

Colman Dock, located on Piers 50 and 52 on Seattle's downtown waterfront, is the Seattle terminus for the Washington State Ferries. The passenger-only service from Vashon Island and from West Seattle, operated by King County, also uses Colman Dock. Access to Colman Dock is provided from Alaskan Way at Yesler Way, and exits are provided to Alaskan Way at Yesler Way and Marion Street.

4.11.1 Vehicle and Passenger Ferries

For the Washington State Ferries service, two Jumbo Mark II boats, each with a capacity of 202 vehicles and 2,500 passengers, operate on the Bainbridge Island service between 4:45 a.m. and 1:35 a.m. on weekdays, with departures and arrivals approximately every 50 minutes. Service to Bremerton is generally provided by two Super Class ferries: the Hyak, with a capacity of 144 vehicles and 2,500 passengers, and the Kaleetan, with a capacity of 144 vehicles and 2,000 passengers. Bremerton service generally operates on approximately 80-minute headways daily between 4:50 a.m. and 12:50 a.m.

4.11.2 Passenger-Only Ferries

The King County Ferry District service from West Seattle currently operates its own passenger-only ferries. The passenger-only boat can accommodate 150 passengers. On weekdays, service is provided approximately every 40 minutes from 6:50 a.m. to 9:30 a.m. and again from 3:00 p.m. to 7:10 p.m., and each hour from 11:00 a.m. to 3:00 p.m. There are special trips beginning at 8:00 p.m. and running hourly until 11:00 p.m. that are offered only on Fridays and when the Mariners, Sounders, or Seahawks play weekday evening games that start after 7:00 p.m. Saturday service is offered every hour from 9:00 a.m. to 11:00 p.m., and Sunday service is hourly from 9:00 a.m. to 7:00 p.m. The West Seattle ferry operates from April through October.

Passenger-only ferries also connect downtown Seattle and Vashon Island. While previously operated by Washington State Ferries, the King County Ferry District assumed operations for this route effective September 28, 2009. Service is provided by a vessel with a capacity for 150 people. The Vashon passenger-only ferry provides peak-only service, operating three morning trips to Seattle, at 6:10, 7:10, and 8:15 a.m., and three afternoon trips from Seattle, at 4:30, 5:30, and 6:30 p.m.

The Port of Kingston operates a passenger-only ferry service, SoundRunner, on weekdays and select holidays between Kingston and Pier 50 in Seattle. This route is served by two 150-passengers boats. The ferries arrive in Seattle four times a day, at 6:40 a.m., 8:25 a.m., 5:05 p.m., and 6:50 p.m. and depart approximately 10 minutes later.

4.11.3 Characteristics of Ferry-Related Traffic

Arterial intersection analysis estimates that 545 vehicles exit Colman Dock during the AM peak hour, while 240 vehicles arrive to travel westbound during the same time period. During the PM peak hour, the pattern reverses to a degree, with 435 vehicles exiting Colman Dock during the PM peak hour and 530 vehicles arriving at Colman Dock during the PM peak hour under current conditions.

The analysis assumes that there is one Bremerton and two Bainbridge route arrivals and departures, with the eastbound ferries at approximately 60 percent capacity and the westbound ferries at about 90 percent capacity. This estimate is based on existing PM peak hour demand at Colman Dock for the 30th busiest day of the year, which corresponds to a 92nd percentile weekday and is of a magnitude that is consistent with traffic counts taken in the vicinity of Colman Dock. Because these volumes do not represent the most severe peak conditions, it is recognized that there are days throughout the year during which higher volumes may occur.

The traffic signals for traffic exiting Colman Dock at either Marion Street or Yesler Way use queue detection to extend the green time for exiting traffic when there is substantial queuing on Colman Dock. Once the extended green is completed, the north-south movements are allocated their normal split timings. The combined splits result in very long, uncoordinated signal cycle lengths. The queue detection continues to trigger extended green time for exiting ferry traffic until the vessel is empty (typically three cycles). While vessels are unloading, approximately 70 to 75 percent of the green time is allocated to traffic exiting Colman Dock. During this time, delay for Alaskan Way traffic increases substantially as ferry traffic movements are prioritized.

Following an unloading event, the signals will attempt to reactivate coordination with neighboring signals and eventually return to normal operation. Once signal recovery is achieved, the north-south flow on Alaskan Way is largely uninterrupted at the Marion Street and Yesler Way cross streets except for pedestrian or occasional automobile crossings. Note that the pattern of regular unloading with such a long green time extension often leads to essentially uncoordinated traffic operations on Alaskan Way during a large share of the peak period.

4.11.3.1 Passenger Connections to the Seattle CBD

The majority of foot passengers arriving at or departing from Colman Dock use the larger vehicle ferries. Loading and unloading is at the upper level of Colman Dock, from which a direct walkway is provided that crosses above Alaskan Way and below the viaduct, connecting to the sidewalk on the south side of Marion Street at First Avenue. Passengers can also enter and exit at Alaskan Way, where they can catch a bus or cross Alaskan Way. Signalized crosswalks crossing Alaskan Way are located at Marion Street, Columbia Street, and Yesler Way. Conflicting traffic volumes are heavy on Alaskan Way, particularly while ferries are unloading at the Marion Street driveway (to northbound and southbound Alaskan Way, as well as eastbound on Marion Street) and at Yesler Way (to southbound Alaskan Way only). Additionally, pedestrians using the Marion Street pedestrian bridge can face conflicts from turning vehicles as they rejoin the street-level sidewalk system at First Avenue and Marion Street. While the intersection is signalized, exiting ferry traffic that wishes to turn right onto southbound First Avenue would face conflicting pedestrians in the crosswalk.

4.11.3.2 Automobile Access and Egress

Both Colman Dock access points, Alaskan Way at Yesler Way and at Marion Street, are estimated to operate at an overall average of LOS C or better during both the AM and PM peak hours (Exhibits 4-45 and 4-46). All major movements operate at LOS C or better during either peak. Note, however, that both the Marion Street and Yesler Way intersections experience increased congestion while ferry vessels unload, with decreased congestion at other times. The data presented here are the average for the entire AM and PM peak hours.

Exhibit 4-45. AM Peak Hour Average Vehicle Delay and LOS by Movement at Colman Dock – 2015 Existing Viaduct

Traffic Movement	Average AM Peak Hour Conditions	
	Delay (seconds)	LOS
Alaskan Way/Marion Street (overall intersection)	**15**	**B**
Eastbound (exiting Colman Dock)	36	D
Northbound Alaskan Way	4	A
Southbound Alaskan Way	6	A
Alaskan Way/Yesler Way (overall intersection)	**30**	**C**
Eastbound (exiting Colman Dock)	8	A
Northbound Alaskan Way	43	D
Southbound Alaskan Way	7	A

Note: LOS = level of service

Exhibit 4-46. PM Peak Hour Average Vehicle Delay and LOS by Movement at Colman Dock – 2015 Existing Viaduct

Traffic Movement	Average PM Peak Hour Conditions	
	Delay (seconds)	LOS
Alaskan Way/Marion Street (overall intersection)	**16**	**B**
Eastbound (exiting Colman Dock)	36	D
Northbound Alaskan Way	3	A
Southbound Alaskan Way	10	B
Alaskan Way/Yesler Way (overall intersection)	**31**	**C**
Eastbound (exiting Colman Dock)	14	B
Northbound Alaskan Way	54	D
Southbound Alaskan Way	10	B

Note: LOS = level of service

4.12 Safety

This section summarizes recent collision history for SR 99 within the transportation study area. While the S. Holgate to S. King Street Viaduct Replacement Project improvements are part of the 2015 Existing Viaduct definition, historical collision data do not reflect these changes because the project is yet to be completed. In general, the S. Holgate to S. King Street Viaduct Replacement Project could potentially change the crash experience on SR 99 in the following ways (compared to existing conditions):

- Addition of new ramp connections to and from Alaskan Way may increase the frequency of collisions compared to the current Spokane Street to Stadium area segment. Collision rates at any ramp location tend to be higher than locations where ramps are not provided. However, the new ramps will be constructed to current applicable design standards, which should limit adverse affects.
- Conversely, the new ramps in the stadium area will modestly reduce use of the Columbia and Seneca Street ramps, which experience high collision rates today. This could result in some improvement of collision rates at these locations.

The analysis was conducted to describe the collision history on SR 99 in terms of rate of occurrence, collision types, and severity. Collision rates are compared with average rates for similar highway facilities in Washington state to help determine whether SR 99 experiences a higher than typical rate of collisions. The corridor is also analyzed on a segment-by-segment basis to identify specific locations where collisions occur with higher frequency or greater severity.

Collision frequency, type, and severity were assessed for the length of SR 99 between S. Spokane Street in the south and Valley Street in the north.

- Collisions on SR 99 occur at higher frequencies than on average for urban, limited-access highways in the state. Collision rates are lower than average rates for urban principal arterials, however.

Individual segments of SR 99 were also assessed to determine where collisions occurred with higher than average frequencies or injury rates, as well as to identify predominant collision types.

- Both northbound and southbound directions of the S. Spokane Street to Stadiums segment experience low collision rates and low rates of injury collisions relative to the rest of the corridor.
- The southbound Downtown to Stadiums segment experiences high collision rates and a high rate of injury collisions relative to the corridor average.

- The northbound and southbound Battery Street Tunnel segments experience much higher rates of collisions than the corridor on average. Northbound, a substantial share of these collisions appears to be associated with the Battery Street Tunnel on-ramp.
- The northbound and southbound North of Battery Street Tunnel segments in the South Lake Union area experience different collision types than elsewhere on the corridor, including enter-at-angle collisions involving side-street connections and pedestrian collisions, which are of concern due to the vulnerability of pedestrians in collisions.

4.12.1 Collision Analysis Methodology

WSDOT provided collision data for SR 99 between S. Spokane Street and Aloha Street for the years 2005 to 2007. Data for these 3 years were analyzed to determine important characteristics of collisions both on the mainline and on connecting ramps within 250 feet of the mainline. Several parameters were analyzed to measure and assess collision characteristics:

- Collision rates by segment - To allow comparison of collision rates between corridor segments as well as to average rates on other similar facilities, collisions per MVMT were calculated for each corridor segment.
- Collision types by segment - The share of collisions for major collision types (e.g., fixed-object collisions, rear-end collisions, etc.) relative to total collisions are reported. Comparing the proportion of accident types by segment can help identify possible contributing factors to collisions.
- Collision severity by segment - The share of injury collisions (injury collisions per MVMT) relative to total collisions is reported.

4.12.1.1 Segments Analyzed

Collision rates were calculated for the northbound and southbound directions of five primary mainline segments on SR 99. Generally, a segment was defined as beginning either 0.05 mile before an on-ramp or 0.05 mile after an off-ramp, and ending either 0.05 mile after the next off-ramp or 0.05 mile before the next on-ramp. This definition typically results in uniform volumes and lane configurations within a segment. Furthermore, collisions occurring on the first 250 feet of a connecting on-ramp or off-ramp are also considered as having occurred on the mainline.

4.12.1.1.1 Northbound

The northbound segments are the following:

- S. Spokane Street to Stadiums: before the S. Spokane Street on-ramp to before the First Avenue S. on-ramp

- Stadiums to Downtown: before the First Avenue S. on-ramp to after the Seneca Street off-ramp
- Downtown to Battery Street Tunnel: after the Seneca Street off-ramp to after the Western Avenue off-ramp
- Battery Street Tunnel: after the Western Avenue off-ramp to before the Denny Way on-ramp (including the Battery Street Tunnel, the Battery Street Tunnel ramps, and the connecting mainline sections external to the tunnel)
- North of Battery Street Tunnel: before the Denny Way on-ramp to after Valley Street

4.12.1.1.2 Southbound

The southbound segments are the following:

- North of Battery Street Tunnel: before Valley Street to after the Denny Way off-ramp
- Battery Street Tunnel: after the Denny Way off-ramp to before the Elliott Avenue on-ramp (including the Battery Street Tunnel, the Battery Street Tunnel off-ramp, and the connecting mainline sections external to the tunnel)
- Battery Street Tunnel to Downtown: before the Elliott Avenue on-ramp to before the Columbia Street on-ramp
- Downtown to Stadiums: before the Columbia Street on-ramp to after the First Avenue S. off-ramp
- Stadiums to S. Spokane Street: after the First Avenue S. off-ramp to after the S. Spokane Street off-ramp

As noted, the short distance between the Elliott/Western ramps and the Battery Street Tunnel ramps was not considered an independent segment; rather it was grouped with the Battery Street Tunnel segment. The corridor north of the Battery Street Tunnel was considered a single segment (North of Battery Street Tunnel).

4.12.2 Collision Analysis Results by Segment

Collision frequency, expressed as the number of collisions per MVMT, is a standardized measure that is useful in comparing collision rates between different segments or even different highways. This section presents collision rates for the major segments of SR 99 within the project area, and for comparative purposes, average collision rates for other similar highway facilities. Collision rates for other facilities should be compared only in terms of general order of magnitude since variations in methodology are common.

4.12.2.1 Overview of Collision Analysis Results

Collisions on the SR 99 corridor from S. Spokane Street to Aloha Street occur at an average rate of 1.83 to 2.03 collisions per MVMT, compared to a historical average of 1.32 to 1.60 collisions per MVMT for all urban, limited-access corridors in Washington. Conversely, the collision rates on SR 99 are 16 to 38 percent lower than system-wide averages for urban principal arterials in Washington, which are 2.41 to 2.97 collisions per MVMT.

Some segments of SR 99 exhibit elevated collision rates relative to the corridor average. The northbound and southbound Battery Street Tunnel segment (Elliott/Western ramps to Denny Way ramps) shows much higher collision rates than most of the other segments in the corridor. Northbound, a substantial share of these collisions appears to be associated with the Battery Street Tunnel on-ramp. A review of the collision locations also indicates that collision frequencies are higher in the curved section of the tunnel, where excessive speed, limited sight distance, and limited roadside clearance are all possible contributing factors.

The southbound Downtown to Stadiums segment (southbound SR 99 between the Columbia Street on-ramp and the First Avenue S. off-ramp) also experiences a high collision rate and moderately high rate of injury collisions relative to the rest of the corridor. A combination of factors likely contributes to these collision rates, including (1) narrow lanes, (2) little roadside clearance, (3) left-side merging traffic from Columbia Street, (4) left-side diverging traffic to First Avenue S., (5) heavy weaving movements associated with left-side on- and off-ramp traffic, and (6) traffic congestion.

The northbound and southbound North of Battery Street Tunnel segment (between the Denny Way ramps and north of Valley Street) in the South Lake Union area exhibits moderate collision rates but unique collision types. The numerous right-angle street connections to SR 99 are a factor in a large share of collisions in this segment, with a much higher rate of enter-at-angle accidents in the northbound direction and a higher rate of sideswipe accidents in the southbound direction. Both the northbound and southbound directions in this segment exhibit lower rates of fixed-object collisions than the corridor averages, and the northbound direction has considerably lower rear-end collision rates than the southbound direction in this segment or the corridor average. Pedestrian collisions are a particular concern in this segment, as SR 99 is at-grade, and pedestrians crossing the roadway (illegally) have been involved in a number of collisions. These collisions most often tend to involve fatalities or serious injury.

4.12.2.2 Collision Rates on SR 99

Collision rates are measured in terms of collisions per MVMT and include those collisions occurring on the first 250 feet of any connecting ramps. Exhibits 4-47 and 4-48 summarize collision rates for the corridor for northbound and southbound segments of SR 99, respectively.

Exhibit 4-47. Collision Rates for Northbound SR 99 Segments (2005–2007)

Segment	Collisions per MVMT
NB S. Spokane Street to Stadiums	1.07
NB Stadiums to Downtown	1.90
NB Downtown to Battery Street Tunnel	1.54
NB Battery Street Tunnel	5.46
NB North of Battery Street Tunnel	1.60
SR 99 corridor average	1.83

Notes: Includes collisions on ramps that are located within 250 feet of the mainline.
MVMT - million vehicle miles of travel
NB = northbound

Exhibit 4-48. Collision Rates for Southbound SR 99 Segments (2005–2007)

Segment	Collisions per MVMT
SB North of Battery Street Tunnel	1.51
SB Battery Street Tunnel	4.81
SB Battery Street Tunnel to Downtown	1.02
SB Downtown to Stadiums	4.54
SB Stadiums to S. Spokane Street	1.21
SR 99 corridor average	2.03

Notes: Includes collisions on ramps that are located within 250 feet of the mainline.
MVMT - million vehicle miles of travel
SB = southbound

In the northbound direction, SR 99 was found to have an overall collision rate of 1.83 collisions per MVMT. The collision rate for the S. Spokane Street to Stadiums segment is very low—about 42 percent lower than the corridor average. The rate of collisions on the Stadiums to Downtown segment is second highest of the five northbound segments, with weaving movements and backups from the Seneca Street and Western Avenue off-ramps likely contributing to higher collision rates on the northbound Stadiums to Downtown segment. In addition, this segment carries the highest volume of traffic on the corridor, which could also be a contributing factor.

The Downtown to Battery Street Tunnel segment has a collision rate lower than the corridor average, despite the fact that backups are regularly observed on this segment. Collisions on the Western Avenue off-ramp—not included in the mainline segment analysis—do occur with higher frequency than on other ramps, however.

The northbound Battery Street Tunnel segment has the highest overall collision rate (5.46) on the corridor. Frequent collisions here may be associated with a number of factors, including limited sight distance and tight curves within the tunnel, lack of clear distance from the tunnel walls, and merging traffic entering from the Battery Street Tunnel on-ramp, which has limited sight distance and a short merge area. Collision reports also indicate that drivers' actions relative to the roadway conditions are a factor in the high rate of collisions here, including excessive speed, unsafe lane changes, and straying from the travel lane. Collision rates on the North of Battery Street Tunnel segment in the South Lake Union area are moderate in relation to other corridor segments.

Southbound, the overall mainline collision rate is higher than northbound: 2.03 collisions per MVMT, with segments showing a similar pattern of collision occurrences relative to the corresponding northbound segments.

The southbound North of Battery Street Tunnel segment has a moderate collision rate relative to other corridor segments. Though lower than the corresponding northbound segment, the southbound Battery Street Tunnel segment also shows a very high rate of collisions. Collision rates are quite low on the southbound Battery Street Tunnel to Downtown segment, but jump substantially on the adjacent Downtown to Stadiums segment. This segment includes a left-side merging on-ramp from Columbia Street and a left-side off-ramp to First Avenue S., and experiences recurrent congestion during the PM peak. The southbound Stadiums to S. Spokane Street segment exhibits a relatively low collision rate, as expected given that the segment is largely a uniform configuration with few conflicts between traffic movements.

4.12.2.2.1 Comparison of Collision Rates on SR 99 to Other Facilities

Exhibit 4-49 summarizes average system-wide collision rates reported for urban areas in Washington. While general comparisons may be made between collision rates on SR 99 and other facilities, factors such as inconsistencies in methodology, unique driver characteristics, and differences in local conditions may influence results. Furthermore, SR 99 is a somewhat unique facility type and is not fully consistent with the Interstate Freeway designation.

Collision rates on SR 99 are 14 to 54 percent higher than the average system-wide collision rates historically reported for urban, limited-access freeways in Washington. Note that the most recent available data showed a statewide rate of 1.32 collisions per MVMT in 2003, while rates dating back to 1996 have been as high as 1.60 collisions per MVMT.

Although SR 99 through the study area most closely matches FHWA's "Principal Arterial—Other Freeways and Expressways" category, collision rates for principal arterials are provided for added context as well, since WSDOT classifies SR 99 as an "Urban Principal Arterial," and the City classifies SR 99 as a

"Principal Arterial." The northern segment of the corridor, north of Denny Way, in some ways operates more like a principal arterial due to the side street connections and adjacent pedestrian activity. Due to the mix of roadway types in the SR 99 corridor, the collision rates for SR 99 can also be compared to the urban principal arterial collision rates of 2.41 to 2.97 collisions per MVMT.

Exhibit 4-49. Average System-Wide Collision Rates Reported for Urban Areas

Segment	Collisions per MVMT
SR 99	
SR 99 northbound corridor average	**1.83**
SR 99 southbound corridor average	2.03
Comparison of Statewide Collision Rates	
WSDOT Urban Interstate Freeways[1]	1.32–1.60
WSDOT Urban Principal Arterials (2000–2003)[1]	2.41–2.97

Notes: MVMT = million vehicle miles of travel
[1.] WSDOT unpublished collision data for 2003 and 1996 Washington State Highway Accident Report (WSDOT 1996b).

SR 99 collision rates are 16 to 38 percent lower than system-wide averages for urban principal arterials in Washington.

4.12.2.3 Collision Type by Segment

To help identify possible factors associated with collisions, the proportion of collisions by type was reviewed for the major corridor segments (Exhibits 4-50 and 4-51). Collisions are categorized into the following types:

- Fixed-object: collisions with roadside barriers or objects (walls, guardrail, other roadside appurtenance)
- Read-end: collisions where one or more vehicles strike slower-moving or stopped vehicles from behind
- Sideswipe: side-to-side collisions between two vehicles traveling in the same direction, often involving a lane change or straying from the travel lane
- Enter-at-angle: collisions with vehicles entering the roadway from side-street connections
- Pedestrian: collisions between vehicles and pedestrians or bicycles
- Other/unknown: all other collision types, including wrong direction of travel, overturned vehicle, and other unknown or unclassified collision types

Exhibit 4-50 summarizes the share of collisions by collision type for northbound SR 99. Fixed-object (34 percent), rear-end (37 percent), and sideswipe (17 percent) collisions predominate on northbound SR 99. Fixed-object collisions are most prevalent northbound on the following segments:

- 49 percent of collisions are fixed-object on the northbound S. Spokane Street to Stadiums segment.
- 33 percent of collisions are fixed-object on the northbound Stadiums to Downtown segment.
- 34 percent of collisions are fixed-object on the northbound Battery Street Tunnel segment.

Rear-end collisions account for especially high shares of collisions on the northbound Downtown to Battery Street Tunnel segment (57 percent) and adjacent Battery Street Tunnel segment (47 percent). Queuing from the Western Avenue off-ramp is likely a primary factor associated with the high share of rear-end collisions on the first segment, while limited sight distances and merging traffic from the Battery Street Tunnel on-ramp contribute to high shares of rear-end collisions on the Battery Street Tunnel segment.

Exhibit 4-50. Mainline Collision Types for Northbound SR 99 Segments

Segment	Collision Types					
	Fixed-Object	Rear-End	Sideswipe	Enter-at-Angle	Pedestrian	Unknown/ Other[1]
NB S. Spokane Street to Stadiums	49%	31%	11%	0%	0%	9%
NB Stadiums to Downtown	33%	32%	26%	0%	0%	9%
NB Downtown to Battery Street Tunnel	23%	57%	20%	0%	0%	0%
NB Battery Street Tunnel	34%	47%	13%	0%	0%	6%
NB North of Battery Street Tunnel	10%	18%	21%	33%	8%	10%
SR 99 corridor average	34%	37%	17%	4%	1%	7%

Notes: NB = northbound

[1] Roll over, wrong direction of travel, or unknown/unclassified.

Sideswipe collisions tend to occur more frequently on segments where frequent lane changing occurs to access connections to and from SR 99 (i.e., northbound Stadiums to Downtown, Downtown to Battery Street Tunnel, and North of Battery Street Tunnel segments).

The northbound North of Battery Street Tunnel segment is unique in that enter-at-angle collisions occur frequently (33 percent) as a result of the existing side-street connections. This segment also experiences collisions involving pedestrians (8 percent), which are a particular concern due to the typical severity of such collisions in terms of injury to the pedestrian.

Exhibit 4-51 summarizes the share of collisions by collision type for southbound SR 99. As found in the northbound direction, the southbound North of Battery Street Tunnel segment also experiences enter-at-angle collisions, though at a lower rate (9 percent). Pedestrian collisions (9 percent) are again a concern on this segment.

The share of fixed-object collisions is very high (52 percent) for the southbound Battery Street Tunnel segment, where a combination of excessive speed and limited lateral clearance in the Battery Street Tunnel are likely factors associated with this type of collision. Note that enter-at-angle collisions here are associated with the Battery Street Tunnel off-ramp and street connections to that ramp.

Sideswipe collisions again tend to account for a greater share of collisions in locations where ramp locations and configurations lead to more lane-changing activity. This is true on the southbound North of Battery Street Tunnel and Downtown to Stadiums segments.

Exhibit 4-51. Mainline Collision Types for Southbound SR 99 Segments

	Collision Types					
Segment	Fixed-Object	Rear-End	Sideswipe	Enter-at-Angle	Pedestrian	Unknown/ Other[1]
SB North of Battery Street Tunnel	15%	35%	24%	9%	9%	9%
SB Battery Street Tunnel	52%	22%	8%	8%	1%	9%
SB Battery Street Tunnel to Downtown	11%	57%	14%	0%	0%	17%
SB Downtown to Stadiums	33%	31%	24%	0%	0%	12%
SB Stadiums to S. Spokane Street	29%	44%	14%	0%	0%	13%
SR 99 corridor average	33%	35%	16%	3%	1%	12%

Notes: SB = southbound

1. Roll over, wrong direction of travel, or unknown/unclassified.

Rear-end collisions predominate on the southbound Battery Street Tunnel to Downtown and Stadiums to S. Spokane Street segments, though as discussed in the following section, the frequency of collisions in general is low on this segment.

4.12.2.4 Collision Severity by Segment

Exhibits 4-52 and 4-53 summarize collision severity for the SR 99 corridor segments in the northbound and southbound directions, respectively. Collision severity is classified as either property-damage-only collisions or injury collisions. The latter category includes collisions that were identified in collision reports as possible injury, evident injury, disabling injury, or fatal collisions. The State of Washington *Police Traffic Collision Report Instruction Manual* defines disabling collisions as those that result in injuries that prevent a person from walking, driving, or continuing normal activities at the time of the collision (State of Washington 2006).

Northbound, injury collisions account for on average 37 percent of all collisions. Variation by segment is minor, with all segments showing injury rates of between 35 and 41 percent. The northbound Downtown to Battery Street Tunnel and North of Battery Street Tunnel segments shows the highest percentage of injury collisions. Although a smaller share of collisions on the Battery Street Tunnel segment involve injuries, the number of injury collisions is still relatively high due to the overall higher frequency of collisions here.

Exhibit 4-52. Collision Severity for Northbound SR 99 Segments

Segment	Property Damage Only	Injury
NB S. Spokane Street to Stadiums	63%	37%
NB Stadiums to Downtown	63%	37%
NB Downtown to Battery Street Tunnel	59%	41%
NB Battery Street Tunnel	65%	35%
NB North of Battery Street Tunnel	59%	41%
SR 99 corridor average	63%	37%

Notes: NB = northbound

Exhibit 4-53. Collision Severity for Southbound SR 99 Segments

Segment	Property Damage Only	Injury
SB North of Battery Street Tunnel	59%	41%
SB Battery Street Tunnel	67%	33%
SB Battery Street Tunnel to Downtown	49%	51%
SB Downtown to Stadiums	58%	42%
SB Stadiums to S. Spokane Street	51%	49%
SR 99 corridor average	58%	42%

Note: SB = southbound

Southbound shows a higher variation in severity by segment. About half of collisions on the southbound Battery Street Tunnel to Downtown and Stadiums to S. Spokane Street segments involve injuries, though these segments have lower collision frequencies overall.

4.12.3 Corridor Design Aspects

SR 99 is a multilane, divided highway that travels through downtown Seattle within the study area. SR 99 is not a limited-access facility and does not meet access and other criteria normally associated with a freeway facility. WSDOT has assigned a functional classification of "Urban Principal Arterial" to SR 99 within the study area. In terms of standard federal functional classifications, the corridor most closely matches FHWA's "Principal Arterial – Other Freeways and Expressways" category. The design class, which defines geometric design data, is "Urban Managed Access – 1" (UMA-1) south of Harrison Street, and "Urban Managed Access – 2" (UMA-2) north of Harrison Street. The primary differences in these classifications are design speed (45 mph or greater for UMA-1, 45 mph or less for UMA-2) and allowance for on-street parking under UMA-2. Access to the corridor is governed by the WSDOT access classifications of "Managed Access – Class 1" south of Thomas Street, which is the highest or most restrictive level of access management, and "Managed Access – Class 3" north of Denny Way. The City classifies SR 99 simply as a "Principal Arterial."

Access to and from SR 99 is provided by ramp connections between S. Spokane Street and the Battery Street Tunnel and by a combination of ramps and right-angle street connections north of the Battery Street Tunnel. The street connections allow only right turns on and off SR 99 (a center median barrier on SR 99 prevents left turns), and stop signs govern traffic entering from these connections. SR 99 was constructed in the 1950s and was designed to meet geometric standards that are less stringent than those typical for new highways today. Furthermore, anticipated traffic volumes in the 1950s were much lower than those experienced today. Lane widths, shoulder widths, acceleration and deceleration lanes, and other geometric features on SR 99 generally conform to a lesser standard than those found on newer highway facilities.

4.13 Event Traffic

4.13.1 South Area

The roadway network in the south end for the 2015 Existing Viaduct assumes the completion of two major interchange/access projects: (1) the S. Holgate Street to S. King Street Viaduct Replacement Project, and (2) the SR 519 Intermodal Access Project, Phase 2. The SR 519 Intermodal Access Project, which was completed in 2010, improved the connection between S. Atlantic Street and I-90/I-5 to accommodate more direct two-way access for stadium area traffic to and from the east. It also converted S. Royal Brougham Way to a local access arterial with a loop ramp section connecting Third Avenue S. to S. Royal Brougham Way on the east side of the BNSF rail line. With the completion of the S. Holgate to S. King Street Viaduct Replacement Project, roadway connections in the south end to and from regional facilities such as SR 99 will be substantially improved.

Regional access from the stadium area to northbound SR 99 and from southbound SR 99 is provided via the on- and off-ramps at First Avenue S. The S. Holgate Street to S. King Street Viaduct Replacement Project will provide ramps to southbound SR 99 and from northbound SR 99 to Alaskan Way S. near S. Dearborn Street. Other regional access to and from the stadium area is provided by I-5 or I-90 via SR 519.

Similar to conditions today, traffic levels near the stadiums are expected to intensify before and after events at Safeco Field and Qwest Field for 2015 Existing Viaduct conditions. Typical travel patterns would change as patrons search for parking, and pedestrian activity increases. As a result, local traffic conditions would be much more congested before and after events compared to typical, non-event conditions. Current estimates that indicate that between 15,000 and 20,000 additional vehicles, beyond background traffic levels, enter and exit the stadium area for a typical Seahawks game. This increase would carry over to the 2015 Existing Viaduct conditions.

Explicit detour routing and comprehensive traffic control measures would likely continue to be used on First Avenue S. and critical east-west arterials (e.g., S. Royal Brougham Way and S. Atlantic Street) for large events at Safeco Field and Qwest Field such as Seahawks and Mariners games and Sounders matches. These measures commonly include police-based traffic management commissioned by the City.

Use of other travel modes to events is encouraged as well. King County Metro operates bus service on First and Fourth Avenues S. and is expected to continue to offer such services. Both Metro buses and Sound Transit's Link LRT would continue operating in the DSTT and E3 Busway to the east of the stadiums. Sound Transit also operates commuter rail service from nearby King Street Station.

4.13.2 North Area

Seattle Center is the major event facility in the north area. This facility is a year-round venue that is home to several annual events, including Bumbershoot, Northwest Folklife Festival, and Seattle Storm Women's National Basketball Association (WNBA) games. Other large-scale events related to holidays, concerts, and children's programs also occur throughout the year.

The primary route to Seattle Center for 2015 Existing Viaduct conditions will continue to be I-5 via Mercer Street, Broad Street and Fifth Avenue N. From Seattle Center to I-5, Mercer Street will provide the primary connection to northbound and southbound I-5. Additional routes to and from Seattle Center include the following:

- Ballard: via Denny Way, Western Avenue, and Elliott Avenue W.
- To SR 99 southbound: via Broad Street and Thomas Street to Aurora Avenue or via Broad Street and Elliott Avenue
- To SR 99 northbound: via Second Avenue to Battery Street or via Mercer Street, Dexter Avenue N., and Thomas Street
- To I-5 southbound: via Second Avenue to Spring Street or via Denny Way to Yale Avenue
- To I-5 northbound: via Denny Way, Boren Avenue, and Olive Way

For larger events at Seattle Center, traffic control measures and minor detours are used to manage access to parking and general circulation. However, due to the smaller scale of events and the capacity of Seattle Center, such measures would not be required as frequently compared to the larger sporting venues in the south (Safeco Field and Qwest Field). Events at Seattle Center are also not as well-served by transit as compared to the south end stadium area, and transit service is not expected to be expanded significantly by 2015. However, local bus and monorail service is and will be continue to provided to and from the downtown core (and to and from some neighborhoods on the periphery).

By 2015, the street network near Seattle Center, including connections to and from SR 99, is not expected to change. However, the Mercer East Project is assumed to be completed which converts Mercer Street into a two-way arterial between Fairview Avenue N. and Dexter Avenue N. At-grade connections to and from SR 99 are maintained, and the northbound off-ramp to Mercer Street and Dexter Avenue N. is also retained. With no new connections in place to accommodate event trips, traffic congestion during Seattle Center events would be similar to today's conditions.

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Chapter 5 OPERATIONAL EFFECTS, MITIGATION, AND BENEFITS

This chapter describes the changes in travel patterns and traffic volumes for the Viaduct Closed (No Build Alternative), the non-tolled Bored Tunnel Alternative, the non-tolled Cut-and-Cover Tunnel Alternative, and the non-tolled Elevated Structure Alternative forecasted for horizon year 2030. It describes the non-tolled alternatives only. For a discussion of tolling, please see Chapter 7 of this report.

5.1 Regional Context and Travel Patterns

The discussion of the regional context and travel patterns illustrates how travel patterns might change in the future. It includes AM and PM peak hour and daily estimates of various travel parameters (e.g., VMT and screenline volumes) as a means of quantifying the travel patterns in and around the SR 99 corridor and as a basis for comparing the different alternatives that were analyzed.

The key findings of the analyses of operational effects and benefits are the following:

- In the Center City, VMT would be lowest and VHT and VHD would be highest for the Viaduct Closed (No Build Alternative) due to considerable reduced capacity and increased congestion without the viaduct. In the four-county region, VMT, VHT, and VHD would be highest for the Viaduct Closed (No Build Alternative) due to traffic diversion, traffic redistribution, and longer trips for the roughly 110,000 daily trips that currently use SR 99, all of which would result in increased congestion.
- The Elevated Structure Alternative would have the highest VMT in the Center City, due to the Elliott/Western ramps and the midtown ramps. However, VHT and VHD for the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative would be lower than VHT and VHD for the Bored Tunnel Alternative due to the connection provided by the Elliott/Western ramps. This pattern holds true for the build alternatives in the four-county region as well.
- Person-trips across all screenlines would be lowest for all time periods under the Viaduct Closed (No Build Alternative), which is likely the result of the removal of the capacity provided by the Alaskan Way Viaduct and the redistribution of some trips away from downtown to avoid the already congested parallel facilities through downtown (i.e., downtown arterials and I-5).

- Person-trips across the south and central screenlines under the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative would be 1 to 2 percent higher in all time periods relative to the number for the Bored Tunnel Alternative, while person-trips across the north screenline would be 0 to 2 percent lower. The Bored Tunnel Alternative is expected to carry more vehicles across the north screenline than the other build alternatives, because it would add north-south roadway capacity on Aurora Avenue between Denny Way and Harrison Street and accommodate more vehicles on SR 99.
- The Bored Tunnel Alternative is expected to result in the highest number of vehicle trips on SR 99 through downtown (i.e., trips between the area north of Denny Way and south of the stadium area) relative to the other alternatives. There would also be a noticeable increase in vehicles traveling along arterials near the waterfront due to the lack of the Elliott and Western Avenue ramps.
- The Cut-and-Cover Tunnel Alternative would carry higher vehicle volumes downtown and southward compared to the Bored Tunnel Alternative as a result of connections at Elliott and Western Avenues and an additional lane on SR 99 along the waterfront.
- The Elevated Structure Alternative is forecasted to carry the highest vehicle volumes on SR 99 downtown and southward relative to the other build alternatives because of additional capacity on SR 99 in Pioneer Square and its connections in midtown and at Elliott and Western Avenues.
- North of the Lake Washington Ship Canal, the build alternatives would carry similar vehicle volumes on east-west arterials near Aurora Avenue.

5.1.1 Vehicle Miles of Travel

VMT for this study is defined as the total number of miles traveled during a specified time period over a specified area, in this case either Seattle's Center City or the four-county Puget Sound region. The following discussions provide estimated VMT for the AM and PM peak hours and daily VMT totals for the Viaduct Closed (No Build Alternative), the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. These estimates were derived using a travel demand model. Exhibit 5-1 is a summary table of VMT.

Exhibit 5-1. Vehicle Miles of Travel

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Seattle's Center City				
AM peak hour	413,000	441,700	447,100	449,300
PM peak hour	521,400	554,500	561,800	564,300
Daily	2,371,400	2,521,600	2,545,400	2,556,600
Four-County Region				
AM peak hour	20,452,500	20,230,900	20,238,000	20,286,300
PM peak hour	24,263,200	23,935,700	23,940,800	23,998,200
Daily	110,820,300	109,471,700	109,497,900	109,668,400

5.1.1.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), total VMT in the Center City during the AM peak hour would be 413,000 miles, and during the PM peak hour, it would be 521,400. The daily total VMT for the Center City would be over 2,371,000 miles. The Viaduct Closed (No Build Alternative) would result in the lowest VMT in the Center City compared to the build alternatives, likely because of increased congestion and delay due to the closure of the viaduct. The redistribution of trips from the viaduct to congested surface streets would tend to discourage travel in this area.

In the four-county region, the AM peak hour VMT would be nearly 20,453,000 miles, and the PM peak hour VMT would be over 24,263,000 miles. The total daily VMT in the four-county region would be over 110,820,000 miles. Of all the alternatives, the Viaduct Closed (No Build Alternative) would result in the highest VMT in the four-county region, likely the result of trip redistribution and longer trips due to the closure of the viaduct.

5.1.1.2 Bored Tunnel Alternative

In the Center City, VMT during the AM peak hour would increase nearly 7 percent for the Bored Tunnel Alternative over the Viaduct Closed (No Build Alternative). The PM peak hour and daily VMT both would increase over 6 percent compared to the Viaduct Closed (No Build Alternative). This increase in VMT would primarily be due to the opening of the bored tunnel, which would allow more traffic to pass through the Center City, since some trips would be redistributed back to areas served by the facility. However, for the four-county region, VMT would decrease by a little over 1 percent in the AM and PM peak hours, as well as daily compared to the Viaduct Closed (No Build Alternative). This decrease in VMT would likely result from the redistribution noted above, with more direct trips and slightly shorter average trip lengths.

5.1.1.3 Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would result in a higher VMT value for the Center City than the Bored Tunnel Alternative. This is likely due to the additional connections to the cut-and-cover tunnel in the Center City that the bored tunnel would not have. In the Center City, VMT for the Cut-and-Cover Tunnel Alternative would be about 1 percent higher than VMT for the Bored Tunnel Alternative for all time periods. In the four-county region, VMT for the Cut-and-Cover Tunnel Alternative would not increase to any appreciable degree compared to VMT for the Bored Tunnel Alternative. This result would be expected because of the similar role of both facilities at the regional level.

5.1.1.4 Elevated Structure Alternative

The Elevated Structure Alternative would result in a higher VMT value for the Center City than the VMT value of the Bored Tunnel Alternative, as well as the highest VMT of all the build alternatives. This result is likely due to the additional connections to the Elevated Structure Alternative as compared to the Bored Tunnel, including the Elliott/Western Connector and the midtown ramps. During the AM and PM peak hours, VMT in the Center City for the Elevated Structure Alternative would be nearly 2 percent higher than VMT for the Bored Tunnel Alternative, while daily VMT would be over 1 percent higher. With the Elevated Structure Alternative, VMT for all time periods in the four-county region would be less than half a percent higher than VMT for the other build alternatives.

5.1.2 Vehicle Hours of Travel

VHT is defined as the calculated total number of hours traveled in specified area, in this case either the four-county Puget Sound region or Seattle's Center City, during a specified time period. The VHT estimates discussed below were derived using the project's travel demand model. The following discussions provide estimated VHT during the AM and PM peak hours and daily VHT totals for the Viaduct Closed (No Build Alternative), the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. Exhibit 5-2 is a summary table of VHT.

Exhibit 5-2. Vehicle Hours of Travel

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Seattle's Center City				
AM peak hour	20,300	18,700	18,400	18,400
PM peak hour	33,600	30,400	29,500	29,600
Daily	107,400	101,000	99,500	99,700
Four-County Region				
AM peak hour	1,107,200	1,094,400	1,094,900	1,105,700
PM peak hour	1,236,400	1,221,700	1,220,900	1,231,700
Daily	4,436,100	4,402,800	4,402,300	4,427,900

5.1.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), VMT in the Center City during the AM peak hour would be 20,300 hours, and during the PM peak hour, it would be 33,600 hours. The daily VHT for the Center City would be over 107,000 hours. VHT for the Viaduct Closed (No Build Alternative) in the Center City would be the highest of all the alternatives, which, similar to VMT, is probably the result of increased congestion and delay due to closure of the viaduct with no replacement.

In the four-county region, the AM peak hour VHT would be over 1,107,000 hours, while the PM peak hour VHT would be over 1,236,000 hours. The daily VHT in the four-county region would be over 4,436,000 hours. VHT in the four-county region would be highest for the Viaduct Closed (No Build Alternative), which again is likely the result of increased congestion due to the closure of the viaduct.

5.1.2.2 Bored Tunnel Alternative

VHT for the Bored Tunnel Alternative would be lower in all time periods when compared to the Viaduct Closed (No Build Alternative). In the Center City, VHT in the AM peak hour would be nearly 8 percent lower, while VHT during the PM peak hour would be almost 10 percent lower. Daily VHT in the Center City would be 6 percent lower than the VHT for the Viaduct Closed (No Build Alternative). The notable decrease in VHT in the Center City would likely result from decreased congestion due to the additional capacity provided by the bored tunnel. In the four-county region, VHT during the AM and PM peak hours for the Bored Tunnel Alternative would be over 1 percent lower than VHT for the Viaduct Closed (No Build Alternative). Daily VHT would be almost 1 percent lower.

5.1.2.3 Cut-and-Cover Tunnel Alternative

Compared to the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would result in a lower VHT value in the Center City. This is likely due to the additional connections provided by the Cut-and-Cover Tunnel Alternative in the Center City that would increase the directness of trips, which the Bored Tunnel does not have. During the AM peak hour, VHT would be almost 2 percent lower than VHT for the Bored Tunnel Alternative. VHT during the PM peak hour would be 3 percent lower, while daily VHT would be about 2 percent lower than VHT for the Bored Tunnel Alternative. However, in the four-county region, VHT under the Cut-and-Cover Tunnel Alternative would not decrease to any appreciable degree compared to VHT for the Bored Tunnel Alternative. This result would be expected because the principal functional differences between the two alternatives consist of connections in the Center City that are not apparent at the regional level.

5.1.2.4 Elevated Structure Alternative

The Elevated Structure Alternative would also result in a decrease in VHT in the Center City area compared to VHT for the Bored Tunnel Alternative. This result again stems from the fact that there are more connections provided by the Elevated Structure Alternative in the Center City than by the Bored Tunnel Alternative, which would increase the directness and shorten the travel time of trips using these connections. In the AM peak hour, VHT for the Elevated Structure Alternative would be about 2 percent lower than VHT for the Bored Tunnel Alternative, while during the PM peak hour, VHT would be almost 3 percent lower. Daily VHT in the Center City would be a little over 1 percent lower than VHT for the Bored Tunnel Alternative.

In the four-county region, VHT in the AM and PM peak hours for the Elevated Structure Alternative would be about 1 percent higher and daily VMT would be just over half a percent higher when compared to VHT for the Bored Tunnel Alternative. This result stems mostly from the fact that the Elevated Structure Alternative would result in the highest VMT in the region; therefore, VHT would also be expected to be higher.

5.1.3 Vehicle Hours of Delay

VHD is defined as the calculated total number of hours of delay incurred (i.e., travel time above that incurred during free-flow operations) by traffic on roadways in specified area during a specified time period. The areas considered for VHD are the same as for those for VMT and VHT, Seattle's Center City and the four-county Puget Sound region. This measure is often used as an indicator of overall traffic congestion. The VHD estimates were derived using the project's travel demand model. The following discussions provide estimated VHD during the AM and PM peak hours and daily VHD totals for the Viaduct Closed

(No Build Alternative), the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. Exhibit 5-3 is a summary table of VHD.

Exhibit 5-3. Vehicle Hours of Delay

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Seattle's Center City				
AM peak hour	8,600	6,800	6,300	6,300
PM peak hour	18,500	14,900	13,800	13,900
Daily	41,300	33,300	31,000	31,100
Four-County Region				
AM peak hour	537,900	524,500	524,800	534,200
PM peak hour	553,800	540,600	539,500	548,800
Daily	1,385,800	1,355,000	1,353,700	1,374,900

5.1.3.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), VHD in the Center City during the AM peak hour would be 8,600 hours, and during the PM peak hour, it would be 18,500 hours. The daily VHD for the Center City would be 41,300 hours. VHD in the Center City for the Viaduct Closed (No Build Alternative) would be highest of all the alternatives, which is likely the result of increased congestion and delay due to closure of the viaduct with no replacement.

In the four-county region, the AM peak hour VHD would be nearly 538,000 hours, while the PM peak hour VMD would be almost 554,000 hours. The daily VHD in the four-county region would be almost 1,386,000 hours. Similar to the Center City, VHD in the four-county region for the Viaduct Closed (No Build Alternative) would be highest; this is again likely the result of increased congestion due to the closure of the viaduct, resulting in increased congestion on alternate routes.

5.1.3.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, VHD would be lower during all time periods when compared to VHD for the Viaduct Closed (No Build Alternative). In the Center City during the AM peak hour, VHD would be nearly 21 percent lower, while VHD during the PM peak hour would be almost 20 percent lower. Daily VHD in the Center City for the Bored Tunnel Alternative would be over 19 percent lower than the VHD for the Viaduct Closed (No Build Alternative). This significant decrease in VHD in the Center City would likely result from decreased congestion due to the additional capacity provided by the bored tunnel. In the four-county region, VHD during the AM peak hour would be about 3 percent lower for the Bored Tunnel Alternative compared to the Viaduct Closed (No Build Alternative; VHD during the PM peak hour and daily VHD would be over 2 percent lower.

5.1.3.3 Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would result in a VHD value in the Center City that is even lower than the VHD for the Bored Tunnel Alternative. This is likely due to alternative connections in the Center City like the Elliott/Western ramps, which the bored tunnel would not provide. VHD during the AM and PM peak hours for the Cut-and-Cover Tunnel Alternative would be over 7 percent lower than VHD for the Bored Tunnel Alternative. The daily VHD in the Center City would be nearly 7 percent lower than VHD for the Bored Tunnel Alternative. However, VHD in the four-county region under the Cut-and-Cover Tunnel Alternative would not change to any appreciable degree compared to the Bored Tunnel Alternative.

5.1.3.4 Elevated Structure Alternative

The Elevated Structure Alternative would also result in VHD in the Center City that is lower than for the Bored Tunnel Alternative. This result is likely due to alternative connections in the Center City such as the Elliott/Western ramps, which would reduce congestion in the north waterfront area (the bored tunnel would not provide this connection). VHD during the AM peak hour under the Elevated Structure Alternative would be over 7 percent lower than VHD for the Bored Tunnel Alternative, while VHD in the Center City during the PM peak hour and daily VHD would be almost 7 percent lower.

In the four-county region, VHD during the AM and PM peak hours and daily VHD for the Elevated Structure Alternative would generally be about 2 percent higher than VHD for the Bored Tunnel Alternative. The reason for the increase in VHD at the regional level may be that the Elevated Structure Alternative would result in the least congestion in the Center City of all the build alternatives, which may increase travel demand on regional freeways and major arterials outside of the Center City. Increased travel demand on these regional routes could modestly increase the level of congestion outside the Center City, resulting in higher VHD.

5.1.4 Person Throughput

Person throughput is a measure of the total number of persons traveling on a given transportation facility. Analysts use person-trips to measure the number of people, rather than vehicles, traveling on the transportation system. Increased use of transit or carpools can increase the overall number of people conveyed, even if vehicle traffic does not increase.

The evaluation of person throughput compares the total number of persons crossing the same screenlines as those used in Chapter 4 to describe the existing conditions: a south screenline south of S. King Street, a central screenline north of Seneca Street, and a north screenline north of Thomas Street. The following discussions provide estimates of person-trips during the AM and PM peak hours and daily totals for the Viaduct Closed (No Build Alternative), the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. Exhibit 5-4 provides a summary table of person throughput by screenline.

Exhibit 5-4. Model-Estimated Daily Person Throughput (Person-Trips)

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
South Screenline (South of S. King Street)				
AM peak hour	61,360	65,840	66,650	66,870
PM peak hour	73,470	79,210	80,360	80,860
Daily	821,800	880,600	890,900	899,800
Central Screenline (North of Seneca Street)				
AM peak hour	53,670	60,170	61,160	61,640
PM peak hour	62,090	69,430	70,760	71,340
Daily	727,600	795,800	808,200	814,900
North Screenline (North of Thomas Street)				
AM peak hour	63,600	67,300	67,150	67,410
PM peak hour	74,900	80,020	79,420	79,860
Daily	839,900	894,700	880,700	882,400

5.1.4.1 South Screenline

Under the Viaduct Closed (No Build Alternative), almost 61,400 people would cross the south screenline during the AM peak hour, while nearly 73,500 people would cross the screenline during the PM peak hour. Nearly 822,000 people would cross the screenline daily. The Bored Tunnel Alternative would carry more person-trips during every time period. AM peak hour crossings would increase by over 7 percent, while PM peak hour crossings would increase nearly 8 percent over the number for the Viaduct Closed (No Build Alternative). Daily crossings would increase over 7 percent (nearly 59,000 crossings).

Compared to the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative would carry even more person-trips. With the Cut-and-Cover Tunnel Alternative, person-trips over the south screenline would increase by over 1 percent for all time periods (over 10,000 person-trips daily). Person-trips under the Elevated Structure Alternative would increase by about 2 percent for all time periods (over 19,000 person-trips daily).

5.1.4.2 Central Screenline

Under the Viaduct Closed (No Build Alternative), the central screenline would accommodate nearly 53,700 crossings during the AM peak hour and nearly 62,100 crossings during the PM peak hour. Almost 728,000 person-trips would cross the screenline daily. Under the Bored Tunnel Alternative, person-trips across this screenline would increases during each time period. AM and PM peak hour person-trips across this screenline would increase by about 12 percent, while daily person-trips would increase over 9 percent (over 68,000 person-trips).

The Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative both would result in increased person-trips compared to the Bored Tunnel Alternative. The Cut-and-Cover Tunnel Alternative would accommodate almost 2 percent more person-trips in every time period, corresponding to a daily increase of over 12,000 person-trips. The Elevated Structure Alternative would carry over 2 percent more person-trips during the AM peak hour and nearly 3 percent more person-trips during the PM peak hour. Daily person-trips for the Elevated Structure Alternative would increase over 2 percent (over 19,000 person-trips) compared to the number for the Bored Tunnel Alternative.

5.1.4.3 North Screenline

Under the Viaduct Closed (No Build Alternative), a total of 63,600 person-trips would cross the north screenline during the AM peak hour, while 74,900 person-trips would cross during the PM peak hour. Daily crossings over this screenline would approach 840,000 person-trips. Once again, the Bored Tunnel Alternative would result in more crossings of this screenline in every time period. Person-trips crossing this screenline during the AM peak hour would increase nearly 6 percent over the number for the Viaduct Closed (No Build Alternative), while PM peak hour person-trips would increase nearly 7 percent. Under the Bored Tunnel Alternative, daily crossings over this screenline would increase about 7 percent (nearly 55,000 person-trips) compared to the Viaduct Closed (No Build Alternative).

In contrast to the other screenlines, the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative would generally result in a modest decrease in person-trips crossing the screenline when compared to the Bored Tunnel Alternative. The difference is due to the addition of the Aurora Avenue arterial south of the north portal for the Bored Tunnel Alternative. Under the Cut-and-Cover Tunnel Alternative, person-trips during the AM and PM peak hours would decrease by less than 1 percent, while daily person-trips would decrease by about 2 percent (14,000 person-trips) compared to the numbers for the Bored Tunnel Alternative. Under the Elevated Structure Alternative, person-trips crossing the north screenline during the AM and PM peak hours would be similar to those for the Bored Tunnel Alternative, while daily crossings would decrease by over 1 percent (over 12,000 person-trips).

5.1.5 Vehicle Volumes at Screenlines

AM and PM peak hour and daily vehicle volumes were assessed to gauge the general impacts on parallel streets and highways. The traffic volume forecasts were measured at the four screenline locations used in Chapter 4 to describe the existing conditions. The forecasted screenline volumes are presented in Exhibit 5-5 and discussed below. Details regarding the distribution of vehicle volumes across specific highway and arterial facilities among the alternatives are discussed in Section 5.1.6.

Exhibit 5-5. Model-Estimated Vehicle Volumes at Screenlines

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Spokane Screenline (North of S. Spokane Street)				
AM peak hour	32,020	34,590	34,790	35,000
PM peak hour	35,800	38,400	38,730	39,090
Daily	464,200	495,900	499,000	502,600
South Screenline (South of S. King Street)				
AM peak hour	34,080	37,360	37,890	38,320
PM peak hour	39,420	43,430	44,160	44,660
Daily	515,800	559,000	565,500	572,800
Central Screenline (North of Seneca Street)				
AM peak hour	29,730	33,580	34,200	34,510
PM peak hour	33,060	37,410	38,200	38,450
Daily	447,500	491,100	498,600	502,200
North Screenline (North of Thomas Street)				
AM peak hour	37,650	40,370	40,280	40,360
PM peak hour	42,510	45,880	45,510	45,630
Daily	538,000	578,000	569,200	569,600

5.1.5.1 Spokane Screenline

Under the Viaduct Closed (No Build Alternative), the vehicle volumes north of S. Spokane Street are expected to be over 32,000 during the AM peak hour, 35,800 during the PM peak hour, and 464,200 over an entire weekday. These forecasted volumes for the Viaduct Closed (No Build Alternative) are the lowest among the alternatives due to lower vehicle capacity resulting from the viaduct closure north of the stadium area ramps.

Volumes for the Bored Tunnel Alternative are projected to be higher than those for the Viaduct Closed (No Build Alternative). The increased capacity would increase vehicle volumes by 8 percent (nearly 2,600 vehicles) in the AM peak hour, 7 percent (2,600 vehicles) in the PM peak hour, and about 6 percent (almost 32,000 vehicles) on a daily basis. These increases reflect added capacity and connections near the stadium area associated with the Bored Tunnel Alternative.

The Cut-and-Cover Tunnel Alternative would result in slightly higher vehicle volumes than the Bored Tunnel Alternative. Increases of less than 1 percent for the AM peak hour, PM peak hour, and daily total are expected.

The highest vehicle volumes at this screenline would result from the Elevated Structure Alternative. Compared to the Bored Tunnel Alternative, an increase of about 1 percent would occur in the AM peak hour, about 2 percent in the PM peak hour, and 1 percent for an average weekday.

5.1.5.2 South Screenline

Under the Viaduct Closed (No Build Alternative), vehicle volumes south of S. King Street would be nearly 34,100 during the AM peak hour, over 39,400 during the PM peak hour, and 515,800 over an entire weekday. These volumes, which are the lowest forecasted volumes for all the alternatives, are the result of reduced vehicle capacity due to the viaduct closure.

Vehicle volumes would increase across this screenline location with the Bored Tunnel Alternative as compared to the Viaduct Closed (No Build Alternative) because it would provide additional roadway capacity in the SR 99 corridor. The increases for the Bored Tunnel Alternative over the Viaduct Closed (No Build Alternative) would be about 10 percent in the AM peak hour (almost 3,300 vehicles) and PM peak hour (about 4,000 vehicles) and over 8 percent (over 43,000 vehicles) for daily vehicle volumes.

The Cut-and-Cover Tunnel Alternative would have slightly higher vehicle volumes at this screenline than those for the Bored Tunnel Alternative. The volumes for the Cut-and-Cover Tunnel Alternative are forecasted to be about 1 to 2 percent higher during the AM and PM peak hours as well as on a daily basis.

The volumes for the Elevated Structure Alternative would be just less than 3 percent higher than those for the Bored Tunnel Alternative in the AM and PM peak hours and 2 percent higher on a daily basis.

5.1.5.3 Central Screenline

Under the Viaduct Closed (No Build Alternative), vehicle volumes north of Seneca Street in the Seattle CBD would be notably affected by the viaduct closure. Volumes traveling across this screenline would be over 29,700 during the AM peak hour, nearly 33,100 in the PM peak hour, and 447,500 for an average weekday. These volumes would be the lowest of all the alternatives, reflecting a reduction in total vehicle trips through downtown due to increased congestion on alternate routes.

The Bored Tunnel Alternative would increase roadway capacity through the central area and is forecasted to have about 13 percent more vehicles at the central screenline during the AM peak hour (almost 3,900 additional vehicles) and PM peak hour (almost 4,400 additional vehicles) than the Viaduct Closed (No Build Alternative). The Bored Tunnel Alternative would also serve almost 10 percent more vehicles on an average weekday basis, accommodating nearly 44,000 additional vehicle trips through downtown.

As with the Spokane and south screenlines, the Cut-and-Cover Tunnel Alternative is expected to have slightly higher vehicle volumes than the Bored Tunnel Alternative north of Seneca Street. These volumes are expected to be about 2 percent higher in the AM and PM peak hours, with slightly lower increases over an entire day.

The volumes for the Elevated Structure Alternative are expected to increase relative to the volumes for the Bored Tunnel Alternative, by 3 percent during the AM and PM peak hours and over 2 percent for an average weekday.

5.1.5.4 North Screenline

Under the Viaduct Closed (No Build Alternative), vehicle volumes at the north screenline would be the lowest among the alternatives, similar to the other three screenline locations. Forecasted vehicle volumes are almost 37,700 in the AM peak hour, just over 42,500 in the PM peak hour, and 538,000 vehicles daily. The closure of SR 99 at the south portal of the Battery Street Tunnel would decrease the overall volume passing across this screenline.

The Bored Tunnel Alternative would serve higher vehicle volumes than the Viaduct Closed (No Build Alternative). These increases would amount to 7 percent (over 2,700 vehicles) in the AM peak hour, nearly 8 percent (almost 3,400 vehicles) in the PM peak hour, and over 7 percent (40,000 vehicles) on an average weekday.

Unlike the other screenline locations, at the north screenline, the Cut-and-Cover Tunnel Alternative would serve similar or slightly lower vehicle volumes than the Bored Tunnel Alternative. The volumes would be less than 1 percent lower in the AM and PM peak hours, and on an average weekday the vehicle volumes would be about 2 percent lower than those for the Bored Tunnel Alternative.

The Elevated Structure Alternative would serve nearly identical vehicle volumes as the Bored Tunnel Alternative during the AM peak hour. Similar to the volumes for the Cut-and-Cover Tunnel Alternative, PM peak hour volumes would decrease by less than 1 percent, while daily volumes would decrease by about 2 percent compared to volumes for the Bored Tunnel Alternative.

5.1.6 Vehicle Volumes on Key Facilities and Arterial Screenlines

Daily volumes along key facilities (SR 99 and I-5) and arterial screenline volumes at locations generally similar to the four screenlines discussed in Section 5.1.5 were compared across the modeled alternatives (see Exhibits 5-6 and 5-7). Daily traffic volumes at two additional screenlines, east and west of Aurora Avenue in north Seattle, are shown graphically in Exhibit 5-8. No comparison to 2015 Existing Viaduct is made due to the different analysis years; however, the Transportation Discipline Report (Appendix C) of the Supplemental Draft EIS (WSDOT et al. 2010) includes data for comparison.

5.1.6.1 S. Spokane Street Area Facilities

The Viaduct Closed (No Build Alternative) would have nearly 38,400 daily vehicles traveling on SR 99. The volumes on SR 99 would be constrained by the transition from a freeway facility north of S. Spokane Street to the Alaskan Way arterial in Pioneer Square. Arterials from East Marginal Way S. to I-5 are expected to have 139,300 daily vehicle trips. I-5 is forecasted to have 281,900 daily vehicles at this location.

The Bored Tunnel Alternative would shift many vehicle trips from I-5 and Alaskan Way to SR 99 at the Spokane screenline. The Bored Tunnel Alternative would reduce daily vehicle volumes on SODO arterials by about 16 percent (22,300 vehicles) and on I-5 by about 5 percent (13,700 vehicles) compared to the Viaduct Closed (No Build Alternative). These arterial volume reductions are due to the continuous SR 99 corridor that would be provided under the Bored Tunnel Alternative as compared to the Viaduct Closed (No Build Alternative).

Compared to the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would reduce daily vehicle volumes on SODO arterials by about 1 percent. Vehicle volumes are expected to increase about 4 percent on SR 99, and I-5 volumes would be unchanged. The SR 99 volumes would increase due to changes in connectivity farther north.

The Elevated Structure Alternative is also expected to result in increased vehicle volumes on SR 99, relative to the volumes under the Bored Tunnel Alternative. While daily vehicle volumes on SODO arterials would decrease about 2 percent relative to the volumes for the Bored Tunnel Alternative, volumes on SR 99 would increase about 8 percent. In addition, I-5 would again remain relatively unchanged, with about 0.5 percent lower daily vehicle volumes than the volumes under the Bored Tunnel Alternative. The volume increase on SR 99 would be due to connectivity changes father north.

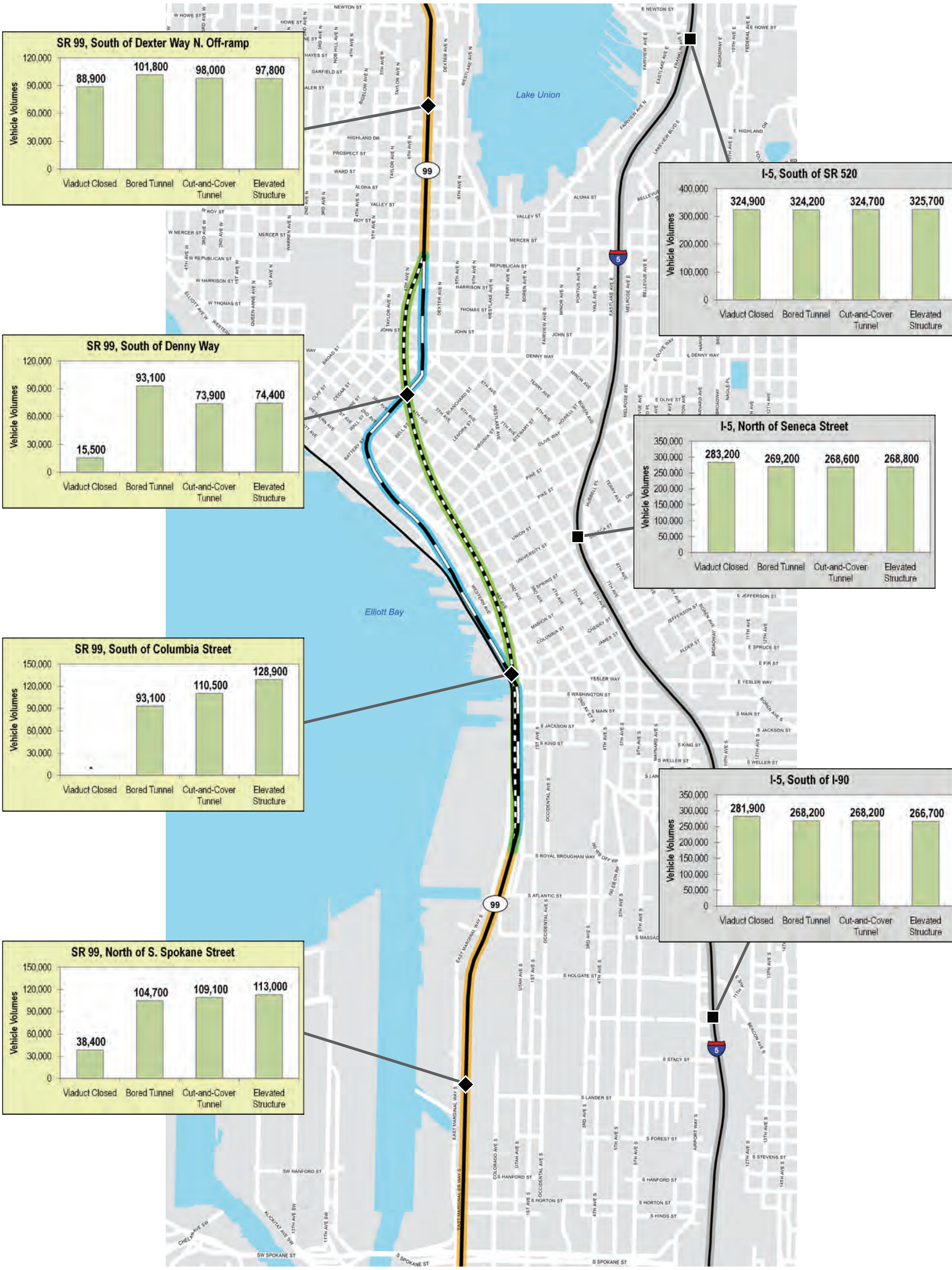

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Exhibit 5-6
Daily Vehicle Volumes on SR 99 and I-5

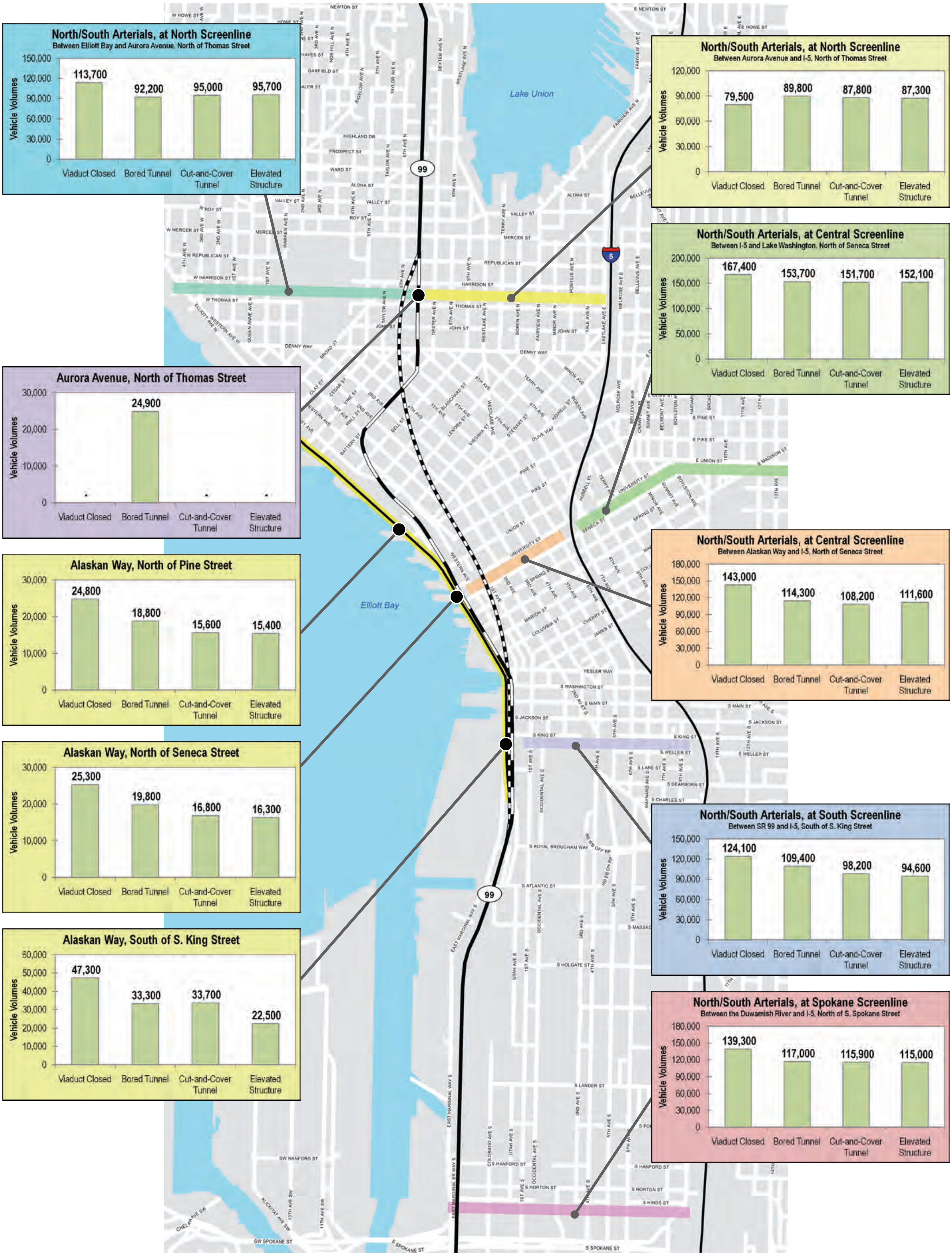

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Exhibit 5-7
Daily Vehicle Volumes on Arterials

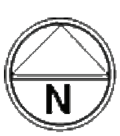


Exhibit 5-8
Daily Vehicle Volumes
on Arterials in North Seattle

5.1.6.2 South Area Facilities

The Viaduct Closed (No Build Alternative) would result in the closure of SR 99 north of S. King Street. These conditions would increase vehicle volumes on other facilities, so that they would be operating at or near capacity. Alaskan Way is forecasted to have 47,300 daily vehicles, and SODO arterials would have 124,100 daily vehicles.

The Bored Tunnel Alternative would keep vehicles on SR 99, resulting in a forecasted 93,100 vehicles traveling through the bored tunnel daily. Providing capacity for these trips would reduce daily vehicle volumes on arterials, decreasing volumes by about 30 percent (14,000 vehicles) on Alaskan Way and by 12 percent (14,700 vehicles) on other Pioneer Square arterials.

SR 99 daily vehicle volumes would increase by approximately 18 percent with the Cut-and-Cover Tunnel Alternative when compared with the Bored Tunnel Alternative. SR 99 volumes would be higher with the Cut-and-Cover Tunnel Alternative because an additional lane would be provided between the stadium area ramps and the Elliott/Western ramps, and direct connections to Elliott and Western Avenues would be provided. Alaskan Way would also have higher vehicle volumes because it would have increased capacity between S. King Street and Yesler Way compared to the Bored Tunnel Alternative. Vehicle volumes on other Pioneer Square arterials would decrease about 10 percent compared to the volumes for the Bored Tunnel Alternative.

The Elevated Structure Alternative is expected to have 38 percent (35,800 vehicles) more trips daily on SR 99 than the Bored Tunnel Alternative. This difference can be attributed to increased capacity provided by an eight-lane cross-section between the stadium area ramps and the midtown ramps, necessary to serve trips accessing SR 99 from the these ramps. Volumes on Alaskan Way for the Elevated Structure Alternative are predicted to be 32 percent lower than the volumes for the Bored Tunnel Alternative because of access provided to and from the south at the midtown ramps in the Seattle CBD and more constricted connections between SR 99 and Alaskan Way compared to the Bored Tunnel Alternative. Vehicle volumes on other Pioneer Square arterials are expected to decrease by about 13 percent with the Elevated Structure Alternative compared to the Bored Tunnel Alternative.

5.1.6.3 Central Area Facilities

Under the Viaduct Closed (No Build Alternative), vehicle volumes at Seneca Street would be zero because SR 99 would be closed, and vehicles would be diverted to other nearby facilities. Alaskan Way would serve 25,300 daily trips, I-5 would have 283,200 daily vehicles, and other downtown arterials would have 143,000 daily vehicles.

Under the Bored Tunnel Alternative, about 93,100 daily vehicle trips would travel through the bored tunnel at this location. Compared to the Viaduct Closed (No Build Alternative), the Bored Tunnel Alternative would reduce daily vehicle volumes by 22 percent (5,500 vehicles) on Alaskan Way, 20 percent (28,700 vehicles) on Seattle downtown arterials, and 5 percent (14,000 vehicles) on I-5.

Compared to the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would further shift daily vehicle volumes from other facilities to SR 99 at this location. The expected 19 percent increase in volumes on SR 99 would result in vehicle volume reductions of about 17 percent on Alaskan Way, 5 percent on downtown arterials, and virtually no change for I-5. SR 99 volumes are expected to increase with the Cut-and-Cover Tunnel Alternative because direct access to Elliott and Western Avenues would be provided, and an additional lane would provide increased capacity on SR 99 south of the Battery Street Tunnel.

The Elevated Structure Alternative would have similar or slightly lower daily vehicle volumes than the Bored Tunnel Alternative for most facilities other than SR 99 at this location. Alaskan Way volumes are forecasted to be 18 percent lower, volumes on downtown arterials would be 2 percent lower, and I-5 volume changes would not be noticeable. These volumes would be lower for facilities other than SR 99 due to the increased capacity provided on SR 99 with the Elevated Structure Alternative. Specifically, the Elevated Structure Alternative would provide an additional lane south of the Battery Street Tunnel, and another lane between the stadium area ramps and midtown ramps.

5.1.6.4 North Area Facilities

Under the Viaduct Closed (No Build Alternative), vehicle volumes on arterials in Uptown and South Lake Union would be higher than the volumes for any of the build alternatives. The limited cross streets at Aurora Avenue and vehicles diverted from southbound Aurora Avenue due to the viaduct closure would cause north-south arterial volumes in the Uptown area to carry around 113,700 vehicles. The South Lake Union volumes are forecasted to be 79,500 vehicles and would be constrained by limited access from southbound Aurora Avenue and from the Uptown area.

Compared to the Viaduct Closed (No Build Alterative), the Bored Tunnel Alternative would reduce arterial volumes at this screenline in Uptown by 19 percent (21,500 vehicles). This reduction is due to more direct east-west trips on improved connections, because many vehicles currently have to cross the screenline twice in order to travel east and west in the Uptown/South Lake Union area. However, increases on the new Aurora Avenue arterial and in South Lake Union could be attributed to the loss of the Battery Street ramps, causing trips to exit at Aurora Avenue; the new east-west arterials at John, Thomas, and Harrison

Streets would cause more vehicle trips to travel between Uptown and South Lake Union.

Under the Cut-and-Cover Tunnel Alternative, vehicle volumes on arterials would be fairly similar to those of the Bored Tunnel Alternative. The forecasted 3 percent increase in Uptown volumes would be matched by a corresponding decrease of 2 percent in South Lake Union. Furthermore, vehicles using the Elliott/Western ramps would add to the screenline volume in Uptown, though many of these trips would still cross the screenline with the Bored Tunnel Alternative by using Alaskan Way as a replacement for that movement. Again, as with the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would improve arterial connections between the two neighborhoods and provide two-way operations on Mercer Street under Aurora Avenue. Although there would be no new Aurora Avenue arterial at this location with this alternative, the SR 99 mainline and Denny Way ramps would serve a similar volume.

Under the Elevated Structure Alternative, vehicle volumes in the Uptown and South Lake Union areas would increase by 4 percent and decrease by 3 percent, respectively. Connections at this screenline would be similar to those provided by the Bored Tunnel Alternative and identical to those provided by the Cut-and-Cover Tunnel Alternative, which would result in similar vehicle volumes and traffic patterns.

5.1.6.5 North Seattle Area Facilities

Vehicle volumes on east-west arterials north of the Lake Washington Ship Canal would be very similar for the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative (see Exhibit 5-8). Volume differences between the build alternatives at the two screenlines in north Seattle are projected to be less than half of 1 percent, indicating that diversion from the 15th Avenue N.W./Elliott Avenue corridor to SR 99 or I-5 is not expected.

The largest effect on vehicle volumes would occur under the Viaduct Closed (No Build Alternative), which would result in a 2 percent decrease in vehicle volumes between Aurora Avenue and 15th Avenue W. compared to the Bored Tunnel Alternative. The Viaduct Closed (No Build Alternative) also is expected to result in a 2 percent increase over the Bored Tunnel Alternative on arterials between Aurora Avenue and I-5, likely due to diversion of vehicles from SR 99 to I-5 in order to access destinations south of downtown.

5.1.7 Daily Traffic Patterns on SR 99

This section provides an overview of traffic patterns on SR 99 within the study area for the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. Daily traffic patterns are shown in Exhibits 5-9 through 5-11.

Exhibit 5-9
Daily SR 99 Traffic Patterns – Bored Tunnel Alternative

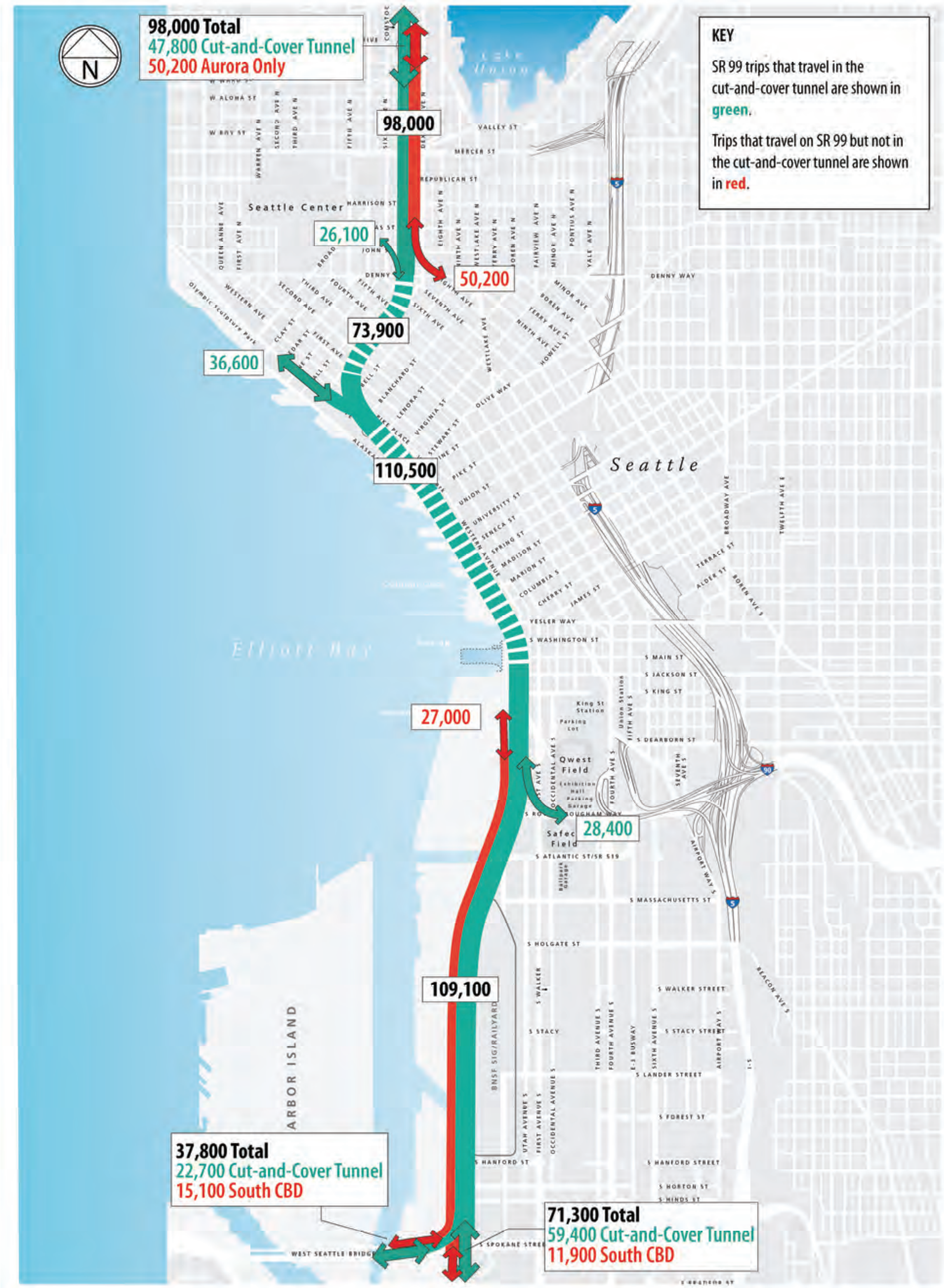


Exhibit 5-10
Daily SR 99 Traffic Patterns –
Cut-and-Cover Tunnel Alternative

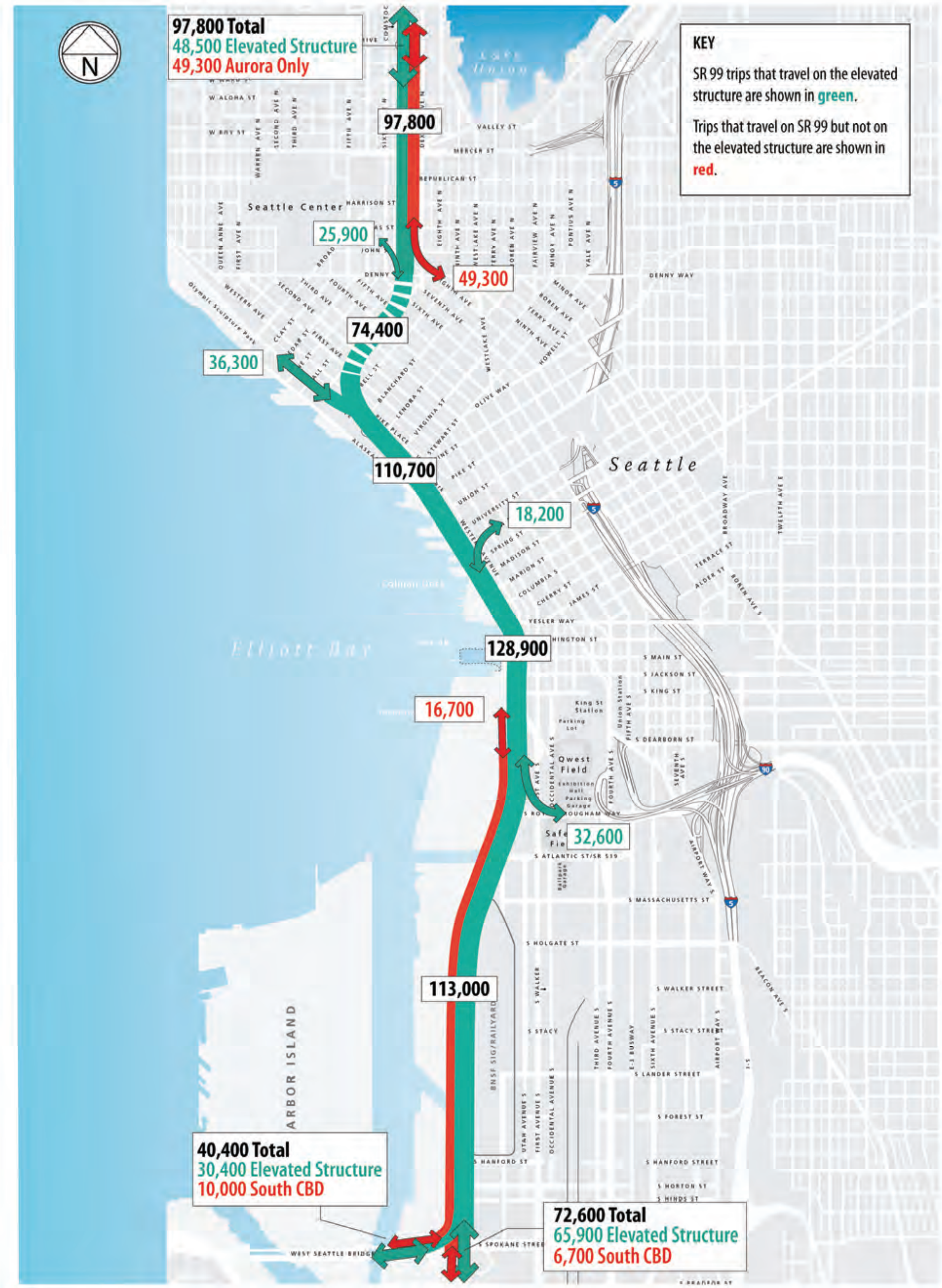


Exhibit 5-11
Daily SR 99 Traffic Patterns – Elevated Structure Alternative

As noted in Chapter 4, SR 99 carries more north-south traffic in the Center City than any facility, other than I-5. The build alternatives would continue this pattern. SR 99 carries a number of users to and from destinations to the south of downtown, including West Seattle and Burien. Trips entering or exiting SR 99 from the West Seattle high bridge or low bridge to Harbor Island would range from 37,100 to 40,400 trips, and trips south of the West Seattle ramps would total 67,600 to 72,600. The Bored Tunnel Alternative would carry fewer trips in the highest traveled segment than the Cut-and-Cover Tunnel and Elevated Structure Alternatives. This is because the bored tunnel would not provide connections to midtown or to Elliott and Western Avenues, whereas both of these connections are accommodated in the Elevated Structure Alternative and only the Elliott/Western ramps are accommodated in the Cut-and-Cover Tunnel Alternative.

The stadium area ramps are a major connection for each of the build alternatives. However, under the Elevated Structure Alternative, the traffic volume entering and exiting SR 99 via these ramps would be slightly lower due to the proximity of the midtown ramps, which would not be provided by the other alternatives. Partially due to the fewer connections provided, the Bored Tunnel Alternative would carry 93,100 trips daily, which is less than the volumes that would be carried in the segments north and south of the bored tunnel. In contrast, both the Cut-and-Cover Tunnel and the Elevated Structure Alternatives would experience their highest traffic volumes in midtown, with 110,500 trips for the Cut-and-Cover Tunnel Alternative and 128,900 trips for the Elevated Structure Alternative.

In the north area of downtown, the Bored Tunnel Alternative would experience 34,400 trips between the south segment and South Lake Union, more than the Cut-and-Cover Tunnel Alternative with 26,100 trips and the Elevated Structure Alternative with 25,900 trips, the differences being attributable to the proximity of the Elliott/Western ramps in the latter two build alternatives. Trips from Denny Way/South Lake Union to points farther north would be lowest under the Bored Tunnel Alternative with 43,200 trips, while each of the other two build alternatives would carry around 50,000 trips.

In the north, SR 99 (on Aurora Avenue N.) is a primary corridor for travel from Ballard, Fremont, and communities along SR 99 farther north to downtown and destinations farther south. North of Aloha Street, the Bored Tunnel Alternative would carry nearly 102,000 trips, while the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative would each carry around 98,000 trips.

5.2 Traffic Operations on SR 99

This section discusses mainline traffic conditions and ramp interactions for the SR 99 corridor in terms of AM and PM peak hour volumes, travel speeds, and LOS on key mainline segments and related on- and off-ramps. This discussion focuses on the applicable modeled conditions for operational impacts represented by the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative.

The key findings of the analyses of traffic operations on SR 99 are the following:

- SR 99 volumes show peak hour directionality, with higher volumes traveling into downtown during the AM peak hour and the reverse during the PM peak hour.
- The volumes estimated for the Cut-and-Cover Tunnel Alternative are generally similar to those forecasted for the Bored Tunnel Alternative, the major difference being the ramps at Elliott and Western Avenues under the Cut-and-Cover Tunnel Alternative. The addition of these ramps results in an increase in forecasted volumes in the cut-and-cover tunnel south of downtown and through midtown relative to the volumes for the Bored Tunnel Alternative. In addition, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union, as the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown.
- Similar to the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would provide ramps at Elliott and Western Avenues. In addition, this alternative would provide ramps in the midtown area, with a southbound on-ramp at Columbia Street and a northbound off-ramp at Seneca Street. These additional ramps would result in an increase in vehicles on the SR 99 mainline south of downtown and through midtown compared with the volumes for the Bored Tunnel Alternative. Similar to the Cut-and-Cover Tunnel Alternative, with the Elevated Structure Alternative, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union as the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown.
- Under the Bored Tunnel Alternative, SR 99 through midtown is expected to operate at LOS E and LOS F in the southbound direction during the AM and PM peak hours, and at LOS D and LOS E in the northbound direction. In the segments north and south of the bored tunnel, SR 99 is expected to operate at similar levels of congestion, except for the southbound lanes south of downtown during the AM peak hour (LOS C).

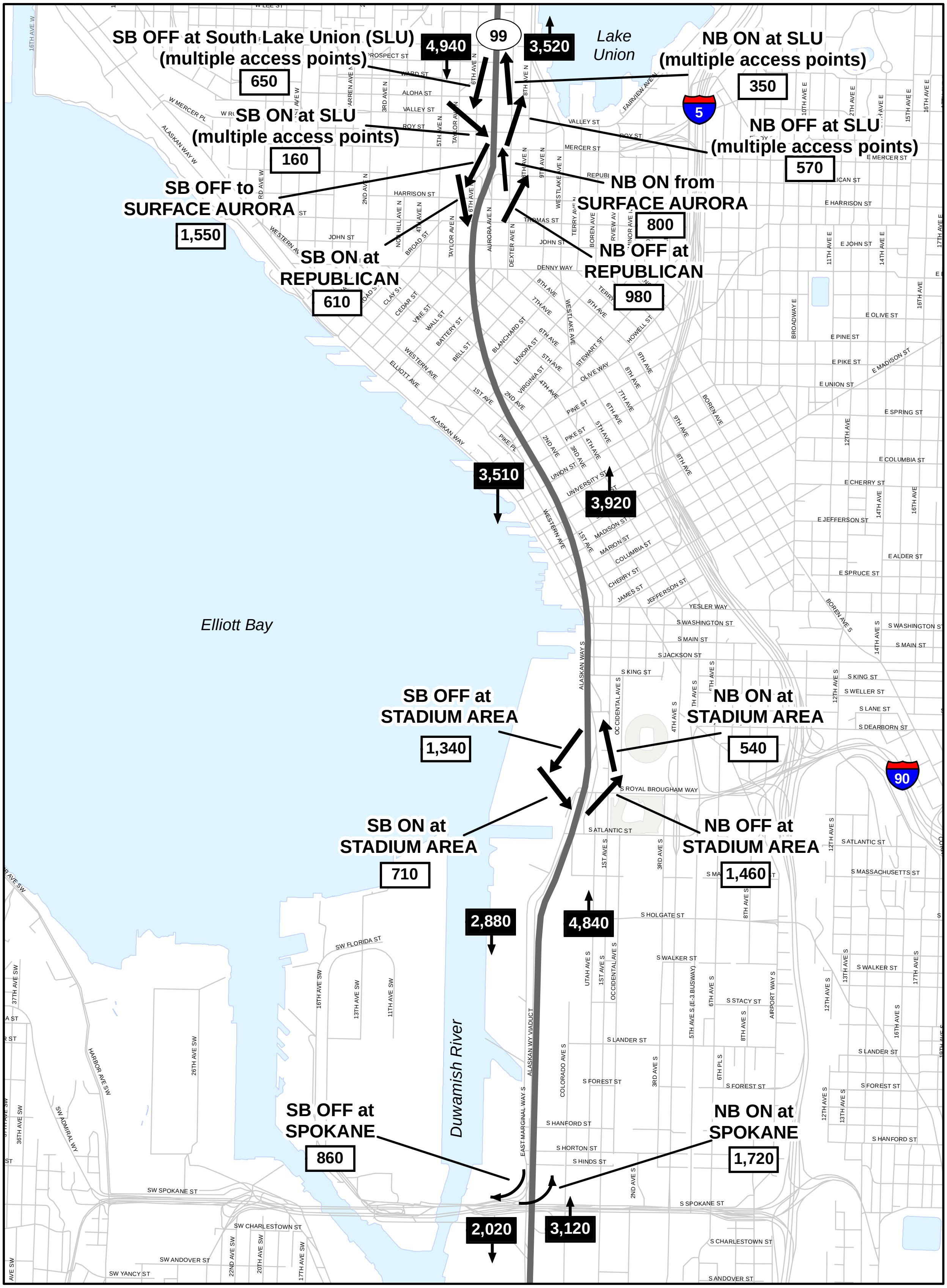
- In comparison with the Bored Tunnel Alternative, LOS on mainline SR 99 under the Cut-and-Cover Tunnel and Elevated Structure Alternatives is expected to be generally similar to slightly better in the southbound direction and generally similar or worse in the northbound direction. Under the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative, the Battery Street Tunnel is expected to operate at LOS E or LOS F during the AM and PM peak hours. For both of these alternatives, SR 99 is expected to operate between LOS D and LOS F in the northbound direction, while some segments would operate at LOS B or LOS C in the southbound direction during the AM peak hour.
- Speeds in the bored tunnel are expected to be approximately 41 to 46 mph in both directions during the AM and PM peak hours. For the Cut-and-Cover Tunnel and Elevated Structure Alternatives, speeds through midtown are expected to be between 31 and 47 mph during the AM and PM peak hours. In the south end of the study area, speeds are expected to be between 32 and 48 mph for all three build alternatives during the AM and PM peak hours. In the north end, speeds are expected to be between 16 and 36 mph for the build alternatives.

5.2.1 Alaskan Way Viaduct Mainline and Ramp Volumes

This section describes the forecasted AM peak hour, PM peak hour, and daily traffic volume on the Alaskan Way Viaduct mainline and ramps for the build alternatives. Specifically, estimates for each connection to and from SR 99 (ramps or side streets) and for each mainline segment (length of SR 99 between connections) are provided in the following subsections. These estimates account for all vehicle types in the corridor. Additional information specific to truck movement is presented in Section 5.7, Truck Traffic and Freight, and transit services are discussed in Section 5.6, Transit Services.

5.2.1.1 AM Peak Hour

As with most urban transportation facilities, traffic volumes on the SR 99 corridor are generally the most pronounced during weekday commuting hours. In the morning, peak hour traffic volumes on SR 99 are fairly directional, with heavier volumes entering the central downtown area from all directions. Exhibits 5-12 through 5-14 show the AM peak hour mainline and ramp volumes for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives, respectively.



0 2,500
Feet

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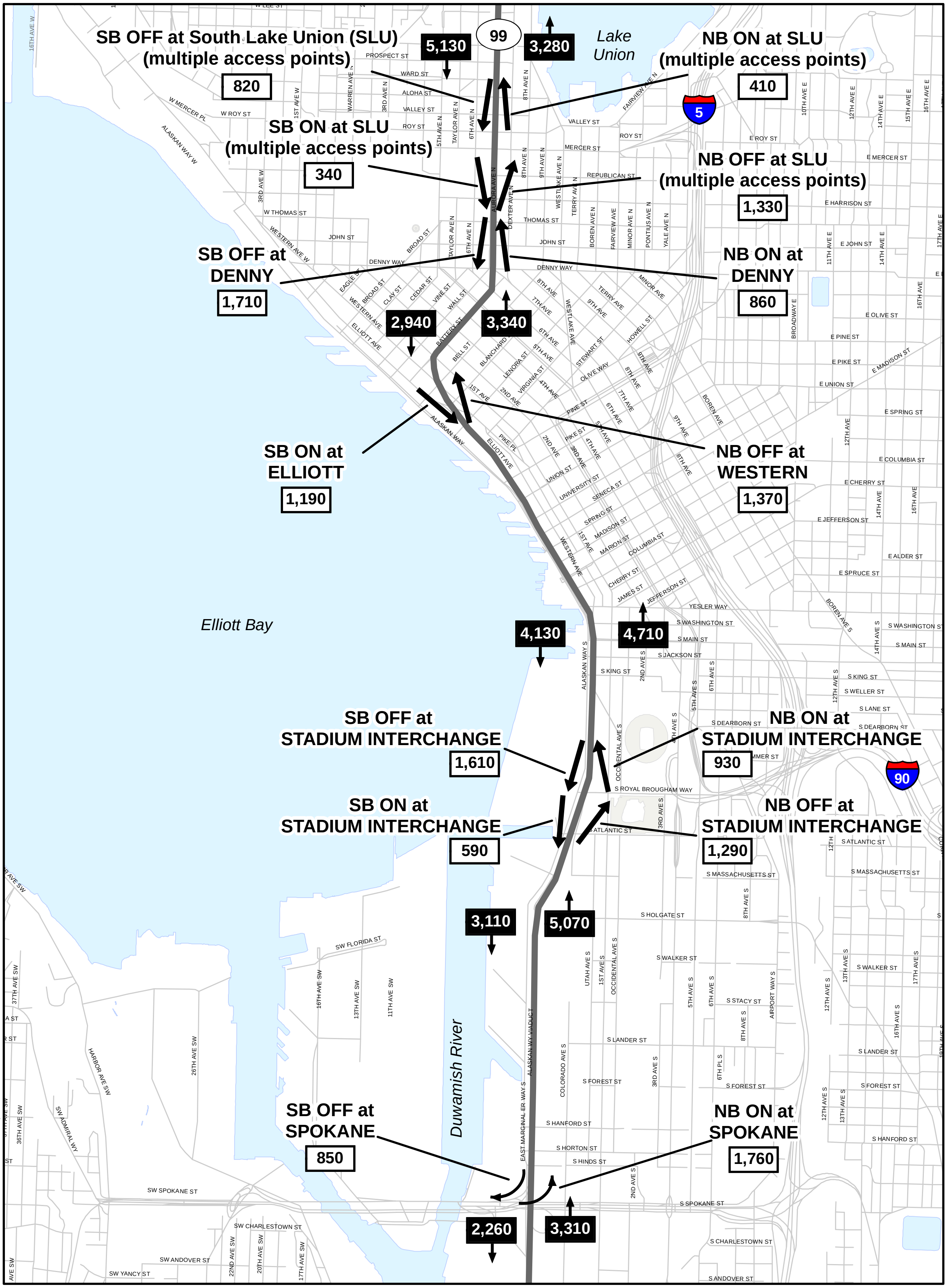
XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-12
AM Peak Hour Mainline and Ramp Volumes - Bored Tunnel Alternative



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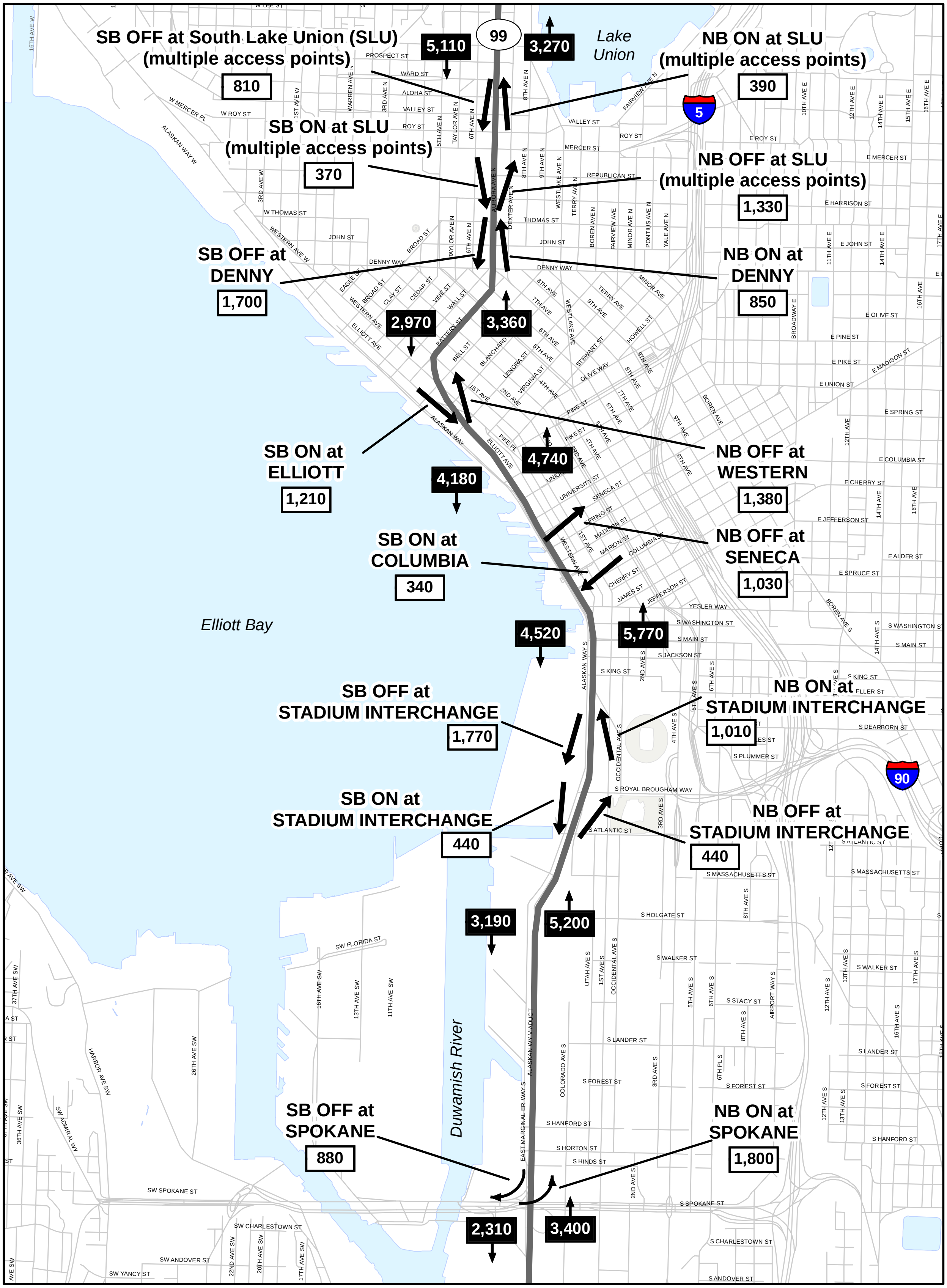
0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-13
AM Peak Hour Mainline and Ramp Volumes - Cut-and-Cover Tunnel Alternative



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0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-14
AM Peak Hour Mainline and Ramp Volumes - Elevated Structure Alternative

5.2.1.1.1 Bored Tunnel Alternative

The forecasted mainline and ramp volumes during the AM peak hour for the Bored Tunnel Alternative are shown in Exhibit 5-12. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,720 vehicles) are approximately double those exiting southbound SR 99 to West Seattle (860 vehicles). South of downtown and the stadium area, mainline SR 99 volumes are considerably higher in the northbound direction (4,840 vehicles) than in the southbound direction (2,880 vehicles). The stadium area ramps also show directional differences, with 1,460 vehicles exiting northbound SR 99 in the morning but only 710 vehicles entering southbound. Similarly, 1,340 vehicles exit southbound in the stadium area, while only 540 vehicles enter northbound.

In the bored tunnel, the northbound volume (3,920 vehicles) exceeds the volume of southbound vehicles (3,510 vehicles). Northbound SR 99 off-ramp volumes at Republican Street (980 vehicles) exceed those on the southbound on-ramp (610 vehicles), while the southbound off-ramp volumes to surface Aurora Avenue (1,550 vehicles) exceed those on the northbound on-ramp from surface

Aurora Avenue (800 vehicles). At the north end of the study area, mainline volumes during the AM peak hour are projected to be higher in the southbound direction (4,940 vehicles) than in the northbound direction (3,520 vehicles), because more vehicles would be entering the South Lake Union and downtown areas.

5.2.1.1.2 Cut-and-Cover Tunnel Alternative

The forecasted mainline and ramp volumes for the Cut-and-Cover Tunnel Alternative are generally similar to those for the Bored Tunnel Alternative, the major difference being the ramps at Elliott and Western Avenues under the Cut-and-Cover Tunnel Alternative. The addition of these ramps, with 1,370 vehicles exiting northbound and 1,190 vehicles entering southbound, results in an increase in forecasted volumes in the cut-and-cover tunnel south of downtown and through midtown relative to the forecasted volumes for the Bored Tunnel Alternative, which are 4,710 vehicles northbound and 4,130 southbound in the midtown segment. In addition, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union (3,340 northbound and 2,940 southbound), because the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown. Forecasted volumes on the mainline and ramps during the AM peak hour under the Cut-and-Cover Tunnel Alternative are shown in Exhibit 5-13.

5.2.1.1.3 Elevated Structure Alternative

Similar to the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would provide ramps at Elliott and Western Avenues. In addition, this alternative would provide ramps in the midtown area, with a southbound on-ramp at Columbia Street and a northbound off-ramp at Seneca Street. These additional ramps are the reason for the forecasted increase in vehicles on the SR 99 mainline south of downtown and through midtown compared with the forecasted volumes for the Bored Tunnel Alternative, with 5,770 vehicles northbound and 4,520 southbound in the segment south of the Seneca and Columbia ramps. Also similar to the Cut-and-Cover Tunnel Alternative, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union (3,360 northbound and 2,970 southbound), because the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown. Forecasted volumes on the mainline and ramps during the AM peak hour for the Elevated Structure Alternative are shown in Exhibit 5-14.

5.2.1.2 PM Peak Hour

Exhibits 5-15 through 5-17 show the forecasted PM peak hour mainline and ramp volumes for the Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative, respectively.

5.2.1.2.1 Bored Tunnel Alternative

Similar to the forecasted volumes during the AM peak hour, the PM peak hour traffic volumes along SR 99 are directional (although generally not as pronounced as the AM peak volumes), with heavier volumes leaving central downtown. Forecasted volumes on the mainline and ramps during the PM peak hour for the Bored Tunnel Alternative are shown in Exhibit 5-15.

At S. Spokane Street, forecasted volumes exiting southbound to West Seattle (2,180 vehicles) are higher than those entering northbound from West Seattle (1,340 vehicles). South of downtown and the stadium area, mainline volumes are noticeably higher in the southbound direction (4,960 vehicles) than in the northbound direction (4,110 vehicles). The stadium area ramps also show directional differences, with 1,560 vehicles entering southbound SR 99 but only 1,000 vehicles exiting northbound. Similarly, 1,170 vehicles enter northbound in the stadium area, while only 620 vehicles exit southbound.

In the bored tunnel, the forecasted northbound volume (4,280 vehicles) exceeds the forecasted volume of southbound vehicles (4,020 vehicles). Southbound SR 99 on-ramp volumes at Republican Street (970 vehicles) exceed those on the northbound off-ramp (900 vehicles), while the northbound on-ramp volumes from surface Aurora Avenue (1,430 vehicles) exceed those on the southbound off-ramp to surface Aurora Avenue (950 vehicles). At the north end of the study

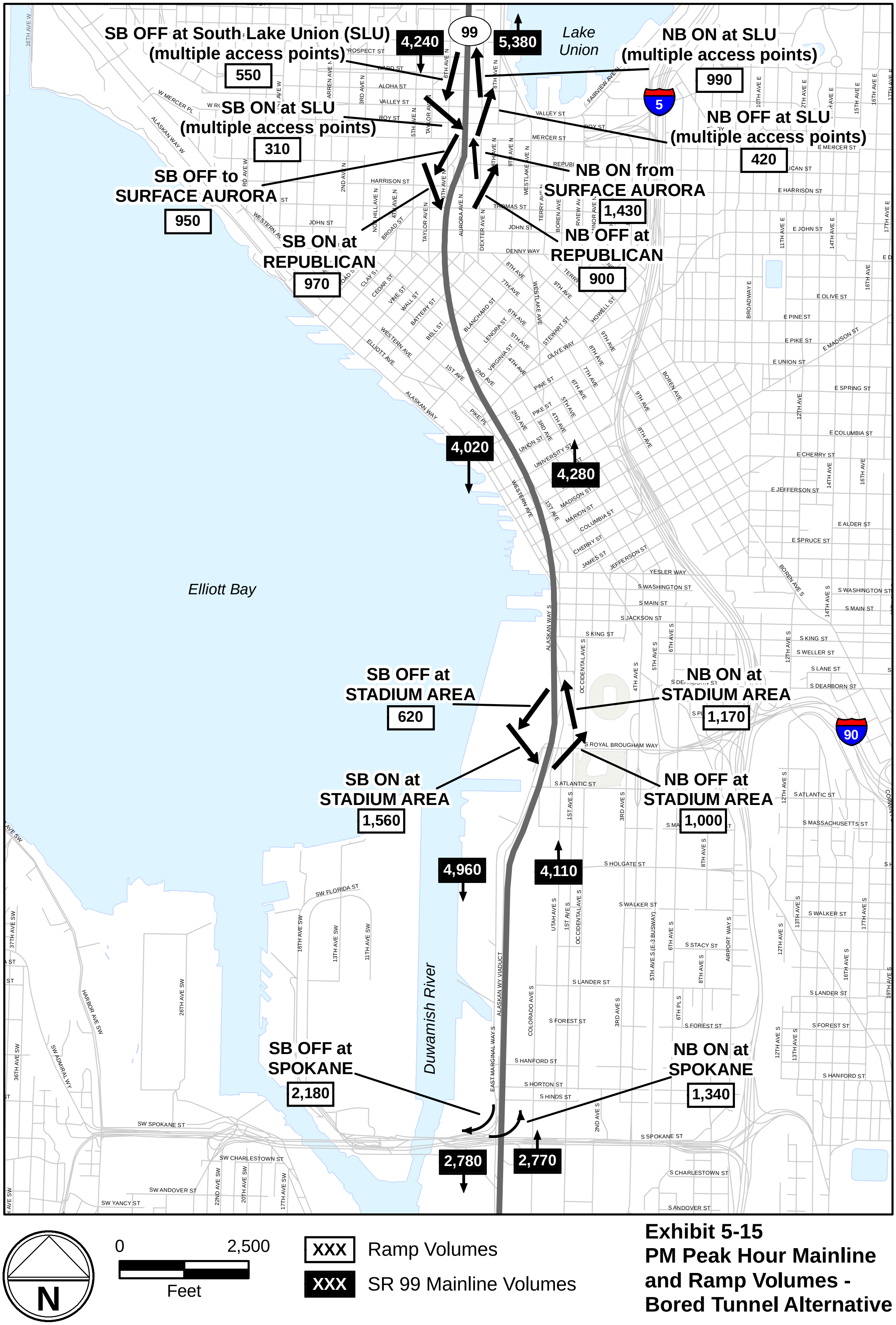


Exhibit 5-15
PM Peak Hour Mainline and Ramp Volumes - Bored Tunnel Alternative

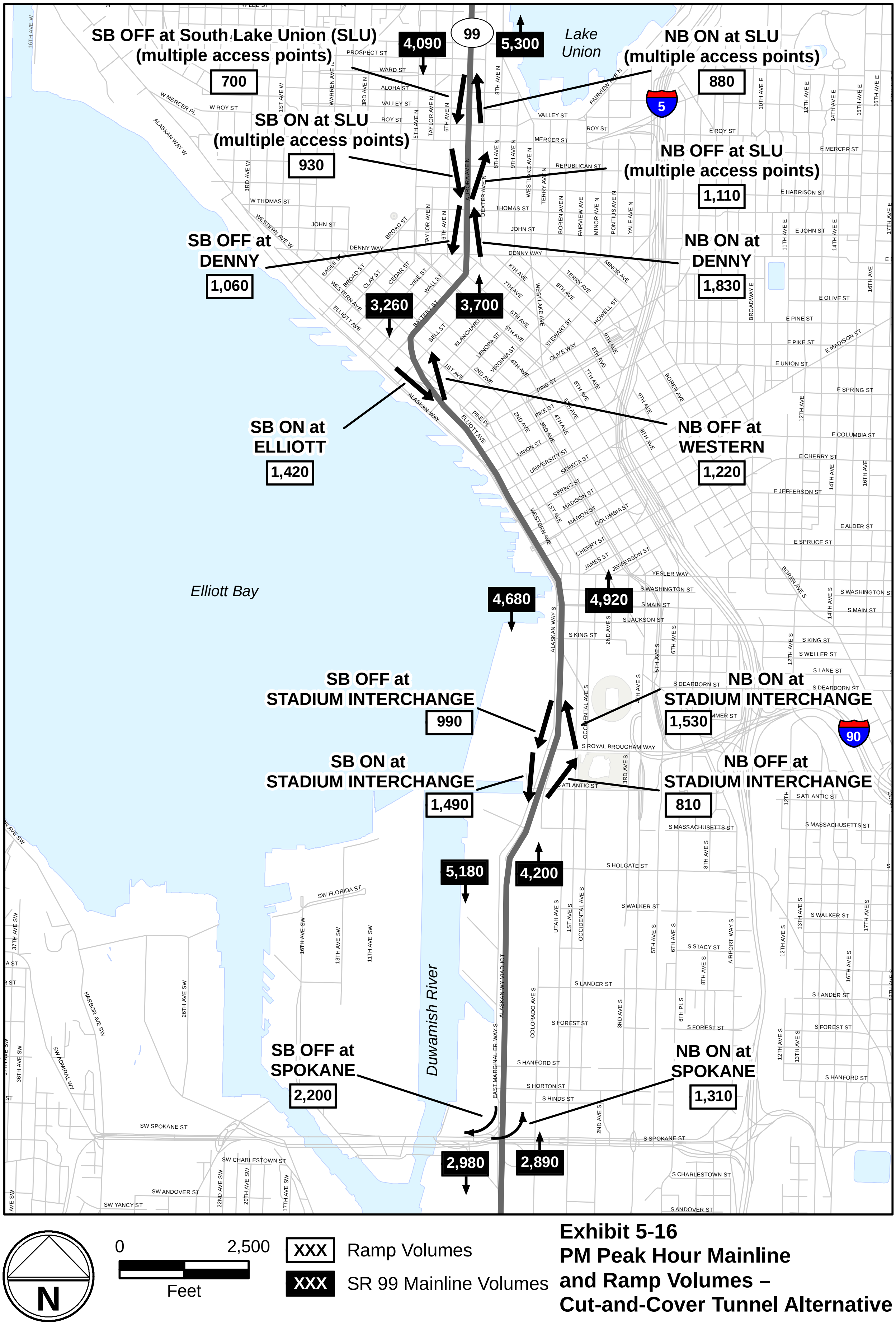
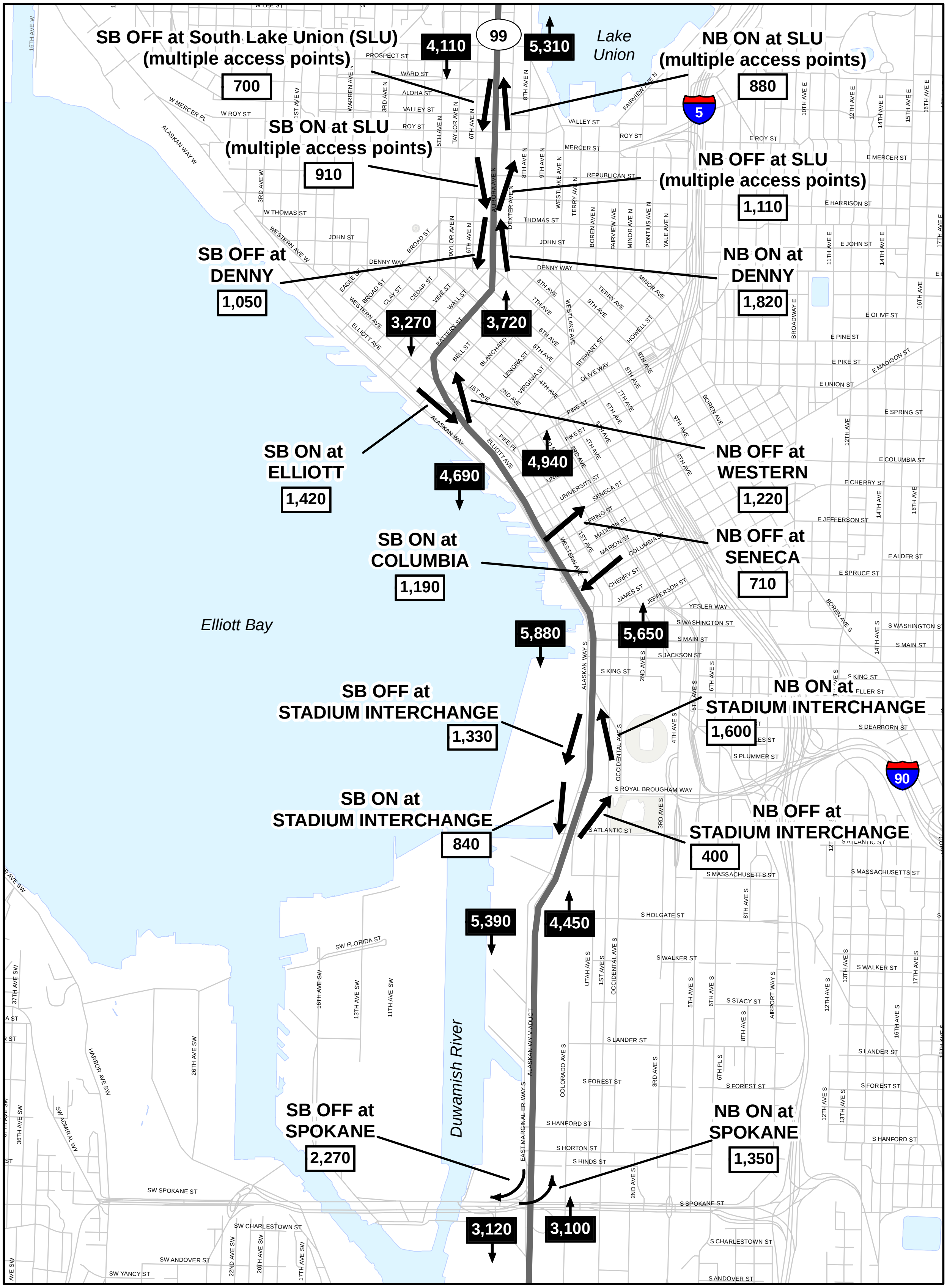


Exhibit 5-16
PM Peak Hour Mainline and Ramp Volumes – Cut-and-Cover Tunnel Alternative



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Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-17
PM Peak Hour Mainline and Ramp Volumes - Elevated Structure Alternative

area, mainline volumes during the PM peak hour are projected to be higher in the northbound direction (5,380 vehicles) than in the southbound direction (4,240 vehicles), because more vehicles would be exiting the South Lake Union and downtown areas.

5.2.1.2.2 Cut-and-Cover Tunnel Alternative

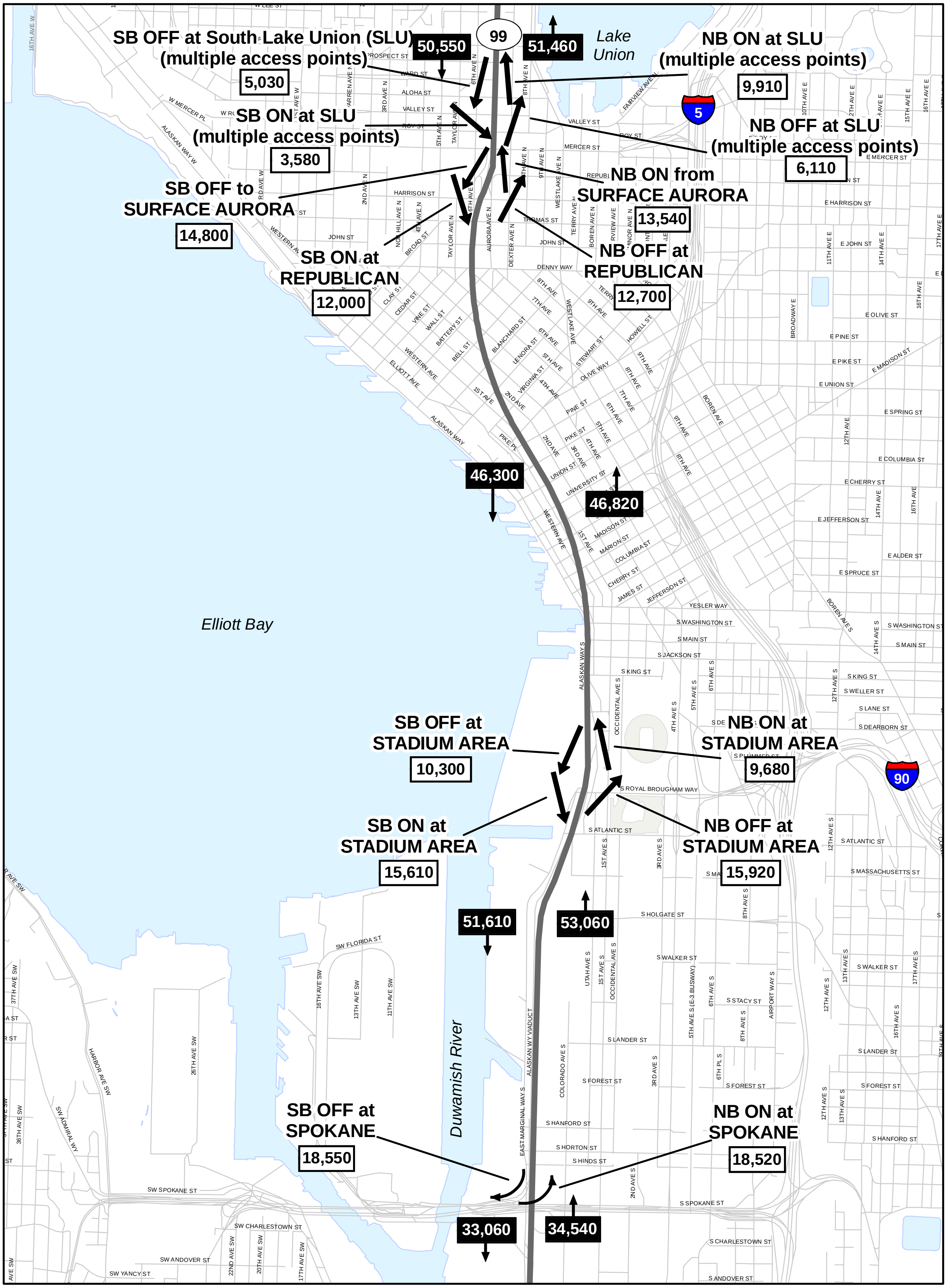
As in the AM peak hour, the forecasted volumes during the PM peak hour for the Cut-and-Cover Tunnel Alternative are generally similar to those for the Bored Tunnel Alternative, the major difference being the ramps at Elliott and Western Avenues in the Cut-and-Cover Tunnel Alternative. The addition of these ramps, with 1,220 vehicles exiting northbound and 1,420 vehicles entering southbound, results in an increase in forecasted volumes in the cut-and-cover tunnel south of downtown and through midtown relative to the forecasted volumes for the Bored Tunnel Alternative, which are 4,920 vehicles northbound and 4,680 southbound in the midtown segment. In addition, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union (3,700 northbound and 3,260 southbound), because the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown. Forecasted volumes on the mainline and ramps during the PM peak hour for the Cut-and-Cover Tunnel Alternative are shown in Exhibit 5-16.

5.2.1.2.3 Elevated Structure Alternative

Similar to the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would provide ramps at Elliott and Western Avenues. In addition, this alternative would provide ramps in the midtown area, with a southbound on-ramp at Columbia Street and a northbound off-ramp at Seneca Street. As forecasted for the AM peak hour, these additional ramps result in an increase in forecasted vehicle volumes on the SR 99 mainline south of downtown and through midtown compared with the forecasted volumes for the Bored Tunnel Alternative, with 5,650 vehicles northbound and 5,880 southbound in the segment south of the Seneca and Columbia ramps. Also similar to the Cut-and-Cover Tunnel Alternative, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union (3,720 northbound and 3,270 southbound), because the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown. Forecasted volumes on the mainline and ramps during the PM peak hour for the Elevated Structure Alternative are shown in Exhibit 5-17.

5.2.1.3 Daily

Daily mainline and ramp volumes for each of the modeled conditions are shown in Exhibits 5-18 through 5-20.



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Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 5-18
Daily Mainline and Ramp Volumes - Bored Tunnel Alternative

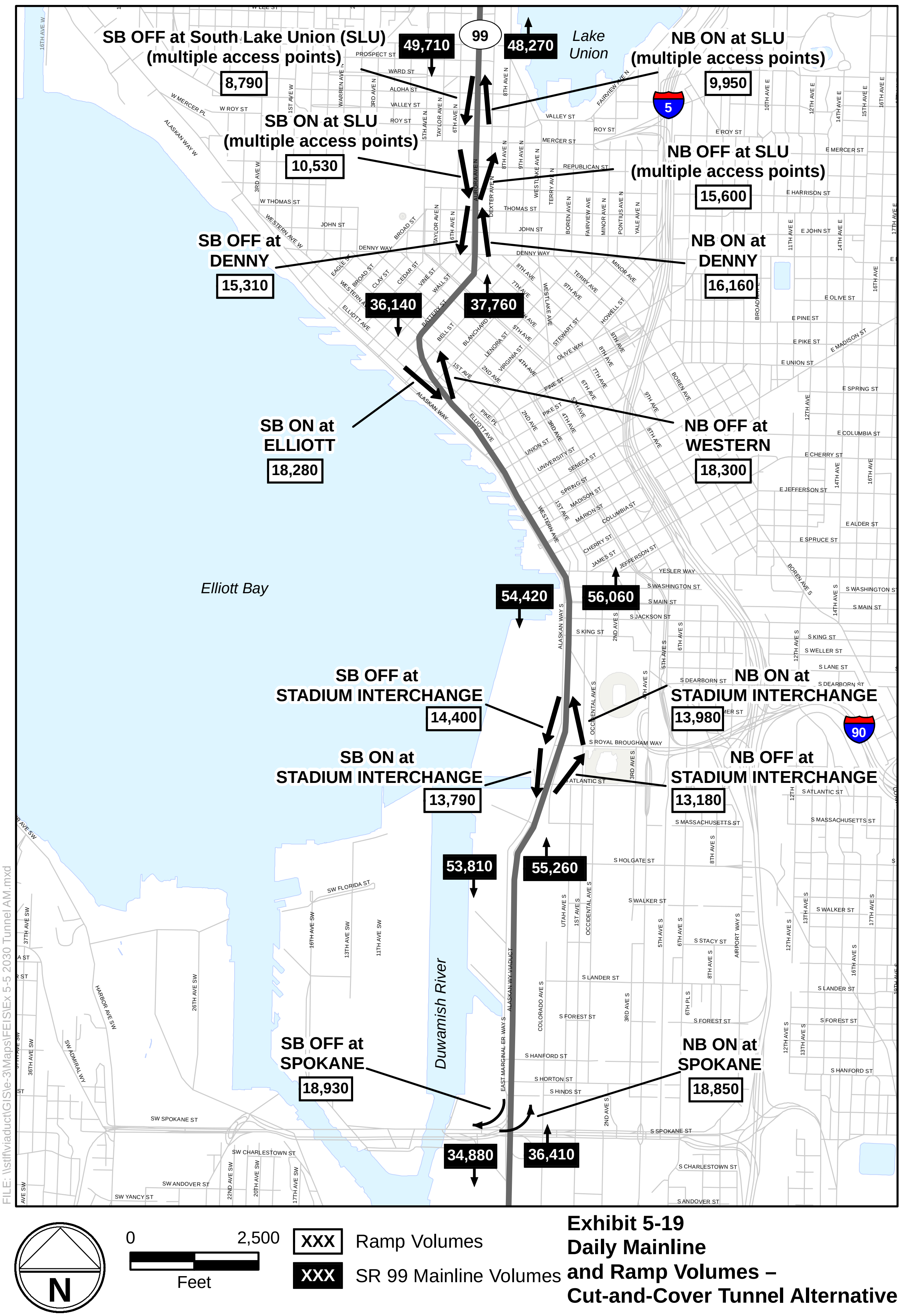
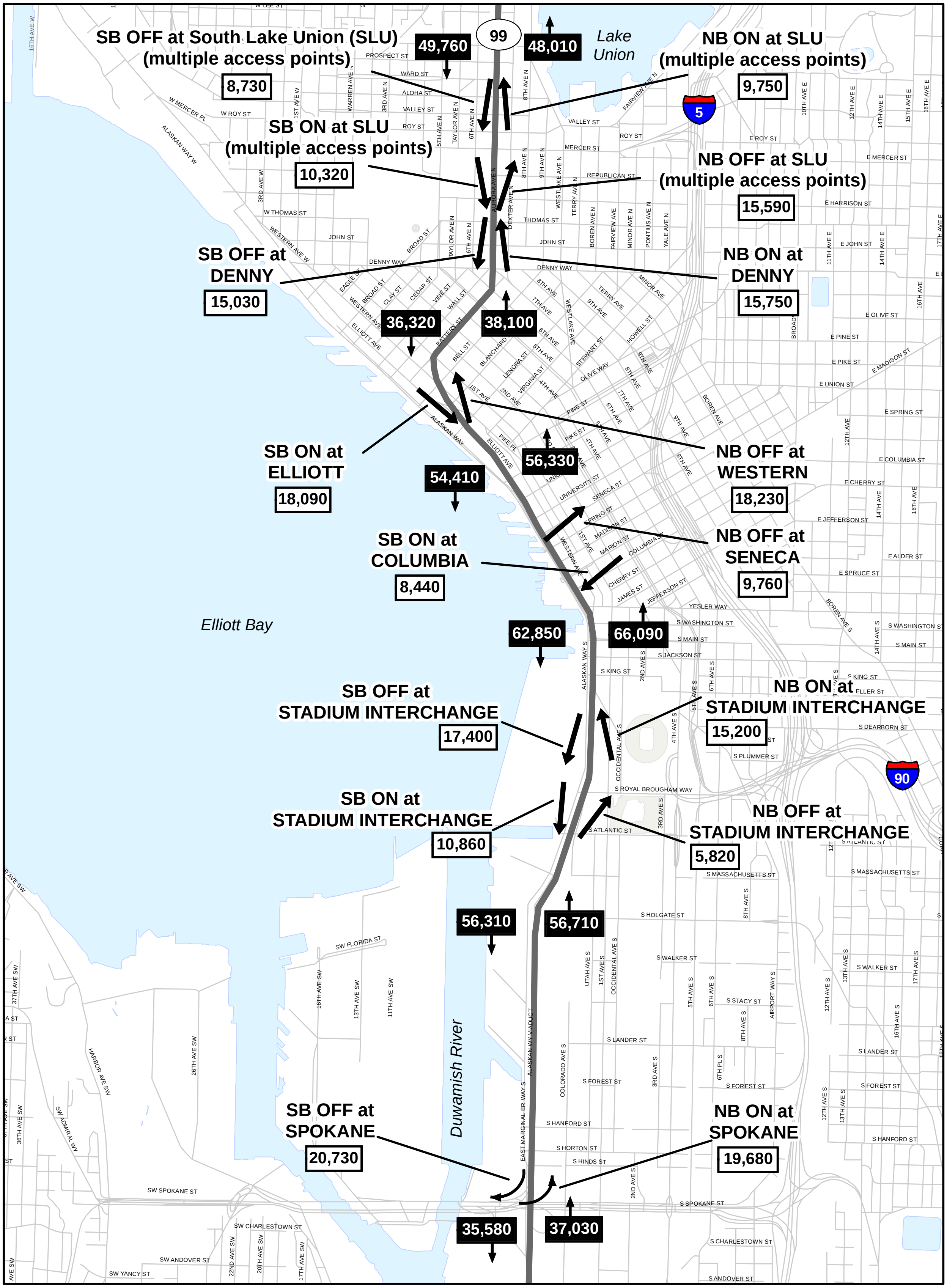


Exhibit 5-19
Daily Mainline and Ramp Volumes – Cut-and-Cover Tunnel Alternative



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XXX Ramp Volumes
XXX SR 99 Mainline Volumes

Exhibit 5-20
Daily Mainline and Ramp Volumes - Elevated Structure Alternative

5.2.1.3.1 Bored Tunnel Alternative

Forecasted daily traffic volumes along SR 99 for the Bored Tunnel Alternative are generally balanced by direction, with similar volumes leaving and entering the central downtown area. Daily mainline and ramp volumes are shown in Exhibit 5-18.

At S. Spokane Street, forecasted volumes exiting southbound to West Seattle (18,550 vehicles) are similar to those entering northbound from West Seattle (18,520 vehicles). South of downtown and the stadium area, mainline volumes are generally balanced by direction. The stadium area ramps are also balanced, with 15,920 vehicles exiting northbound and 15,610 vehicles entering southbound. Similarly, 9,680 vehicles enter northbound in the stadium area, while 10,300 vehicles exit southbound.

In the bored tunnel, the forecasted northbound volume (46,820 vehicles) is similar to the volume of southbound vehicles (46,300 vehicles). Southbound SR 99 on-ramp volumes at Republican Street (12,000 vehicles) are also similar to those on the northbound off-ramp (12,700 vehicles), while the southbound off-ramp volumes to surface Aurora Avenue (14,800 vehicles) exceed those on the northbound on-ramp from surface Aurora Avenue (13,540 vehicles). At the north end of the study area, daily mainline volumes are projected to be slightly higher in the northbound direction (51,460 vehicles) than in the southbound direction (50,550 vehicles).

5.2.1.3.2 Cut-and-Cover Tunnel Alternative

Similar to the volumes during the AM and PM peak hours, forecasted daily volumes for the Cut-and-Cover Tunnel Alternative are generally similar to those forecasted for the Bored Tunnel Alternative, the major difference being the ramps at Elliott and Western Avenues under the Cut-and-Cover Tunnel Alternative. The addition of these ramps, with 18,300 vehicles exiting northbound and 18,280 vehicles entering southbound, results in an increase in forecasted volumes in the cut-and-cover tunnel south of downtown and through the midtown segment compared with the Bored Tunnel Alternative, with 56,060 vehicles northbound and 54,420 southbound in the midtown area. In addition, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union (37,760 northbound and 36,140 southbound), because the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown. Daily mainline and ramp volumes forecasted for the Cut-and-Cover Tunnel Alternative are shown in Exhibit 5-19.

5.2.1.3.3 Elevated Structure Alternative

Similar to the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would provide ramps at Elliott and Western Avenues. In addition, this alternative would provide ramps in the midtown area, with a southbound on-ramp at Columbia Street and a northbound off-ramp at Seneca Street. As during the AM and PM peak hours, these additional ramps result in a forecasted increase in vehicles on the SR 99 mainline south of downtown and through midtown compared with the Bored Tunnel Alternative, with 66,090 vehicles northbound and 62,850 southbound in the segment south of the Seneca and Columbia ramps. Also similar to the Cut-and-Cover Tunnel Alternative, the Battery Street Tunnel is forecasted to carry a lower volume of vehicles than the bored tunnel leading into and out of South Lake Union (38,100 northbound and 36,320 southbound), because the availability of the Elliott/Western ramps would decrease the need for vehicles to use the tunnel north of midtown. Daily mainline and ramp volumes forecasted for the Elevated Structure Alternative are shown in Exhibit 5-20.

5.2.2 SR 99 Mainline Level of Service

This section describes LOS for corridor segments during the AM and PM peak hours under the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. Although LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing the modeled conditions on the SR 99 mainline because the ramp locations and segment arrangements may vary considerably among the modeled conditions. In addition, as described in Chapter 2, the LOS estimates presented here are based on the Transportation Research Board's HCM density ranges for freeways, which presume faster free-flow speeds than the planned speeds in the corridor segments under any of the modeled conditions. As a result, the perceived level of traffic congestion on mainline segments may be somewhat less than the level that would typically be estimated by the HCM method. The SR 99 mainline LOS results are therefore better suited for providing relative comparisons between the modeled conditions than for providing a precise indication of congestion. Projected speeds and travel times along the facility are better indicators of expected performance. SR 99 mainline LOS is summarized by segment for each build alternative in Exhibits 5-21 and 5-22, reflecting both directions in the AM and PM peak hours.

5.2.2.1 Bored Tunnel Alternative

The bored tunnel is projected to operate at LOS E in the southbound direction and at LOS D in the northbound direction during the AM peak hour. During the PM peak hour, southbound tunnel operations are projected at LOS F, while northbound operations are projected at LOS E.

In the south end from approximately S. Spokane Street to the stadium off-ramp area, southbound SR 99 speeds and densities would be at LOS C during the AM peak hour, with northbound operations at LOS E. During the PM peak hour, southbound operations would be at LOS F, while northbound operations would be at LOS D. In the north end, SR 99 operations are projected to be at LOS E or LOS F in both directions during the AM and PM peak hours.

5.2.2.2 Cut-and-Cover Tunnel Alternative

Compared with the Bored Tunnel Alternative, mainline operations under the Cut-and-Cover Tunnel Alternative through midtown are generally projected to degrade, with the exception of the southbound direction during the PM peak hour. During the AM peak hour, operations in the cut-and-cover tunnel would degrade from LOS E to LOS F in the southbound direction and from LOS D to LOS E in the northbound direction. During the PM peak hour, southbound operations would improve from LOS F to LOS D, while northbound operations would degrade from LOS E to LOS F.

Exhibit 5-21. Peak Hour Northbound SR 99 Segment LOS

Segment	AM Peak Hour			PM Peak Hour		
	Bored Tunnel Alternative[1]	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative	Bored Tunnel Alternative[1]	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
South Corridor						
S. Spokane on-ramp to stadium off-ramp	E	E	E	D	E	D
Stadium off-ramp to stadium on-ramp	N/A	E	D	N/A	F	D
Midtown						
Stadium on-ramp to Western off-ramp	N/A	E	N/A	N/A	F	N/A
Stadium on-ramp to Seneca off-ramp	N/A	N/A	E	N/A	N/A	E
Seneca off-ramp to Western off-ramp	N/A	N/A	F	N/A	N/A	F
Bored tunnel	D	N/A	N/A	E	N/A	N/A
Battery Street Tunnel	N/A	F	F	N/A	F	F
North Corridor						
North of Battery Street Tunnel	N/A	D	D	N/A	E	F
North of bored tunnel	E	N/A	N/A	F	N/A	N/A

Note: Conditions under the Viaduct Closed (No Build Alternative) were not modeled.
HCM = Highway Capacity Manual
LOS = level of service
N/A = not applicable
1. LOS shown for the bored tunnel was calculated using the HCM analysis method, based on 55 mph free-flow speed. The actual bored tunnel would have a lower design speed (50 mph) and posted speed (50 mph or lower); therefore, the LOS shown should be considered conservative. Actual performance is better measured by means of projected speed comparisons.

Exhibit 5-22. Peak Hour Southbound SR 99 Segment LOS

Segment	AM Peak Hour			PM Peak Hour		
	Bored Tunnel Alternative[1]	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative	Bored Tunnel Alternative[1]	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
South Corridor						
Stadium on-ramp to S. Spokane off-ramp	C	B	C	F	E	F
Stadium off-ramp to stadium on-ramp	N/A	C	B	N/A	D	E
Midtown						
Elliott on-ramp to stadium off-ramp	N/A	F	N/A	N/A	D	N/A
Columbia on-ramp to stadium off-ramp	N/A	N/A	D	N/A	N/A	E
Elliott on-ramp to Columbia on-ramp	N/A	N/A	C	N/A	N/A	D
Bored tunnel	E	N/A	N/A	F	N/A	N/A
Battery Street Tunnel	N/A	E	E	N/A	E	E
North Corridor						
North of Battery Street Tunnel	N/A	F	F	N/A	E	E
North of bored tunnel	F	N/A	N/A	E	N/A	N/A

Note: Conditions under the Viaduct Closed (No Build Alternative) were not modeled.
HCM = Highway Capacity Manual
LOS = level of service
N/A = not applicable
[1] LOS shown for the bored tunnel was calculated using the HCM analysis method, based on 55 mph free-flow speed. The actual bored tunnel would have a lower design speed (50 mph) and posted speed (50 mph or lower); therefore, the LOS shown should be considered conservative. Actual performance is better measured by means of projected speed comparisons.

In the south end, mainline operations in the southbound direction would remain at LOS C or improve to LOS B during the AM peak hour, while improving from LOS F to LOS D or LOS E during the PM peak hour. Northbound operations would remain at LOS E during the AM peak hour and degrade from LOS D to LOS E or LOS F during the PM peak hour. In the north end, southbound mainline operations are projected to remain at LOS F during the AM peak hour and at LOS E during the PM peak hour. In the northbound direction, mainline operations would improve from LOS E to LOS D during the AM peak hour and from LOS F to LOS E during the PM peak hour.

5.2.2.3 Elevated Structure Alternative

Under the Elevated Structure Alternative, mainline operations through midtown would improve in the southbound direction during the AM peak hour from LOS E to LOS D or LOS C and improve during the PM peak hour from LOS F to LOS E or LOS D in comparison with the Bored Tunnel Alternative. In the northbound direction, mainline operations would degrade from LOS D to LOS E or LOS F during the AM peak hour and would remain at LOS E or degrade to LOS F during the PM peak hour.

In the south end, mainline operations in the southbound direction would remain at LOS C or improve to LOS B during the AM peak hour and would remain at LOS F or improve to LOS E during the PM peak hour. In the northbound direction, mainline operations would remain at LOS E or improve to LOS D during the AM peak hour and would remain at LOS D during the PM peak hour.

In the north end, southbound mainline operations are projected to remain at LOS F during the AM peak hour and LOS E during the PM peak hour. In the northbound direction, operations would improve from LOS E to LOS D during the AM peak hour and would remain at LOS F during the PM peak hour.

5.2.3 SR 99 Mainline Speeds

This section discusses travel speeds for corridor segments during the AM and PM peak hours under the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. As with LOS, comparing travel speeds between the modeled conditions can present certain challenges because the ramp and segment arrangements vary among the modeled conditions. The speeds are presented in Exhibits 5-23 and 5-24; to assist in comparison, the results are presented side-by-side graphically in Exhibits 5-25 and 5-26.

Under the Bored Tunnel Alternative, speeds in the tunnel would be approximately 41 to 46 mph in both directions during both the AM and PM peak hours. Under the Cut-and-Cover Tunnel Alternative, speeds in the tunnel segment through midtown would be 31 mph in the southbound direction and 44 mph in the northbound direction during the AM peak hour. During the PM peak hour, speeds would be 43 mph in the southbound direction and 31 mph in the northbound direction. Under the Elevated Structure Alternative, midtown mainline speeds would be between 41 and 47 mph in the southbound direction during the AM and PM peak hours. In the northbound direction, speeds would be between 31 and 41 mph during both the AM and PM peak hours.

In the south end of the corridor, mainline speeds under the Bored Tunnel Alternative would be between 45 and 48 mph in both directions during both the AM and PM peak hours, except for southbound speeds in the PM peak hour, which are projected to be 32 mph. Under the Cut-and-Cover Tunnel Alternative, south end mainline speeds would be similar to those for the Bored Tunnel Alternative during the AM peak hour. During the PM peak hour, speeds would improve to 43 mph in the southbound direction and would decrease to 42 mph in the northbound direction. Under the Elevated Structure Alternative, mainline speeds would also be similar to those of the Bored Tunnel Alternative during the

Exhibit 5-23. Peak Hour Northbound SR 99 Segment Speeds

Segment	AM Peak Hour (miles per hour)			PM Peak Hour (miles per hour)		
	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
South Corridor						
S. Spokane on-ramp to stadium off-ramp	45	46	47	47	42	47
Midtown						
Stadium off-ramp to Western off-ramp	N/A	44	N/A	N/A	31	N/A
Stadium off-ramp to Seneca off-ramp	N/A	N/A	39	N/A	N/A	41
Seneca off-ramp to Western off-ramp	N/A	N/A	31	N/A	N/A	36
Bored tunnel	44	N/A	N/A	41	N/A	N/A
Battery Street Tunnel	N/A	32	32	N/A	25	33
North Corridor						
North of Battery Street Tunnel	N/A	35	35	N/A	34	34
North of bored tunnel	33	N/A	N/A	26	N/A	N/A

Notes: Conditions under the Viaduct Closed (No Build Alternative) were not modeled.
N/A = not applicable

Exhibit 5-24. Peak Hour Southbound SR 99 Segment Speeds

Segment	AM Peak Hour (miles per hour)			PM Peak Hour (miles per hour)		
	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
South Corridor						
Stadium on-ramp to S. Spokane off-ramp	48	48	48	32	43	35
Midtown						
Elliott on-ramp to stadium on-ramp	N/A	31	N/A	N/A	43	N/A
Columbia on-ramp to stadium on-ramp	N/A	N/A	46	N/A	N/A	41
Elliott on-ramp to Columbia on-ramp	N/A	N/A	47	N/A	N/A	47
Bored tunnel	46	N/A	N/A	45	N/A	N/A
Battery Street Tunnel	N/A	34	34	N/A	34	34
North Corridor						
North of Battery Street Tunnel	N/A	16	16	N/A	33	34
North of bored tunnel	30	N/A	N/A	36	N/A	N/A

Notes: Conditions under the Viaduct Closed (No Build Alternative) were not modeled.
N/A = not applicable

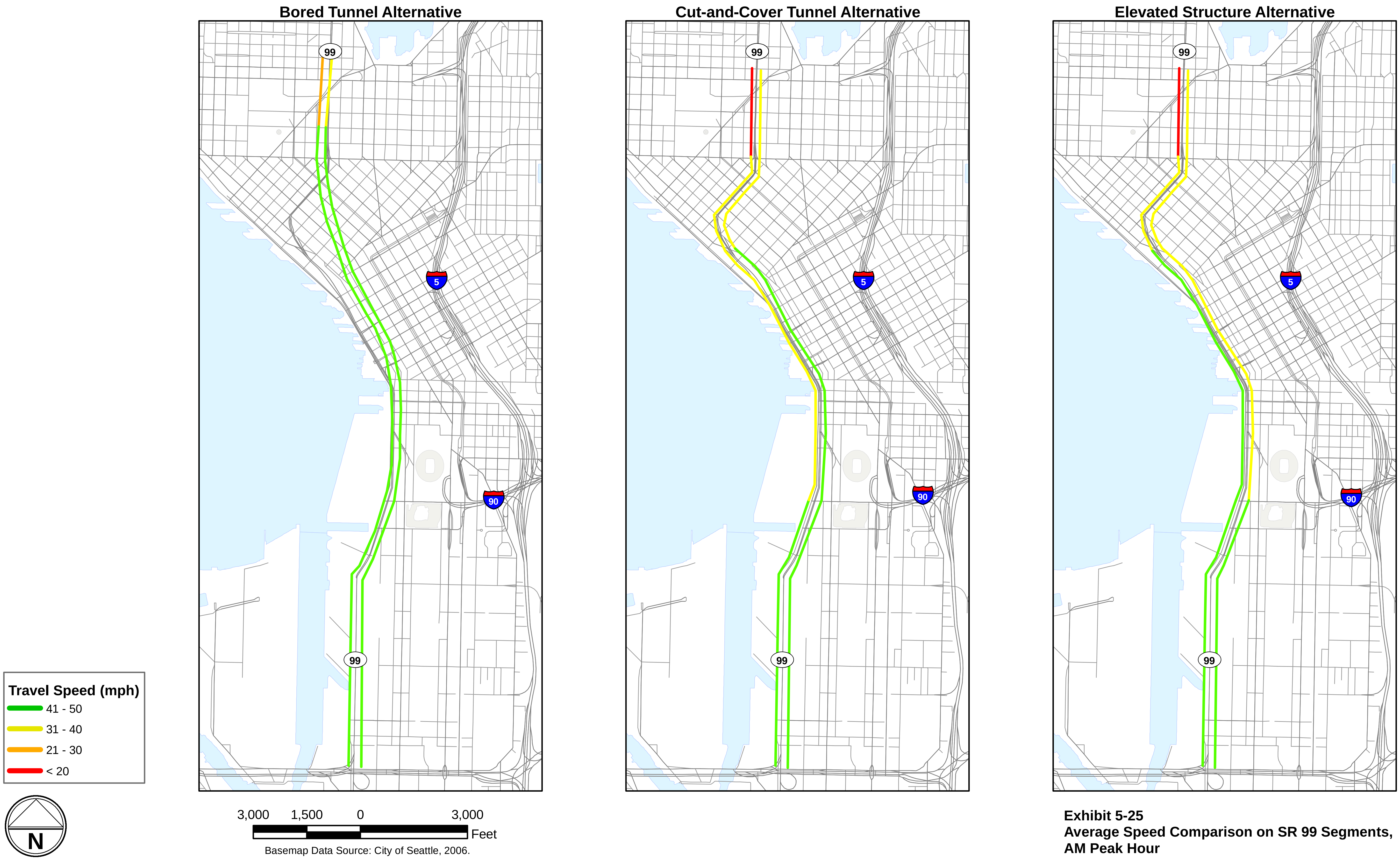


Exhibit 5-25
Average Speed Comparison on SR 99 Segments, AM Peak Hour

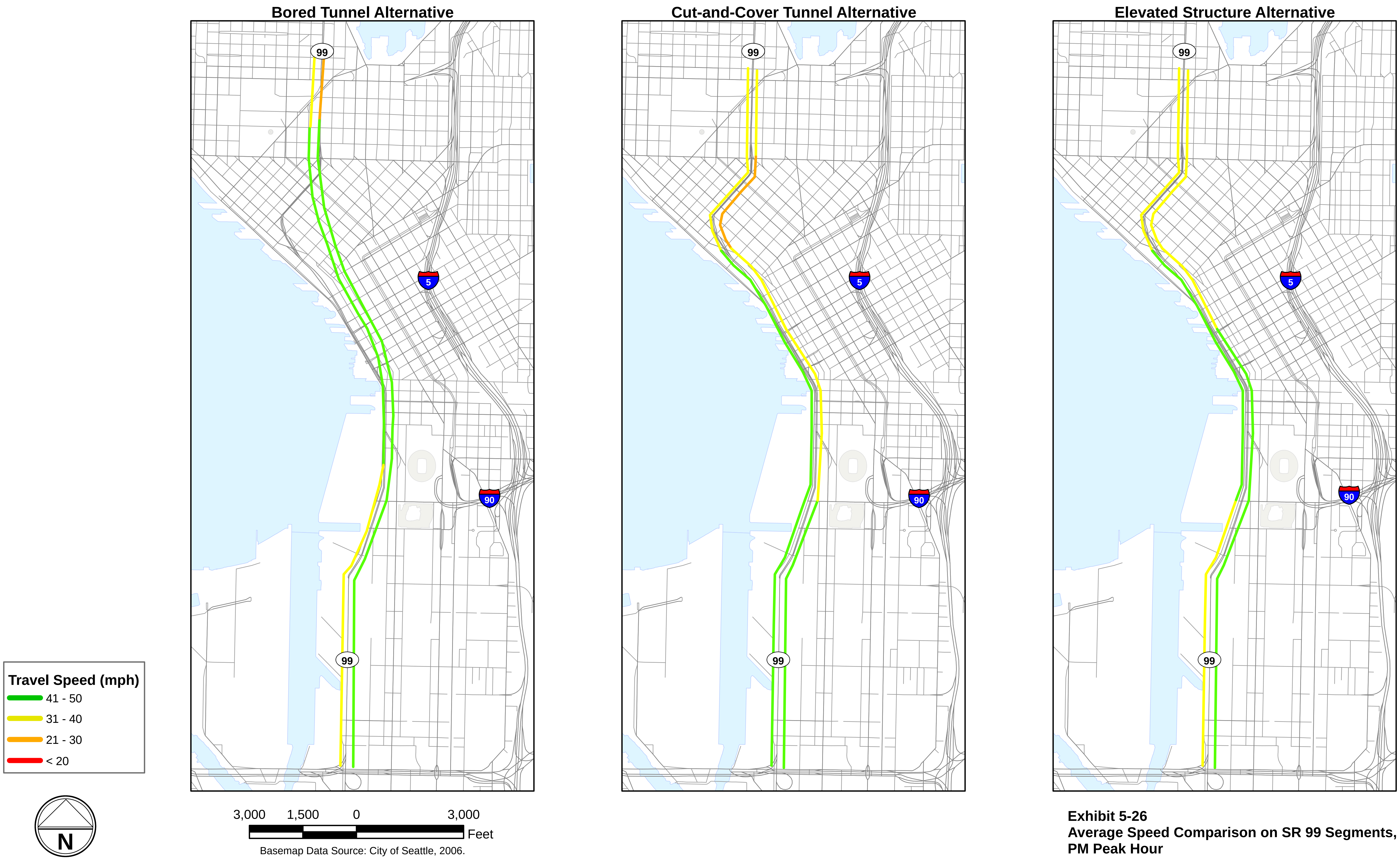


Exhibit 5-26
Average Speed Comparison on SR 99 Segments, PM Peak Hour

AM peak hour. During the PM peak hour, speeds would be 35 mph in the southbound direction and 47 mph in the northbound direction.

In the southbound direction, bottlenecks would be expected north of the stadium area ramps under both the Cut-and-Cover Tunnel and Elevated Structure Alternatives. Due to these bottlenecks, all of the traffic demand would not be served under these alternatives. As a result, during the peak hour, the Cut-and-Cover Tunnel and Elevated Structure Alternatives exhibit higher speeds than the Bored Tunnel Alternative in the south end of the corridor, which is downstream of the bottlenecks.

In the north end, mainline speeds for the Bored Tunnel Alternative would be between 26 and 36 mph in both directions during the AM and PM peak hours. Under the Cut-and-Cover Tunnel Alternative, southbound speeds would decrease to 16 mph and northbound speeds would remain similar to Bored Tunnel Alternative speeds at 35 mph during the AM peak hour. During the PM peak hour, southbound speeds would remain similar to Bored Tunnel Alternative speeds at 33 mph and would improve to 34 mph in the northbound direction. North end speeds under the Elevated Structure Alternative would be similar to those of the Cut-and-Cover Tunnel Alternative.

5.3 Traffic Operations at Key Arterial Intersections

This section describes the evaluation of intersection operations at selected locations to assess the impacts of each of the modeled conditions on other streets within the transportation system. Intersection performance is discussed for the three build alternatives.

Specific intersection performance under the Viaduct Closed (No Build Alternative) was not analyzed. Traffic data for modeled conditions under the Viaduct Closed (No Build Alternative) are provided for most traffic conditions that were measured, such as VMT, VHD, and traffic volumes (discussed in Section 5.1). In addition, volume-to-capacity ratios at select locations in the study area were evaluated. Please see Supplemental Draft EIS, Appendix C, Attachment B, Analysis of 2030 Viaduct Closed (No Build Alternative) (WSDOT et al. 2010). Results of this high-level analysis indicate that traffic conditions without the viaduct would be extremely congested. Detailed traffic models are not reliable or accurate in these circumstances; therefore, some conditions such as travel times, travel speeds, and congested intersections cannot be meaningfully evaluated and instead are qualitatively discussed.

The primary performance measure used for the analysis of intersection operations is LOS, which is a commonly used measure of operational effectiveness for transportation facilities. LOS is used to assess a variety of transportation facilities, ranging from arterials to freeway segments. For the evaluation of signalized intersections, LOS is specifically based on the average vehicle delay calculated for a given intersection. LOS is represented by a letter grade ranging from "A" (short delays and free-flow traffic conditions) to "F" (very congested or break-down conditions). More detail about the LOS designations for signalized intersections is provided in Exhibit 2-5.

The results of the intersection analysis are summarized for the south, central, and north areas. The specific locations selected for analysis were based on several factors related to the proximity of the intersection to the SR 99 corridor or its access points, forecasted traffic volumes associated with the locations under the range of modeled conditions, and current congestion levels. Only signalized intersections were analyzed. All signalized intersections directly affected by, or created as a result of, the implementation of each build alternative were included in the analysis.

Intersections that are projected to operate at LOS E or LOS F are the locations that are most likely to experience substantial congestion during the peak hour. Intersections that operate at LOS A through LOS D would experience little to moderate congestion levels during peak times and generally are not of concern. Although traffic congestion is common in the greater downtown area, the determination of LOS E and LOS F intersections identifies those areas where congestion may affect major travel movements and specific travel modes such as transit or freight. Also of concern is whether congestion may lead to air quality issues, which is discussed in Appendix M, Air Discipline Report.

The key findings of the analyses of traffic operations at arterial intersections for the Viaduct Closed (No Build Alternative) are the following:

- The Viaduct Closed (No Build Alternative) would displace a large number of trips from SR 99 to other routes, leading to a high level of traffic congestion throughout the day. Although not specifically analyzed for intersection operations, the Viaduct Closed (No Build Alternative) is likely to increase the number of intersections operating at LOS E and LOS F, and it would likely increase delay at many of these locations well beyond the LOS F threshold, leading to substantial congestion and delay. For more details, please see Attachment B, Analysis of Viaduct Closed (No Build Alternative), of Appendix C of the 2010 Supplement Draft EIS (WSDOT et al. 2010).

The key findings of the analyses of traffic operations at arterial intersections in the south area are the following:

- With the Bored Tunnel Alternative, most intersections in the south area are expected to operate at LOS D or better conditions. In general, traffic operations on surface streets would improve with the Bored Tunnel Alternative compared to the Viaduct Closed (No Build Alternative) due to much lower traffic volumes. However, three intersections during the AM peak hour and six intersections during the PM peak hour are forecasted to operate at LOS E or LOS F with the Bored Tunnel Alternative.

- With the Cut-and-Cover Tunnel Alternative, most intersections in the south area are expected to operate at LOS D or better conditions. However, six intersections during the AM peak hour and three intersections during the PM peak hour are forecasted to operate at LOS E or LOS F. Due to difference in ramp volumes in the south, some intersections that operate poorly with the Bored Tunnel Alternative are expected to improve with the Cut-and-Cover Tunnel Alternative and vice versa.
- With the Elevated Structure Alternative, most intersections in the south area are expected to operate at LOS D or better. However, four intersections during both the AM and PM peak hours are forecasted to operate at LOS E or LOS F. Due to differences in ramp volumes in south, some intersections that operate poorly with the Bored Tunnel Alternative are expected to improve under the Elevated Structure Alternative, and vice versa.
- Compared to the Bored Tunnel Alternative, the Cut-and-Cover Tunnel and the Elevated Structure Alternatives would have higher ramp volumes at the S. Royal Brougham Way ramps. Because of this, increased vehicle volumes and delay are expected for these alternatives at intersections near the ramp terminals. Volumes on ramps to and from the north are likely to be higher due to the direct SR 99 access provided via the Elliott/Western ramps.
- Compared to vehicle volumes along Fourth Avenue S. with the Bored Tunnel Alternative, vehicle volumes with the Cut-and-Cover Tunnel and the Elevated Structure Alternatives are expected to be lower, because less traffic would use surface streets to access destinations that could be reached instead via SR 99 and the Elliott/Western ramps.

The key findings of the analyses of traffic operations at arterial intersections in the central area are the following:

- Most of intersections evaluated in the central area with the Bored Tunnel Alternative are forecasted to operate at LOS D or better during the AM and PM peak hours. The intersections of Second Avenue at Marion Street and Fourth Avenue at Madison Street are forecasted to operate under constrained conditions (LOS E) during the AM peak hour. The intersections of Fourth Avenue at Columbia Street, Western Avenue at Broad Street, and Fourth Avenue at Seneca Street are expected to operate at LOS E during the AM peak hour. These intersections are expected to operate under constrained conditions as a result of the increased use of Second and Fourth Avenues as routes through the city due to ramp and access changes resulting from the Bored Tunnel Alternative.

- With the Cut-and-Cover Tunnel Alternative, all intersections evaluated in the central area are expected to operate at LOS D or better, with a few exceptions. However, the intersections that would operate under constrained conditions (LOS E or LOS F) with the Cut-and-Cover Tunnel Alternative would also operate under constrained conditions with the Bored Tunnel Alternative.
- With the Elevated Structure Alternative, all intersections evaluated in the central area are expected to operate at LOS D or better, with a few exceptions. However, the intersections that would operate under constrained conditions (LOS E or LOS F) with the Elevated Structure Alternative would also operate under constrained conditions with the Bored Tunnel Alternative, except for the intersection of First Avenue at Columbia Street. This intersection is forecasted to operate at LOS F during the PM peak hour as a result of the traffic traveling on Columbia Street to access the southbound Columbia Street on-ramp to SR 99.

The key findings of the analyses of traffic operations at arterial intersections in the north area are the following:

- The Bored Tunnel Alternative would create a number of new intersections in the north area, all of which are expected to operate well. Elsewhere, 8 intersections are expected to operate at LOS E or LOS F during AM peak hour with the Bored Tunnel Alternative, while 10 intersections are expected to operate at LOS E or LOS F during the PM peak. Many of these intersections are located along Mercer Street, which carries a substantial share of the east-west traffic in the area.
- Many of the same intersections that would operate with congested conditions under the Bored Tunnel Alternative would also operate with congested conditions (LOS E or LOS F) under the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative. The extension of two-way Mercer Street west of Fifth Avenue N. with the Cut-and-Cover Tunnel and the Elevated Structure Alternatives would improve operations at the intersection of Fifth Avenue N. at Roy Street during the AM peak hour. The intersection of northbound Aurora Avenue at Denny Way is expected to operate with congested conditions under the Cut-and-Cover Tunnel and Elevated Structure Alternatives, unlike the Bored Tunnel Alternative. With the Cut-and-Cover Tunnel and the Elevated Structure Alternatives, there would be fewer access points to Aurora Avenue; therefore, traffic volumes would be higher at the ramps along Aurora

Avenue with these alternatives than the volumes with the Bored Tunnel Alternative.

5.3.1 South Area

Detailed results for the intersection analysis in the south area are provided in Exhibit 5-27.

5.3.1.1 Viaduct Closed (No Build Alternative)

SR 99 mainline traffic in the south area would transition from the reconstructed S. Holgate Street to S. King Street segment of SR 99 to and from the Alaskan Way surface street via a set of single-lane ramps connecting to an unimproved Alaskan Way at S. King Street. This configuration would result in a substantial reduction in capacity in the corridor relative to the capacity under the 2015 Existing Viaduct. As a result, severe backups are expected to form at the transition points, spreading elsewhere into the street network.

The Viaduct Closed (No Build Alternative) would displace a large number of trips from SR 99 to other routes, leading to high levels of traffic congestion throughout the day. Please see Section 5.1 for more discussion of the forecasted volumes and diversions expected under the Viaduct Closed (No Build Alternative).

Although not specifically assessed for intersection operations, inferences based on modeled changes in travel patterns may be drawn. The locations in the south area most likely to experience considerable congestion are the transition ramps from SR 99 to Alaskan Way S./East Frontage Road/S. King Street, as well as the intersections along First Avenue S. at S. Atlantic Street and at S. Royal Brougham Way, along Alaskan Way north of S. King Street, and most intersections on First Avenue between S. King Street and Madison Street. These locations are expected to operate with substantial levels of congestion due to the large increases in traffic volumes diverted from the SR 99 corridor.

5.3.1.2 Bored Tunnel Alternative

With the Bored Tunnel Alternative, the existing ramps at First Avenue S. would be replaced with a northbound on-ramp and southbound off-ramp near S. Royal Brougham Way. In addition, a northbound off-ramp to and southbound on-ramp provided from Alaskan Way S. will be provided at S. Dearborn Street as part of the S. Holgate Street to S. King Street Viaduct Replacement Project.

In general, with the Bored Tunnel Alternative, surface streets in the south area are expected to operate with less congestion and delay than with the Viaduct Closed (No Build Alternative) due to much lower traffic volumes.

Exhibit 5-27. Signalized Intersection Level of Service and Average Vehicle Delay – South Area

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
Alaskan Way	Yesler Way	D	42	C	21	B	14	B	18	B	13	B	16
Alaskan Way S.	S. Main Street	B	13	A	6	A	4	A	6	A	5	A	5
Alaskan Way S.	S. Jackson Street	B	10	B	15	A	9	A	4	A	4	A	6
Alaskan Way S.	S. King Street	C	28	C	22	B	13	B	19	A	6	A	10
Alaskan Way S.	S. Dearborn Street	D	41	C	23	C	26	C	24	C	21	C	34
East Frontage Road	S. Royal Brougham Way/ SR 99 ramps	B	11	E	57	C	26	C	23	D	52	D	44
East Frontage Road	S. Atlantic Street	D	43	E	73	F	83	C	26	C	34	D	47
East Marginal Way S.	h-shaped overcrossing	C	28	C	20	B	10	B	18	B	15	A	9
East Marginal Way S./ Terminal 46	S. Atlantic Street	E	77	F	119	F	95	D	43	C	29	D	47
East Marginal Way S.	S. Hanford Street	D	37	D	37	D	37	C	32	C	32	C	32
Colorado Avenue	S. Atlantic Street	E	56	F	85	D	46	D	49	C	33	D	37
First Avenue	Yesler Way	D	39	C	20	C	22	F	105	E	75	F	138
First Avenue S.	S. Main Street	B	13	B	14	B	16	B	10	B	16	C	21
First Avenue S.	S. Jackson Street	B	20	B	15	C	21	B	17	B	17	B	18
First Avenue S.	S. King Street	C	24	B	17	B	17	D	39	B	12	B	17
First Avenue S.	S. Dearborn Street	B	18	B	17	B	15	C	23	B	20	C	28

Exhibit 5-27. Signalized Intersection Level of Service and Average Vehicle Delay – South Area (continued)

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
First Avenue S.	S. Royal Brougham Way	C	28	D	37	C	29	C	28	C	34	D	39
First Avenue S.	S. Atlantic Street	D	39	F	109	F	135	F	111	E	71	F	91
First Avenue S.	S. Holgate Street	D	47	E	55	E	55	C	33	C	34	C	22
First Avenue S.	S. Lander Street	C	20	C	20	C	20	D	38	D	51	C	24
Second Avenue.	Yesler Way	B	13	B	16	B	16	B	16	B	13	B	13
Second Avenue S.	S. Main Street	C	31	C	32	C	32	C	33	C	35	C	20
Second Avenue S.	S. Jackson Street	D	45	D	37	D	37	F	103	D	37	D	48
Fourth Avenue S.	S. Main Street	A	8	A	4	A	4	A	6	A	10	A	8
Fourth Avenue S.	S. Jackson Street	D	41	C	30	C	30	D	52	D	54	E	61
Fourth Avenue S.	Airport Way S.	E	61	D	47	D	47	E	57	E	68	E	62
Fourth Avenue S.	S. Royal Brougham Way	D	36	D	35	D	35	F	82	D	52	D	45
Fourth Avenue S.	S. Holgate Street	C	28	C	26	C	26	E	57	D	42	D	44
Fourth Avenue S.	S. Lander Street	C	24	C	25	C	25	C	28	C	32	C	22

Note: LOS = level of service

5.3.1.2.1 AM Peak Hour

As shown in Exhibit 5-27, most intersections analyzed in the south area are expected to operate at LOS D or better during the AM peak hour. The intersections of East Marginal Way S. (Terminal 46 driveway) at S. Atlantic Street, Colorado Avenue at S. Atlantic Street, and Fourth Avenue S. at Airport Way S. are expected to operate at LOS E during the AM peak hour. In general, operations in the south area would be affected by the heavy freight movements in the area. Please see Section 5.7 for more discussion of freight traffic.

5.3.1.2.2 PM Peak Hour

During the PM peak hour, most intersections analyzed in the south area are expected to operate at LOS D or better during the PM peak hour. The intersections of Fourth Avenue S at Airport Way S. and at S. Holgate Street are expected to operate at LOS E during the PM peak hour. The intersections of First Avenue at Yesler Way, First Avenue S. at S. Atlantic Street, Second Avenue S. at S. Jackson Street, and Fourth Avenue S. at S. Royal Brougham Way are expected to operate at LOS F during the PM peak hour. In general, operations in the south area would be affected by the heavy freight movements in the area. Please see Section 5.7 for more discussion of freight traffic.

While several intersections in the south area are forecasted to operate at LOS E/F under the Bored Tunnel Alternative, operations are expected to be much better than those under the Viaduct Closed (No Build Alternative). Delays at the south area intersections are expected to be considerably less with the Bored Tunnel Alternative than the Viaduct Closed (No Build Alternative), because much of the traffic traveling along SR 99 could continue to use the corridor. With the Viaduct Closed (No Build Alternative), most intersections in the south area are expected to operate with substantial levels of congestion due to the large increases in traffic volumes diverted from the SR 99 corridor. Please see Section 5.1 for more information of forecasted volumes and expected diversions.

5.3.1.3 Cut-and-Cover Tunnel Alternative

With the Cut-and-Cover Tunnel Alternative, connections in the south area would be similar to those provided by the Bored Tunnel Alternative. In general, operations in the south area would be affected by the heavy freight movements in the area. Please see Section 5.7 for more discussion of freight traffic.

5.3.1.3.1 AM Peak Hour

Most intersections analyzed in the south area are expected to operate at LOS D or better during the AM peak hour under the Cut-and-Cover Tunnel Alternative. Two of the intersections that are forecasted to operate at LOS F under the Cut-and-Cover Tunnel Alternative would also operate at LOS E under the Bored

Tunnel Alternative during the AM peak hour. These include the intersections of East Marginal Way S. (Terminal 46 driveway) at S. Atlantic Street and Colorado Avenue at S. Atlantic Street. At these two locations, LOS is expected to be worse under the Cut-and-Cover Tunnel Alternative compared to the Bored Tunnel Alternative due to increased volumes along S. Atlantic Street. More traffic would use the S. Royal Brougham Way ramps under the Cut-and-Cover Tunnel Alternative when compared to the Bored Tunnel Alternative, resulting in more traffic on surrounding surface streets, including S. Atlantic Street. Ramp volumes are likely to be higher under the Cut-and-Cover Tunnel Alternative due to traffic traveling on SR 99 and using the Elliott/Western ramps, which would be open under the Cut-and-Cover Tunnel Alternative. Under the Bored Tunnel Alternative, traffic that would otherwise use the Elliott/Western ramps would divert instead to city surface streets, such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue to reach the intended destinations.

Four intersections that would operate at LOS D or better under the Bored Tunnel Alternative are expected to operate at LOS E or LOS F under the Cut-and-Cover Tunnel Alternative during the AM peak hour. The intersections of East Frontage Road at S. Royal Brougham Way/SR 99 ramps, East Frontage Road at S. Atlantic Street, and First Avenue S. at S. Holgate Street are expected to operate at LOS E during the AM peak hour. The intersection of First Avenue S. at S. Atlantic Street is expected to operate at LOS F during the AM peak hour. Again, higher ramp volumes at the S. Royal Brougham Way ramps under the Cut-and-Cover Tunnel Alternative compared to the Bored Tunnel Alternative are the reason for the projected increase in delay on nearby surface streets and intersections.

The intersection of Fourth Avenue S. at Airport Way S. is expected to operate at LOS D under the Cut-and-Cover Tunnel Alternative (compared to LOS E under the Bored Tunnel Alternative) due to lower volumes along Fourth Avenue S. Volumes are expected to be higher along Fourth Avenue S. under the Bored Tunnel Alternative because more traffic would use surface streets to access destinations that could be reached via SR 99 and the Elliott/Western ramps under the Cut-and-Cover Tunnel Alternative.

5.3.1.3.2 PM Peak Hour

Most intersections are expected to operate at LOS D or better during the PM peak hour under the Cut-and-Cover Tunnel Alternative. The intersections of First Avenue at Yesler Way and First Avenue S. at S. Atlantic Street are forecasted to operate at LOS E during the PM peak hour, an improvement from the Bored Tunnel Alternative for which these intersections are forecasted to operate at LOS F during the PM peak hour. Traffic volumes along First Avenue S. are expected to be lower under the Cut-and-Cover Tunnel Alternative compared to the Bored Tunnel Alternative, because more traffic is expected to use SR 99.

The intersection of Fourth Avenue S. at Airport Way S. is forecasted to operate at LOS E under the Cut-and-Cover Tunnel Alternative, similar to the Bored Tunnel Alternative during the PM peak hour. Overall, volumes along Fourth Avenue S. are forecasted to be lower under the Cut-and-Cover Tunnel Alternative, because more traffic is expected to use SR 99 instead of surface streets. As a result, three intersections that are forecasted to operate below LOS D under the Bored Tunnel Alternative are expected to operate at LOS D under the Cut-and-Cover Tunnel Alternative: Second Avenue S. at S. Jackson Street, Fourth Avenue S. at S. Royal Brougham Way, and Fourth Avenue S. at S. Holgate Street.

5.3.1.4 Elevated Structure Alternative

With the Elevated Structure Alternative, the existing ramps to First Avenue would be replaced with a northbound on-ramp near S. Royal Brougham Way. Unlike the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, the southbound off-ramp would be on S. Dearborn Street between Alaskan Way S. and First Avenue S. The northbound off-ramp would be provided to Alaskan Way S. at S. Dearborn Street, and the southbound on-ramp would be provided on Alaskan Way S., just south of S. Dearborn Street. In general, operations in the south area would be affected by the heavy freight movements in the area. Please see Section 5.7 for more discussion of freight traffic.

5.3.1.4.1 AM Peak Hour

Most intersections analyzed in the south area are expected to operate at LOS D or better during the AM peak hour under the Elevated Structure Alternative. The intersection of East Marginal Way S. (Terminal 46 driveway) at S. Atlantic Street is forecasted to operate at LOS F under the Elevated Structure Alternative, as compared to LOS E under the Bored Tunnel Alternative during the AM peak hour.

Three intersections that would operate at LOS D under the Bored Tunnel Alternative are expected to operate at LOS E or LOS F under the Elevated Structure Alternative during the AM peak hour. The intersection of First Avenue S. at S. Holgate Street is expected to operate at LOS E during the AM peak hour. The intersections of East Frontage Road at S. Atlantic Street and First Avenue S. at S. Atlantic Street are expected to operate at LOS F during the AM peak hour. Higher ramp volumes at the S. Royal Brougham Way ramps under the Elevated Structure Alternative when compared to the Bored Tunnel Alternative are the reason for the projected increase in traffic and delay on nearby surface streets and intersections. Ramp volumes to and from the north are likely to be higher under the Elevated Structure Alternative due to traffic traveling on SR 99 and using the Elliott/Western ramps. Under the Bored Tunnel Alternative, the lack of Elliott/Western ramps would divert traffic instead to city surface streets, such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue to reach the intended destinations.

The intersections of Colorado Avenue at S. Atlantic Street and Fourth Avenue S. at Airport Way S. are expected to operate at LOS D under the Elevated Structure Alternative (compared to LOS E under the Bored Tunnel Alternative) due to lower volumes along Fourth Avenue S. Volumes are expected to be higher along Fourth Avenue S. under the Bored Tunnel Alternative, because more traffic would use surface streets to access destinations that could be reached via SR 99 and the Elliott/Western ramps under the Elevated Structure Alternative.

5.3.1.4.2 PM Peak Hour

Most intersections are expected to operate at LOS D or better during the PM peak hour under the Elevated Structure Alternative. The intersections of First Avenue at Yesler Way and First Avenue S. at S. Atlantic Street are forecasted to operate at LOS F during the PM peak hour, similar to the Bored Tunnel Alternative. The intersection of Fourth Avenue S. at S. Jackson Street is forecasted to operate at LOS E, compared to LOS D under the Bored Tunnel Alternative.

In addition, the intersection of Fourth Avenue S. at Airport Way S. is forecasted to operate at LOS E under the Elevated Structure Alternative during the PM peak hour, similar to the Bored Tunnel Alternative. Overall, volumes along Fourth Avenue S. are forecasted to be lower under the Elevated Structure Alternative because more traffic is expected to use SR 99 instead of surface streets. As a result, three intersections that are forecasted to operate at LOS E or LOS F under the Bored Tunnel Alternative are expected to operate at LOS D under the Elevated Structure Alternative: Second Avenue S. at S. Jackson Street, Fourth Avenue S. at S. Royal Brougham Way, and Fourth Avenue S. at S. Holgate Street.

5.3.2 Central Area

Detailed results for the intersection analysis in the central area are provided in Exhibit 5-28.

5.3.2.1 Viaduct Closed (No Build Alternative)

With the Viaduct Closed (No Build Alternative), traffic delays and congestion levels for intersections in the central area are expected to be higher than the delays and congestion levels under the 2015 Existing Viaduct for the majority of locations. Key groupings of intersections that would likely experience the most pronounced increases in congestion include the signalized intersections along Alaskan Way (surface arterial), intersections on First Avenue, and intersections along the one-way system of Second and Fourth Avenues.

While the geometric constraints upstream and downstream of the central waterfront area would effectively meter traffic volumes into the downtown core, the redistribution of SR 99 traffic to surface arterials would result in utilization of available capacity on these downtown streets. Therefore, high levels of congestion would be expected for key north-south arterials, as well as for east-west connectors to and from I-5 between Union and James Streets.

5.3.2.2 Bored Tunnel Alternative

With the Bored Tunnel Alternative, the Columbia and Seneca Street ramps would be removed. Access to and from downtown from the south would be provided by the northbound off-ramp to and southbound on-ramp from Alaskan Way S. at S. Dearborn Street. In addition, the existing Elliott/Western ramps and Battery Street ramps would not be replaced.

In general, under the Bored Tunnel Alternative, surface streets are expected to operate with less congestion and delay than under the Viaduct Closed (No Build Alternative) due to much lower traffic volumes. The Viaduct Closed (No Build Alternative) would displace a large number of trips from SR 99 to other routes, leading to high levels of traffic congestion on city streets throughout the day. Please see Section 5.1 for more discussion of volumes and diversion expected under the Viaduct Closed (No Build Alternative).

5.3.2.2.1 AM Peak Hour

The majority of intersections evaluated in the central area are forecasted to operate at LOS D or better, with a few exceptions. During the AM peak hour, the intersections of Second Avenue at Marion Street, Fourth Avenue at Madison Street, and Fourth Avenue at Columbia Street are forecasted to operate under constrained conditions (LOS E) due to the greater use of Second and Fourth Avenue as routes through the CBD.

5.3.2.2.2 PM Peak Hour

With the Bored Tunnel Alternative, the intersection of Western Avenue at Broad Street is expected to experience heavy congestion during the PM peak hour. All approaches for this location, with the exception of the northbound Western Avenue approach, are expected to operate under constrained conditions (at or below LOS E). The intersections of Second Avenue at Marion Street and Fourth Avenue at Seneca Street are expected to operate at LOS E during the PM peak hour, similar to the AM peak hour, likely because of greater use of Second Avenue and Fourth Avenue as routes through the CBD. In addition, the intersection of Fourth Avenue at Seneca Street would operate under congested conditions (LOS E) due to volumes coming from the Seneca Street off-ramp on I-5.

Exhibit 5-28. Signalized Intersection Level of Service and Average Vehicle Delay – Central Area

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
Alaskan Way	Madison Street	A	6	B	13	B	13	B	14	B	19	C	21
Alaskan Way	Marion Street	B	11	A	10	A	9	B	13	A	6	A	9
Alaskan Way	Columbia Street	B	18	A	10	A	7	A	9	B	12	A	7
Elliott Avenue	Broad Street	C	25	C	35	D	46	D	39	D	36	D	46
Elliott Avenue	Wall Street	B	13	D	36	D	46	B	11	D	40	D	44
Elliott Avenue	Bell Street	A	2	A	5	A	4	A	3	A	4	A	6
Western Avenue	Broad Street	B	17	B	17	B	19	E	70	E	70	E	64
Western Avenue	Wall Street	C	27	C	30	D	38	C	28	C	27	C	33
Western Avenue	Battery Street/SR 99 off-ramp	A	2	A	2	A	2	A	3	A	1	A	4
Western Avenue	Spring Street	B	17	C	27	B	15	B	11	C	29	B	17
Western Avenue	Madison Street	B	18	B	18	B	18	B	20	C	24	C	26
Western Avenue	Marion Street	C	21	C	20	B	19	B	12	B	18	C	22
First Avenue	Seneca Street	B	19	B	18	C	29	C	23	C	22	C	28
First Avenue	Spring Street	D	40	C	27	B	13	C	32	C	27	C	21
First Avenue	Madison Street	B	10	A	8	A	7	B	12	A	8	B	11
First Avenue	Marion Street	B	17	B	14	C	26	B	15	B	14	C	25
First Avenue	Columbia Street	A	9	B	15	B	15	C	21	C	28	F	143

Exhibit 5-28. Signalized Intersection Level of Service and Average Vehicle Delay – Central Area (continued)

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
Second Avenue	Wall Street	B	17	B	19	C	20	B	17	C	25	B	20
Second Avenue	Battery Street	A	6	B	10	A	8	A	8	B	16	B	14
Second Avenue	Bell Street	A	6	A	5	A	10	A	10	A	9	B	15
Second Avenue	Pine Street	B	10	D	51	B	10	B	18	B	18	B	14
Second Avenue	Pike Street	B	14	C	22	C	25	B	10	B	10	B	15
Second Avenue	Union Street	B	15	B	14	B	18	B	17	C	25	C	24
Second Avenue	University Street	B	14	A	8	B	11	C	21	B	14	C	24
Second Avenue	Seneca Street	B	18	B	18	D	43	B	11	B	18	C	27
Second Avenue	Spring Street	D	39	C	21	C	24	B	14	D	38	C	28
Second Avenue	Madison Street	C	32	B	16	B	19	C	25	C	21	B	17
Second Avenue	Marion Street	E	60	D	43	D	49	E	72	C	26	D	48
Second Avenue	Columbia Street	A	8	B	17	B	17	C	30	B	15	C	30
Second Avenue	Cherry Street	B	11	A	7	B	14	B	13	B	16	A	9
Fourth Avenue	Wall Street	A	7	B	12	A	9	A	6	A	9	B	12
Fourth Avenue	Battery Street	B	13	B	19	B	11	C	20	C	20	D	44
Fourth Avenue	Bell Street	A	7	A	6	A	8	A	10	A	7	A	9
Fourth Avenue	Blanchard Street	A	8	A	7	A	10	A	8	A	6	A	8
Fourth Avenue	Pine Street	C	22	C	26	D	36	C	27	C	20	D	42
Fourth Avenue	Pike Street	B	18	C	26	C	29	C	33	C	29	D	39

Exhibit 5-28. Signalized Intersection Level of Service and Average Vehicle Delay – Central Area (continued)

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
Fourth Avenue	Union Street	B	12	B	18	B	14	B	15	B	18	B	13
Fourth Avenue	University Street	A	8	A	5	A	4	D	50	D	39	D	45
Fourth Avenue	Seneca Street	B	15	B	15	A	10	E	56	E	60	E	56
Fourth Avenue	Spring Street	D	39	C	22	B	11	D	36	C	21	C	24
Fourth Avenue	Madison Street	E	66	D	41	C	34	D	53	D	50	D	41
Fourth Avenue	Marion Street	C	20	C	27	C	27	D	46	C	22	B	19
Fourth Avenue	Columbia Street	E	79	D	39	C	25	D	42	D	40	C	32
Fourth Avenue	Cherry Street	B	16	B	11	B	15	B	12	B	13	B	10

Note: LOS = level of service

5.3.2.3 Cut-and-Cover Tunnel Alternative

With the Cut-and-Cover Tunnel Alternative, the northbound Western Avenue off-ramp and southbound Elliott Avenue on-ramp would be replaced. The northbound Seneca Street off-ramp and southbound Columbia Street on-ramp would not be provided. The Battery Street ramps would be closed and used for emergency and maintenance vehicle use only.

5.3.2.3.1 AM Peak Hour

During the AM peak hour, all intersections evaluated in the central area under the Cut-and-Cover Tunnel Alternative are expected to operate at LOS D or better. Under the Cut-and-Cover Tunnel Alternative, more traffic is expected to use SR 99 and the Elliott/Western ramps to reach the intended destinations, with less diversion to surface streets. This would result in less congestion on streets such as Second and Fourth Avenues. In comparison, under the Bored Tunnel Alternative, without the Elliott/Western ramps, more traffic is expected to divert from SR 99 to surface streets such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue.

5.3.2.3.2 PM Peak Hour

Under the Cut-and-Cover Tunnel Alternative, the intersection of Western Avenue at Broad Street is expected to experience heavy congestion during the PM peak hour, similar to the Bored Tunnel Alternative. Under the Cut-and-Cover Tunnel Alternative, more traffic is expected to use SR 99 and the Elliott/Western ramps to reach the intended destinations, with less diversion to surface streets and, therefore, less congestion on streets such as Second and Fourth Avenues. However, the intersection of Fourth Avenue at Seneca Street is expected to operate at LOS E during the PM peak hour under the Cut-and-Cover Tunnel Alternative due to high volumes exiting the I-5 ramp at Seneca Street.

5.3.2.4 Elevated Structure Alternative

With the Elevated Structure Alternative, the Columbia and Seneca ramps, and well as the Elliott/Western ramps, would be replaced with new ramps in similar locations. The Battery Street ramps would be closed and used for emergency and maintenance vehicle use only.

5.3.2.4.1 AM Peak Hour

During the AM peak hour, all intersections evaluated in the central area under the Elevated Structure Alternative are expected to operate at LOS D or better. Under the Elevated Structure Alternative, more traffic is expected to use SR 99, the Columbia/Seneca ramps, and the Elliott/Western ramps to reach the intended destinations, with less diversion to surface streets and, therefore, less congestion on streets such as Second and Fourth Avenues. In comparison, under the Bored

Tunnel Alternative, without the Columbia/Seneca ramps and the Elliott/Western ramps, more traffic is expected to divert from SR 99 to surface streets such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue.

5.3.2.4.2 PM Peak Hour

Under the Elevated Structure Alternative, the intersection of Western Avenue at Broad Street is expected to experience heavy congestion during the PM peak hour, similar to the Bored Tunnel Alternative. Unlike the Bored Tunnel Alternative, the intersection of First Avenue at Columbia Street is forecasted to operate at LOS F during the PM peak hour, due to the traffic traveling on Columbia Street to access the southbound Columbia Street on-ramp to SR 99. In addition, the intersection of Fourth Avenue at Seneca Street is expected to operate at LOS E during the PM peak hour under the Elevated Structure Alternative, similar to the Bored Tunnel Alternative, due to high volumes exiting the I-5 ramp at Seneca Street.

5.3.3 North Area

Detailed results for the intersection analysis in the north area are provided in Exhibit 5-29.

5.3.3.1 Viaduct Closed (No Build Alternative)

In the north area, congestion levels for the Viaduct Closed (No Build Alternative) are generally expected to be higher than those for the 2015 Existing Viaduct in the majority of locations. While the Battery Street Tunnel would remain open under the Viaduct Closed (No Build Alternative), the SR 99 corridor would terminate at the Battery Street/Western Avenue ramps. Forecasted traffic volumes for the Viaduct Closed (No Build Alternative) indicate that most of southbound traffic on SR 99 would use the Broad Street and Denny Way off-ramps rather than the Battery Street Tunnel off-ramp. Similarly, in the northbound direction, most trips destined to the north would likely use the Denny Way on-ramp rather than the upstream on-ramp at the south end of the Battery Street Tunnel. As a result, key intersections on Broad Street and Wall Street (southbound SR 99 traffic) and on Battery Street (northbound SR 99 traffic) would be affected noticeably. Heavy queuing and long backups may be particularly severe at the SR 99 ramp termini intersections at Denny Way and on side-street exits.

5.3.3.2 Bored Tunnel Alternative

With the Bored Tunnel Alternative in the north area, several network changes are expected for the SR 99 interchange area and surface streets south of Mercer Street. East-west arterials such as John, Thomas, and Harrison Streets would all intersect with a redesigned Aurora Avenue that would allow east-west through-

Exhibit 5-29. Signalized Intersection Level of Service and Average Vehicle Delay – North Area

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
Western Avenue W.	Elliott Avenue W.	B	15	B	17	D	47	D	48	D	49	D	46
W. Mercer Place	Elliott Avenue W.	E	68	F	82	E	79	F	103	F	114	F	107
First Avenue	Denny Way	E	67	D	41	D	41	E	64	C	34	D	42
Second Avenue	Denny Way	A	9	A	8	A	10	B	15	B	10	B	11
Broad Street	Denny Way	B	17	C	23	C	24	C	28	C	28	C	25
Fifth Avenue	Denny Way	B	15	B	14	B	19	C	33	C	27	B	19
Fifth Avenue N.	Broad Street	D	39	C	21	D	44	D	41	D	39	C	30
Fifth Avenue N.	Harrison Street	B	12	B	15	B	11	A	9	B	16	B	12
Fifth Avenue N.	Mercer Street	E	66	D	38	D	55	F	94	E	57	F	86
Fifth Avenue N.	Roy Street	E	62	C	23	C	23	D	47	D	39	D	36
Taylor Avenue N.	Mercer Street	B	20	B	11	B	15	D	35	A	8	A	7
Sixth Avenue	Battery Street	B	11	B	10	B	13	E	79	C	30	C	26
Sixth Avenue	Denny Way	C	28	A	10	C	25	C	25	C	23	C	34
Sixth Avenue N.	John Street	A	10	-	-	-	-	A	9	-	-	-	-
Sixth Avenue N.	Thomas Street	A	9	B	16	B	16	B	12	B	17	C	26
Sixth Avenue N.	Harrison Street	B	18	B	14	C	23	B	14	C	23	B	18
Sixth Avenue N.	Republican/SR 99 on-ramp	A	5	A	0	A	1	A	1	A	2	A	2
Sixth Avenue N.	Mercer Street	A	9	B	18	C	21	B	18	D	53	D	45
Aurora Avenue NB	Denny Way	-	-	F	94	F	112	-	-	F	132	F	152
Aurora Avenue SB	Denny Way	-	-	D	40	D	39	-	-	E	66	F	85
Aurora Avenue	Denny Way	D	40	-	-	-	-	F	82	-	-	-	-

Exhibit 5-29. Signalized Intersection Level of Service and Average Vehicle Delay – North Area (continued)

Street	Cross Street	AM Peak Hour						PM Peak Hour					
		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure		Bored Tunnel		Cut-and-Cover Tunnel		Elevated Structure	
		LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)	LOS	Delay (sec.)
Aurora Avenue	John Street	A	10	-	-	-	-	B	11	-	-	-	-
Aurora Avenue	Thomas Street	B	17	-	-	-	-	D	36	-	-	-	-
Aurora Avenue	Harrison Street	C	21	-	-	-	-	B	15	-	-	-	-
Dexter Avenue	Denny Way	F	137	E	73	D	40	F	81	F	109	F	158
Dexter Avenue N.	John Street	A	9	-	-	-	-	A	9	-	-	-	-
Dexter Avenue N.	Thomas Street	B	14	B	11	B	10	B	19	C	25	C	34
Dexter Avenue N.	Harrison Street	B	13	B	17	B	16	B	13	C	27	C	31
Dexter Avenue N.	Republican/SR 99 off-ramp	C	28	C	29	D	38	D	38	D	49	D	37
Dexter Avenue N.	Mercer Street	E	61	D	54	E	62	E	78	F	98	F	124
Dexter Avenue N.	Roy Street	C	26	D	46	D	36	C	20	D	55	D	55
Dexter Avenue N.	Aloha Street	C	35	C	29	C	29	C	25	D	39	D	52
Ninth Avenue N.	Mercer Street	C	35	C	29	D	38	F	90	F	101	F	93
Westlake Avenue N.	Mercer Street	E	79	E	60	E	70	F	171	F	157	F	189
Fairview Avenue N.	Valley Street	D	48	D	50	D	53	D	47	D	48	D	47
Fairview Avenue N./ I-5 ramp	Mercer Street	E	68	F	113	F	81	F	188	F	201	F	220

Notes: LOS = level of service
NB = northbound
SB = southbound

movements. The northbound SR 99 off-ramp south of Mercer Street and the southbound on-ramp to SR 99 would both be located at Republican Street. Additional surface street changes would include closing Broad Street, extending Sixth Avenue N. to Mercer Street, connecting Harrison Street between Sixth Avenue N. and Taylor Avenue N., and converting Sixth Avenue N. from one-way to two-way between Denny Way and Wall Street. These changes would improve access between SR 99 and the local street grid, thereby attracting additional trips to the South Lake Union area. As a result, some increase in local street congestion is expected.

In general, under the Bored Tunnel Alternative, surface streets are expected to operate with less congestion and delay than under the Viaduct Closed (No Build Alternative) due to much lower traffic volumes on surface streets.

5.3.3.2.1 AM Peak Hour

Under the Bored Tunnel Alternative, several intersections are expected to operate under congested conditions (LOS E or worse) during the AM peak hour. The intersections of Fifth Avenue N. at Mercer Street and Fifth Avenue N. at Roy Street are both expected to operate at LOS E, largely due to the increase in traffic volumes along Fifth Avenue N. as a result of the closure of Broad Street and the conversion of Mercer to two-way traffic, east of Fifth Avenue N.

In addition, the intersection of Dexter Avenue at Denny Way is expected to operate at LOS F. The increased delay at this intersection would primarily be due to the projected increase in traffic along the Dexter Avenue and Denny Way corridor.

The intersection of First Avenue at Denny Way is forecasted to operate at LOS E during the AM peak hour, a result of heavy east-west movements coupled with traffic exiting the downtown and Belltown areas northbound via First Avenue. In addition, queuing and delays along the north-south streets intersecting with Mercer Street are expected. The intersections of Westlake Avenue N. at Mercer Street at and Dexter Avenue N at Mercer Street are expected to operate at LOS E during the AM peak hour due to high volumes on Mercer Street, Westlake Avenue N., and Dexter Avenue N.

The intersection of Fairview Avenue N./I-5 ramps at Mercer Street is projected to operate at LOS E during the AM peak hour when it would accommodate heavy southbound movements from I-5 and eastbound movements on Mercer Street.

To the west, the intersection of Elliott Avenue W. at W. Mercer Place is projected to operate at LOS E during the AM peak hour. Heavy north-south volumes on Elliott Avenue and increased southbound traffic turning left from Elliott Avenue W. to W. Mercer Place would result in degraded LOS at this intersection.

5.3.3.2.2 PM Peak Hour

During the PM peak hour, many of the intersections operating at LOS E or LOS F during the AM peak hour would continue operating at a low LOS. These include the intersections of Elliott Avenue W. at W. Mercer Place, First Avenue at Denny Way, Fifth Avenue N. at Mercer Street, Dexter Avenue at Denny Way, Dexter Avenue N. at Mercer Street, Westlake Avenue N. at Mercer Street, and Fairview Avenue N./I-5 ramp at Mercer Street.

In addition, the intersection of Ninth Avenue N. at Mercer Street is expected to operate at LOS F during the PM peak hour due to increases in traffic on all approaches. The majority of the additional queues and delays at this location are expected on the southbound Ninth Avenue N. approach and westbound Mercer Street.

The intersection of Aurora Avenue at Denny Way is expected to operate at LOS F during the PM peak hour, which can be attributed to traffic increase on both Denny Way and Aurora Avenue. In addition, the nearby intersection of Dexter Avenue at Denny Way is expected to operate at LOS F, and the intersection of Sixth Avenue at Battery Street is expected to operate at LOS E. Expected queuing activity between these two closely spaced intersections would likely cause spillback to adjacent intersections along Denny Way, resulting in additional delays on Denny Way.

5.3.3.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, several network changes are expected in the north area. The Denny Way ramps would be rebuilt in their current location. East-west side street connections to SR 99 between John and Aloha Streets would be replaced by a northbound off-ramp to Republican Street and improved right-turn on and off connections at Roy Street. The east-west arterials of Thomas and Harrison Streets would be connected over SR 99, improving access to the local street grid. Two-way Mercer would extend from Elliott Avenue W. to I-5. These changes would improve access between SR 99 and the local street grid, attracting additional trips to the South Lake Union area. As a result, some increase in local street congestion is expected.

5.3.3.3.1 AM Peak Hour

Many of the same intersections that would operate with congested conditions under the Bored Tunnel Alternative would also operate with congested conditions (LOS E or worse) under the Cut-and-Cover Tunnel Alternative.

To the east, the intersection of W. Mercer Place at Elliott Avenue W. is projected to operate at LOS F during the AM peak hour. Operation of BAT lanes during the peak hours would reduce the number of through-lanes. This reduction, coupled with heavy north-south volumes on Elliott Avenue and increased southbound traffic turning left from Elliott Avenue W. to W. Mercer Place, would result in degraded LOS at this intersection.

The intersection of Dexter Avenue at Denny Way is expected to operate at LOS E under the Cut-and-Cover Tunnel Alternative. The increased delay at this intersection would result primarily from the projected increase in traffic along the Dexter Avenue and Denny Way corridor.

The intersection of Mercer Street at Westlake Avenue N. is expected to operate under congested conditions (LOS E or worse) during the AM peak hour, similar to operations under the Bored Tunnel Alternative, due to high volumes at this intersection.

The intersection of Fairview Avenue N./I-5 ramps at Mercer Street is projected to operate at LOS F during the AM peak hour when it would accommodate heavy southbound movements from I-5 and eastbound movements on Mercer Street similar to those resulting from the Bored Tunnel Alternative.

The intersection of Fifth Avenue N. at Roy Street is expected to operate at LOS C during the AM peak hour under the Cut-and-Cover Tunnel Alternative, an improvement from the Bored Tunnel Alternative, which would result in intersection operations of LOS E. Under the Cut-and-Cover Tunnel Alternative, Mercer Street would be a two-way street west of Fifth Avenue N., thereby improving operating conditions compared to the Bored Tunnel Alternative where traffic traveling westbound would have to turn and travel south on Fifth Avenue N. to Denny Way or turn north on Fifth Avenue N. to continue west along Roy Street.

Under the Cut-and-Cover Tunnel Alternative, the intersection of northbound Aurora Avenue at Denny Way is forecasted to operate at LOS F during the AM peak hour. The intersection of southbound Aurora Avenue at Denny Way is forecasted to operate at LOS D. This relatively high projected LOS at the intersection of northbound Aurora Avenue at Denny Way reflects the relatively long green time that would be given to the high-volume east-west movement. However, the southbound movement at this intersection is forecasted to operate at LOS F during the AM peak hour. This would be a result of the southbound left-turn lane traffic spilling back into the southbound through-lanes, causing this intersection to essentially operate with one southbound through-lane, instead of two lanes, for much of the AM peak hour.

5.3.3.3.2 PM Peak Hour

During the PM peak hour, many of the same intersections that would operate with congested conditions under the Bored Tunnel Alternative would also operate with congested conditions (LOS E or worse) under the Cut-and-Cover Tunnel Alternative.

Intersections that are expected to operate below LOS D conditions, similar to operations under the Bored Tunnel Alternative, include W. Mercer Place at Elliott Avenue W., Fifth Avenue N. at Mercer Street, Dexter Avenue at Denny Way, Ninth Avenue N. at Mercer Street, Westlake Avenue N. at Mercer Street, and Fairview Avenue N./I-5 ramps at Mercer Street.

In addition, the intersection of northbound Aurora Avenue at Denny Way is forecasted to operate at LOS F and the intersection of southbound Aurora Avenue at Denny Way is forecasted to operate at LOS E. Because access to Aurora Avenue would be limited under the Cut-and-Cover Tunnel Alternative, volumes on the Denny Way ramps are forecasted to be higher for the Cut-and-Cover Tunnel Alternative than for the Bored Tunnel Alternative. These high volumes, coupled with high east-west volumes on Denny Way, would result in congested operations at these intersections.

5.3.3.4 Elevated Structure Alternative

Traffic operations in the north area under the Elevated Structure Alternative would be similar to those for the Cut-and-Cover Tunnel Alternative.

5.3.3.4.1 AM Peak Hour

Many of the same intersections that would operate with congested conditions under the Bored Tunnel Alternative would also operate with congested conditions (LOS E or worse) under the Elevated Structure Alternative.

To the east, the intersection of Elliott Avenue W. at W. Mercer Place is projected to operate at LOS E during the AM peak hour. Operation of BAT lanes during the peak hours would reduce the number of through-lanes. This reduction, coupled with heavy north-south volumes on Elliott Avenue and increased southbound traffic turning left from Elliott Avenue W. to W. Mercer Place would result in degraded LOS at this intersection.

The intersection of Dexter Avenue at Denny Way is expected to operate at LOS D under the Elevated Structure Alternative, an improvement over the Bored Tunnel Alternative.

The intersections of Westlake Avenue N. at Mercer Street and Dexter Avenue N. at Mercer Street are expected to operate with congested conditions (LOS E or worse) during the AM peak hour, similar to conditions under the Bored Tunnel Alternative, due to high volumes at these intersections.

The intersection of Fairview Avenue N./I-5 ramps at Mercer Street is projected to operate at LOS F during the AM peak hour when it would accommodate heavy southbound movements from I-5 and eastbound movements on Mercer Street.

The intersection of Fifth Avenue N. at Roy Street is expected to operate at LOS C during the AM peak hour under the Elevated Structure Alternative, an improvement from the Bored Tunnel Alternative operations of LOS E. Under the Elevated Structure Alternative, Mercer Street would be a two-way street west of Fifth Avenue N., thereby improving operating conditions compared to the Bored Tunnel Alternative where traffic traveling westbound would have to turn and travel south on Fifth Avenue N. to Denny Way or turn north on Fifth Avenue N. to continue west along Roy Street.

Under the Elevated Structure Alternative, the intersection of northbound Aurora Avenue at Denny Way is forecasted to operate at LOS F during the AM peak hour. The intersection of southbound Aurora Avenue at Denny Way is forecasted to operate at LOS D. This relatively high projected LOS at the intersection of northbound Aurora Avenue at Denny Way reflects the relatively long green time that would be given to the high-volume east-west movement. However, the southbound movement at this intersection is forecasted to operate at LOS F during the AM peak hour. This would be a result of the southbound left-turn lane traffic spilling back into the southbound through-lanes, causing this intersection to operate essentially with one southbound through-lane, instead of two lanes, for much of the AM peak hour.

5.3.3.4.2 PM Peak Hour

During the PM peak hour, many of the same intersections that would operate with congested conditions under the Bored Tunnel Alternative would also operate with congested conditions (LOS E or worse) under the Elevated Structure Alternative.

Intersections that are expected to operate below LOS D conditions, similar to operations under the Bored Tunnel Alternative, include Elliott Avenue W. at W. Mercer Place at, Fifth Avenue N. at Mercer Street, Dexter Avenue at Denny Way, Dexter Avenue N. at Mercer Street, Ninth Avenue N. at Mercer Street, Westlake Avenue N. at Mercer Street, and Fairview Avenue N./I-5 ramps at Mercer Street.

In addition, the intersections of northbound Aurora Avenue at Denny Way and southbound Aurora Avenue at Denny Way are forecasted to operate at LOS F during the PM peak hour. As access to Aurora Avenue would be limited under the Elevated Structure Alternative, volumes on the Denny Way ramps are forecasted to be higher for the Elevated Structure Alternative than for the Bored Tunnel Alternative. These high volumes, coupled with high east-west volumes on Denny Way, would result in congested operations at these intersections.

5.4 AM and PM Peak Hour Travel Times

The key findings related to effects on peak hour travel times are the following:

- Projected travel times for most of the routes investigated are not expected to vary noticeably among the build alternatives. The majority of travel times during the AM and PM peak hours are expected to be within 2 to

3 minutes of each other. Some larger travel time variations may occur for specific routes, as indicated in the analysis summary, but such increases or reductions would likely remain within a range of 3 to 5 minutes for the AM and PM peak hours.

- The largest travel time variations between the alternatives are spread among a variety of routes including the south end route between West Seattle and the CBD, the north end route between Woodland Park and S. Spokane Street, and the west side route between Ballard and S. Spokane Street. For the peak direction of travel (varies by route) in the AM peak hour, differences of 4 to 5 minutes were noted between the alternatives. For the PM peak hour, the greatest differences in peak direction (varies by route) travel time between alternatives were 3 to 4 minutes.
- Based on the routes analyzed, travel times would generally be longer for the Bored Tunnel Alternative compared to the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative.
- The Viaduct Closed (No Build Alternative) would likely result in much longer travel times than those of the build alternatives. As an example, travel times for the Woodland Park to S. Spokane Street route under the Viaduct Closed (No Build Alternative) conditions could be up to three times longer than the travel times for the Bored Tunnel Alternative.

AM and PM peak hour travel times for routes using the SR 99 corridor are presented and compared as a gauge of how efficient an alternative may be in providing mobility during periods of high use. The analyzed travel time routes are shown in Exhibit 2-6. Travel times are described for the key regional and downtown routes that were deemed appropriate for representing the primary travel patterns experienced on or adjacent to the SR 99 corridor:

- South to and from downtown, represented by West Seattle to CBD (Fourth Avenue and Seneca Street) via SR 99
- North to and from downtown via SR 99, represented by Woodland Park (SR 99 and N. 50th Street) to CBD (Fourth Avenue and Seneca Street)
- Through-trips on SR 99, represented by Woodland Park to S. Spokane Street
- Through-trips on the Elliott/Western corridor, represented by Ballard Bridge to S. Spokane Street:
  - Via Alaskan Way (or Alaskan Way Viaduct if applicable)
  - Via Mercer Street, bored tunnel
- Northgate to Boeing Access Road via I-5
- Mercer Street from I-5 to Elliott Avenue W.
- Second Avenue from Wall Street to S. Royal Brougham Way

- Fourth Avenue from S. Royal Brougham Way to Battery Street

Exhibit 5-30 summarizes corridor travel times by route and direction.

Exhibit 5-30. Corridor Travel Times

	AM Peak Hour (minutes)			PM Peak Hour (minutes)		
	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
West Seattle to CBD (Fourth Avenue and Seneca Street)						
Northbound	26	23	20	-	-	-
Southbound	-	-	-	27	24	22
Woodland Park to CBD (Fourth Avenue and Seneca Street)						
Southbound	22	24	24	-	-	-
Northbound	-	-	-	18	17	17
Woodland Park to S. Spokane Street						
Southbound	16	20	19	15	14	15
Northbound	12	12	13	16	17	16
Ballard Bridge to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)						
Southbound	17	16	15	19	21	20
Northbound	21	15	16	24	23	25
Ballard Bridge to S. Spokane Street (via Mercer Street, Bored Tunnel)						
Southbound	17	N/A	N/A	22	N/A	N/A
Northbound	25	N/A	N/A	27	N/A	N/A
Northgate to Boeing Access Road (via I-5)						
Southbound	31	31	31	38	38	38
Northbound	32	32	32	35	35	34
Mercer Street (I-5 to Elliott Avenue W.)						
Westbound	12	8	9	14	11	11
Eastbound	8	9	10	13	16	15
Second Avenue (Wall Street to S. Royal Brougham Way)						
Southbound	15	14	14	16	14	14
Fourth Avenue (S. Royal Brougham Way to Battery Street)						
Northbound	12	12	12	14	13	13

Notes: CBD = Central Business District
N/A = not applicable

5.4.1 West Seattle to CBD

This route represents trips between West Seattle (specifically the intersection of California Avenue S.W. at S.W. Alaska Street) and the CBD (specifically at Fourth Avenue and Seneca Street) and was evaluated only for the direction of peak traffic flow (i.e., northbound in the AM peak hour and southbound in the PM peak hour).

For the northbound direction during the AM peak hour, travel times for the Bored Tunnel Alternative would be approximately 3 to 4 minutes longer than those for the Cut-and-Cover Tunnel Alternative and 5 to 6 minutes longer than those for the Elevated Structure Alternative. These differences in travel time are largely due to the variations between the alternatives in terms of downtown access from the SR 99 corridor, particularly the number of ramp exits to the surface street network. The Elevated Structure Alternative would result in the shortest travel times for this route, mainly because of the midtown Seneca Street off-ramp that would provide direct access to the downtown core. The projected travel times for the Cut-and-Cover Tunnel Alternative are in the middle of the range because no direct midtown ramp would be provided but an off-ramp to Western Avenue would be provided downstream (distributing northbound traffic away from the stadium area ramps). Travel times under the Bored Tunnel Alternative would be the longest for this route because all downtown-destined traffic would have to exit in the stadium area, resulting in higher concentrations of volumes.

The same general travel time order noted for the AM peak hour carries over to the southbound direction during the PM peak hour. The Bored Tunnel Alternative would result in the longest travel times from the CBD to West Seattle with the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative resulting in progressively shorter travel times. The numbers and locations of access ramps for each alternative would again play a major role in the effects on travel times for this route.

Peak hour travel times with the Viaduct Closed (No Build Alternative) were not estimated due to the expected variability in traffic conditions when the viaduct is not in operation. Traffic conditions with this alternative would be severely congested to a degree where detailed traffic models are typically not reliable indicators of delays or traffic flow. Consequently, measures such as travel times cannot be meaningfully evaluated; instead, they are qualitatively discussed. For the West Seattle to CBD route, SR 99 mainline traffic would transition from the previously reconstructed S. Holgate Street to S. King Street segment of SR 99 to and from surface arterials. This SR 99/surface street interface would introduce a substantial reduction in capacity on the corridor relative to alternatives that would provide a continuous SR 99 facility. As a result, severe backups in the AM and PM peak hours are expected to form at the transition points.

5.4.2 Woodland Park to CBD

This route represents trips between N. 50th Street/SR 99 and downtown Seattle and was evaluated only for the direction of peak traffic flow (i.e., southbound in the AM peak hour and northbound in the PM peak hour).

In the southbound direction during the AM peak hour, travel times for the various alternatives would all be generally similar, with those for the Cut-and-Cover Tunnel and the Elevated Structure Alternatives approximately 1 minute longer than would those for the Bored Tunnel Alternative. For the Bored Tunnel Alternative, the additional intersections along Aurora Avenue N. (between Harrison Street and Denny Way) would generally increase travel times for this route compared to the other two alternatives, which would provide more direct access to Denny Way from the SR 99 mainline. However, weaving congestion on SR 99 for both the Cut-and-Cover Tunnel and Elevated Structure Alternatives would result in longer mainline delays, thereby offsetting any benefits of more direct ramp access. The differences in travel time between the Cut-and-Cover Tunnel and Elevated Structure Alternatives (less than half a minute) are considered modest and are attributable to modeling variations.

In the northbound direction during the PM peak hour (CBD to Woodland Park), travel times for the Bored Tunnel Alternative would be 1 to 2 minutes longer than would those for both the Cut-and-Cover Tunnel and Elevated Structure Alternatives. This is due to additional intersections on Aurora Avenue from Denny Way to the northbound on-ramp to SR 99.

Under the Viaduct Closed (No Build Alternative), the high concentrations of southbound AM peak hour traffic at Denny Way would result in severe congestion levels on surface streets and significant backups on SR 99/Aurora Avenue N. Travel times in the southbound direction would reflect this congestion and would be considerably longer than the travel times for any of the build alternatives. Similar highly congested conditions would result in the northbound direction during the PM peak hour, with severe delays at the intersection of Denny Way and SR 99/Aurora Avenue N.

5.4.3 Woodland Park to S. Spokane Street

This route represents one of the longer travel time routes; it travels directly through the study area along the SR 99 corridor and captures trips not originating or destined to the Seattle CBD. Travel times for both peak and off-peak directions are provided to evaluate travel times for a wide range of users during peak hours.

During the AM peak hour, travel times in the southbound direction would be shortest for the Bored Tunnel Alternative at approximately 16 minutes, primarily due to the configuration of the off-ramp to the CBD and the absence of access ramps in the central waterfront, which result in fewer friction points and traffic flow disturbances. The Cut-and-Cover Tunnel and Elevated Structure Alternatives, on the other hand, would include a southbound SR 99 weaving area between Roy Street and Denny Way, as well as on-ramps in the central waterfront. As a result, travel times for these alternatives are expected to be 3 to 4 minutes longer than those for the Bored Tunnel Alternative. Northbound AM peak hour travel times from S. Spokane Street to Woodland Park would be similar for all three build alternatives (approximately 12 to 13 minutes). Delays for northbound off-ramp traffic in the stadium area would be greatest for the Bored Tunnel Alternative but the additional ramp access points provided by the Cut-and-Cover Tunnel and Elevated Structure Alternatives would also result in some additional delays.

During the PM peak hour, travel times in the northbound direction for the Cut-and-Cover Tunnel Alternative would be longer by 1 to 2 minutes than the travel times for the other build alternatives. This is due to the heavy SR 99 congestion at the Western Avenue off-ramp, which would not be as pronounced with the Elevated Structure Alternative (where the midtown ramps would be provided). Southbound travel times would generally be similar for all three of the build alternatives.

Under the Viaduct Closed (No Build Alternative), exclusive use of surface arterials would result in greater use of Elliott Avenue from Ballard, which in turn would lead to severe congestion levels at most intersections and significant backups on Alaskan Way. Travel times in both directions would reflect this congestion and would be considerably longer than those of any of the other alternatives.

5.4.4 Ballard Bridge to S. Spokane Street – Via Alaskan Way Viaduct and/or Alaskan Way

This route reflects the travel times for longer distance through-trips between Ballard and S. Spokane Street, connecting two neighborhoods on the fringe of the study area.

The Bored Tunnel Alternative would not replace the Elliott/Western ramps, which would result in slightly longer trips in the AM peak hour for both directions of travel compared to the other two build alternatives. This is expected because the Cut-and-Cover Tunnel and Elevated Structure Alternatives would provide more direct access between SR 99 and Elliott Avenue.

During the PM peak hour, travel times for the northbound direction would be 1 to 2 minutes longer for the Elevated Structure Alternative than the Bored Tunnel and the Cut-and-Cover Tunnel Alternatives. This is due to the high levels of congestion that would develop at the various off-ramps provided by this alternative (to the stadium area, Seneca Street, and Western Avenue). In the southbound direction, travel times would be longest for the Cut-and-Cover Tunnel Alternative due to the high concentration of traffic along Elliott Avenue accessing the SR 99 on-ramp. Because of the SR 99 mainline congestion resulting from the Cut-and-Cover Tunnel and Elevated Structure Alternatives and modest volumes on the Alaskan Way surface street, the Bored Tunnel Alternative would result in the shortest southbound travel times.

Similar to the other travel times routes, under the Viaduct Closed (No Build Alternative), exclusive use of surface arterials for trips between Ballard and S. Spokane Street would result in greater use of Elliott Avenue from Ballard, which in turn would lead to severe congestion levels at most intersections and significant backups on Alaskan Way. Travel times in both directions would reflect this congestion and would be considerably longer than those of the other alternatives.

5.4.5 Ballard Bridge to S. Spokane Street – Via Mercer Street and Bored Tunnel

This route is relevant only to the Bored Tunnel Alternative, because the Ballard connection to and from SR 99 for the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative, and the Viaduct Closed (No Build Alternative) would be made via the Elliott/Western ramps or the Alaskan Way surface street. In the southbound direction, this route would connect Ballard to S. Spokane Street via a combination of Elliott Avenue, W. Mercer Place, Mercer Street, Sixth Avenue N., and the bored tunnel (SR 99). The northbound route would be via the bored tunnel (SR 99), the Republican Street off-ramp to Dexter Avenue N., Mercer Street, Fifth Avenue N., Roy Street, Queen Anne Avenue N., W. Mercer Street, and W. Mercer Place to Elliott Avenue.

For both the AM and PM peak hours, travel times in the southbound direction would be shorter than those in the northbound direction. This is expected because the northbound path from S. Spokane Street to Ballard would generally be more circuitous than the southbound route, requiring a number of additional turning movements and passing through additional signalized intersections.

5.4.6 Northgate to Boeing Access Road – Via I-5

This route defines the I-5 path between Northgate and the area near Boeing Field and reflects longer distance trips outside of, but parallel to, the SR 99 corridor.

Travel times between Northgate and Boeing Access Road would generally be the longest of any route evaluated, primarily due to the physical distance covered by the route. The results of the operational analysis indicate that differences in travel time between the build alternatives during the AM peak hour would be modest (less than 1 minute), for both the northbound and southbound directions. Overall travel times during the PM peak hour are expected to be longer than those during the AM peak hour. However, as noted for the AM peak hour, northbound and southbound travel times during the PM peak hour would be similar, with differences of less than 1 minute.

The effects of the Viaduct Closed (No Build Alternative) on travel time in the I-5 corridor would be fairly noticeable, because drivers would shift to I-5 as an alternate route for bypassing the downtown core or for traveling to and from the CBD. As a result, I-5 traffic volumes are expected to increase dramatically during the AM and PM peak hours, resulting in increased delays and travel times for all users in both directions.

5.4.7 Mercer Street – I-5 to Elliott Avenue W.

The Mercer Street route is defined by trips along Mercer Street between Elliott Avenue W. and I-5 and captures west side traffic to and from the SR 99 and I-5 corridors. East-west travel times for the Mercer Street corridor would vary by both alternative and direction of travel.

The Mercer Street lane configuration for the Cut-and-Cover Tunnel and Elevated Structure Alternatives assumes the completion of the Mercer East and Mercer West projects, which collectively would result in arterial widening between Elliott Avenue W. and the I-5 ramps and conversion to two-way operations between Queen Anne Avenue and the I-5 ramps. For the Bored Tunnel Alternative, the arterial would be widened and converted to two-way operation only between Fifth Avenue N. and I-5.

During the AM peak hour, travel times would vary noticeably among the build alternatives. In the westbound direction from I-5 to Elliott Avenue W., the Elevated Structure Alternative would result in the shortest travel times, followed by the Cut-and-Cover Tunnel Alternative and the Bored Tunnel Alternative. Travel times for the Bored Tunnel Alternative would be the longest, partly due to the less direct westbound path between Fifth Avenue and Queen Anne Avenue, which would require the use of Roy Street as part of the Mercer/Roy one-way couplet. In the eastbound direction, travel times for the Bored Tunnel Alternative would be the shortest due to the one-way couplet, which would provide greater throughput capacity from Queen Anne Avenue to Fifth Avenue N. This greater eastbound capacity, in turn, would reduce the travel times for the longer route.

During the PM peak hour, travel times would follow the same general trend: under the Bored Tunnel Alternative, travel times in the westbound direction would be the longest and travel times in the eastbound direction would be the shortest.

Under the Viaduct Closed (No Build Alternative), travel times on Mercer Street between Elliott Avenue W. and I-5 would be severely affected, because a large percentage of trips would shift from the SR 99 corridor to I-5 via Mercer Street. This added traffic would exacerbate an already congested east-west corridor, thereby leading to large increases in intersections delays and backups in both directions.

5.4.8 Second Avenue – Wall Street to S. Royal Brougham Way

The Second Avenue route represents trips in the southbound direction within the CBD. Travel times for this route help to describe how each alternative could accommodate surface street traffic relative to the volumes served on the SR 99 corridor.

During the AM peak hour, average travel times along Second Avenue would be slightly longer for the Bored Tunnel Alternative compared to both the Cut-and-Cover Tunnel and Elevated Structure Alternatives. The longer projected travel times for the Bored Tunnel Alternative are likely due to the absence of the midtown and Elliott/Western ramps, resulting in less total traffic in the bored tunnel and, therefore, greater traffic volumes on surface streets such as Second Avenue. During the PM peak hour, travel times are also expected to be longer for the Bored Tunnel Alternative than the other two alternatives. The differences in travel times during the PM peak hour would be more pronounced due to the higher system-wide volumes and delays at signalized intersections along Second Avenue.

Under the Viaduct Closed (No Build Alternative), travel times on Second Avenue would increase dramatically compared to those of the build alternatives because traffic from the SR 99 corridor would shift to alternate streets such as Second Avenue.

5.4.9 Fourth Avenue – S. Royal Brougham Way to Battery Street

Similar to the Second Avenue route, the Fourth Avenue route represents trips made in the northbound direction within the CBD. Travel times on Fourth Avenue also help to describe how each alternative could accommodate surface street traffic relative to the volumes served on the SR 99 corridor.

During the AM peak hour, average travel times along Fourth Avenue would be similar for the three build alternatives despite slightly heavier volumes projected for the Bored Tunnel Alternative due to the absence of the midtown and Elliott/Western ramps. The differences in AM peak hour volumes are not expected to affect arterial performance noticeably because the overall volumes are relatively low, especially compared to the PM peak hour. In fact, during the PM peak hour, travel times are expected to be slightly longer for the Bored Tunnel Alternative than the other two build alternatives.

Under the Viaduct Closed (No Build Alternative), travel times would increase significantly on Fourth Avenue compared to any of the other alternatives because traffic from the SR 99 corridor would shift to alternate northbound arterials such as Fourth Avenue.

5.5 Roadway Connectivity and Access

This section discusses the provision and quality of connections between the SR 99 corridor and other streets and highways in the study area.

The key findings related to effects on roadway connectivity and access are the following:

- For all of the build alternatives, connections to SR 519, the stadium area, the central waterfront, Pioneer Square, and the southern portion of downtown will be improved by new access to southbound SR 99 and from northbound SR 99 provided by the S. Holgate Street to S. King Street Viaduct Replacement Project (Alaskan Way S. ramps).

- The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would relocate access to and from SR 99 to the area near S. King Street. The Seneca Street and Columbia Street ramps at First Avenue would not be replaced in their current location; this access would instead be provided by the Alaskan Way S. ramps. Traffic could use these ramps for distribution to several downtown arterial routes via Alaskan Way and the downtown street grid rather than accessing downtown directly at the current ramp locations.
- The Elevated Structure Alternative would continue to provide access to central downtown via the Seneca Street and Columbia Street ramps.
- The Bored Tunnel Alternative would remove the northbound off-ramp to Western Avenue and the southbound on-ramp from Elliott Avenue. SR 99 trips to and from northwest Seattle communities (Ballard, Magnolia, and Belltown) would have several routing choices. One option would be to exit and enter SR 99 on the Alaskan Way S. ramps and continue on Alaskan Way or other downtown arterials to reach the Elliott/Western corridor in Belltown. Another option would be to continue through the bored tunnel to the South Lake Union exits at Republican Street or Roy Street and then use various combinations of Mercer Street, Harrison Street, Broad Street, or Denny Way to reach the Elliott/Western corridor.
- Under the Elevated Structure and Cut-and-Cover Tunnel Alternatives, the northbound off-ramp to Western Avenue and the southbound on-ramp from Elliott Avenue would remain. SR 99 trips to and from northwest Seattle communities would have access similar to the existing conditions.
- Under all of the build alternatives, the lightly used Battery Street Tunnel ramps adjacent to the Battery Street Tunnel would be closed. Under the Bored Tunnel Alternative, new consolidated ramps would be provided at Aurora Avenue/Denny Way to replace this access.
- Under all of the build alternatives, connections in the South Lake Union, Uptown, and Queen Anne areas would be improved, including the connections of several east-west arterial streets that are currently disconnected. Connections to SR 99 would be provided by new ramps at Republican Street, by ramps to Denny Way, or by arterial connections north of Mercer Street (similar to existing conditions north of Mercer Street).

Exhibit 5-31 details the connections to and from SR 99 for the three build alternatives.

Exhibit 5-31. Connections To and From SR 99

	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Stadium Area (South of S. King Street)			
SB SR 99 to stadium area	S. Royal Brougham Way off-ramp	S. Royal Brougham Way off-ramp	S. Royal Brougham Way off-ramp
Stadium area to NB SR 99	S. Royal Brougham Way on-ramp	S. Royal Brougham Way on-ramp	S. Royal Brougham Way on-ramp
Stadium area to SB SR 99	Alaskan Way S. on-ramp	Alaskan Way S. on-ramp	Alaskan Way S. on-ramp
NB SR 99 to stadium area	Alaskan Way S. off-ramp	Alaskan Way S. off-ramp	Alaskan Way S. off-ramp
Downtown Seattle (S. King Street – Stewart Street)			
SB SR 99 to downtown	Harrison Street off-ramp	Denny Way off-ramp	Denny Way off-ramp
Downtown to NB SR 99	Harrison Street on-ramp	Denny Way on-ramp	Denny Way on-ramp
Downtown to SB SR 99	Alaskan Way S. on-ramp	Alaskan Way S. on-ramp	Columbia Street on-ramp and Alaskan Way S. on-ramp
NB SR 99 to downtown	Alaskan Way S. off-ramp	Alaskan Way S. off-ramp	Seneca Street off-ramp and Alaskan Way S. off-ramp
Elliott and Western Corridor (Stewart Street – Denny Way)			
SB SR 99 to Belltown	Harrison Street off-ramp	Denny Way off-ramp	Denny Way off-ramp
Belltown to NB SR 99	Harrison Street on-ramp	Denny Way on-ramp	Denny Way on-ramp
Belltown to SB SR 99	Arterial routes to Republican Street on-ramp or Alaskan Way S. on-ramp	Elliott Avenue on-ramp	Elliott Avenue on-ramp
NB SR 99 to Belltown	Arterial routes from Republican Street off-ramp or Alaskan Way S. off-ramp	Western Avenue off-ramp	Western Avenue off-ramp
South Lake Union Area (North of Denny Way)			
SB SR 99 to Uptown	Harrison Street off-ramp or arterial connections (north of Mercer Street)	Denny Way off-ramp or Roy Street	Denny Way off-ramp or Roy Street

Exhibit 5-31. Connections To and From SR 99 (continued)

	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
SB SR 99 to South Lake Union	Harrison Street off-ramp or arterial connections (north of Mercer Street), then cross SR 99 on Mercer Street	Denny Way off-ramp or Roy Street, then cross SR 99 on Mercer Street	Denny Way off-ramp or Roy Street, then cross SR 99 on Mercer Street
Uptown to SB SR 99	Republican Street on-ramp or arterial connections (north of Mercer Street)	Roy Street	Roy Street
South Lake Union to SB SR 99	Cross SR 99 on Harrison Street, Thomas Street, John Street, Mercer Street, or Denny Way to Republican Street on-ramp or arterial connections (north of Mercer)	Harrison Street, Thomas Street, Mercer Street, or Denny Way across SR 99 to Roy Street	Harrison Street, Thomas Street, Mercer Street, or Denny Way across SR 99 to Roy Street
NB SR 99 to Uptown	Republican Street off-ramp or arterial connections (north of Mercer), then cross SR on Harrison Street, Thomas Street, John Street, Mercer Street, or Denny Way	Republican Street off-ramp or Roy St to Harrison Street, Thomas Street, Mercer Street, or Denny Way across SR 99	Republican Street off-ramp or Roy St to Harrison Street, Thomas Street, Mercer Street, or Denny Way across SR 99
NB SR 99 to South Lake Union	Republican Street off-ramp or arterial connections (north of Mercer Street)	Republican Street off-ramp or Roy Street	Republican Street off-ramp or Roy Street
Uptown to NB SR 99	Harrison Street on-ramp or cross SR 99 at Mercer to arterial connections (north of Mercer Street)	Cross SR 99 on Harrison Street, Thomas Street, Mercer Street, or Denny Way to Roy Street	Cross SR 99 on Harrison Street, Thomas Street, Mercer Street, or Denny Way to Roy Street
South Lake Union to NB SR 99	Harrison Street on-ramp or arterial connections (north of Mercer)	Denny Way on-ramp or Roy Street	Denny Way on-ramp or Roy Street

Notes: NB = northbound
SB = southbound

5.5.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), it is assumed that the Alaskan Way Viaduct would not be in operation. As a result, the ramps at First Avenue S., Columbia Street, Seneca Street, Elliott Avenue, and Western Avenue would be closed. Alaskan Way would operate with its current lane configuration. Connections to and from the south, serving areas such as West Seattle, would be provided by ramps at Alaskan Way near S. Royal Brougham Way (to southbound SR 99) and to First Avenue S. near S. Royal Brougham Way (from northbound SR 99). In the north end, access would be provided by the existing Denny Way ramps.

The S. Holgate Street to S. King Street Viaduct Replacement Project will be completed before 2015 and would be operational in the case of the Viaduct Closed (No Build Alternative). The primary difference in the transportation network between the 2005 existing facility and the facility after the completion of the S. Holgate to S. King Street Viaduct Replacement Project is the new ramps that will be provided to southbound SR 99 and from northbound SR 99 to Alaskan Way S. near S. Dearborn Street. Furthermore, the connection between East Marginal Way S. and First Avenue S. on S. Atlantic Street will be improved with a new grade-separated facility (i.e., the h-shaped overcrossing) that can operate even while the rail crossing is blocked by train movements, which will improve access to the First Avenue S. ramps for traffic traveling on East Marginal Way S.

5.5.2 Bored Tunnel Alternative

5.5.2.1 To and From Stadium Area/SR 519

Under the Bored Tunnel Alternative, access to the stadium area would be provided by a new interchange connecting to Alaskan Way S., S. Royal Brougham Way, and the East Frontage Road. Access from southbound SR 99 and to northbound SR 99 would be maintained, although relocated from First Avenue S. to ramps connecting to the East Frontage Road in the vicinity of S. Royal Brougham Way. Access to and from the south would be provided via new ramps connecting to Alaskan Way S. near S. Dearborn Street. S. Royal Brougham Way would end east of SR 99 at its intersection with the SR 99 southbound off-ramp and SR 99 northbound on-ramp.

5.5.2.2 To and From Downtown Seattle

Under the Bored Tunnel Alternative, the ramps to downtown would not be provided in their current locations. Instead, access would be provided from northbound SR 99 to Alaskan Way S. and from Alaskan Way S. to southbound SR 99 south of S. King Street. The removal of the Seneca and Columbia Street ramps would alter traffic patterns, and the Alaskan Way surface street would be expected to carry additional traffic to and from downtown and the stadium area.

An advantage of this configuration is that the downtown Seattle street grid would be better able to accommodate traffic flows than the single-point locations where the Columbia and Seneca Street ramps begin and end. In addition, traffic would be able to distribute from Alaskan Way to the downtown street grid using any of several cross streets, including S. Jackson Street, S. Main Street, Yesler Way, and Columbia, Marion, Madison, and Spring Streets, rather than being concentrated in single locations.

Because the stadium area ramps would be less centrally located to downtown than the existing ramps, trips destined for the central and northern portions of downtown would have to travel a few additional blocks on arterial streets rather than on SR 99. Conversely, trips destined to and from the southern portion of downtown would find that the stadium area ramps provide more direct access. In addition, with the stadium area ramps provided by the Bored Tunnel Alternative, access to SR 99 for trips to and from the Seattle Ferry Terminal at Colman Dock would be more direct than it is with the existing Seneca and Columbia Street ramps.

5.5.2.3 To and From Belltown/Interbay

Under the Bored Tunnel Alternative, the northbound off-ramp to Western Avenue and the southbound on-ramp from Elliott Avenue would be removed. Trips that currently use these ramps could instead exit and enter SR 99 on the Alaskan Way ramps and continue on Alaskan Way or other downtown arterials to reach the Elliott/Western corridor in Belltown. Another option would be to use Mercer Street or Denny Way and Broad Street to access SR 99 at Republican Street and continue through the bored tunnel.

In addition, the lightly used and geometrically substandard Battery Street Tunnel ramps adjacent to the Battery Street Tunnel would be closed as part of the decommissioning of the Battery Street Tunnel. The Harrison Street ramps from Aurora Avenue provide good access to and from SR 99 for these trips; however, use of these ramps for these trips would also involve travel on east-west streets through Belltown.

5.5.2.4 To and From Uptown/South Lake Union

Under the Bored Tunnel Alternative, access in the South Lake Union and Uptown areas would be improved in terms of operational safety and connectivity compared to the existing configuration. SR 99 would be lowered below grade from the Battery Street Tunnel to approximately Mercer Street. Direct arterial connections to SR 99 in this segment would no longer be provided, and access would instead be consolidated on ramps at Harrison Street and Republican Street and arterial connections north of Mercer Street. The new ramps would be a considerable operational improvement over the right-angle turns on and off the facility serving these movements today.

South of Mercer Street, access to and from SR 99 would be provided at Harrison and Republican Streets. Because the bored tunnel would extend north of Harrison Street, SR 99 would no longer be a barrier to the connection of John, Thomas, and

Harrison Streets, allowing the local street grid between Denny Way and Harrison Street to be connected. Broad Street would be closed between Fifth Avenue N. and Ninth Avenue N., allowing the street grid to be reestablished in this area. Mercer Street would continue to cross under SR 99 as it does today, but it would be widened and converted to a two-way street with three lanes in each direction and a center turn lane.

Sixth Avenue N. would be extended to Mercer Street, providing access to the new southbound on-ramp at Republican Street. With the new alignment of Sixth Avenue N., only eastbound traffic from Mercer Street would be able to access the extended roadway, because westbound left turns would be prohibited due to geometric constraints associated with intersection spacing.

North of Mercer Street, the existing arterial connections to SR 99 would remain.

5.5.3 Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative

5.5.3.1 To and From Downtown Seattle

Under the Cut-and-Cover Tunnel Alternative, the ramps to downtown would not be provided in their current locations. Instead, access would be provided from northbound SR 99 to Alaskan Way S. and from Alaskan Way S. to southbound SR 99 south of S. King Street. The removal of the Seneca and Columbia Street ramps would alter traffic patterns, and the Alaskan Way surface street would be expected to carry additional traffic to and from downtown and the stadium area. However, the Elevated Structure Alternative would preserve the Seneca and Columbia Street ramps, which would result in traffic patterns similar to current patterns.

Because the stadium area ramps would be less centrally located to downtown than the existing ramps, trips destined for the central and northern portions of downtown would have to travel a few additional blocks on arterial streets rather than on SR 99. Conversely, trips destined to and from the southern portion of downtown would find that the stadium area ramps provide more direct access. In addition, with the stadium area ramps provided by these two alternatives, access to SR 99 for trips to and from the Seattle Ferry Terminal at Colman Dock would be more direct than it is with the existing Seneca and Columbia Street ramps.

5.5.3.2 To and From Belltown/Interbay

Unlike the Bored Tunnel Alternative, the Cut-and-Cover Tunnel and Elevated Structure Alternatives would replace the northbound off-ramp to Western Avenue and the southbound on-ramp from Elliott Avenue in roughly their current configuration. Traffic to and from Belltown and Interbay could continue to use the Elliott/Western ramps as the primary access to SR 99.

Under the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the lightly used Battery Street ramps adjacent to the Battery Street Tunnel would be closed.

5.5.3.3 To and From Uptown/South Lake Union

Under the Cut-and-Cover Tunnel and Elevated Structure Alternatives, access in the South Lake Union and Uptown areas would be improved in terms of operational safety and connectivity compared to the existing configuration. SR 99 would be lowered below grade from the Battery Street Tunnel to approximately Mercer Street. Direct arterial connections to SR 99 in this segment would no longer be provided, and access would instead be consolidated on ramps at Denny Way, Harrison Street, and Roy Street.

South of Mercer Street, access to northbound and from southbound SR 99 would be provided at Denny Way. Access from northbound SR 99 would be provided with an off-ramp at Republican Street, connecting to Dexter Avenue N. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would provide new bridges at Thomas and Harrison Streets, thereby providing greater connectivity on the local street grid. Broad Street would be closed between Fifth Avenue N. and Ninth Avenue N., allowing the street grid to be reestablished in this area. Mercer Street would continue to cross under SR 99 as it does today, but it would be widened and converted to a two-way street with three lanes in each direction and a center turn lane.

North of Mercer Street, the arterial connections would be consolidated to a single connection to Roy Street, providing right-angle turns on and off in both directions of SR 99. This would provide the only connection to southbound SR 99 from the Uptown and South Lake Union areas.

5.6 Transit Services

This section identifies the expected operational effects of the Viaduct Closed (No Build Alternative), Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative on transit services using both qualitative and quantitative information. These effects would result from road network changes, priority treatments, new connections to transit service, and other characteristics associated with the alternatives. The estimated effects include variations in ridership, travel times, and major changes in LOS at intersections with public transit operations.

For the evaluation of effects on transit ridership, two pieces of information generated by the travel demand model were considered: (1) estimated daily transit demand at three selected screenlines: south (south of S King Street), central (north of Seneca Street), and north (north of Thomas Street) and (2) estimated daily transit ridership for travel to, from, and within the Center City.

The peak hour travel times identified in this section include transit times where available. Transit travel times were identified for the Elliott Avenue, Aurora Avenue, Second Avenue, and Fourth Avenue corridors, which include existing and potential added bus lanes. Estimated transit travel times were identified through the VISSIM operations model, which can forecast travel times that take operating and dwell times into account. For the West Seattle corridor, travel times for general-purpose traffic are identified for all three of the build alternatives. Although travel times were not estimated for the Viaduct Closed (No Build Alternative), traffic conditions, including public transportation vehicles, are expected to be severely congested. These congested conditions would affect the speed and reliability of bus operations in the study area.

A third factor affecting transit operations is the LOS at intersections served by buses. Using the results discussed in Section 5.3 for the south, central, and north areas, transit operations at intersections operating at LOS E or LOS F were evaluated. As with transit travel times, LOS conditions for the Viaduct Closed (No Build Alternative) were not analyzed. However, traffic conditions at intersections under the Viaduct Closed (No Build Alternative) would be extremely congested to the point of affecting the speed and reliability of buses operating at these locations.

The key findings related to effects on transit services are the following:

- For the Viaduct Closed (No Build Alternative), transit effects such as travel times and mode shares were not generated by the travel demand model. However, conditions under the Viaduct Closed (No Build Alternative) would likely result in substantial additional travel time for traffic, which would affect the speed and reliability of transit vehicles.
- Under the Bored Tunnel and the Cut-and-Cover Tunnel Alternatives, transit access for bus routes operating between south King County/West Seattle and downtown Seattle would no longer be available at the Columbia and Seneca Street ramps. However, more direct transit service would be provided to locations in south downtown.
- Under the Bored Tunnel Alternative, the existing on- and off-ramps at Denny Way would be closed and replaced with downtown access ramps to and from SR 99 three blocks farther north near Harrison Street.
- Under the Bored Tunnel Alternative, transit-only lanes would be provided in both directions on Aurora Avenue N., from south of Harrison Street through the Denny Way intersection.
- Along the Elliott Avenue corridor, the transit travel times would generally be the same for all of the build alternatives. The largest difference would be 2 minutes in additional travel time for the Cut-and-Cover Tunnel Alternative as compared to the Bored Tunnel Alternative for northbound trips in the PM peak hour.
- For southbound trips along the Aurora Avenue corridor, transit travel times for the Bored Tunnel Alternative would be less than those for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. Under the

Bored Tunnel Alternative, transit travel times for northbound trips would be somewhat longer than those for trips under the Cut-and-Cover Tunnel and Elevated Structure Alternatives due to added bus stops along Aurora Avenue N. in South Lake Union.

- For West Seattle/downtown Seattle trips, longer travel times are forecasted for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives as compared to the Elevated Structure Alternative. The Elevated Structure Alternative would provide more direct SR 99 access to the Seattle CBD.
- For the Second and Fourth Avenue corridors, there would be relatively small variations in transit travel time for all three of the build alternatives.
- Under all three of the build alternatives, most intersections evaluated in the study area, including locations with transit operations, are forecasted to operate at LOS D or better during the AM and PM peak hours.

5.6.1 Roadway Network Changes Affecting Transit Operations

This section discusses characteristics of the roadway network under each alternative, such as new transit priority treatments, that could affect transit operations.

5.6.1.1 South Area

This section describes roadway network changes for the south area.

5.6.1.1.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), SR 99 mainline traffic in the south area, including bus trips, would transition from the reconstructed S. Holgate Street to S. King Street segment of SR 99 to and from Alaskan Way. This transition would occur via a set of single-lane ramps connecting to an unimproved Alaskan Way at S. King Street. As a result, severe backups are expected to occur for general-purpose traffic and bus operations at transition points, spreading elsewhere into the street network.

Although the Viaduct Closed (No Build Alternative) was not specifically assessed for intersection operations, inferences may be drawn based on modeled changes in travel patterns. The locations in the south that are most likely to experience considerable congestion are the transition ramps from SR 99 to Alaskan Way S./East Frontage Road/S. King Street. Also likely to be affected are the intersections along First Avenue S. at S. Atlantic Street and at S. Royal Brougham Way, along Alaskan Way north of S. King Street, and at most intersections on First Avenue between S. King Street and Madison Street. These locations, many of which would be used by high volumes of transit vehicles, are expected to operate with substantial levels of congestion due to the large increases in traffic volumes diverted from the SR 99 corridor.

5.6.1.1.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, the Columbia and Seneca Street ramps on SR 99 would be removed, and all transit vehicles currently operating on SR 99 would need to exit and enter SR 99 in the stadium area. This change in service coverage would increase the number of buses traveling through south downtown Seattle by approximately 520 buses per day. Northbound buses traveling on SR 99 from West Seattle and south King County would use the new ramps located in the stadium area and then travel on arterials in Pioneer Square to Third and Fourth Avenues to access the downtown Seattle grid.

This change in access in the south area would increase transit travel time for destinations in the CBD. Some of these travel time effects would be mitigated by the provision of a northbound transit-only lane on SR 99 from S. Holgate Street to near the off-ramp at S. Dearborn Street. Although transit travel time would be increased, with the new stadium area ramps, transit vehicles traveling on SR 99 to the south end of downtown Seattle would have improved access to locations in SODO, as well as Pioneer Square and other locations in south downtown. These markets traditionally have had transit access only via local streets.

5.6.1.1.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and Cover Tunnel Alternative, the transit network would generally be the same as that for the Bored Tunnel Alternative. Buses would be able to access the downtown Seattle via the stadium area ramps connecting to SR 99.

5.6.1.1.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, the transit network and any priority treatments would be same as those for the 2015 Existing Viaduct with the S. Holgate Street to S. King Street Viaduct Replacement Project. Buses would be able to access the central portion of downtown Seattle via the Columbia and Seneca Streets ramps and the stadium area ramps connecting to SR 99.

5.6.1.2 Central Area

This section describes transit network changes for the central area.

5.6.1.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), transit operations in the central area would be affected by expected conditions. Key locations that would likely experience the most pronounced increases in congestion include signalized intersections along Alaskan Way (surface arterial), intersections on First Avenue, and intersections along the one-way system of Second and Fourth Avenues. Second Avenue and Fourth Avenue are major transit corridors serving both Seattle and regional markets. High levels of congestion also would be expected on east-west transit connectors to and from I-5 between Union Street and James Street.

5.6.1.2.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, the Columbia and Seneca Street ramps would be removed. Access to and from downtown Seattle from the south would be provided by the northbound off-ramp and the southbound on-ramp to Alaskan Way at S. Dearborn Street. In general, under the Bored Tunnel Alternative, traffic operations on surface streets are expected to operate with less congestion and delay than that resulting from the Viaduct Closed (No Build Alternative) due to much lower traffic volumes.

5.6.1.2.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, the transit network would generally be similar to that for the Bored Tunnel Alternative.

5.6.1.2.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, the transit network and priority treatments would be the same as those for the 2015 Existing Viaduct with S. Holgate Street to S. King Street Viaduct Replacement Project.

5.6.1.3 North Area

This section describes transit network changes and transit priority treatments for the north area.

5.6.1.3.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), the Battery Street Tunnel would remain open, but most traffic is expected to exit the SR 99 corridor north of the tunnel. Key intersections on Broad Street and Wall Street (southbound SR 99 traffic) and on Battery Street (northbound SR 99 traffic) would be affected. Heavy queuing and long backups may be particularly severe at the SR 99 ramp termini intersections at Denny Way and on side-street exits; thereby affecting both north-south and east-west bus movements.

5.6.1.3.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, transit vehicles would use new SR 99 center lane on- and off-ramps at Harrison Street. This configuration would require southbound transit vehicles on SR 99 to weave across two lanes of traffic just south of Aloha Street to access the exit ramp in the center lane. In the northbound direction, transit vehicles entering SR 99 from Harrison Street would weave across northbound traffic on SR 99 in order to service stops along Aurora Avenue.

Transit lanes on Aurora Avenue between Harrison Street and Denny Way and along Battery and Wall Streets would provide continuous exclusive bus treatment from Third Avenue to the Harrison Street ramps in both directions, thereby improving the speed and reliability of bus service operating to and from SR 99.

The Bored Tunnel Alternative would also provide added traffic and pedestrian access across Aurora Avenue in the South Lake Union area. New east-west streets would connect John, Thomas, and Harrison Streets. The access improvements would result in opportunities for potential new transit connections as well as improved pedestrian access to transit in South Lake Union.

5.6.1.3.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and Cover Alternative, the transit network would differ from that of the Bored Tunnel Alternative in that it would not include the new north-south roadway (Aurora Avenue), which would limit transit access along SR 99 in South Lake Union and Uptown.

5.6.1.3.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, the transit network and priority treatments would be the same as those for the Cut-and-Cover Tunnel Alternative in the north area.

5.6.2 Modeled Transit Ridership at Corridor Screenlines

Projected daily transit ridership in 2030 at three selected screenlines is summarized in Exhibit 5-32. AM peak period transit ridership in 2030, which was estimated by the regional travel demand model, is summarized in Exhibit 5-33.

Exhibit 5-32. Model-Estimated Daily Transit Ridership (Person-Trips) at Selected Screenlines

Screenline	Viaduct Closed	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
South (south of S. King Street)	160,800	164,900	166,500	165,400
Central (north of Seneca Street)	162,400	178,000	180,400	182,100
North (north of Thomas Street)	165,400	168,400	166,700	167,600

Exhibit 5-33. Model-Estimated AM Peak Period Transit Ridership (Person-Trips) at Selected Screenlines

Screenline	Viaduct Closed	Bored Tunnel	Cut-and Cover Tunnel	Elevated Structure
South (south of S. King Street)	54,090	56,200	56,600	55,850
Central (north of Seneca Street)	48,500	54,090	54,690	54,950
North (south of Thomas Street)	50,990	52,530	52,300	52,670

5.6.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), daily transit ridership would range between 160,800 at the south screenline and 165,400 at the north screenline.

During the AM peak hour, 2030 ridership would range between 48,500 at the central screenline and about 54,100 at the south screenline. Comparisons of daily and peak period transit ridership resulting from the other alternatives are provided in the following sections.

5.6.2.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, daily transit ridership in 2030 would range between 164,900 at the south screenline and 178,000 at the north screenline. In the AM peak period, 2030 ridership would range between 52,530 at the north screenline and 56,200 at the south screenline.

Compared to the Viaduct Closed (No Build Alternative), daily transit ridership at the south and north screenlines would increase by approximately 2 percent under the Bored Tunnel Alternative. However, a much greater variation in ridership, about 10 percent, would occur for the Bored Tunnel Alternative at the central screenline as compared to the Viaduct Closed (No Build Alternative).

The higher level of 2030 daily transit ridership under the Bored Tunnel Alternative would be attributable to the better operating conditions for buses as compared to the Viaduct Closed (No Build Alternative). Under the Viaduct Closed (No Build Alternative), the Alaskan Way Viaduct would no longer be available and a replacement facility would not be provided. As a result, operating conditions in the affected corridor, including those at the three selected screenlines, would result in additional travel times for buses. The additional travel times, in turn, would result in lower daily transit demand. The more extensive difference in transit demand related to the central screenline would be attributable to the more lengthy travel times experienced by the large concentration of bus routes in this segment of the corridor.

During the AM peak period, the Bored Tunnel Alternative would result in 3 and 4 percent higher levels of transit ridership at the south and north screenlines, respectively, than those for the Viaduct Closed (No Build Alternative). A much greater variation in AM peak period ridership, about 12 percent, would occur at the central screenline under the Bored Tunnel Alternative as compared to the Viaduct Closed (No Build Alternative). The difference in daily transit ridership between the Bored Tunnel Alternative and the Viaduct Closed (No Build Alternative) would be comparable to the differences in the AM peak period.

5.6.2.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, daily and peak period transit ridership at each screenline would approximate the levels for the Bored Tunnel Alternative. Compared to the Viaduct Closed (No Build Alternative), there would be about a 4 percent increase in daily transit ridership with the Cut-and-Cover Tunnel Alternative at the south screenline and a 1 percent increase at the north screenline. However, a much greater variation in daily ridership, about 11 percent, would occur at the central screenline under the Cut-and-Cover Tunnel Alternative as compared to the Viaduct Closed (No Build Alternative).

As with the Bored Tunnel Alternative, the higher level of daily transit ridership under the Cut-and-Cover Tunnel Alternative would be attributable to the better operating conditions for buses as compared to those under the Viaduct Closed (No Build Alternative). The greater difference in transit demand related to the central screenline would be attributable to the more lengthy travel times experienced by the large concentration of bus routes in this segment of the corridor.

During the AM peak period, there would be about 3 percent higher levels of transit ridership under the Cut-and-Cover Tunnel Alternative at the south and north screenlines than those for the Viaduct Closed (No Build Alternative). A much higher variation in peak period ridership, about 13 percent, would occur under the Cut-and-Cover Tunnel Alternative at the central screenline as compared to the Viaduct Closed (No Build Alternative). During the peak periods, the difference in transit ridership between the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Viaduct Closed (No Build Alternative) would be comparable to those for daily ridership.

5.6.2.4 Elevated Structure Alternative

With the Elevated Structure Alternative, daily and peak period transit ridership at each screenline would approximate the levels for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. Compared to the Viaduct Closed (No Build Alternative), there would be about a 3 percent increase in daily transit ridership with the Elevated Structure Alternative at the south screenline and a 1 percent increase at the north screenline. A much greater variation in daily ridership, about 12 percent, would occur under the Elevated Structure Alternative at the central screenline as compared to the Viaduct Closed (No Build Alternative).

As with the Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative, the higher level of 2030 daily transit ridership under the Elevated Structure Alternative would be attributable to the relatively better operating conditions for buses as compared to those under the Viaduct Closed (No Build Alternative). The greater difference in transit demand related to the central screenline would be attributable to the more lengthy travel times experienced by the large concentration of bus routes in this segment of the corridor.

In the AM peak period, there would be about 3 percent higher levels of transit ridership under Elevated Structure Alternative at the south and north screenlines. A much greater variation in peak period ridership, about 13 percent, would occur under the Elevated Structure Alternative at the central screenline as compared to the Viaduct Closed (No Build Alternative). During the peak periods, the difference in transit ridership between the Bored Tunnel Alternative, the Cut-and-Cover

Tunnel Alternative, the Elevated Structure Alternative, and the Viaduct Closed (No Build Alternative) would be comparable to those for daily ridership.

5.6.3 Daily Transit Mode Share – Seattle Center City Travel

Daily transit mode shares involving Seattle Center City travel under each alternative are identified in the following subsections. The mode shares are for home-based work (i.e., commuting to work) and non-work travel in 2030 to, from, and within the Seattle Center City. The estimated daily transit mode shares for the Viaduct Closed (No Build Alternative) and the three build alternatives are indicated in Exhibit 5-34.

Exhibit 5-34. Model-Estimated Daily Transit Mode Shares: To, From, and Within Seattle's Center City

	Viaduct Closed	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
Home-based work	39.6%	41.0%	40.9%	40.6%
Non-work	9.8%	10.1%	10.0%	10.0%

5.6.3.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), about 40 percent of home-based work trips would use public transportation. For non-work travel, the transit mode share is estimated to be about 10 percent. Comparisons of ridership for the Seattle Center City under the build alternatives are provided in the following subsections.

5.6.3.2 Bored Tunnel Alternative

When compared to the transit share for the Viaduct Closed (No Build Alternative), the projected transit share of home-based work trips with the Bored Tunnel Alternative would be about 1 percent higher. For non-work trips, the transit share under the Bored Tunnel Alternative would be similar to the share under the Viaduct Closed (No Build Alternative). Although relatively small in terms of the percentage of variation, the higher share of home-based work trips under the Bored Tunnel Alternative represents a substantial number of added transit riders as compared to the Viaduct Closed (No Build Alternative).

With the Viaduct Closed (No Build Alternative), the Alaskan Way Viaduct would no longer exist, and a replacement facility would not be available. As a result, operating conditions for transit vehicles in the affected corridor under the Viaduct Closed (No Build Alternative) would likely contribute to slower operating speeds and a less usage by the public as compared to conditions under the Bored Tunnel Alternative.

5.6.3.3 Cut-and-Cover Tunnel Alternative

When compared to transit share for the Viaduct Closed (No Build Alternative), the projected transit share of home-based work trips with the Cut-and-Cover Tunnel Alternative would be about 1 percent higher. At about 40 percent and 10 percent, respectively, the transit shares of home-based work trips and non-work trips would be similar under the Cut-and-Cover Tunnel and Bored Tunnel Alternatives.

Although relatively small in terms of the percentage of variation, the higher share of home-based work trips under the Cut-and-Cover Tunnel Alternative represents a substantial number of added transit riders as compared to the Viaduct Closed (No Build Alternative). With the Viaduct Closed (No Build Alternative), the Alaskan Way Viaduct would no longer exist, and a replacement facility would not be provided. As a result, operating conditions in the affected corridor under the Viaduct Closed (No Build Alternative) would likely contribute to slower operating speeds and less usage by the public as compared to conditions under the Cut-and-Cover Tunnel Alternative.

5.6.3.4 Elevated Structure Alternative

When compared to the transit share for the Viaduct Closed (No Build Alternative), the projected transit share of home-based work trips with the Elevated Structure Alternative would be 1 percent higher. For non-work trips, the transit share under the Elevated Structure Alternative would be similar to the share under Viaduct Closed (No Build Alternative). At about 40 percent and 10 percent, the transit shares of home-based work trips and non-work trips, respectively, would be similar under all three build alternatives.

Although relatively small in terms of the percentage of variation, the higher share of home-based work trips under the Elevated Structure Alternative represents a substantial number of added transit riders as compared to the Viaduct Closed (No Build Alternative). With the Viaduct Closed (No Build Alternative), the Alaskan Way Viaduct would no longer be available, and a replacement facility would not be provided. As a result, operating conditions in the affected corridor under the Viaduct Closed (No Build Alternative) would likely contribute to slower operating speeds and less usage by the public as compared to conditions under the Elevated Structure Alternative.

As discussed further in Section 5.6.4, the Elevated Structure Alternative would result in shorter travel times for travel between West Seattle and downtown Seattle as compared to the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. However, the ridership estimates for Seattle Center City indicate that the Bored Tunnel Alternative would have higher ridership levels than those under the Elevated Structure and Cut-and-Cover Tunnel Alternatives.

5.6.4 Peak Hour Travel Times for Transit Corridors

The following subsections describe estimated 2030 peak hour travel times for several transit corridors primarily serving downtown Seattle. These travel times, for trips both entering and leaving downtown Seattle, were estimated for the three build alternatives. For the Viaduct Closed (No Build Alternative), potential transit travel times are discussed qualitatively.

Transit travel times are available for the Ballard to CBD (Denny Way) and Aurora Avenue, Second Avenue, and Fourth Avenue corridors. However, for some sections of the West Seattle to CBD corridor, the information from the mix of travel operations models does not identify transit-specific travel times explicitly. Therefore, travel time information for general-purpose traffic is referenced to allow comparisons between the modeled travel time conditions in 2030.

5.6.4.1 Viaduct Closed (No Build Alternative)

Peak hour travel times for the transit corridors under the Viaduct Closed (No Build Alternative) were not prepared due to the variability of traffic conditions when the viaduct is not in operation. Traffic conditions under this alternative would be severely congested to a degree where detailed traffic models are typically not reliable indicators of delays or traffic flow. Consequently, measures such as travel times cannot be meaningfully evaluated; instead, they are qualitatively discussed.

In the south area, SR 99 mainline traffic would transition from the previously reconstructed S. Holgate Street to S. King Street segment of SR 99 to and from the Alaskan Way surface street. This traffic would include buses connecting to downtown Seattle from West Seattle and other locations to the south. This roadway configuration at the SR 99/surface street interface would substantially reduce the capacity in the corridor relative to the capacity for alternatives that would provide a continuous SR 99 facility. As a result, severe backups in the AM peak hour are expected to form at the transition points, spreading elsewhere into the street network.

In the central area, the lack of throughput capacity would result in substantially more traffic and associated delays. These delays would affect transit operations, especially east-west movements that would not have the benefit of bus-only lanes.

In the north area, substantial effects on transit speed and reliability would occur, particularly in the area of Denny Way and SR 99. High concentrations of traffic demand in this area, particularly during peak commuting periods, would be forced to transition between Aurora Avenue N. and surface streets in order to access or travel through downtown Seattle. The high volumes of traffic on surface streets would also affect transit operations on Elliott Avenue.

5.6.4.2 Build Alternatives

Exhibit 5-35 shows estimated peak hour travel times in 2030 for five transit corridors with the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives. For the Elliott Avenue and Aurora Avenue corridors, transit travel times are provided by the VISSIM operations model. For the Second Avenue and Fourth Avenue corridors, travel times are provided by the Synchro operations model. Some sections of the West Seattle to CBD corridor reflect general-purpose traffic performance captured as a mix of results from the EMME travel demand model, VISSIM, and Synchro. However, a segment of the West Seattle to CBD corridor includes a northbound bus-only lane on SR 99 north of S. Holgate Street. For this portion of the corridor, travel times for transit and general-purpose traffic are identified.

Exhibit 5-35. Peak Hour Transit Travel Times Along Major Transit Corridors – All Build Alternatives

	AM Peak Hour (minutes)			PM Peak Hour (minutes)		
	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
Elliott Avenue[1]						
Southbound	8	8	8	8	8	8
Northbound	7	7	7	8	10	9
Aurora Avenue[2]						
Southbound	6	9	9	5	5	5
Northbound	7	6	6	7	5	5
Second Avenue[3]						
Southbound	14	14	14	15	15	14
Fourth Avenue[4]						
Northbound	14	13	14	14	13	13
West Seattle to CBD[5]						
Northbound	26	23	20	18	19	16
Southbound	16	14	12	27	24	22

Notes: CBD = Central Business District
1. Transit travel times on Elliott Avenue between the Ballard Bridge and Denny Way.
2. Transit travel times on Aurora Avenue between the Aurora Bridge and Denny Way.
3. Transit travel times on Second Avenue between Wall Street and S. Royal Brougham Way.
4. Transit travel times on Fourth Avenue between S. Royal Brougham Way and Battery Street.
5. Travel times are for general-purpose traffic; Fourth Avenue and Seneca Street is the terminus in Seattle CBD.

5.6.4.2.1 Elliott Avenue Corridor

For the Elliott Avenue corridor between the Ballard Bridge and Denny Way, relatively small differences between the alternatives are projected in terms of peak hour transit travel times. The greatest difference in transit travel times in the Elliott Avenue corridor would be 2 additional minutes for PM peak hour northbound travel under the Cut-and-Cover Tunnel Alternative as compared to the Bored Tunnel Alternative.

5.6.4.2.2 Aurora Avenue Corridor

Transit travel times in the Aurora Avenue corridor would be affected by roadway changes under each alternative in the north area. Of particular importance is the availability under the Bored Tunnel Alternative of arterial bus lanes on a new north-south arterial (Aurora Avenue) coupled with new east-west arterial connections to Aurora Avenue in the South Lake Union area. During the AM peak hour, longer transit travel times for southbound trips (approximately 3 minutes) would occur under the Cut-and-Cover Tunnel and Elevated Structure Alternatives as compared to the Bored Tunnel Alternative.

Under the Cut-and-Cover Tunnel and Elevated Structure Alternatives, traffic exiting in the South Lake Union area would be required to use ramps at Denny Way, which may result in backups on Aurora, thereby affecting both general-purpose traffic and transit access.

During the PM peak hour, shorter travel times would occur in the Aurora Avenue corridor for northbound trips under the Cut-and-Cover Tunnel and Elevated Structure Alternatives compared to the Bored Tunnel Alternative. Under the Bored Tunnel Alternative, buses would be serving new bus zones along the Aurora corridor, resulting in increased operating and dwell times; these zones would not be served by the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

5.6.4.2.3 Second and Fourth Avenue Corridors

Second and Fourth Avenues represent a one-way couplet (southbound only on Second Avenue and northbound only on Fourth Avenue) with large volumes of buses, particularly during peak hours.

The estimated differences in transit travel time between the alternatives would be no more than 1 minute. In the AM peak hour, transit travel times on Second Avenue would be the same for each alternative. Also in the AM peak hour, transit travel times on Fourth Avenue under the Bored Tunnel and Elevated Structure Alternatives would be approximately 1 minute longer than those under the Cut-and-Cover Tunnel Alternative.

In the PM peak hour, transit travel times on Second Avenue under the Bored Tunnel and Cut-and-Cover Tunnel Alternatives would be approximately 1 minute longer than those under the Elevated Structure Alternative. Also in the peak hour, travel times on Fourth Avenue under the Bored Tunnel Alternative would be approximately 1 minute longer than those under the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

5.6.4.2.4 West Seattle to CBD Corridor

General-purpose travel times in the West Seattle to CBD corridor would be influenced by the availability or absence of the Seneca and Columbia Street ramps in the central area. Under the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, traffic destined to the CBD would exit at the stadium area ramps. Under the Elevated Structure Alternative, the Seneca and Columbia Street ramps would be available, thereby providing a more direct trip to the corridor terminus at Fourth Avenue and Second Street.

Although the Bored Tunnel Alternative would increase travel time for general-purpose traffic destined to the CBD, buses would be able to access locations in the south area more directly. With the Elevated Structure Alternative, most transit riders with destinations in the Pioneer Square and stadium area would need to transfer to other bus routes to complete their trip.

During the AM peak hour, travel time for northbound traffic in the West Seattle to CBD corridor for the Elevated Structure Alternative would be approximately 6 minutes less than the travel time for the Bored Tunnel Alternative, and about 3 minutes less than the travel time for the Cut-and-Cover Tunnel Alternative. However, under all of the build alternatives, northbound transit vehicles could use a northbound bus-only shoulder lane located between S. Holgate Street and S. Dearborn Street during the AM and PM peak periods. Under the Bored Tunnel Alternative, this shoulder lane would result in a savings in transit travel time of about 1 minute compared to general-purpose traffic. For the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the savings in travel time would be less than 1 minute.

During the PM peak hour, travel time for northbound traffic in the West Seattle to CBD corridor for the Elevated Structure Alternative would be about 2 minutes less than travel time for the Bored Tunnel Alternative and about 3 minutes less than travel time for Cut-and-Cover Tunnel Alternative. For southbound trips during the PM peak hour, travel time for the Elevated Structure Alternative would be about 5 minutes less than the travel time for the Bored Tunnel Alternative and about 2 minutes less than the travel time for the Cut-and-Cover Tunnel Alternative. As with northbound trips during the AM peak hour, the additional travel time under the Bored Tunnel and Cut-and-Cover Tunnel Alternatives would be attributable to the lack of access ramps from SR 99 in the central area.

5.6.5 Intersection Level of Service Changes Affecting Transit

In addition to travel time changes along key corridors, transit service also could be affected by LOS conditions at intersections with bus operations. The following subsections summarize the changes in LOS expected for each alternative.

Information presented for the south, central, and north areas is based on the results of the LOS analysis described in Section 5.3. While the selected intersections are expected to include high volumes of buses, transit could also be serving other streets that currently do not have major transit coverage. The results presented in this section address streets with existing major bus operations.

5.6.5.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), at the south end of downtown Seattle, SR 99 mainline traffic would transition from the previously reconstructed S. Holgate Street to S. King Street segment of SR 99 to and from the Alaskan Way surface street. The transitions would be via a set of single-lane ramps connecting to an unimproved Alaskan Way at S. King Street. This configuration would substantially reduce the capacity of the corridor relative to the 2015 Existing Viaduct. As a result, severe backups, including those involving northbound buses from West Seattle and other locations south of downtown Seattle, are expected to form at transition points, spreading elsewhere into the street network.

Although the Viaduct Closed (No Build Alternative) was not specifically assessed in terms of intersection operations, inferences may be drawn based on modeled changes in travel patterns. The locations in the south end most likely to experience considerable congestion include the following:

- Transition ramps from SR 99 to Alaskan Way S./East Frontage Road/ S. King Street
- Intersections along First Avenue S. at S. Atlantic Street and at S. Royal Brougham Way
- Fourth Avenue S. and S. Jackson Street
- Along Alaskan Way north of S. King Street
- Most intersections on First Avenue between S. King Street and Madison Street

These locations are expected to operate with substantial levels of congestion under the Viaduct Closed (No Build Alternative) due to the large increases in traffic volumes diverted from the SR 99 corridor. At many of these locations, bus operations would be affected to the point that the speed and reliability of transit service would be disrupted.

5.6.5.2 Build Alternatives

The traffic analysis indicated that several locations with transit operations would be at LOS E or LOS F during peak hours. Intersections that are projected to operate at LOS E or LOS F are most likely to experience substantial congestion. Intersections that operate at LOS A through LOS D would experience little to moderate congestion levels and are generally not of concern.

The following subsections describe LOS at locations with transit service under the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives. Information is presented for the south, central, and north areas.

5.6.5.2.1 South Area

In general, traffic operations on surface streets in the south area would improve under the build alternatives as compared to the Viaduct Closed (No Build Alternative). Under the Bored Tunnel Alternative, most intersections evaluated in the south area are forecasted to operate at LOS D or better during the AM and PM peak hours. However, five intersections with bus operations would operate at LOS E or LOS F in 2030. In several locations, these LOS conditions would occur as a result of all three build alternatives.

The intersection of First Avenue S. and S. Atlantic Street would operate at LOS E or LOS F during the PM peak hour under all three build alternatives. The same intersection would operate at LOS F during the AM peak hour under the Cut-and-Cover Tunnel and Elevated Structure Alternatives, but it would operate at LOS D during the AM peak hour under the Bored Tunnel Alternative. The intersection of Fourth Avenue S. and Airport Way S. in the stadium area would operate at LOS E under all three build alternatives during the PM peak hour.

Higher ramp volumes at the S. Royal Brougham Way ramps in the AM peak hour under the Cut-and-Cover Tunnel Alternative would result in increased volume and delay at intersections near the ramp terminals, compared to the Bored Tunnel Alternative. Volumes on ramps to and from the north would likely be higher due to traffic traveling on SR 99 and using the Elliott/Western ramps.

Under the Bored Tunnel Alternative, the Elliott/Western ramps would not be open. Traffic instead would use surface streets, such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue to reach the intended destinations. The intersection of Fourth Avenue S. and S. Royal Brougham Way would operate at LOS F under the Bored Tunnel Alternative during the PM peak hour only. The increased volumes would degrade LOS at the affected intersections. The intersection of Fourth Avenue S. and S. Holgate Street would operate at LOS E during the PM peak hour under the Bored Tunnel Alternative. In the Pioneer Square area, the intersection of Second Avenue S. and S. Jackson Street would operate at LOS F during the PM peak hour under the Bored Tunnel Alternative. These intersections are expected to operate at LOS D or better under the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

5.6.5.2.2 Central Area

In general, bus operations on surface streets in the central area would improve under the build alternatives as compared to the Viaduct Closed (No Build Alternative). Most intersections evaluated in the central area under the Bored Tunnel Alternative, including locations with transit operations, are forecasted to operate at LOS D or better during the AM and PM peak hours. However, five intersections with bus operations would operate at LOS E or LOS F in 2030.

Under the Elevated Structure Alternative, the intersection of First Avenue and Columbia Street would operate at LOS F during the PM peak hour. Under the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, the same intersection would operate at LOS A, B, or C during the AM and PM peak hours. The intersection of Fourth Avenue and Seneca Street would operate at LOS E under all three build alternatives during the PM peak hour. However, two other intersections on Fourth Avenue, at Madison and Columbia Street, would operate at LOS E only under the Bored Tunnel Alternative during the AM peak hour. The intersection of Second Avenue and Marion Street would operate at LOS E under the Bored Tunnel Alternative during the AM and PM peak hours. The same intersection would operate at LOS D or better under the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

Traffic at these intersections would include substantial bus volumes. These intersections are all expected to operate under constrained conditions due to increased use of Second and Fourth Avenues as routes through the CBD as an alternative to the Elliott/Western ramp connection. This ramp connection would not be replaced under the Bored Tunnel Alternative.

5.6.5.2.3 North Area

In general, bus operations on surface streets in the north area would improve under the build alternatives as compared to the Viaduct Closed (No Build Alternative). Most intersections evaluated in the north area under the three build alternatives, including locations with transit operations, are forecasted to operate at LOS D or better during the AM and PM peak hours. However, 12 intersections with bus operations would operate at LOS E or LOS F in 2030 during the AM peak hour, the PM peak hour, and, in some cases, both the AM and the PM peak hours.

LOS E or LOS F is projected during both the AM and the PM peak hours for all three build alternatives at the following intersections:

- Aurora Avenue northbound on-ramp and Denny Way for the Elevated Structure and Cut-and-Cover Tunnel Alternatives and Aurora Avenue and Denny Way for the Bored Tunnel Alternative. (Access at this intersection is slightly different but comparable under the three build alternatives.)
- W. Mercer Place and Elliott Avenue W.
- Dexter Avenue N. and Denny Way (except for the Elevated Structure Alternative during the AM peak hour with LOS D)
- Dexter Avenue N. and Mercer Street
- Westlake Avenue N. and Mercer Street
- N. Fairview Avenue/I-5 ramp and Mercer Street

Other intersections would operate at LOS E or LOS F during either the AM peak hour or the PM peak hour under one or more of the build alternatives:

- Fifth Avenue N. and Mercer Street during the PM peak hour: all build alternatives
- Fifth Avenue N. and Roy Street during the AM peak hour: Bored Tunnel Alternative
- Aurora Avenue off-ramp and Denny Way during the PM peak hour: Cut-and-Cover Tunnel and Elevated Structure Alternatives (this location is comparable to the Bored Tunnel Alternative results for Aurora Avenue and Denny Way)
- Ninth Avenue N. and Mercer Street during the PM peak hour: all three build alternatives

Two intersections would operate at LOS E or LOS F only under the Bored Tunnel Alternative during the AM peak hour, the PM peak hour, or both:

- First Avenue and Denny Way during the AM and PM peak hours
- Sixth Avenue and Battery Street during the PM peak hour

Note that for the Aurora Avenue and Denny Way intersection, LOS was not analyzed for either the Cut-and-Cover Tunnel Alternative or the Elevated Structure Alternative. LOS for the Denny Way/Aurora Avenue on-ramp and Denny Way/Aurora Avenue off-ramp would be comparable to conditions under the Bored Tunnel Alternative.

Changes in access between SR 99 and the local street grid in the north area could attract additional trips. As a result, some increases in local street congestion that would affect transit operations are expected. The new street connections and intersections constructed under the Cut-and-Cover Tunnel, Elevated Structure, and Bored Tunnel Alternatives all would operate at LOS D or better. These new facilities also would allow new east-west pedestrian access to transit in South Lake Union.

5.6.6 Transit Priority Measures for Alternatives

This section identifies transit priority measures expected under each alternative. These measures would complement bus operations serving the project area in 2030. Exhibit 5-36 shows the location of the peak-only northbound bus lane on SR 99 in the area south of downtown Seattle. This lane would be provided under the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives. Exhibit 5-37 shows the location of the bus-only lanes on the new surface Aurora Avenue that would be provided under the Bored Tunnel Alternative only. The bus-only lanes would continue south of Denny Way to Third Avenue. However, between Fifth and Third Avenues, these lanes would be included in baseline characteristics and would not be components of the Bored Tunnel Alternative.

Exhibit 5-36
Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative
Peak-Only Northbound Bus-Only Lane on SR 99 – South Area

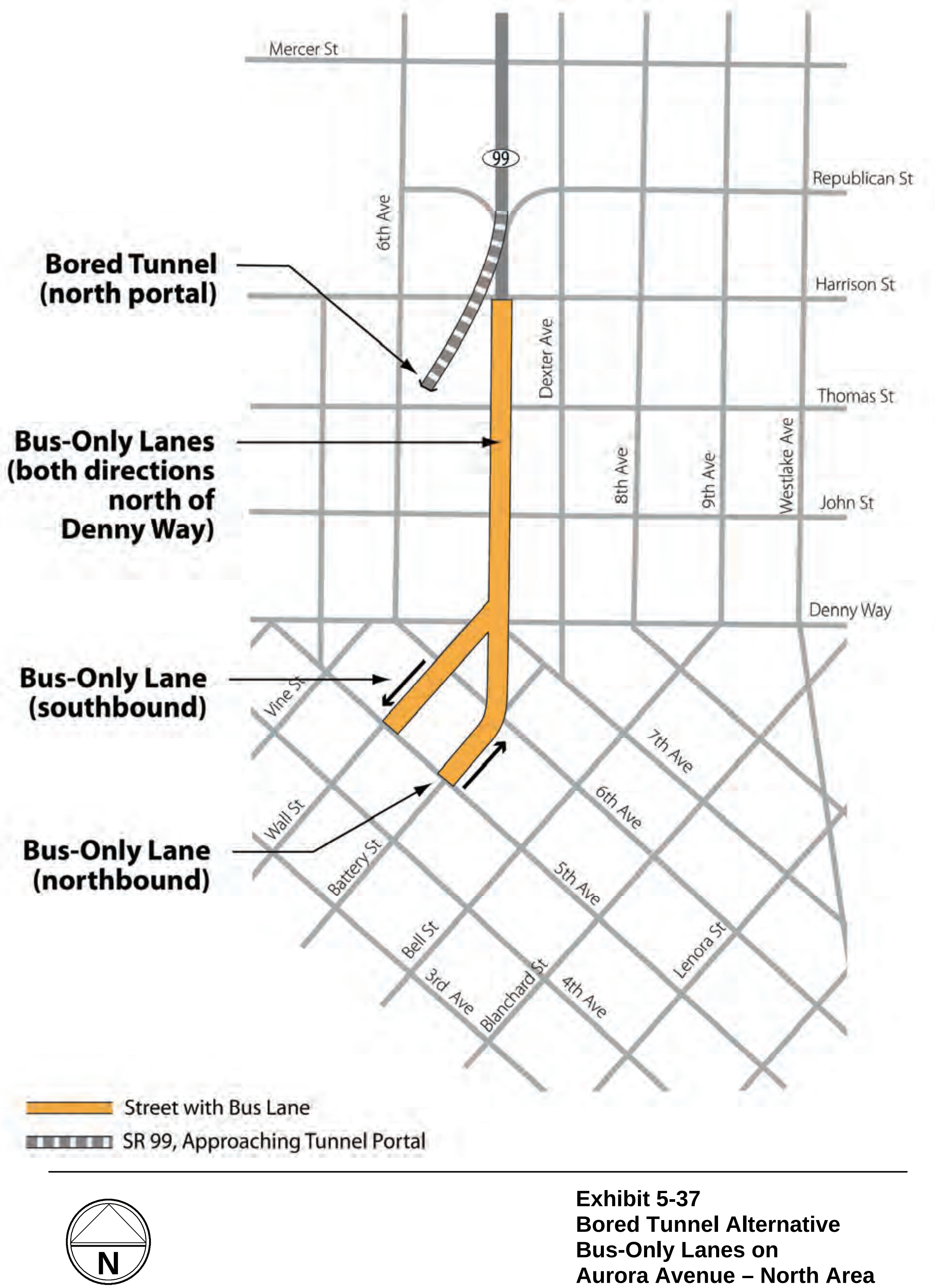


Exhibit 5-37
Bored Tunnel Alternative
Bus-Only Lanes on
Aurora Avenue – North Area

5.6.6.1 Viaduct Closed (No Build Alternative)

With the Viaduct Closed (No Build Alternative), no added priority measures such as bus-only lanes would be provided. Although existing transit priority facilities on surface streets would still be in place, substantial volumes of buses are expected because the viaduct would no longer be available. These added volumes would particularly affect operations of bus-only lanes on Second and Fourth Avenues in the central area as well as on Aurora Avenue in the north.

5.6.6.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, a peak-only shoulder bus-only lane would be provided on northbound SR 99 from approximately S. Holgate Street to the beginning of the northbound right-turn pocket at S. Dearborn Street. The bus-only lane would allow transit vehicles to bypass potential queues emanating from the intersection at the ramp terminus. In addition, in the north, right-side arterial transit lanes would be provided on the new north-south arterial (Aurora Avenue N.) between Denny Way and Harrison Street to facilitate transit flow through this area. The primary benefit of this transit lane is expected to be the priority treatment for transit operations through the Denny Way intersection.

5.6.6.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, a peak-only shoulder bus-only lane would be provided on northbound SR 99 from approximately S. Holgate Street to the beginning of the northbound right-turn pocket at S. Dearborn Street. The bus-only lane would allow transit vehicles to bypass potential queues emanating from the intersection at the ramp terminus. As compared to the Bored Tunnel Alternative, transit service under the Cut-and-Cover Tunnel Alternative would not benefit from the bus-only lanes provided on the new north-south arterial (Aurora Avenue N.).

5.6.6.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, a peak-only shoulder bus-only lane would be provided on northbound SR 99 from approximately S. Holgate Street to the beginning of the northbound right-turn pocket at S. Dearborn Street. The bus-only lane would allow transit vehicles to bypass potential queues emanating from the intersection at the ramp terminus. During the PM peak hour, southbound buses accessing SR 99 at Columbia Street would continue to operate in mixed traffic. In the north area, southbound buses during the AM peak hour would continue to be subjected to backups along Aurora Avenue N.

5.7 Truck Traffic and Freight

The key findings related to effects on truck traffic and freight are as follows:

- Under all of the build alternatives, freight connections between SR 99 and streets in the SODO area, including the stadium area ramps and East Marginal Way S., would be improved as a result of improved street connectivity provided by the S. Holgate Street to S. King Street Viaduct Replacement Project.
- Under the Bored Tunnel Alternative, freight connections to the Interbay and BINMIC areas would no longer be provided on SR 99 at the north end of the central waterfront (Elliott/Western ramps area). Freight traffic from Elliott/Western Avenues would connect to Alaskan Way via Broad Street. These trucks would experience potentially longer delays at Broad Street due to increased traffic, as well as regular train crossings. Connection to SR 99 in the south end of the central waterfront would occur roughly at S. King Street. Alternatively, this freight traffic could use Mercer Street to access the bored tunnel via the Republican Street ramps. Both the Cut-and-Cover Tunnel and the Elevated Structure Alternatives would still retain access to the Interbay and BINMIC areas via the ramps at Elliott/Western Avenues.
- Under the Bored Tunnel Alternative, ramp connections in the South Lake Union area would be altered compared to the existing connections. Direct connections to Mercer Street (northbound) for freight traffic headed to South Lake Union and to Broad Street (southbound) for freight traffic headed to the Uptown and Belltown areas would be eliminated and replaced by new connections to Republican and Harrison Streets. These new off-ramps would connect to cross streets, and they would be designed to accommodate truck movements.
- Under the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, hazardous and flammable cargo and over-height loads would be prohibited on SR 99 through downtown Seattle all day; they would have to be transported through downtown on either Alaskan Way or I-5. This change would affect freight from the Ballard/Interbay areas. Currently, hazardous and flammable materials are prohibited only during the peak hours on the Alaskan Way Viaduct and all day in the Battery Street Tunnel. Under the Viaduct Closed (No Build Alternative), peak hour restrictions for the transport of hazardous and flammable materials on the Alaskan Way Viaduct would be removed since the viaduct would be closed to all traffic, although all-day restrictions for hazardous and flammable materials for the Battery Street Tunnel would remain in effect.

- Under all of the build alternatives, truck travel times would generally be comparable, although trips that use the bored tunnel to travel the Ballard to S. Spokane Street corridor would experience longer travel times due to the removal of the Elliott/Western ramps.
- Under all of the build alternatives, minimal effects on freight rail operations are expected because the S. Holgate Street to S. King Street Viaduct Replacement Project will provide a grade separation for street and train traffic. Travel time could be increased at the railroad crossing at Broad Street, Wall Street, and Vine Street during peak hours due to higher volumes, as well as regular train crossings.
- All of the build alternatives are also expected to result in minimal impacts on rail operations at Broad Street and Alaskan Way. The Bored Tunnel Alternative would result in fewer traffic effects in the vicinity of the rail crossing (Elliott Avenue and Broad Street) during the AM peak hour compared to the Cut-and-Cover Tunnel and Elevated Structure Alternatives as more traffic is diverted to nearby arterials. The elimination of the Elliott and Western Avenue connections to SR 99 likely would be the reason for this diversion.
- The Bored Tunnel Alternative in the north portal area is designed to facilitate freight operations in the immediate area.

5.7.1 Freight Connections

5.7.1.1 South Area

5.7.1.1.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), it is assumed that the Alaskan Way Viaduct would not be in operation. As a result, the ramps at First Avenue S., Columbia Street, Seneca Street, Elliott Avenue, and Western Avenue would be closed. Alaskan Way would operate with its current lane configuration. Connections to and from the south serving areas such as West Seattle would be provided by ramps at Alaskan Way S. near S. Royal Brougham Way (to southbound SR 99) and First Avenue S. near S. Royal Brougham Way (from northbound SR 99).

5.7.1.1.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, full connections for freight would be provided between SR 99 and the local arterial system around the stadium area. Northbound off-ramps and southbound on-ramps would be provided at S. Royal Brougham Way for freight trips that wish to access downtown streets (or trips that would be prohibited from using the bored tunnel). Northbound freight vehicles with over-height loads or hazardous or flammable cargo would be required to exit

SR 99 at the stadium area to travel through downtown. Alaskan Way would remain a likely route for these vehicles.

5.7.1.1.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, full connections for freight would be provided in the south area, similar to the Bored Tunnel Alternative.

5.7.1.1.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, the roadway network would be the same as that under the 2015 Existing Viaduct, with improvements provided by the S. Holgate to S King Street Viaduct Replacement Project. Freight vehicles that currently use the Columbia and Seneca Street ramps would continue to do so because these ramps are part of this alternative.

5.7.1.2 Central Area

5.7.1.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), truck access along the central area would be facilitated by use of Alaskan Way or downtown streets, provided these trucks are not carrying restricted loads. Given the expected increase in traffic delay on downtown streets due to traffic diversion, many truck operators may use I-5 to travel through Seattle's Center City.

5.7.1.2.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, access to Alaskan Way along the central waterfront would be maintained for trucks that are excluded from the bored tunnel or are destined to areas northwest of downtown. Although the existing connections on SR 99 at Elliott and Western Avenues would no longer exist under the Bored Tunnel Alternative, freight would have access to areas in northwest Seattle via other routes, including connections from Alaskan Way to Broad Street and then to Elliott and Western Avenues. Travel times for freight would be slightly longer than those under 2015 Existing Viaduct, because vehicles would encounter signalized intersections along Alaskan Way. Travel time could be increased at the railroad crossing at Broad Street, Wall Street, and Vine Street during peak hours due to higher traffic volumes, as well as regular train crossings. In the north area, full connections would be provided between SR 99 and the local arterial system. Southbound freight vehicles with over-height loads or hazardous or flammable cargo would be required to exit SR 99 at Harrison Street to travel through downtown.

5.7.1.2.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, the roadway network would be similar to the network resulting from the Bored Tunnel Alternative, with the exception of the retention of the Elliott/Western ramps serving the Interbay, Queen Anne, Magnolia, Ballard, and BINMIC areas.

5.7.1.2.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, the roadway network would be the same as that under the 2015 Existing Viaduct. As with the Cut-and-Cover Tunnel Alternative, the Elliott/Western ramps would be retained.

5.7.1.3 North Area

5.7.1.3.1 Viaduct Closed (No Build Alternative)

Although the Battery Street Tunnel would remain open under the Viaduct Closed (No Build Alternative), the SR 99 corridor would terminate at the Denny ramps. Southbound traffic could exit either at Denny Way or farther upstream because heavy queuing is expected on the Denny off-ramp. The on-ramp to Aurora Avenue N. north of Denny Way would be retained. Truck operators seeking egress from or access to SR 99 would likely experience severe delays on nearby streets and intersections. The entire length of Broad Street would be retained under the Viaduct Closed (No Build Alternative).

5.7.1.3.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, the northbound off-ramp to Mercer Street would be replaced by a northbound off-ramp at Republican Street. Trucks would use this ramp to access Mercer Street (via Dexter Avenue N.). The newly constructed Sixth Avenue N. alignment for accessing southbound SR 99 from Mercer Street would affect freight operations. The connections for entering vehicles would be improved compared to the existing side-street connections, but the new alignment would also have steeper grades between Mercer and Harrison Streets.

The new alignment of Sixth Avenue N. would result in access to southbound SR 99 from Mercer Street for both eastbound and westbound freight traffic. Eastbound traffic (west of Aurora Avenue) would turn right onto Sixth Avenue N., and then left at the T-intersection at Republican Street. Westbound traffic would not be allowed to make a left turn to Sixth Avenue N. from Mercer Street. For freight operators that choose to access southbound SR 99 in the South Lake Union area, westbound traffic would be required to travel via a circuitous path to reach the southbound on-ramp. Westbound freight trips on Mercer Street would need to turn left on Dexter Avenue N., turn right on Harrison Street, cross SR 99, and turn right on Sixth Avenue N. to reach the Republican Street on-ramp. Because of the number of turns, the difficult right turns for trucks, and the tight curves at the on-ramp, some truck drivers may opt to bypass this route and take another route through the corridor. Another option would be to travel westbound on Mercer Street, turn right on Taylor Avenue N., then turn right on Roy Street with a connection to southbound Aurora Avenue. Trucks that access southbound Sixth Avenue N. from Mercer Street would encounter grades of about 6.5 percent. Those trucks continuing on after the Republican Street intersection (to Harrison Street) would encounter grades of 7.6 percent. These grades do not exceed City standards.

Overall, freight vehicles using the Mercer Street underpass would encounter grades on either side of SR 99 that may slow them down for a short distance. Grades on the Mercer Street underpass at Aurora Avenue would remain as they are today, at 7.5 percent on the west side. On the east side of Aurora, the Mercer Street grade would be 7.2 percent as a result of the two-way Mercer Project.

5.7.1.3.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, SR 99 north of the Battery Street Tunnel would be improved and widened up to Aloha Street. Access to SR 99 would be provided at Denny Way and Roy Street, and egress from SR 99 would be provided at Denny Way, Republican Street, and Roy Street. Two new bridges would be built at Thomas and Harrison Streets.

5.7.1.3.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, the road connections from the Battery Street Tunnel north would be the same as those under the Cut-and-Cover Tunnel Alternative.

5.7.2 Ability of Design to Facilitate Freight Operations

5.7.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), northbound truck traffic on the SR 99 mainline would need to connect to Alaskan Way at about S. King Street. All traffic, including trucks, would transition to single-lane ramps, which likely would result in increased demand and delay during the peak commuting periods. Truck operators desiring to use downtown city streets as an alternate to Alaskan Way would likely experience increased delay due to trip diversion.

Truck operators using Alaskan Way along the central waterfront would likely experience increased delay at signalized and unsignalized intersections due to higher volumes of general-purpose traffic.

Although the Battery Street Tunnel would remain open under the Viaduct Closed (No Build Alternative), the SR 99 corridor would terminate at the Battery Street/Western Avenue ramps. Unlike conditions under the three build alternatives, Broad Street would remain open between Fifth and Ninth Avenues N., providing a truck route that would help connect I-5 with the waterfront. However, key intersections on Broad Street and Wall Street (southbound SR 99 traffic) and on Battery Street (northbound SR 99 traffic) would be affected by increased traffic diverted from SR 99 in the north.

Restrictions due to hazardous or flammable cargo and over-height loads would no longer be in effect due to the closure of the Alaskan Way Viaduct. Current restrictions for the Battery Street Tunnel would likely remain in effect.

5.7.2.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, new connections in the South Lake Union area would be designed to adequately accommodate turning trucks at key intersections. In addition, with the closure of Broad Street east of Taylor Avenue N., trucks would use two-way Mercer Street to travel from SR 99 and I-5 to Fifth Avenue N. The likely truck route connecting I-5 to the waterfront would be Mercer Street (at I-5) to Fifth Avenue N., Fifth Avenue N. to Broad Street, and Broad Street to Alaskan Way.

As the project moves forward, the street designs would continue to evolve. While it is early in the design process, the project would continue to evaluate configurations that would provide adequate design features (e.g., adequate turning radii and lane widths) to facilitate turning movements for trucks (i.e., vehicles ranging from about 45 to 75 feet in length).

Hazardous and flammable cargo and over-height loads would be prohibited in the bored tunnel all day; they would have to be transported through downtown Seattle on either the Alaskan Way surface street or I-5. This change would affect freight from the Ballard/Interbay areas because hazardous and flammable materials are currently prohibited on the Alaskan Way Viaduct only during peak hours.

5.7.2.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, new connections in the South Lake Union area would be similar to those for the Bored Tunnel Alternative. In the north area, Broad Street, which is a popular street used by trucks to connect with I-5 and the waterfront, would be closed between Fifth and Ninth Avenues N. The truck route connecting I-5 to the waterfront would likely be the same as the route described for the Bored Tunnel Alternative.

Under the Cut-and-Cover Tunnel Alternative, restrictions on the transport of hazardous and flammable materials, including heating oil, are expected. The restrictions are expected to be similar to those for the Bored Tunnel Alternative. The primary alternate routes for transporting flammable and hazardous materials would be the Alaskan Way surface street or I-5.

5.7.2.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, new connections in the South Lake Union area would be similar to those for the Bored Tunnel Alternative. In the north area, Broad Street, which is a popular street used by trucks to connect with I-5 and the waterfront, would be closed between Fifth and Ninth Avenues N. The truck route connecting I-5 to the waterfront would likely be the same as the route described for the Bored Tunnel Alternative.

Under the Elevated Structure Alternative, restrictions on the transport of hazardous and flammable materials, including heating oil, are expected. The restrictions are expected to be similar to those in place today on the Alaskan Way Viaduct, with peak hour restrictions on the elevated structure for vehicles carrying hazardous materials and full prohibition in the Battery Street Tunnel. The primary alternate routes for transporting flammable and hazardous materials would be the same as those described for the Cut-and-Cover Tunnel Alternative.

5.7.3 Peak Hour Travel Times for Truck Freight Routes

The following subsections describe estimated 2030 AM and PM peak hour travel times for common travel routes used by freight trucks. These travel times are presented by direction for the three build alternatives. For the Viaduct Closed (No Build Alternative), the potential travel times are discussed qualitatively.

Exhibit 5-38 shows estimated peak hour travel times in 2030 for four typical truck freight corridors under the three build alternatives:

- Ballard to S. Spokane Street (via Mercer Street, bored tunnel)
- Ballard to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)
- Northgate to Boeing Access Road (via I-5)
- Mercer Street (via I-5 to Elliott Avenue W.)

The information is presented by direction for the AM and PM peak hours.

5.7.3.1 Viaduct Closed (No Build Alternative)

Under Viaduct Closed (No Build Alternative), 2030 travel times are expected to be substantially longer than the travel times for the three build alternatives. With the viaduct closed, truck traffic that would normally have used SR 99 through Seattle’s Center City would need to exit SR 99 in the south at S. Royal Brougham Way and travel to Alaskan Way, travel on city streets, or use I-5. Significant traffic diversion from SR 99 would lead to higher vehicle volumes on these alternate routes and greater delay, resulting in longer travel times.

5.7.3.2 Ballard to S. Spokane Street

Under the Bored Tunnel Alternative, freight trucks traveling from Ballard to S. Spokane Street using the bored tunnel would take 17 minutes going in the southbound direction during the AM peak hour; trucks carrying hazardous or flammable cargo would be prohibited from the bored tunnel all day and would need to travel through downtown Seattle on either Alaskan Way or I-5. During the AM peak hour, trucks traveling in the northbound direction would take 25 minutes to cover the length of the corridor.

Exhibit 5-38. Peak Hour Travel Times Along Major Corridors Used by Freight Trucks

	AM Peak Hour (minutes)			PM Peak Hour (minutes)		
	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure	Bored Tunnel	Cut-and-Cover Tunnel	Elevated Structure
Ballard to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)						
Southbound	17	16	15	19	21	20
Northbound	21	15	16	24	23	25
Ballard to S. Spokane Street (via Mercer Street, Bored Tunnel)						
Southbound	17	N/A	N/A	22	N/A	N/A
Northbound	25	N/A	N/A	27	N/A	N/A
Northgate to Boeing Access Road						
Southbound	31	31	31	38	38	38
Northbound	32	32	32	35	35	34
Mercer Street (I-5 to Elliott Avenue W.)						
Westbound	12	8	9	14	11	11
Eastbound	8	9	10	13	16	15

Note: N/A = not applicable

During the PM peak hour, truck traffic traveling in this corridor would take a little longer to cover the Ballard to S. Spokane Street corridor using the bored tunnel because demand (and delay) during the PM peak hour would generally be greater than that during the AM peak hour. In the southbound direction during the PM peak hour, trucks would take 22 minutes to cover the length of the corridor, whereas trucks traveling in the northbound direction would cover the corridor in 27 minutes.

Because they would be restricted from using the bored tunnel, trucks hauling hazardous and flammable materials between Ballard and the SODO areas would have the option to travel the corridor using Alaskan Way. In the AM peak hour, trucks traveling in the southbound direction in this corridor would take 17 minutes while those traveling in the northbound direction would take 21 minutes. In the PM peak hour, trucks traveling in the southbound direction would cover the corridor in 19 minutes. Those traveling in the northbound direction would take 24 minutes.

Under the Cut-and-Cover Tunnel Alternative, freight trucks traveling southbound on this route would take 16 minutes during the AM peak hour, and northbound trucks would take 15 minutes to travel the route. This travel time is slightly less than that under the Bored Tunnel Alternative and similar to that under the Elevated Structure Alternative. In the PM peak hour, trucks traveling the corridor would take about 21 to 23 minutes to travel in the southbound and northbound directions, respectively.

5.7.3.3 Northgate to Boeing Access Road

Under the Bored Tunnel Alternative, longer distance trucks traveling through Seattle's Center City would likely use I-5. During the AM peak hour, trucks traveling from Northgate to the Boeing Access Road (via I-5) would take 31 minutes to travel the length of the corridor. Trucks traveling in the northbound direction would take 32 minutes. During the more congested PM peak hour, it would take trucks 38 minutes to travel in the southbound direction. In the northbound direction, they would take 35 minutes to travel the length of the corridor. Trucks traveling to the north from downtown in the afternoon and to downtown from the north in the morning would enjoy the benefits of additional capacity (and higher speeds) provided by the directional I-5 express lanes.

In general, trucks operating in the I-5 corridor (Northgate to the Boeing Access Road) would experience similar travel times under all three build alternatives during the AM and PM peak hours.

5.7.3.4 Mercer Street

Mercer Street provides a popular route for truck trips traveling east-west across the city. Under the Bored Tunnel Alternative, during the 2030 AM peak hour, westbound trucks would expect to take 12 minutes to travel the corridor (I-5 to Elliott Avenue W.). Trucks operating in the eastbound direction would take 8 minutes to travel the corridor. The longer westbound travel times would be the result of additional traffic displaced from the bored tunnel due to the removal of the Elliott/Western ramps and the shifting of westbound traffic to Roy Street due to the conversion of Mercer Street to two-way traffic east of Fifth Avenue N., inducing out-of-the-way travel for freight operators.

During the PM peak hour, truck trips would take 14 minutes to travel in the westbound direction and 13 minutes to travel in the eastbound direction.

The Cut-and-Cover Tunnel Alternative would result in an AM peak hour westbound travel time that is slightly shorter than that of the Bored Tunnel Alternative at 8 minutes versus 12 minutes. In the eastbound direction, the travel time would be slightly longer than that of the Bored Tunnel Alternative at 9 minutes versus 8 minutes but shorter than that of the Elevated Structure Alternative at 9 minutes versus 10 minutes. During the PM peak hour, the Cut-and-Cover Tunnel Alternative would result in a travel time that is shorter than that of the Bored Tunnel Alternative at 11 minutes versus 14 minutes and comparable to that of the Elevated Structure Alternative in both directions. The Cut-and-Cover Tunnel Alternative would result in a slightly longer travel time in the eastbound direction in comparison to that of the Bored Tunnel Alternative at 16 minutes versus 13 minutes, and a slightly longer travel time in comparison to that of the Elevated Structure Alternative at 16 minutes versus 15 minutes.

5.7.4 Freight Train Operations

Minimal effects on rail operations are expected for the Viaduct Closed (No Build Alternative) and the three build alternatives because the S. Holgate Street to S. King Street Viaduct Replacement Project will separate street and train traffic. If closures of the rail line are necessary, they would be temporary.

All of the build alternatives are expected to result in minimal impacts on rail operations at Broad Street and Alaskan Way. None of the build alternatives should have any effect on the north portal of the train tunnel at this location. The Bored Tunnel Alternative would result in lower traffic volumes in the vicinity of the rail crossing (the intersection of Elliott Avenue and Broad Street) during the AM peak hour compared to those of the Cut-and-Cover Tunnel and Elevated Structure Alternatives as more traffic is diverted to nearby arterials due to the elimination of the Elliott and Western Avenue connections to SR 99. During the PM peak hour, the Bored Tunnel Alternative would result in greater delay at the intersection of Elliott Avenue and Broad Street because more traffic uses this intersection during the evening commuting hours. Intersection delays for the Cut-and-Cover Tunnel and Elevated Structure Alternatives would be about the same during the AM and PM peak hours. LOS for each of the build alternatives ranges from LOS C to D for both peak hours.

5.8 Parking

This section summarizes the effects of the alternatives on public parking. The discussion refers to the five areas that were evaluated for parking effects, which are referred to as subareas and are shown in Exhibit 4-41.

The key findings related to effects on parking are the following:

- There would be approximately twice as many parking spaces removed for the Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative as those removed for the Bored Tunnel Alternative.
- The effects on on-street and off-street parking in the stadium area would be the same for all three build alternatives, with about 110 on-street spaces removed and 250 off-street spaces removed.
- The Bored Tunnel Alternative would result in no long-term effects on existing parking under the viaduct, and it would not change the parking supply in the Pioneer Square, central, or Belltown subareas.

- The Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative would remove about half of the on-street parking spaces under the viaduct and along Alaskan Way in the central subarea.
- The parking effects north of the Battery Street Tunnel for the Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative would be the same. The Bored Tunnel Alternative would remove about 40 more on-street parking spaces in the north subarea than the other two alternatives.

Exhibit 5-39 summarizes the total on-street and off-street parking losses for each build alternative. All three build alternatives are expected to result in a reduction in parking facilities relative to existing conditions. The reduction in the number of parking spaces would be approximately 640 spaces for the Bored Tunnel Alternative, 1,190 for the Cut-and-Cover Tunnel Alternative, and 1,380 spaces for the Elevated Structure Alternative.

Exhibit 5-39. Public Parking Removals by Alternative

	Spaces Removed[1]		Net Change
	On-Street Spaces	Off-Street Spaces	
Bored Tunnel Alternative	-390	-250	-640
Cut-and-Cover Tunnel Alternative	-690	-500	-1,190
Elevated Structure Alternative	-750	-630	-1,380

Note: [1] Negative numbers indicate parking removals.

5.8.1 Viaduct Closed (No Build Alternative)

The Viaduct Closed (No Build Alternative) represents a condition where the SR 99 viaduct is closed to traffic. Closing the SR 99 viaduct would not affect parking spaces because there are no parking spaces on the viaduct. However, if the viaduct were to collapse, as in Scenario 2 of the Viaduct Closed (No Build Alternative), the parking under the viaduct would become unavailable. In that scenario, it also would be likely that the parking along Alaskan Way would be inaccessible for a time while the area is being cleared and restored.

5.8.2 Bored Tunnel Alternative

Exhibit 5-40 summarizes the potential parking effects of the Bored Tunnel Alternative. The Bored Tunnel Alternative would permanently affect parking spaces in the stadium subarea and the north subarea. No spaces in the Pioneer Square, central, or Belltown subareas would be affected in the final build conditions of the Bored Tunnel Alternative. Effects on additional parking spaces during construction are covered in Chapter 6, Construction Effects and Mitigation. Potential future removal of spaces related to the Alaskan Way surface street reconfiguration component of the Program is discussed in Chapter 8, Cumulative Effects.

Exhibit 5-40. Parking Effects of the Bored Tunnel Alternative

Subarea	Existing Conditions[1]			Spaces Removed[2]		Net Change
	On-Street Spaces	Off-Street Spaces	Total Spaces	On-Street Spaces	Off-Street Spaces	
Stadium	190	250	440	-110	-250	-360
North	320	0	320	-280	0	-280
Total spaces	**510**	**250**	**760**	**-390**	**-250**	**-640**

Notes: [1] Spaces within the streets affected by the Bored Tunnel Alternative.
[2] Negative numbers indicate parking removals.

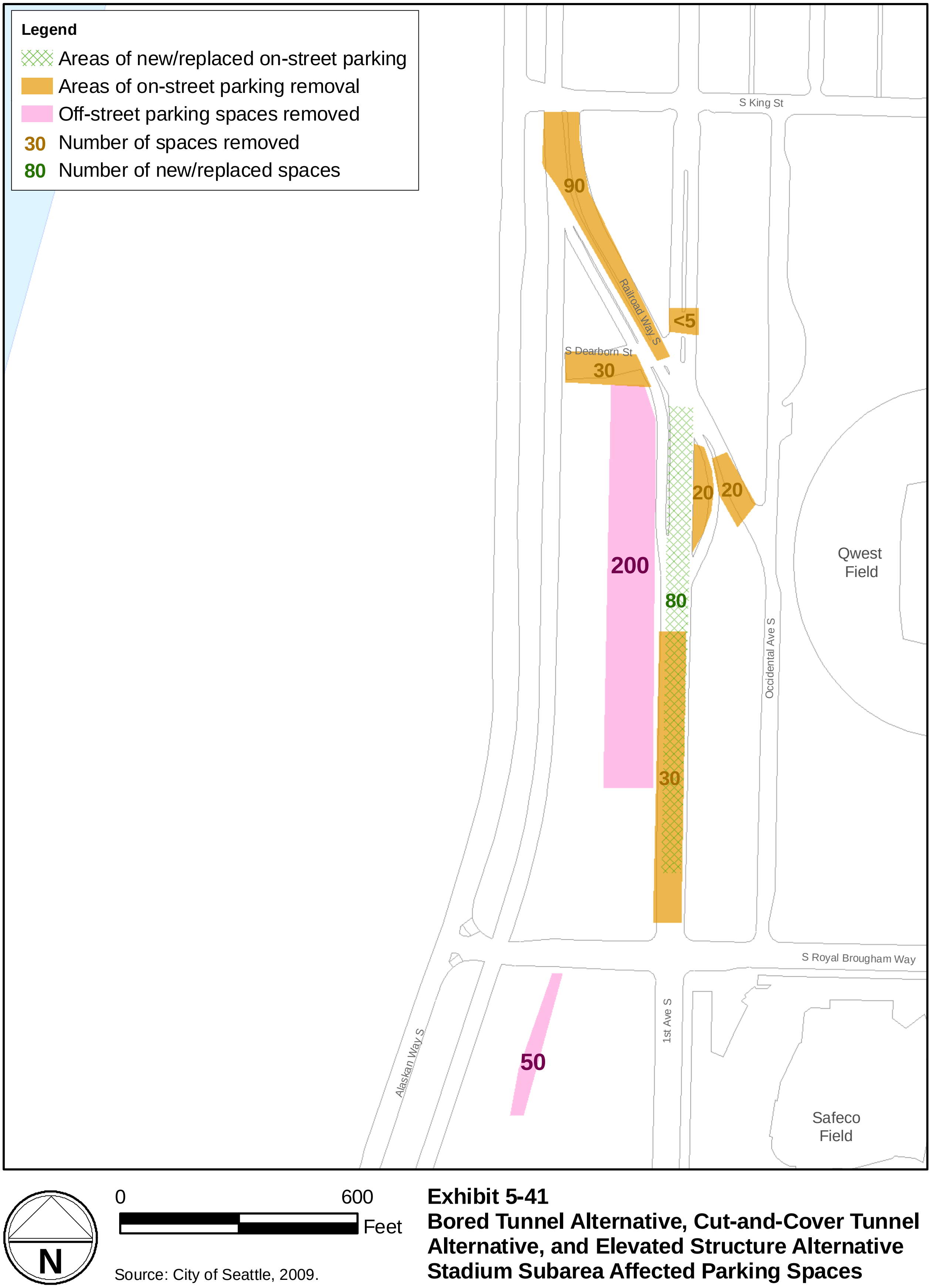
5.8.2.1 Stadium Subarea

Exhibit 5-41 shows the location of the affected parking spaces in the stadium subarea for the Bored Tunnel Alternative.

The stadium subarea encompasses the area from approximately S. Atlantic Street to S. King Street. There are currently about 190 on-street spaces in this area that are outside the boundaries of the S. Holgate Street to S. King Street Viaduct Replacement Project. Of these 190 spaces, 140 are short-term and 50 are long-term spaces. The Bored Tunnel Alternative would replace approximately 80 on-street spaces, with an overall loss of about 110 spaces. On-street parking is available within several blocks of the spaces that would be removed. Most of the on-street spaces that would be permanently removed are along Railroad Way S. and currently allow 2-hour metered parking. Drivers who would have otherwise used these spaces may have to travel several blocks farther to find available on-street spaces on surrounding streets, or they could use a pay lot.

The parking removals are consistent with Seattle's Comprehensive Plan (2005a). Goal TG18 indicates that in making decisions about on-street parking, transportation is the primary purpose of the arterial 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. SDOT will ultimately determine how on-street parking spaces are managed and will likely encourage short-term parking instead of long-term parking.

Approximately 250 off-street parking spaces would be permanently affected by the Bored Tunnel Alternative. Of these spaces, about 200 are on the WOSCA property and are currently unavailable due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project. However, the S. Holgate Street to S. King Street Viaduct Replacement Project assumed that these 200 spaces could be replaced. With the Bored Tunnel Alternative, there may be space on the WOSCA site to replace some of the off-street parking; however, the



Source: City of Seattle, 2009.

Exhibit 5-41
Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative Stadium Subarea Affected Parking Spaces

conservative assumption is that these spaces would not be replaced. As a result, the 200 spaces on the WOSCA site are included as an effect of the Bored Tunnel Alternative. Future use of the space will be decided by WSDOT or potential future property owners.

In the stadium subarea, the majority of the removed parking spaces would be off-street spaces (i.e., public pay lots), which are abundant and underutilized in the stadium area when events are not taking place. The off-street parking utilization rate for the stadium area is about 31.1 percent on an average non-event weekday (PSRC 2007a). Because parking lots are generally underutilized in the stadium area, parking spaces are not expected to be difficult to find during average days.

During events at the stadiums, finding available parking may be more challenging or may cost more than it current does. However, a number of major parking facilities are located near the stadiums, including the Safeco Field Garage, Qwest Event Center Garage, Union Station Garage, North Lot (Qwest Field), Impark Parking, and Home Plate Parking. These six parking facilities provide about 6,900 parking spaces for use during events. Many smaller parking lots and garages are also located within walking distance of the stadiums. Event-goers will continue to be encouraged to use bus and rail service and to carpool to the stadiums. The Safeco Field Transportation Management Plan (Baseball Club of Seattle, LLP, and the Seattle Mariners 2009) and the Qwest Field Transportation Management Program (Washington State Public Stadium Authority et al. 2009) both include parking reduction and transit-related goals and mitigation measures that aim to reduce the number of event attendees who require parking near the stadiums.

The Bored Tunnel Alternative would not affect parking in Pioneer Square, the central subarea, or the Belltown subarea in the built condition.

5.8.2.2 North Subarea

The north subarea extends from just south of Denny Way at the Battery Street Tunnel north portal along SR 99 to Aloha Street and includes some surrounding streets. There are approximately 90 on-street short-term parking spaces and approximately 230 on-street long-term spaces within the north portal area, for a total of 320 on-street spaces. The on-street long-term spaces mainly consist of metered spaces with a 10-hour limit. For the Bored Tunnel Alternative, approximately 40 spaces would be replaced, resulting in a loss of 280 on-street spaces, compared with existing conditions. Most of these spaces would be removed to accommodate bicycle lanes or vehicle lanes. Off-street public parking is not expected to be affected. The removal of these on-street spaces may make it more difficult to find on-street metered parking. However, there would be on-street parking spaces within a block or two of the spaces that would be removed, in addition to off-street lots and garages within several blocks. Exhibit 5-42 shows the location of the affected parking spaces in the north subarea.

As discussed for the stadium subarea, the removal of on-street parking spaces in the north subarea would be consistent with Seattle's Comprehensive Plan (City of Seattle 2005a). In making decisions about on-street parking, transportation is the primary purpose of the arterial street system. In addition, it is the City's general policy to replace short-term parking only when the project results in a concentrated and substantial amount of on-street parking loss. SDOT will ultimately determine how on-street parking spaces are managed; therefore, no assumptions are made about whether the new and replaced on-street spaces would be long- or short-term spaces.

5.8.3 Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would affect parking in all five subareas (Exhibit 5-43).

5.8.3.1 Stadium Subarea

Exhibit 5-41 shows the location of the affected parking spaces in the stadium subarea for the Cut-and-Cover Tunnel Alternative. The parking effects in the stadium subarea are the same as those described for the Bored Tunnel Alternative, and they are the same for all three build alternatives.

5.8.3.2 Pioneer Square Subarea

The Cut-and-Cover Tunnel Alternative would affect approximately 180 on-street parking spaces in the Pioneer Square subarea, from S. King Street to Columbia Street. Of these, about 70 would be replaced, resulting in about 110 fewer on-street parking spaces. Almost all of the affected spaces are short-term spaces, with the exception of about 10 unrestricted unmetered spaces along Alaskan Way. The loss of 110 on-street spaces could make it slightly more difficult for short-term parkers, such as shoppers and restaurant patrons, to find parking in this area. Exhibit 5-44 shows the locations of parking removals in the Pioneer Square, central, and Belltown subareas for the Cut-and-Cover Tunnel Alternative.

5.8.3.3 Central Subarea

The central subarea includes the parking under the viaduct and along Alaskan Way from about Columbia Street to Wall Street. Approximately 510 on-street spaces would be affected by the Cut-and-Cover Tunnel Alternative, of which 240 spaces would be permanently removed. These 240 spaces represent about half of the on-street spaces under the viaduct and along Alaskan Way. The remaining affected 270 spaces would be replaced. All of the 270 affected spaces in this area are short-term spaces, including passenger and taxi loading zones. On-street parking along the waterfront is highly utilized under existing conditions; therefore, the removal of many of the spaces would make it even more difficult to find parking.

Source: City of Seattle, 2009.

Exhibit 5-42
Bored Tunnel Alternative
North Subarea
Affected Parking Spaces

Exhibit 5-43. Parking Effects of the Cut-and-Cover Tunnel Alternative

Subarea	Existing Conditions[1]			Spaces Removed or Added[2]		Net Change
	On-Street Spaces	Off-Street Spaces	Total Spaces	On-Street Spaces	Off-Street Spaces	
Stadium	190	250	440	-110	-250	-360
Pioneer Square	180	0	180	-110	0	-110
Central	510	70	580	-240	-70	-310
Belltown	80	150	230	10	-150	-140
North	250	30	280	-240	-30	-270
Total spaces	**1,210**	**500**	**1,710**	**-690**	**-500**	**-1,190**

Notes: [1] Spaces within the streets affected by the Cut-and-Cover Tunnel Alternative.
[2] Negative numbers indicate parking removals, and positive numbers indicate a net gain in spaces.

Many parkers would likely need to seek short-term parking in surrounding parking garages, which could be more expensive and farther away from their destinations on the waterfront.

In addition to the on-street parking effects, there also would be an off-street public parking lot located across from the Seattle Aquarium that would be removed. This lot holds approximately 70 public pay spaces.

5.8.3.4 Belltown Subarea

The Belltown subarea includes parking along Alaskan Way north of Wall Street, plus parking on Battery Street and Elliott and Western Avenues. Approximately 80 on-street spaces would be affected by the Cut-and-Cover Tunnel Alternative. Due to the removal of the viaduct and reconstruction of Elliott and Western Avenues, about 90 spaces could be replaced, resulting in a net gain of about 10 spaces.

Two public pay lots under the viaduct in the Elliott/Western vicinity and one on Battery Street would be removed by the Cut-and-Cover Tunnel Alternative. These lots total about 150 spaces.

5.8.3.5 North Subarea

In the north subarea, about 250 on-street spaces and 30 off-street spaces would be affected by the Cut-and-Cover Tunnel Alternative. It would not be feasible to replace most of these spaces due to the reconfiguration of the roadways for travel lanes. A total of 240 on-street spaces in the north subarea would be removed. This includes about 70 short-term spaces and 170 long-term spaces, and 30 off-street spaces would also be removed, for a total of 270 spaces removed by the Cut-and-Cover Tunnel Alternative. The number of parking spaces removed is similar to the 280 spaces removed by the Bored Tunnel Alternative. However, the

Source: City of Seattle, 2009.

Exhibit 5-44
Cut-and-Cover Tunnel Alternative
Pioneer Square, Central, and Belltown Subareas Affected Parking Spaces

location of the spaces is different. Many of the spaces that would be removed by the Bored Tunnel Alternative are on Sixth Avenue N., and nearly all of the spaces are south of Broad Street. For the Cut-and-Cover Tunnel Alternative, about 70 of the affected spaces are north of Broad Street on Roy Street, Aloha Street, and Valley Street. The removal of the on-street spaces may make it more difficult to find on-street parking. However, there would be on-street parking spaces within a block or two of the spaces that would be removed, in addition to off-street lots and garages within several blocks. Exhibit 5-45 indicates the locations of the parking effects in the north subarea.

5.8.4 Elevated Structure Alternative

The Elevated Structure Alternative would affect parking in all five subareas (Exhibit 5-46).

The Elevated Structure Alternative would affect roughly the same number of parking spaces as the Cut-and-Cover Tunnel Alternative in the built condition. The Elevated Structure and Cut-and-Cover Tunnel Alternatives would affect about twice as many spaces as the Bored Tunnel Alternative in the built condition.

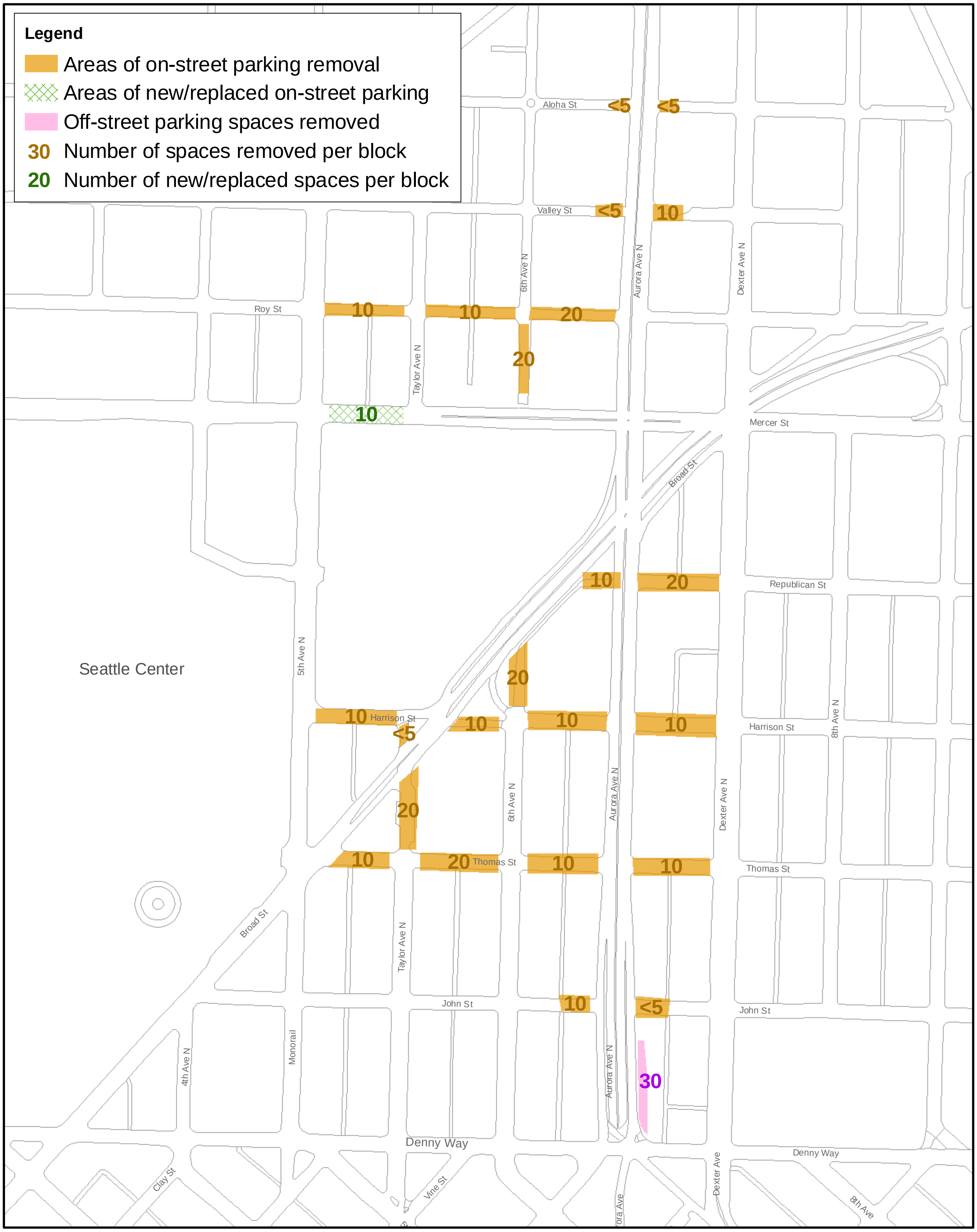
5.8.4.1 Stadium Subarea

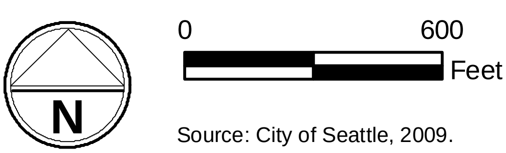
Exhibit 5-41 shows the location of the affected parking spaces in the stadium subarea for the Elevated Structure Alternative. The parking effects in the stadium subarea are the same as those described for the Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative.

5.8.4.2 Pioneer Square Subarea

The Elevated Structure Alternative would affect approximately 180 on-street parking spaces in the Pioneer Square subarea, from S. King Street to Columbia Street. Of these, about 50 would be replaced, resulting in about 130 fewer on-street parking spaces. Almost all of the affected spaces are short-term spaces, with the exception of about 10 unrestricted unmetered spaces along Alaskan Way. This loss could make it slightly more difficult for short-term parkers, such as shoppers and restaurant patrons, to find parking.

The Elevated Structure Alternative would also remove a parking garage on S. King Street that has approximately 130 spaces. This parking garage is within the project area for the Elevated Structure Alternative and would need to be demolished. The other two alternatives would not require the demolition of this parking garage. The net effect would be a loss of about 260 parking spaces in the Pioneer Square subarea.





Source: City of Seattle, 2009.

Exhibit 5-45
Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative North Subarea Affected Parking Spaces

Exhibit 5-46. Parking Effects of the Elevated Structure Alternative

Subarea	Existing Conditions[1]			Spaces Removed[2]		Net Change
	On-Street Spaces	Off-Street Spaces	Total Spaces	On-Street Spaces	Off-Street Spaces	
Stadium	190	250	440	-110	-250	-360
Pioneer Square	180	130	310	-130	-130	-260
Central	510	70	580	-250	-70	-320
Belltown	80	150	230	-20	-150	-170
North	250	30	280	-240	-30	-270
Total spaces	**1,210**	**630**	**1,840**	**-750**	**-630**	**-1,380**

Notes: [1] Spaces within the streets affected by the Elevated Structure Alternative.
[2] Negative numbers indicate parking removals.

Exhibit 5-47 shows the locations of parking removals in the Pioneer Square, central, and Belltown subareas for the Elevated Structure Alternative.

5.8.4.3 Central Subarea

The Elevated Structure Alternative would affect approximately 510 on-street parking spaces in the central subarea, of which 250 would be permanently removed. These 250 spaces represent about half of the on-street spaces under the viaduct and along Alaskan Way. The remaining 260 on-street spaces affected by the Elevated Structure Alternative would be replaced. All 250 affected spaces in this area are short-term spaces, including passenger and taxi loading zones. On-street parking along the waterfront is highly utilized under existing conditions; therefore, the removal of many of the spaces would make it even more difficult to find parking. Many parkers would likely need to seek short-term parking in surrounding parking garages, which could be more expensive and farther away from their destinations on the waterfront.

About 70 off-street spaces located in a surface parking lot on the east side of Alaskan Way near the Seattle Aquarium would be removed to accommodate the realigned Alaskan Way surface street.

5.8.4.4 Belltown Subarea

The Belltown subarea includes parking along Alaskan Way north of Wall Street, plus parking on Battery Street and Elliott and Western Avenues. Approximately 80 on-street spaces would be affected by the Elevated Structure Alternative and about 60 spaces would be replaced.

Two public pay lots under the viaduct in the Elliott/Western vicinity and one on Battery Street would be removed by the Elevated Structure Alternative. These lots total about 150 spaces.

Source: City of Seattle, 2009.

Exhibit 5-47
Elevated Structure Alternative
Pioneer Square, Central, and Belltown Subareas Affected Parking Spaces

5.8.4.5 North Subarea

The parking effects of the Elevated Structure Alternative in the north subarea are the same as those of the Cut-and-Cover Tunnel Alternative and are shown in Exhibit 5-45. As stated in Section 5.8.3.5, a total of 240 on-street spaces in the north subarea would be removed, including about 70 short-term spaces and 170 long-term spaces. About 70 of the affected spaces are located north of Broad Street on Roy Street, Aloha Street, and Valley Street.

5.9 Pedestrians

The key findings related to effects on pedestrians are the following:

- Pedestrian connectivity, mobility, and access would be improved in the south area. All three build alternatives would construct improvements that include the removal of the First Avenue S. ramps at Railroad Way S. and new cross street connections with associated sidewalk facilities between S. Royal Brougham Way and S. King Street east of the SR 99 ramp system. In addition, the Port Side Pedestrian/Bike Trail and City Side trail are included in the S. Holgate Street to S. King Street Viaduct Replacement Project.
- Pedestrian connectivity in the north area would also be improved. The Bored Tunnel Alternative would construct new crossings over SR 99 at John, Thomas, and Harrison Streets; the Cut-and-Cover Tunnel and Elevated Structure Alternatives would provide crossings at Thomas and Harrison Streets. Mercer Street would undergo improvements with all three build alternatives, and reconstruction of SR 99 would allow for improved sidewalk facilities. Broad Street would be closed to allow the street grid west of SR 99 to be connected from approximately Fifth Avenue N. to Ninth Avenue N.

5.9.1 Pedestrian Facilities Provided

5.9.1.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), no additional pedestrian facilities are expected to be constructed within the project area; therefore, the pedestrian facilities would be very similar to those described for the 2015 Existing Viaduct. However, a key difference between the 2015 Existing Viaduct and the Viaduct Closed (No Build Alternative) is the expected increase in vehicle traffic on surface streets through downtown Seattle. In certain instances, the increase in automobile traffic may result in an increase in intersection-related conflicts between pedestrians and automobiles at intersections. This could be particularly true for pedestrian crossings that conflict with right-turning automobile movements. In addition to potential pedestrian and automobile conflicts, pedestrians may also experience an increase in crossing wait times due to the expected increase in vehicle volumes on surface streets in downtown Seattle.

5.9.1.2 Bored Tunnel Alternative

5.9.1.2.1 South Area

Pedestrian crossings of the SR 99 ramp system would be at S. Dearborn Street, the overcrossing at S. Royal Brougham Way, and S. Atlantic Street. These sidewalk facilities would not directly connect to the Port Side Pedestrian/Bike Trail due to the BNSF tail track. However, the City Side Trail will be accessible from these sidewalk facilities, as it is located east of the tail track. Traffic volumes on arterial streets in the south area would be slightly lower, in general, than those with the Viaduct Closed (No Build Alternative); therefore, the potential for conflicts with pedestrians may be slightly lower.

5.9.1.2.2 Central Area

A new Alaskan Way promenade/public space along the waterfront would be provided as part of the Program, described in Chapter 8.

The Marion Street pedestrian bridge would be reconstructed after the removal of the viaduct to help maintain elevation for ferry passenger movements between the upper level of the ferry terminal and First Avenue.

5.9.1.2.3 North Area

North of the Battery Street Tunnel, the Bored Tunnel Alternative would construct new crossings over SR 99 at John, Thomas, and Harrison Streets. Mercer Street would be widened and modified for two-way operations, and the reconstruction of SR 99 would accommodate improved sidewalk facilities in the north area. In addition, Broad Street would be closed to allow the street grid west of SR 99 to be connected from approximately Fifth Avenue N. to Ninth Avenue N. A new Sixth Avenue N. would be provided between Harrison and Mercer Streets.

The new crossings at John, Thomas, and Harrison Streets would include approximately 10-foot-wide sidewalks on both sides. On the north side of Mercer Street, there would be 25 feet for bicycle and pedestrian pathways. A sidewalk would also be located along the south side of Mercer Street; it would end near the north portal. Under the Bored Tunnel Alternative, the modest decrease in arterial volumes compared to those of the Viaduct Closed (No Build Alternative) may slightly reduce the likelihood of vehicle-pedestrian conflicts.

5.9.1.3 Cut-and-Cover Tunnel Alternative

5.9.1.3.1 South Area

Under the Cut-and-Cover Tunnel Alternative, arterial volumes in the south area would be slightly lower than those resulting from the Bored Tunnel Alternative due to the Elliott/Western ramps. This may result in a slightly lower potential for vehicle-pedestrian conflicts compared to the Bored Tunnel Alternative.

Pedestrian accommodations south of S. King Street would be similar to those associated with the Bored Tunnel Alternative.

5.9.1.3.2 Central Area

In the central waterfront, the Cut-and-Cover Tunnel Alternative would feature a promenade with sidewalks on the west side of Alaskan Way between S. Jackson Street and Union Street. This area would be approximately 70 feet wide. The pedestrian promenade would be reduced to approximately 20 feet wide in the area near Pier 48, continuing north to Pier 66. Between approximately Union Street and Vine Street, the existing 20-foot-wide sidewalk along the waterfront would be replaced with a 15-foot-wide sidewalk that would widen to 25 feet at about Vine Street. On the east side of Alaskan Way between S. King Street and Pike Street, there would be a 20-foot-wide sidewalk with landscaping. Between Pike and Pine Streets, the sidewalk east of Alaskan Way would narrow to 13 feet, and from Pine Street to Broad Street, it would further narrow to 8 feet.

Pedestrian connections from the Pike Place Market vicinity to the waterfront would be provided by a landscaped walkway lid over the SR 99 roadway, called the Pike Place Market Lid. The lid would cover the top of the tunnel as it rises above the ground, providing a 100-foot-wide terrace between Union and Pine Streets. At the north end of the terrace, the lid would gradually ramp up to Victor Steinbrueck Park, extending the park by 75 feet on its western side. A stairway would connect the walkway lid to the east side of the waterfront at Pike Street, and elevators would provide Americans with Disabilities Act (ADA) access between the waterfront and the area around the north end of Pike Place Market. A pedestrian walkway would connect the north end of Victor Steinbrueck Park with the Lenora Street pedestrian bridge.

5.9.1.3.3 North Area

North of the Battery Street Tunnel, pedestrian connectivity would be improved across SR 99 and across what is currently Broad Street. Crossings of SR 99 would be provided at Thomas and Harrison Streets. As described for the Bored Tunnel Alternative, Mercer Street would include improved pedestrian facilities and Broad Street would be closed and backfilled. In contrast to the south area, under the Cut-and-Cover Tunnel Alternative, arterial volumes in the north area would be slightly higher than those resulting from the Bored Tunnel Alternative; this could slightly increase the risk for vehicle-pedestrian conflicts.

5.9.1.4 Elevated Structure Alternative

5.9.1.4.1 South Area

Similar to the Cut-and-Cover Tunnel Alternative, under the Elevated Structure Alternative, traffic volumes on south arterials would be lower than those resulting from the Bored Tunnel Alternative, resulting in a possible slight decline in vehicle-pedestrian conflicts.

Pedestrian accommodations south of S. King Street would be similar to those associated with the Bored Tunnel Alternative.

5.9.1.4.2 Central Area

In the central waterfront, the Elevated Structure Alternative would include a 10-foot-wide bicycle path and a 9-foot-wide sidewalk near Pier 48, on the west side of Alaskan Way. There would be an area up to about 50 feet wide on the east side of the elevated structure that would include a sidewalk and landscaping. Farther north along the waterfront, the pedestrian facilities would widen into a 20-foot promenade, 12-foot bicycle path, and 9-foot sidewalk on the west side of Alaskan Way. On the east side of the elevated structure, there would be an area up to about 34 feet wide consisting of a sidewalk and landscaping. On the east side of Alaskan Way, the bases of the elevated structure’s support columns would be located partially within the area containing the sidewalk and landscaping.

Near the Seattle Aquarium, a new park would be built, with the bicycle path and sidewalk located east of the park on the west side of Alaskan Way. Farther north on the west side of Alaskan Way, the pedestrian promenade would be about 15 feet wide. A sidewalk, varying from about 8 to 9 feet wide, would run along the east side of the Alaskan Way surface street, similar to current conditions.

5.9.1.4.3 North Area

North of the Battery Street Tunnel, the improvements would be the same as those described for the Cut-and-Cover Tunnel Alternative. Traffic volumes on arterials in the north area would be slightly higher for the Elevated Structure Alternative than for the Bored Tunnel Alternative, potentially increasing the risk of vehicle-pedestrian conflicts slightly.

5.9.2 Pedestrian Mobility and Access

5.9.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), no additional pedestrian facilities are expected to be constructed within the project area; therefore, the pedestrian facilities would be very similar to those described for the 2015 Existing Viaduct.

5.9.2.2 Bored Tunnel Alternative

In the south portal area, the addition of sidewalks as part of the new cross street connection provided by the Bored Tunnel Alternative would improve pedestrian mobility and access between the stadium and waterfront areas, as well as connectivity to regional facilities to the north.

A new Alaskan Way promenade/public space would be provided along the waterfront as part of the Program, described in Chapter 8.

North of the Battery Street Tunnel, the improvements associated with the Bored Tunnel Alternative that would provide connections across SR 99 at John, Thomas, Harrison, and Mercer Streets would dramatically increase pedestrian safety and mobility across SR 99 in the Seattle Center and South Lake Union areas and greatly improve the pedestrian experience. The Republican Street off-ramp would disrupt pedestrian flow along SR 99, similar to the disruption caused by the northbound off-ramp to Mercer Street today.

5.9.2.3 Cut-and-Cover Tunnel Alternative

South of S. King Street, the addition of sidewalks as part of the new cross street connection provided by the Cut-and-Cover Tunnel Alternative would improve pedestrian mobility and access between the stadium and waterfront areas.

The Pike Place Market Lid would improve the pedestrian connection to the waterfront from Victor Steinbrueck Park and the Pike Place Market area.

North of the Battery Street Tunnel, new connections would be constructed across SR 99 at Thomas, Harrison, and Mercer Streets, increasing nonmotorized mobility across SR 99 in the South Lake Union area. However, compared to the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would not provide as many connections across SR 99.

5.9.2.4 Elevated Structure Alternative

South of S. King Street, the addition of sidewalks as part of the new cross street connection provided by the Elevated Structure Alternative would improve pedestrian mobility and access between the stadium and waterfront areas.

Along the central waterfront, pedestrian mobility and access would be similar to today's conditions with the viaduct, although the Elevated Structure Alternative would be wider than the existing viaduct.

North of the Battery Street Tunnel, effects on pedestrian mobility and access would be the same for the Elevated Structure Alternative as those described for the Cut-and-Cover Tunnel Alternative.

5.10 Bicycles

The key findings related to effects on bicycle traffic are the following:

- The Mercer Street undercrossing would include a combined bicycle and pedestrian pathway on the north side of the roadway. This off-street facility would provide cyclists with considerably improved east-west mobility and rider experience in the Seattle Center/South Lake Union area.
- The connection of the street grid at John, Thomas, and Harrison Streets for the Bored Tunnel Alternative and at Thomas and Harrison for the Cut-and-Cover Tunnel Alternative and Elevated Structure Alternative would considerably enhance overall connectivity and accessibility for bicyclists.

5.10.1 Bicycle Facilities Provided

5.10.1.1 Viaduct Closed (No Build Alternative)

With the Viaduct Closed (No Build Alternative), no substantial additional bicycle facilities are expected to be constructed within the project area. However, a key difference between the 2015 Existing Viaduct and the Viaduct Closed (No Build Alternative) is the expected increase in vehicle traffic on surface streets through downtown Seattle. With the viaduct closed, traffic using Alaskan Way to enter downtown streets could conflict with the bicycle trail on the east side of Alaskan Way because turning vehicles increase the potential for conflicts. Bicyclists riding in the street or within marked bicycle lanes may face increased potential for conflicts with vehicles given the higher volume of traffic, particularly along Dexter Avenue N., Alaskan Way, and East Marginal Way S.

5.10.1.2 Bored Tunnel Alternative

Bicycle facilities in the south area would remain the same as those discussed in Section 4.10.2. The available facilities would include the Port Side Pedestrian/Bike Trail adjacent to the Port of Seattle properties on the west side of SR 99, and the City Side Trail as a combined pedestrian/bicycle facility that would continue north on the east side of the SR 99 ramp system to S. King Street. These trails are included as part of the S. Holgate Street to S. King Street Viaduct Replacement Project

A new Alaskan Way promenade/public space and Alaskan Way surface street improvements along the waterfront would be provided as part of the Program, described in Chapter 8.

Bicycle facilities in the north area would include bicycle and pedestrian pathways on the north side of Mercer Street. In addition to these facilities, the new John, Harrison, and Thomas Street crossings of Aurora Avenue would provide additional connectivity and mobility for cyclists in the Seattle Center/South Lake

Union area. The John Street crossing of Aurora Avenue would also include bicycle lanes in both directions.

5.10.1.3 Cut-and-Cover Tunnel Alternative

As discussed for the Bored Tunnel Alternative, bicycle facilities in the south area would remain the same as those discussed in Section 4.10.2 and would include the Port Side Pedestrian/Bike Trail and the City Side Trail.

Along Alaskan Way, 5-foot-wide bicycle lanes would be provided on each side of the street from S. King Street to Clay Street. These lanes would be an improvement for bicycles compared with existing conditions.

North of the Battery Street Tunnel, bicycle accommodations would be largely the same as described for the Bored Tunnel Alternative. However, the Cut-and-Cover Tunnel Alternative would not provide a connection over SR 99 at John Street. Bicycle facilities on the north side of Mercer Street would include bicycle and pedestrian pathways.

5.10.1.4 Elevated Structure Alternative

As discussed for the Bored Tunnel Alternative and Cut-and-Cover Tunnel Alternative, bicycle facilities in the south area would remain the same as those discussed in Section 4.10.2 and would include the Port Side Pedestrian/Bike Trail and the City Side Trail.

Along the central waterfront, the Port Side Pedestrian/Bike Trail would transition to a bicycle trail and sidewalk. The bicycle path would be approximately 10 to 12 feet wide. In addition, from S. Washington to Pine Streets, Alaskan Way would include space for bicyclists in the 14-foot-wide travel lanes in both directions. North of Pine Street, 4-foot-wide bicycle lanes would be provided on both sides of the Alaskan Way surface street, with the northbound bicycle lane widening to 5 feet north of Wall Street. These facilities would improve conditions for bicycles compared with existing conditions.

North of the Battery Street Tunnel, bicycle accommodations would be the same as those associated with the Cut-and-Cover Tunnel Alternative.

5.10.2 Bicyclist Mobility and Access

5.10.2.1 Viaduct Closed (No Build Alternative)

With the Viaduct Closed (No Build Alternative), no additional bicycle facilities are expected to be constructed within the project area; therefore, the bicycle facilities would be very similar to those described for the 2015 Existing Viaduct.

5.10.2.2 Bored Tunnel Alternative

In the south area, no additional bicycle facilities would be constructed as part of the Bored Tunnel Alternative. The available accommodations would remain the same, as discussed in Section 4.10.2. It is anticipated that both the Port Side Pedestrian/Bike Trail and the City Side Trail, which are part of the S. Holgate to S. King Street Viaduct Replacement Project, would improve bicyclist mobility and access in the area.

The shared-use facility on Mercer Street would increase bicycle connections across SR 99 and improve rider safety and overall experience in the Seattle Center/South Lake Union area. These enhancements to bicycle mobility would be further improved with the bicycle lanes included as part of the John Street crossing of SR 99. It should be noted that Dexter Avenue N. is projected to experience an increase in automobile traffic, and the northbound off-ramp to Republican Street would likely experience higher usage than the existing off-ramp to Mercer Street, largely due to improved access to westbound Mercer Street and other cross streets. The combination of these two changes may affect the comfort level of bicyclists and their use of the Dexter Avenue N. bicycle lanes and increase the potential for conflict between bicyclists and vehicles.

5.10.2.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, the bicycle facilities south of S. King Street would be similar to those provided by the Bored Tunnel Alternative; therefore, they would have similar effects on bicyclist mobility and access in the area.

Along the waterfront, bicycle lanes would be provided on both sides of Alaskan Way, increasing mobility for bicycles compared with existing conditions.

North of the Battery Street Tunnel, bicycle accommodations would be largely the same as those described for the Bored Tunnel Alternative, except that there would be no John Street crossing of Aurora Avenue N. This difference would not be enough to affect the overall mobility and access of bicyclists in the area as described for the Bored Tunnel Alternative.

5.10.2.4 Elevated Structure Alternative

Bicycle facilities south of S. King Street would be similar to those provided by the Bored Tunnel Alternative; therefore, they would have similar effects on bicyclist mobility and access in the area.

In the central waterfront, the Elevated Structure Alternative would include a bicycle path as well as space for bicyclists in the outside travel lanes on Alaskan Way. North of Pine Street, bicycle lanes would be provided on both sides of the Alaskan Way, which would increase mobility for bicycles compared with existing conditions.

North of the Battery Street Tunnel, bicycle accommodations would be largely the same as those described for the Bored Tunnel Alternative, except that there would be no John Street crossing of Aurora Avenue N. This difference would not be enough to affect the overall mobility and access of bicyclists in the area as described for the Bored Tunnel Alternative.

5.11 Ferries

Colman Dock, located on Piers 50 and 52 on Seattle's downtown waterfront, is the Seattle terminus for the Washington State Ferries. The passenger-only service from Vashon Island and West Seattle, operated by King County, also uses Colman Dock. Access to Colman Dock is provided from Alaskan Way at Yesler Way, and exits are provided to Alaskan Way at Yesler Way and Marion Street.

Travel model results and traffic analysis tools were used to determine potential effects on vehicles exiting or entering Colman Dock. In the future, signal operations for the ferries were assumed to remain similar to current conditions (i.e., vehicles exiting the ferries would preempt north-south traffic on Alaskan Way for 180 seconds).

The key findings related to effects on ferry users are the following:

- With the Viaduct Closed (No Build Alternative), volumes on Alaskan Way would be 20 to 40 percent higher in the vicinity of the Seattle Ferry Terminal compared with the Bored Tunnel Alternative. This would result in very poor operating conditions for vehicles entering and exiting Colman Dock, especially during the peak hours.
- During peak hours, overall LOS at the intersections of Alaskan Way at Marion Street and Alaskan Way at Yesler Way is forecasted to be LOS D or better for all three build alternatives.
- Under all three build alternatives, as with the existing ferry operations, service disruptions due to issues with vessels or terminals or demand spikes associated with peak summer holiday traffic would likely still cause some disruption to traffic operations along Alaskan Way in the vicinity of Marion Street and Yesler Way.

5.11.1 Viaduct Closed (No Build Alternative)

With the viaduct closed, traffic volumes on Alaskan Way would be 20 to 40 percent higher in the vicinity of the Seattle Ferry Terminal compared to the Bored Tunnel Alternative. This would result in very poor operating conditions for vehicles entering and exiting Colman Dock, especially during the peak hours.

5.11.2 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, the intersections of Alaskan Way at Marion Street and Alaskan Way at Yesler Way would continue to perform well (LOS D or better) during both the AM and PM peak hours even with the expected increase in background traffic over those time periods. As with existing ferry operations, however, service disruptions due to issues with vessels or terminal, or demand spikes associated with peak summer holiday traffic would likely still cause some disruption to traffic operations along Alaskan Way near Marion Street and Yesler Way. In these instances, vehicles trying to enter Colman Dock may exceed the storage capacity of the left-turn pocket in the current design and affect northbound through-traffic on Alaskan Way.

5.11.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, access to the Seattle Ferry Terminal would be similar to the access provided by the Bored Tunnel Alternative. The intersections of Alaskan Way at Marion Street and Alaskan Way at Yesler Way would continue to perform well (LOS D or better) during both the AM and PM peak hours. The Cut-and-Cover Tunnel Alternative would provide additional capacity on Alaskan Way, south of Yesler Way. This may help reduce traffic disruptions along Alaskan Way during service disruptions due to issues with vessels or terminals or demand spikes associated with peak summer holiday traffic.

5.11.4 Elevated Structure Alternative

Under the Elevated Structure Alternative, access to the Seattle Ferry Terminal would be similar to the access provided by the Bored Tunnel Alternative. The intersections of Alaskan Way at Marion Street and Alaskan Way at Yesler Way would continue to perform well (LOS D or better) during both the AM and PM peak hours. The Elevated Structure Alternative would provide additional capacity on Alaskan Way, south of Yesler Way. This may help reduce traffic disruptions along Alaskan Way during service disruptions due to issues with vessels or terminals or demand spikes associated with peak summer holiday traffic.

5.12 Safety

This section reviews the corridor design features to identify potential effects on traffic safety, including pedestrians and bicycles.

The key findings related to traffic safety are the following:

- The connection of the street grid between Denny Way and Mercer Street provided by the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative would result in substantially improved pedestrian, bicycle, and vehicle routes across SR 99, which is expected to decrease the number of pedestrian-vehicle collisions in this area (previously identified as a pedestrian accident location).

- North of the Battery Street Tunnel, the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative would consolidate access points, eliminate conflicting weaving movements that exist currently, and provide acceleration and deceleration lanes. These changes could potentially decrease collision rates on SR 99 between Denny Way and Mercer Street.
- The Bored Tunnel Alternative would decommission the Battery Street Tunnel and the associated northbound on-ramp and southbound off-ramp (the Battery Street ramps), as well as the Elliott/Western ramps, eliminating areas with higher than average collision rates at the ramps and within the Battery Street Tunnel.
- The Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative would remove the current midtown ramps at Seneca and Columbia Streets. This change would eliminate the current diverging, merging, and weaving movements associated with the Seneca and Columbia Street ramps that lead to queuing and collisions on the mainline.
- The Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative are expected to increase the total volume of traffic on the Alaskan Way surface street, which could increase the number of conflicts between vehicles, pedestrians, and cyclists. These effects would be mitigated by the design of Alaskan Way to moderate traffic speeds and provide frequent, signalized pedestrian crossings of Alaskan Way.

5.12.1 Viaduct Closed (No Build Alternative)

With the 2030 Viaduct Closed (No Build Alternative), traffic operations on I-5 and downtown surface streets would deteriorate considerably because drivers who previously used the viaduct would divert to these other roadways. From a safety perspective, the primary potential adverse effects associated with this alternative are the following:

- Potential increases in congestion-related collisions on I-5 and downtown streets, which would experience increases in both the duration and intensity of congestion
- Potential for collisions at exits from SR 99 north and south of the closed portions of the corridor resulting from abrupt changes in speed and severe congestion at the exits
- Increased potential for conflicts between vehicles, pedestrians, and cyclists resulting from additional traffic on streets throughout the downtown, South Lake Union, waterfront, and stadium areas

5.12.2 Bored Tunnel Alternative

Exhibits 5-48 and 5-49 highlight the updated design features that have relevance to the safe operation of the corridor for the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative, which are discussed in the following subsections.

Exhibit 5-48. SR 99 Mainline Design Features

Mainline Design Features	Location	Existing Facility	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Access control	Stadium area	Managed vehicle access (access by ramp connections only)			
	Midtown	Managed vehicle access (access by ramp connections only)			
	North	Partially managed (right-on, right-off) access	South of Mercer Street – managed vehicle access (access by ramp connections only); north of Mercer Street – partially managed (right-on, right-off) access		
Maximum grade (up or down)	Stadium area	5%	6.5%	5%	5%
	Midtown	4%	4%	7%	7%
	North area	5%	5.1%	7%	7%
Lane width	Stadium area	12–13.5 feet	11–12 feet	12 feet	12 feet
	Midtown	9.5–13 feet	11 feet	11–12 feet	12 feet
	North area	10–13 feet	11–12 feet	11–12 feet	11–12 feet
Inside shoulder width	Stadium area	1 foot	4–5 feet	2-4 feet	2–4 feet
	Midtown	1 foot	2 feet (SB) 8 feet (NB)[1]	4 feet	4–10 feet
	North area	1 foot	8 feet (SB) 8 feet (NB)	2 feet	2 feet
Outside shoulder width	Stadium area	1 foot	8–12 feet	10 feet	10 feet
	Midtown	1 foot	8 feet (SB)[1] 2 feet (NB)	10 feet	10 feet
	North area	0 feet (sidewalks)	8 feet (SB) 8–10 feet (NB)	10 feet	10 feet
Vertical clearance	Entire corridor	14 feet (Battery Street Tunnel)	15.5 feet (bored tunnel)	16.5 feet (cut-and-cover tunnel and upgraded Battery Street Tunnel)	16.5 feet (upgraded Battery Street Tunnel)

Exhibit 5-48. SR 99 Mainline Design Features (continued)

Mainline Design Features	Location	Existing Facility	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Pedestrian accommodation	Stadium area	Pedestrians prohibited; grade-separated crossings provided			
	Midtown	Pedestrians prohibited; grade-separated crossings provided			
	North area	Grade-separated crossings at Broad and Mercer Streets	Multiple grade-separated crossings between Denny Way and Mercer Street		

Notes: NB = northbound
SB = southbound
1. Contractor selected for construction of the Bored Tunnel Alternative has proposed an 8-foot shoulder, rather than a 6-foot shoulder as originally proposed.

5.12.2.1 Mainline Design Features

Within the project area, SR 99 is currently a controlled-access facility and would remain a controlled-access facility. Between S. Royal Brougham Way and Republican Street, SR 99 would be a full limited-access facility, with on-ramps and off-ramps the sole means of accessing the corridor. The access points provided by the Bored Tunnel Alternative would be improved considerably compared to many of the ramps in place today by designing to higher standards, consolidating access points, and eliminating many of the right-turn-on, right-turn-off access points on Aurora Avenue N. north of Denny Way.

The design of the Bored Tunnel Alternative would provide 11- to 12-foot-wide lanes along the length of SR 99 through the project area, providing drivers with more consistent lane widths and eliminating the excessively narrow (9.5- to 10-foot-wide) and wide (up to 13.5-foot-wide) lanes on the existing viaduct. Under the Bored Tunnel Alternative, the widths of the inside and outside shoulders would also be widened considerably relative to the shoulders on the existing viaduct and within the Battery Street Tunnel today. This shoulder widening would provide greater clearance between traffic and roadside barriers and additional space on the side of the roadway for disabled vehicles and emergency operations. The existing viaduct typically provides 1 foot for both the inside and outside shoulder width, whereas the Bored Tunnel Alternative would provide 2- and 8-foot-wide shoulders in the bored tunnel, and generally 8 to 10 feet elsewhere. While shoulders inside the bored tunnel would be improved compared to the viaduct today, they still would be narrower than prescribed by full limited-access facility standards. The vertical clearance would be improved as well, from 14 feet in the Battery Street Tunnel today to 15.5 feet in the bored tunnel.

Exhibit 5-49. SR 99 Ramp Design Features

Ramp Design Features	Location	Existing Facility	Bored Tunnel Alternative	Cut-and-Cover Tunnel Alternative	Elevated Structure Alternative
Maximum grade (up or down)	Stadium area	6%	6%–7%	7%	5%
	Midtown	8%	No midtown ramps provided	7%	8%
	North area	2%–3%	6%	7%	7%
Outside shoulder width	Stadium area	6 feet	2–8 feet	8 feet	8 feet
	Midtown	1 foot	No midtown ramps provided	8 feet	8 feet
	North area	N/A	4–10 feet	2–4 feet	2–4 feet
Ramp locations with design limitations (see narrative)	Stadium area	SB off-ramp to Railroad Avenue	N/A	N/A	N/A
	Midtown	NB off-ramp to Seneca Street, NB off-ramp to Western Avenue, NB on-ramp from Western Avenue, SB on-ramp from Columbia Street	N/A	N/A	NB Seneca Street off-ramp, SB Columbia Street on-ramp
	North area	Multiple, closely-spaced cross street connections	Ramps at Republican Street and Harrison Street; multiple, closely-spaced cross street connections north of Mercer Street		

Notes: N/A = not applicable
NB = northbound
SB = southbound

North of the Battery Street Tunnel, the SR 99 mainline would be fully grade-separated between Denny Way and Mercer Street, with access consolidated to ramp entrances and exits. John, Thomas, and Harrison Streets would be connected over SR 99, which would remain in a tunnel or cut-and-cover section. These new crossings would include sidewalks on both sides of the roadway and provide pedestrian and bicycle crossing opportunities at regular intervals. The redesigned Mercer Street crossing would also provide for grade-separated pedestrian access across SR 99. Collectively, these improvements are expected to sharply reduce or virtually eliminate illegal pedestrian crossings of the corridor, which have historically led to collisions involving pedestrians on the Aurora Avenue N. segment north of the Battery Street Tunnel.

5.12.2.2 Ramp Design Features

With numerous ramp connections—many with design limitations such as short deceleration lengths, limited vehicle storage, and high curvature–conflicts between entering, exiting, and through-traffic contribute to high collision rates on some SR 99 segments today (see Chapter 4, Affected Environment, for details). The Bored Tunnel Alternative would consolidate access locations to fewer ramps and improve the geometric characteristics of these ramps, features that are expected to reduce the collision rate on the SR 99 corridor and connecting ramps.

Although the Bored Tunnel Alternative would improve the ramp designs considerably compared to the existing facility, topographic features and the densely developed urban setting dictate that some ramps under the Bored Tunnel Alternative include some design deviations from the standards. In the stadium area, the northbound on-ramp to SR 99 would have a reduced merge section relative to the full standard. In the north end, the southbound on-ramp from Sixth Avenue N. would have a short acceleration lane, while the southbound off-ramp to Harrison Street would have reduced gore width. On northbound SR 99, the surrounding features dictate a sharp 90-degree curve and short off-ramp to Republican Street. Even with these limitations, these ramp designs are expected to operate with improved safety relative to the current side-street connections provided on the existing facility.

5.12.2.3 Surface Streets

Under the Bored Tunnel Alternative, additional traffic would use Alaskan Way to access downtown, especially between the Alaskan Way S. ramps and Spring Street. The increase in volumes on Alaskan Way would create the potential for more conflicts between vehicles, pedestrians, and bicyclists relative to the 2015 Existing Viaduct along Alaskan Way, though to a much lesser degree than the potential under the Viaduct Closed (No Build Alternative) (see Section 5.1.7 for further information on changes in traffic patterns). The design process for the central waterfront, which is a separate project, is expected to incorporate traffic-calming features that regulate the speed of traffic and provide regularly spaced, signalized pedestrian crossings. Conflicts between pedestrians, bicyclists, and vehicles at former ramp locations downtown (Seneca Street and Columbia Street near First Avenue) would decrease considerably due to the elimination of these ramps.

5.12.3 Cut-and-Cover Tunnel Alternative

Under the Cut-and-Cover Tunnel Alternative, 12-foot-wide lanes would generally be provided south of the Battery Street Tunnel, with 2-foot-wide inside shoulders and full (approximately 10-foot-wide) outside shoulders. Approaching the Battery Street Tunnel, lane and shoulder widths would taper to match the existing configuration. The Cut-and-Cover Tunnel Alternative would result in minor shoulder improvements and alignment changes on the Elliott/Western ramps that should have a positive effect on the incidence of collisions at these locations.

The Battery Street ramps would be closed, eliminating a major contributor to collisions at the south end of the Battery Street Tunnel. The Battery Street Tunnel would continue to have narrow lanes and shoulders and a set of reverse curves. The vertical clearance would be improved, however, from the current 14 feet to 16.5 feet.

North of the Battery Street Tunnel, the SR 99 mainline would be fully grade-separated between Denny Way and Mercer Street, with access consolidated to ramp entrances and exits. Collisions associated with the existing side street connections would be eliminated, which may reduce overall collision rates in this area. The new grade-separated crossings at Thomas Street and Harrison Street would provide additional pedestrian crossings and are expected to reduce the number of collisions involving pedestrians in the corridor.

As with the Bored Tunnel Alternative, traffic increases on Alaskan Way associated with closure of the Columbia and Seneca Street ramps and the related diversion of traffic to Alaskan Way could increase the potential for conflicts between vehicles, pedestrians, and bicyclists. This is expected to be mitigated by designing Alaskan Way for moderate travel speeds and providing frequent opportunities for pedestrian crossings.

5.12.4 Elevated Structure Alternative

Lane widths and shoulder widths would be improved on the elevated structure compared to the existing facility. Twelve-foot-wide lanes would generally be provided south of the Battery Street Tunnel, with increased inside shoulders and full (approximately 10-foot-wide) outside shoulders.

The northbound Seneca Street off-ramp would be reconstructed similar to its current configuration, with only minor improvements. Southbound, the Columbia Street on-ramp would be added as a fourth lane, rather than merging as the existing ramp does. Currently, vehicles merge from the on-ramp with limited sight distance to the left side of the mainline, causing one of the highest accident rates in the corridor. The new add lane is expected to reduce collisions associated with existing merging conflicts.

The Western/Elliott ramps, Battery Street Tunnel, and segment north of the Battery Street Tunnel would all have the same configurations and safety findings as those described for the Cut-and-Cover Tunnel Alternative.

5.13 Event Traffic

The key findings related to effects on event traffic are the following:

- The convergence of additional traffic streams into and out of the stadium area (due to the new ramp connections) for the various alternatives would continue to require traffic management measures for key arterials and intersections near the stadiums before and after large events.
- Improved access to and from SR 99 near the north area and added network redundancy across SR 99 for all the build alternatives would result in reduced congestion before and after Seattle Center events.
- Retention of the Elliott/Western ramps for the Cut-and-Cover Tunnel and the Elevated Structure Alternatives would provide more access options for events in the north area compared to the Bored Tunnel Alternative.
- Overall levels of traffic congestion for the three build alternatives would likely be similar. However, the Viaduct Closed (No Build Alternative) would result in far higher levels of congestion compared to other modeled conditions.

5.13.1 South Area

By the 2030 horizon year, sporting and other major events at Safeco Field and Qwest Field would likely continue to draw large crowds and result in high concentrations of traffic movements into and out of the stadium area before and after events. Regardless of the regional connections in place, vehicular and pedestrian-related congestion associated with such events would be managed in a manner similar to current practices in terms of detours, traffic control, and turning movement restrictions. Event-related traffic associated with the stadium facilities in the south area are discussed qualitatively below in the context of the four applicable modeled conditions: for the Viaduct Closed (No Build Alternative), Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative.

5.13.1.1 Viaduct Closed (No Build Alternative)

For the Viaduct Closed (No Build Alternative), traffic conditions during events in the south area would be adversely affected by the closure of SR 99 due to the removal of regional facility access to and from the north. While connections to and from I-5 would be maintained for broader regional access, these routes would become more congested as drivers increasingly rely on them to avoid delays on the local street network. North-south arterials in the downtown core such as First and Fourth Avenues would also experience greater levels of demand and congestion as drivers use these routes to continue north to communities such as Ballard and Green Lake.

5.13.1.2 Bored Tunnel Alternative

Changes to the street system in the stadium area for the Bored Tunnel Alternative would include the following:

- The surface frontage road west of First Avenue S. and east of SR 99 (known as the East Frontage Road) would be widened and would provide access to and from the north.
- The First Avenue S. ramps to and from the north (SR 99) would be removed but replaced by similar connections to and from the north of S. Royal Brougham Way and the East Frontage Road.
- The southbound weaving segment between the Columbia Street on-ramp and First Avenue S. off-ramp would be removed due to the new SR 99 ramp reconfiguration (e.g., removal of Columbia southbound on-ramp).
- New intersections along First Avenue S., Alaskan Way S. (extended segment), and East Marginal Way S. would be introduced between S. Royal Brougham Way and S. King Street.

These roadway changes would likely improve circulation and reduce overall congestion levels at critical intersections near the stadiums during large events by providing more direct access to regional facilities such as SR 99 and I-5. In addition, due to less reliance on First Avenue S. for access to and from the north in the modified roadway network, traffic levels on First Avenue S. between S. Royal Brougham Way and S. King Street may be reduced before and after events.

However, SR 99 ramp access at S. Dearborn Street (specifically to and from the south) may result in some increases in traffic demand on First Avenue S. north of S. Royal Brougham Way, thereby counteracting potential reductions in demand due to the ramp reconfigurations. Nonetheless, the overall reduction in circulation needed to access regional facilities should result in more efficient distribution of traffic into and out of the stadium area.

Similar opportunities for short-term traffic management and detour routing would be maintained with the new roadway network. Likewise, pedestrian movements would be managed at key crossing points near the stadiums and on major arterials, similar to current practices.

5.13.1.3 Cut-and-Cover Tunnel Alternative

The roadway network and improvements in the south area for the Cut-and-Cover Tunnel Alternative would be nearly identical to those for the Bored Tunnel

Alternative. Regional access to and from major roadway facilities such as SR 99, I-5, and I-90 before and after large events in the stadium area would be noticeably improved, thereby reducing overall event-related congestion levels. Higher concentrations of traffic may occur on First Avenue S. as a result of the ramp convergence areas between S. Royal Brougham Way and S King Street. However, the improved ramp connectivity to SR 99 would add significant capacity for event ingress and egress.

5.13.1.4 Elevated Structure Alternative

Access to and from event venues in the stadium area for the Elevated Structure Alternative would be similar to that for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives in terms of the general connectivity to and from regional roadway facilities such as SR 99, I-5, and I-90. However, the SR 99 ramps to and from the south would converge at the intersection of East Marginal Way S. and S. Dearborn Street, which would result in high levels of congestion and ultimately provide slightly less direct access to the stadium area. Consequently, the congestion impacts on event traffic may translate to longer delays and travel times to and from larger events compared to those of the Cut-and-Cover Tunnel Alternative. Nonetheless, the regional connections and added capacity for event ingress and egress provided by this alternative would be an improvement over existing conditions.

5.13.2 North Area

As discussed in Chapter 4, event traffic related to Seattle Center currently relies on Mercer Street, Denny Way, Broad Street, Elliott Avenue, Western Avenue, and various connections to and from SR 99 for ingress and egress before and after sporting events, concerts, festivals, etc. As Seattle Center aims to attract larger numbers of visitors in the future, attendance levels would generally increase and be accompanied by larger background demands on local streets and regional facilities such as SR 99 and I-5.

Substantial modifications to the local street system are proposed by the various build alternatives, which likely would improve access to and from SR 99 as well as across SR 99. Changes associated with the Bored Tunnel Alternative would add redundancy in the street grid and potentially reduce congestion during major events. Similar enhancements are included as part of the Cut-and-Cover Tunnel and Elevated Structure Alternatives in terms of access to, from, and across SR 99.

Event-related traffic associated with Seattle Center is discussed qualitatively below for the Viaduct Closed (No Build Alternative), Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative.

5.13.2.1 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), events at Seattle Center would generate high concentrations of traffic on all surface streets that provide access to parking garage and loading/unloading zones. Due to closure of the viaduct south of the Battery Street Tunnel, traffic interactions and delays on SR 99 (southbound) in the South Lake Union area would be more pronounced and would spill over to connecting surface arterials. Also, access to Seattle Center via the Elliott/Western ramps would no longer be available. As a result, access to and from the SR 99 corridor between Denny Way and Aloha Street would be compromised as event traffic mixes with the background trip activity to an even greater degree. Requirements for traffic control and management, directional signage, and potential lane restrictions would be extensive to ensure that event patrons are able to access event venues in a reasonable manner.

5.13.2.2 Bored Tunnel Alternative

The proposed roadway elements for the Bored Tunnel Alternative represent substantial changes to the street network near Seattle Center and areas adjacent to the South Lake Union neighborhood. Key elements associated with the Bored Tunnel Alternative include the following:

- Reconstruction of Aurora Avenue N. as a multilane surface roadway between Denny Way and Harrison Street
- Connection of roadways across SR 99 at John, Thomas, and Harrison Streets
- Removal of the Elliott/Western ramps to and from the north and south
- SR 99 ramps at Harrison Street connecting to Aurora Avenue N. to and from the north
- SR 99 ramps at Republican Street to and from the south
- Maintenance of SR 99 access at Roy Street and Aloha Street (both directions)
- Two-way Mercer Street from Dexter Avenue N. to Fifth Avenue N.

With greater redundancy in the street network provided by the Bored Tunnel Alternative, improved opportunities for traffic distribution across a more defined grid would be possible, thereby spreading traffic flow over a wider range of arterials and connectors. This would result in greater potential to reduce congestion on major arterials such as Mercer Street by providing alternative east-west routes and better circulating event trips to and from parking garages on the periphery of Seattle Center. While the capacity of Mercer Street to handle egress traffic after events would be reduced to some degree with the conversion of Mercer Street to two-way operations (compared to the original one-way system), the added east-west connectors (John, Thomas, and Harrison Streets) and access improvements to and from SR 99 should serve event traffic more efficiently overall. These benefits would be particularly noticeable for northbound access to Seattle Center before events. The two-way configuration of Mercer Street may also provide travel time benefits to traffic from I-5 heading toward Seattle Center before events.

In addition, the surface Aurora Avenue configuration would allow better pedestrian access to Seattle Center from SR 99/Aurora Avenue and across Aurora Avenue, including improved access for pedestrians who use transit.

5.13.2.3 Cut-and-Cover Tunnel Alternative

The network improvements in the north area for the Cut-and-Cover Tunnel Alternative would be slightly different from those for the Bored Tunnel Alternative in terms of ramp access and connectivity, but they would likely affect event traffic similarly. The differences between the Cut-and-Cover Tunnel Alternative and the Bored Tunnel Alternative in terms of network changes are summarized below:

- No Aurora Avenue N. surface roadway between Denny Way and Harrison Street
- Traditional right-side on- and off-ramps for SR 99 in the South Lake Union area (with the exception of a northbound left-side on-ramp from Denny Way)
- Retention of the Elliott/Western ramps to and from the south
- Full two-way Mercer Street conversion between Queen Anne Avenue and the I-5 ramps

These differences would result in greater event-related access options and more direct connections to and from I-5 (due to two-way Mercer Street west of Fifth Avenue N.) compared to the Bored Tunnel Alternative. As such, travel times are expected to be shorter and traffic concentrations are expected to be lower for the Cut-and-Cover Tunnel Alternative before and after large events at Seattle Center.

5.13.2.4 Elevated Structure Alternative

The network improvements associated with the Elevated Structure Alternative in the north area would be identical to those described for the Cut-and-Cover Tunnel Alternative. The differences between the Elevated Structure Alternative and the Bored Tunnel Alternative would relate to the lack of Aurora Avenue N. surface roadway, the presence of right-side on- and off-ramps for SR 99 in the South Lake Union area (with the exception of a northbound left-side on-ramp from Denny Way), retention of the Elliott/Western ramps, and full two-way Mercer Street conversion between Queen Anne Avenue and the I-5 ramps.

These changes would result in the same event-related access options and connection to and from I-5 as the Cut-and-Cover Tunnel Alternative. The travel times and traffic concentrations would therefore be similar before and after large events at Seattle Center.

5.14 Potential 2040 Effects on Operational Performance

This section provides a qualitative discussion of the potential effect of year 2040 conditions on the performance of the three build alternatives. Exhibit 5-50 shows projected land use in the central Puget Sound region by selected districts. Exhibits 5-51 and 5-52 show the projected growth in population and employment by district from 2005 to 2030 and from 2030 to 2040. Exhibit 5-53 provides a map of the selected districts. The districts that contain the majority of the expected SR 99 corridor users are the Greater Downtown, Northwest Seattle, and West Seattle districts and, to a lesser extent, the North Seattle and South Seattle districts. In general, the rate of growth for population and households in the corridor's primary market area is expected to be approximately the same between 2030 and 2040 and between 2005 and 2030, whereas growth in employment is expected to decrease somewhat. In particular, the growth in employment for the Greater Seattle district is expected to be only 5 percent between 2030 and 2040. Nonetheless, the absolute increase in population and employment in the corridor travelshed between 2030 and 2040 is expected to be substantial and result in an increase in travel within the corridor.

Travel demand forecasts rely directly on household, population, and employment forecasts. Compared to 2030 projections, there would likely be a somewhat higher level of travel demand in the SR 99 corridor in 2040. However, the rate of traffic growth between 2030 and 2040 would likely be less than the rate of land use growth for the following reasons:

- Transit mode share to and from downtown as well as within the Seattle city limits is expected to grow as Sound Transit Link LRT and King County RapidRide BRT expand and the roadway system becomes more congested, thereby encouraging greater usage of transit.
- Population in the Greater Seattle district is expected to grow substantially over the next 40 years, resulting in a higher proportion of residents living closer to their jobs—hence, a higher proportion of workers that would either walk or take local transit to work.

Overall, while land use in the SR 99 corridor is expected to grow by 6 to 7 percent on average between 2030 and 2040, growth in vehicle trips is expected to be somewhat less due to the reasons provided above. As a result, the overall operational effects of any of the build alternatives beyond what is projected for 2030 are not expected to be substantial.

Exhibit 5-50. Regional Land Use Forecasts Summarized by District

District Name	Total Households (housing units)			Total Population (persons)			Total Employment (persons employed)		
	2005	2030	2040	2005	2030	2040	2005	2030	2040
Greater Downtown	42,400	75,400	90,900	70,800	116,900	137,600	280,800	354,200	370,700
Northwest Seattle	52,400	61,200	65,200	106,000	116,700	121,200	39,700	54,000	61,400
West Seattle	35,400	38,500	41,300	78,800	80,100	83,300	19,200	26,900	31,400
North Seattle	91,300	110,000	117,800	198,600	223,000	231,900	108,000	138,200	150,400
South Seattle	45,800	55,500	60,800	120,700	135,800	144,600	112,900	135,100	148,400
Snohomish County and Shoreline	277,500	421,200	485,500	737,400	1,037,200	1,154,800	251,300	370,100	428,700
Eastside	203,500	286,900	320,300	515,900	668,500	721,900	343,000	493,500	540,300
S. King and Pierce Counties	513,300	716,100	815,000	1,350,800	1,748,400	1,923,000	592,800	793,000	906,100
Kitsap County	115,000	169,800	198,000	306,700	417,600	469,900	99,700	132,700	151,800
Regional total	1,376,500	1,934,600	2,194,800	3,485,700	4,544,200	4,988,100	1,847,400	2,497,700	2,789,300

Source: PSRC 2006.

Exhibit 5-51. Forecasted Land Use Growth Summarized by District

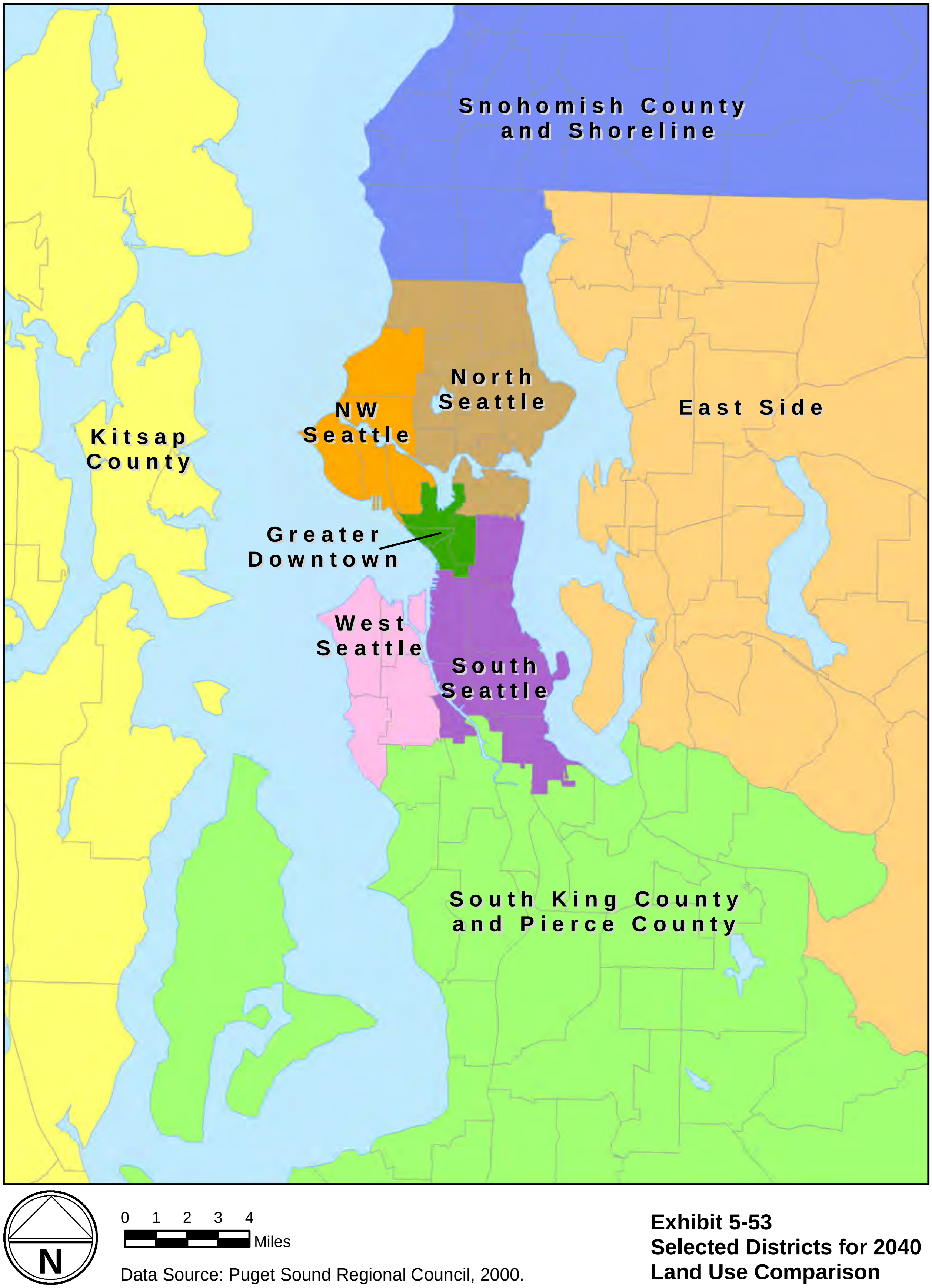
District Name	Household Growth		Population Growth		Employment Growth	
	2005–2030	2030–2040	2005–2030	2030–2040	2005–2030	2030–2040
Greater Downtown	33,000	15,500	46,100	20,700	73,400	16,500
Northwest Seattle	8,800	4,000	10,700	4,500	14,300	7,400
West Seattle	3,100	2,800	1,300	3,200	7,700	4,500
North Seattle	18,700	7,800	24,400	8,900	30,200	12,200
South Seattle	9,700	5,300	15,100	8,800	22,200	13,300
Snohomish County and Shoreline	143,700	64,300	299,800	117,600	118,800	58,600
Eastside	83,400	33,400	152,600	53,400	150,500	46,800
S. King and Pierce Counties	202,800	98,900	397,600	174,600	200,200	113,100
Kitsap County	54,800	28,200	110,900	52,300	33,000	19,100
Regional total	558,100	260,200	1,058,500	443,900	650,300	291,600

Source: PSRC 2006.

Exhibit 5-52. Forecasted Land Use Growth by Percentage, Summarized by District

District Name	Household Growth		Population Growth		Employment Growth	
	2005–2030	2030–2040	2005–2030	2030–2040	2005–2030	2030–2040
Greater Downtown	78%	21%	65%	18%	26%	5%
Northwest Seattle	17%	7%	10%	4%	36%	14%
West Seattle	9%	7%	2%	4%	40%	17%
North Seattle	20%	7%	12%	4%	28%	9%
South Seattle	21%	10%	13%	6%	20%	10%
Snohomish County and Shoreline	52%	15%	41%	11%	47%	16%
Eastside	41%	12%	30%	8%	44%	9%
S. King and Pierce Counties	40%	14%	29%	10%	34%	14%
Kitsap County	48%	17%	36%	13%	33%	14%
Regional total	41%	13%	30%	10%	35%	12%

Source: PSRC 2006.



Data Source: Puget Sound Regional Council, 2000.

Exhibit 5-53
Selected Districts for 2040
Land Use Comparison

5.15 Operational Mitigation

Because the operational effects of each of the build alternatives would be substantially better than those of the Viaduct Closed (No Build Alternative), long-term (after construction) transportation mitigation measures would not be necessary because all of the build alternatives would result in better long-term operations on SR 99 and adjacent city streets. Under the build alternatives, both travel times and intersection LOS in the study area would improve compared to the Viaduct Closed (No Build Alternative), and each of the build alternatives would result in lower daily traffic volumes on the Center City street grid than those of the Viaduct Closed (No Build Alternative).

Although tolling the build alternatives would likely result in additional volumes on streets in the north and south areas due to some drivers avoiding the toll, the daily volumes and resulting travel speeds and nonmotorized mobility would remain consistent with the classification of these streets and would be similar to those found on other arterials and streets in the Center City. Even with the diverted traffic, the transportation network would operate more effectively under the build alternatives than under the Viaduct Closed (No Build Alternative). (See Chapter 7 for further discussion of tolling effects.

Despite the expected operations under the build alternatives, WSDOT has acknowledged that an acceptable long-term solution should be sought to minimize the amount of diverted traffic due to tolling in order to optimize the operation of the transportation network. Strategies for optimization are being developed by the Tolling Advisory Committee, which is not a decision-making body. Therefore, when the committee completes its work in 2012, additional action may be required by Washington State, the City of Seattle, the Port of Seattle, and King County to implement the strategies developed by the committee or other tolling mitigation strategies developed before project completion. If necessary, additional environmental analysis may be performed to evaluate the potential effects of the proposed strategies before implementation. Potential strategies for reducing and managing diverted traffic are described in the following subsections.

5.15.1 Potential Strategies for Reducing Traffic Diversion

Potential strategies for reducing the amount of traffic diverted from SR 99 include the following:

- Refinements of the tolling strategy, which may include modifications of the toll rates and the times during which the tolls would be charged, as well as implementation of regional tolling and/or tolls on other state and city facilities
- A reduction in the amount of toll revenue needed (resulting in a reduced toll rate) by identifying alternative funding sources

5.15.2 Potential Strategies for Managing Traffic Diversion

Potential strategies for managing the traffic diverted from SR 99 include the following:

- Establishment of priorities for street use by time of day for various users (automobiles, trucks, bicycles, pedestrians, transit, and parking).
- Identification of opportunities for traffic calming and other restrictions on certain modes of travel
- Creation of “transit first” policies by means of transit priority streets and other methods to improve transit speed and reliability
- Use of other traffic demand management measures
- Funding for enhanced transit and vanpools

Chapter 6 CONSTRUCTION EFFECTS AND MITIGATION

This chapter summarizes the construction activities and the potential transportation effects for each of the build alternatives by traffic stage. It reviews the traffic management approaches (detours) and expected performance associated with major construction stages. Finally, mitigation measures to keep people and goods moving during construction are discussed.

The potential construction effects vary substantially among the build alternatives. Exhibit 6-1 provides an overview of the construction duration and SR 99 closures estimated for each build alternative. Because of the dynamic nature of construction activities, the transportation effects would vary according to the construction stage. The most disruptive construction stage for each of the build alternatives was assumed for this analysis of transportation effects. Generally, the most disruptive transportation effects (i.e., substantial sustained effects) would occur during Traffic Stage 5 for the Bored Tunnel Alternative, Traffic Stage 4 for the Cut-and-Cover Tunnel Alternative, and Traffic Stage 5 for the Elevated Structure Alternative. The actual traffic staging would be developed further and would likely be modified during construction.

Exhibit 6-1. Duration of Construction and SR 99 Closures by Build Alternative

Build Alternative	Total Construction Duration	Approximate Duration of SR 99 Closure
Bored Tunnel	65 months	Several weeks at the end of Stage 7
Cut-and-Cover Tunnel	105 months	39 to 42 months (depending on direction of travel) in Stage 4
Elevated Structure	120 months	4 months in Stage 4 3 months in Stage 7

6.1 Construction Assumptions

6.1.1 Bored Tunnel Alternative

The following assumptions were used to develop the construction schedule and traffic staging for the Bored Tunnel Alternative:

- Funding would be available to build this project as proposed.
- The NEPA ROD would be obtained by August 2011, and construction would start immediately after the ROD is obtained.
- The existing Alaskan Way Viaduct would carry SR 99 traffic during the construction of the bored tunnel, with a one-lane reduction in each direction in the area of the south portal construction zone.
- Construction may occur up to 24 hours per day, 7 days per week for the entire construction period, within permitting requirements.

- Access to the Seattle Ferry Terminal and the ferries would be maintained. Access to Terminal 46 and its cargo operations would also be maintained.
- All utilities can be relocated from Denny Way, Sixth Avenue N., Taylor Avenue N., and Broad Street for the north portal cut-and-cover structure.
- The major electrical transmission line under the existing viaduct would be relocated before the viaduct demolition activities.
- Service to utility customers would be maintained during construction to the greatest extent possible.
- All of the necessary right-of-way, easements, permits, and construction staging areas would be acquired before construction.
- Parking under the viaduct would be removed before the demolition and removal of the viaduct.
- Transit access needs to be maintained during construction to the greatest extent possible.

6.1.2 Cut-and-Cover Tunnel Alternative

The following assumptions were used to develop the construction schedule and traffic staging for the Cut-and-Cover Tunnel Alternative:

- Funding would be available to build this project as proposed.
- Construction may occur up to 24 hours per day, 7 days per week for the entire construction period, within permitting requirements.
- Access to the Seattle Ferry Terminal and the ferries would be maintained. Access to Terminal 46 and its cargo operations would also be maintained.
- All utilities can be relocated from Denny Way, Sixth Avenue N., Taylor Avenue N., and Broad Street for the north portal cut-and-cover structure.
- The major electrical transmission line under the existing Alaskan Way Viaduct would be relocated before viaduct demolition activities.
- Service to utility customers would be maintained during construction to the greatest extent possible.
- All of the necessary right-of-way, easements, permits, and construction staging areas would be acquired before construction.
- Parking under the viaduct would be removed before the demolition and removal of the viaduct.
- Transit access needs to be maintained during construction to the greatest extent possible.
- Alaskan Way can be closed to north-south traffic for approximately 4 years. (East-west access to businesses and the ferry terminal would remain open.)

6.1.3 Elevated Structure Alternative

The following assumptions were used to develop the construction schedule and traffic staging for the Elevated Structure Alternative:

- Funding would be available to build this project as proposed.
- Construction may occur up to 24 hours per day, 7 days per week for the entire construction period, within permitting requirements.
- Access to the Seattle Ferry Terminal and the ferries would be maintained. Access to Terminal 46 and its cargo operations would also be maintained.
- The major electrical transmission line under the existing Alaskan Way Viaduct would be relocated before viaduct demolition activities.
- Service to utility customers would be maintained during construction to the greatest extent possible.
- All of the necessary right-of-way, easements, permits, and construction staging areas would be acquired before construction.
- Parking under the viaduct would be removed before the demolition and removal of the viaduct.
- Transit access needs to be maintained during construction to the greatest extent possible.
- There would be two dedicated lanes in each direction on SR 99 throughout the project construction except during closure periods.

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

The replacement of the existing Alaskan Way Viaduct between S. Holgate Street and S. King Street is treated in the same way for each of the three build alternatives. The following description of the construction timeline for the S. Holgate Street to S. King Street Viaduct Replacement Project is a common assumption for the transportation analysis for each build alternative.

From November 2010 to June 2011, Alaskan Way would be closed between S. Royal Brougham Way and S. Atlantic Street and would operate with only one lane in each direction from S. King Street to S. Royal Brougham Way. During the same timeframe, First Avenue S. would be reduced to one lane in each direction between Railroad Way S. and the WOSCA site. There would also be periodic lane closures in the evening.

In June 2011, the closure of Alaskan Way S. would expand north to S. King Street. During this closure of Alaskan Way S., the detour route would be S. Atlantic Street, East Frontage Road, S. Royal Brougham Way, First Avenue S., Railroad Way S., then under the viaduct to S. Jackson Street, and back to Alaskan Way S. First Avenue S. would begin to operate with two lanes in each direction. SR 99 would operate on the existing viaduct, and the mainline speed limit would be reduced from 50 to 40 mph; the posted speed limit on curves would be 25 mph.

The southbound off-ramp and northbound on-ramp on the WOSCA detour would be opened in April 2011. These ramps would tie into, and thus replace, the existing First Avenue S. ramps and would be accessed via S. Atlantic Street for the southbound off-ramp and S. Royal Brougham Way for the northbound on-ramp. A description of the WOSCA detour is provided in Appendix B, Alternatives Description and Construction Methods Discipline Report.

Construction during the S. Holgate Street to S. King Street Viaduct Replacement Project includes construction of the East Frontage Road, the WOSCA detour, the new southbound SR 99 structure, the h-shaped overcrossing of the BNSF tail track, and an eastward shift of First Avenue S.

6.2 Construction Durations

6.2.1 Bored Tunnel Alternative

The Bored Tunnel Alternative would require about 65 months of construction, which can be divided into eight traffic stages, starting with utility work and early construction activities before the construction of the south portal. At the end of the bored tunnel construction, a closure of SR 99 for several weeks would be required to connect SR 99 to the bored tunnel at the end of Traffic Stage 7.

Some construction related to the S. Holgate Street to S. King Street Viaduct Replacement Project would overlap the construction of the Bored Tunnel Alternative. Construction for the S. Holgate Street to S. King Street Viaduct Replacement Project began in May 2010 and will continue through mid-2014. Construction activities associated with the Bored Tunnel Alternative would continue for approximately 2.5 years after the completion of the S. Holgate Street to S. King Street Viaduct Replacement Project. Aside from the disruptions associated with the S. Holgate Street to S. King Street Viaduct Replacement Project, the primary construction activities that would affect traffic would occur in the north portal area, as well as on surface streets along the central waterfront during viaduct demolition in Traffic Stage 8.

In addition, the Bored Tunnel Alternative assumes that both south and north pedestrian connections along First Avenue S. between S. Royal Brougham Way and S. King Street would be maintained to the maximum extent possible. There may be short periods when some of the connections may be detoured during key construction activities.

The following subsections describe the current planning for a likely construction sequence for the elements of the Bored Tunnel Alternative, along with approximate construction durations. These durations have been developed as estimates based on what is known about the design of the Bored Tunnel Alternative at this early stage.

6.2.1.1 Bored Tunnel Alternative Traffic Stage 1

Traffic Stage 1 would last approximately 3.5 months, roughly from August through December 2011. Significant construction activities are shown in Exhibit 6-2.

Exhibit 6-2. Bored Tunnel Alternative Traffic Stage 1 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (3.5 months)
Support in place or replace utilities along tunnel corridor	2 months (continues in Stages 2 and 3)
Initiate design and procurement of the tunnel boring machine	3.5 months (continues in Stages 2, 3, and 4)
Begin project mobilization	3.5 months (continues in Stages 2 and 3)
Conduct soil improvements in the south along tunnel alignment up to Madison Street in the north	3.5 months (continues in Stages 2 and 3)

As part of the traffic patterns established by the S. Holgate Street to S. King Street Viaduct Replacement Project, mainline SR 99 would be open. The SR 99 mainline northbound on-ramp and southbound off-ramp at Railroad Way S. to and from First Avenue S. would be moved to the newly constructed transitional ramp structures that would allow access to the area via S. Atlantic Street and S. Royal Brougham Way.

S. Royal Brougham Way will be closed permanently from Alaskan Way S. to the newly constructed East Frontage Road as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. Alaskan Way S. would be closed between S. King and S. Atlantic Streets to accommodate construction activities at the south portal of the bored tunnel. Traffic on Alaskan Way S. would be routed along the following detour: S. Atlantic Street to the East Frontage Road to S. Royal Brougham Way to First Avenue S. to Railroad Way S. to Alaskan Way S., then under the viaduct to S. Jackson Street, and back to Alaskan Way S. This detour would stay in effect until the bored tunnel opens.

First Avenue S. would operate with two lanes in each direction beginning in June 2011. This would continue until Traffic Stage 8.

6.2.1.1.1 Traffic Stage 1 Traffic Revisions – SR 99

For the 3.5 months of Traffic Stage 1, SR 99 would operate on the existing Alaskan Way Viaduct. The WOSCA southbound off-ramp and northbound on-ramp would be open with a posted advisory speed of 25 mph. The southbound off-ramp would consist of one lane until widening to two lanes before the terminus at S. Atlantic Street. North- and southbound traffic would be reduced by one lane for certain segments on the existing SR 99: two lanes in each direction would be open from near the S. Holgate Street to the First Avenue S. ramps, and three lanes would be open between the First Avenue S. ramps and the Elliott/Western ramps. This would be the case for the duration of project construction for the Bored Tunnel Alternative. The speed limit on mainline SR 99 would be 40 mph.

6.2.1.1.2 Traffic Stage 1 Traffic Revisions – Surface Streets

Traffic revisions in the south portal area would include the following:

- Alaskan Way S. would be closed from S. King Street to S. Atlantic Street. The previously described detour route would be used (see Section 6.2.1.1).

6.2.1.2 Bored Tunnel Alternative Traffic Stage 2

Traffic Stage 2 would last approximately 5 months, from December 2011 to May 2012. Primary construction activities are shown in Exhibit 6-3. As part of the traffic patterns established by the S. Holgate Street to S. King Street Viaduct Replacement Project, southbound SR 99 would begin operating on the WOSCA detour and new southbound SR 99 structure near S. Royal Brougham Way (also part of the S. Holgate Street to S. King Street Viaduct Replacement Project). Northbound SR 99 would continue on the existing viaduct with a one-lane reduction beginning at approximately S. Holgate Street.

Exhibit 6-3. Bored Tunnel Alternative Traffic Stage 2 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (5 months)
Support in place or replace utilities along tunnel corridor	5 months (continues in Stage 3)
Initiate design and procurement of the tunnel boring machine	5 months (continues in Stage 3 and 4)
Begin project mobilization	3.5 months (continues in Stage 3)
Conduct soil improvements in the south along tunnel alignment up to Madison Street in the north	4.5 months (continues in Stage 3)
Construct support (shoring systems) for excavation features and soil excavation; establish staging yard at WOSCA site	5 months (continues in Stage 3 and 4)

Note: WOSCA = Washington-Oregon Shippers Cooperative Association

There would be periodic closures of Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations. All lanes on Sixth Avenue N. from Thomas Street to Broad Street and all lanes on Harrison Street from Sixth Avenue N. to SR 99 would be closed beginning in February 2012. All other conditions would remain the same as those in Traffic Stage 1.

6.2.1.2.1 Traffic Stage 2 Traffic Revisions – SR 99

Northbound SR 99 would continue to operate on the existing viaduct. Southbound SR 99 would switch to operation on the WOSCA detour and new southbound SR 99 structure, which would require a weekend closure at the beginning of Traffic Stage 2 for the tie-in. Both the southbound off-ramp and the northbound on-ramp on the WOSCA detour would remain open. North- and southbound traffic would be reduced by one lane for certain segments on the existing SR 99, with changes at the same locations as in Traffic Stage 1 (see Section 6.2.1.1.1). The speed limit on mainline SR 99 would continue to be 40 mph.

6.2.1.2.2 Traffic Stage 2 Traffic Revisions – Surface Streets

Traffic revisions in the south portal area of the bored tunnel would include the following:

- Alaskan Way S. would be closed between S. King Street and S. Atlantic Street. The detour route established in Traffic Stage 1 would be used (see Section 6.2.1.1).

Traffic revisions in the north portal area would include the following:

- Periodic closures would occur on Sixth Avenue N., Taylor Avenue N., and Broad Street for utility relocations.
- Closures of the following would also be implemented beginning in February 2012: Sixth Avenue N. between Thomas Street and Broad Street, and Harrison Street between Sixth Avenue N. and SR 99.

6.2.1.3 Bored Tunnel Alternative Traffic Stage 3

Traffic Stage 3 would last approximately 7 months, from May to December 2012. Primary construction activities are shown in Exhibit 6-4.

Demolition of the viaduct between S. Royal Brougham Way and S. King Street, as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, would take approximately 3 months at the beginning of this stage. This demolition would close SR 99 to all traffic for 1 week. Once this demolition is completed, both northbound and southbound SR 99 traffic would use the WOSCA detour at about S. Royal Brougham Way and connect back to SR 99 using the existing ramp structure from First Avenue S. at Railroad Way S. The northbound on-ramp and southbound off-ramp would remain on the temporary ramps until the new alignment opens.

Exhibit 6-4. Bored Tunnel Alternative Traffic Stage 3 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (7 months)
Support in place or replace utilities along tunnel corridor	7 months
Initiate design and procurement of the tunnel boring machine	7 months (continues in Stage 4)
Begin project mobilization	3.5 months
Conduct soil improvements in the south along tunnel alignment up to Madison Street in the north	3.5 months
Construct support (shoring systems) for excavation features and soil excavation; establish staging yard at WOSCA site	7 months
Demolish viaduct between S. Royal Brougham Way and S. King Street [1]	1 month
North end: Construct support walls for north portal and tunnel boring machine retrieval pit	5 months (continues in Stage 4)

Note: WOSCA = Washington-Oregon Shippers Cooperative Association

1. This activity is part of the S. Holgate Street to S. King Street Viaduct Replacement Project.

6.2.1.3.1 Traffic Stage 3 Traffic Revisions – SR 99

After the 1-week closure for the tie-in by the S. Holgate Street to S. King Street Viaduct Replacement Project, SR 99 would operate on the WOSCA detour and new southbound SR 99 structure in both directions. The WOSCA detour northbound on-ramp and southbound off-ramp would continue to operate. The speed limit on mainline SR 99 would continue to be 40 mph.

6.2.1.3.2 Traffic Stage 3 Traffic Revisions – Surface Streets

- Alaskan Way S. would be closed between S. King Street and S. Atlantic Street. Alaskan Way S. would operate using the detour route established in Traffic Stage 1 (see Section 6.2.1.1).
- The north portal closures would remain the same as those established in Traffic Stage 2: Sixth Avenue N. from Thomas Street to Broad Street and Harrison Street from Sixth Avenue N. to SR 99.
- Mercer Street east of Ninth Avenue N. is expected to be open to two-way traffic.

6.2.1.4 Bored Tunnel Alternative Traffic Stage 4

Traffic Stage 4 would last approximately 3 months, from December 2012 to March 2013, as shown in Exhibit 6-5. The only changes in traffic revisions from Traffic Stage 3 would be in the north portal area, as part of the Mercer Street widening activities performed by the City.

Exhibit 6-5. Bored Tunnel Alternative Traffic Stage 4 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (3 months)
Initiate design and procurement of the tunnel boring machine	3 months
Construct support (shoring systems) for excavation features and soil excavation; establish staging yard at WOSCA site	3 months
South portal: Construct cut-and-cover tunnel segment from S. Dearborn to S King Streets	2 months (continues in Stage 5)
North end: Construct support walls for north portal and tunnel boring machine retrieval pit	3 months
North end: Construct cut-and-cover tunnel segment and tunnel operations building	1 month (continues in Stages 5, 6, and 7)
Construct Mercer Street overcrossing and widen Mercer Street from Fifth to Ninth Avenues N.	10 months (continues in Stages 5 and 6)

Note: WOSCA = Washington-Oregon Shippers Cooperative Association

6.2.1.4.1 Traffic Stage 4 Traffic Revisions – SR 99

SR 99 would continue to operate on the WOSCA detour and new southbound SR 99 structure in both directions and use the WOSCA detour ramps at the south area. The speed limit on mainline SR 99 would continue to be 40 mph. To facilitate the widening of the SR 99 overcrossing of Mercer Street, SR 99 would be narrowed to two lanes in each direction from Harrison Street to Valley Street.

6.2.1.4.2 Traffic Stage 4 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel would include the following:

- Alaskan Way S. would continue to be closed from S. King Street to S. Atlantic Street, and the established detour from Traffic Stage 1 would remain open (see Section 6.2.1.1).

Traffic revisions near the north portal of the bored tunnel would include the following:

- Harrison Street would be closed between Sixth Avenue N. and SR 99.
- Mercer Street would be open with two eastbound lanes between Fifth and Ninth Avenues N.
- Sixth Avenue N. would be closed between Thomas Street and Broad Street.

6.2.1.5 Bored Tunnel Alternative Traffic Stage 5 – Analyzed for Traffic Effects

Traffic Stage 5 would last approximately 16 months, from March 2013 to July 2014. Primary construction activities are shown in Exhibit 6-6.

Exhibit 6-6. Bored Tunnel Alternative Traffic Stage 5 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (16 months)
Assemble tunnel boring machine	3 months
Bored tunnel: Drive tunnel boring machine	13 months
Bored tunnel: Install interior tunnel structures and systems	8 months (continues in Stages 6 and 7)
South end: Construct tunnel operations building	13 months (continues in Stages 6 and 7)
South portal: Construct cut-and-cover tunnel segment from S. Dearborn to S King Streets	2 months
Construct revised WOSCA detour (southbound)	1 month
Construct Mercer Street overcrossing and widen Mercer Street from Fifth to Ninth Avenues N.	12 months (continues in Stages 6)
North portal: Construct tunnel operations building	16 months (continues in Stages 6 and 7)
North portal: Construct Harrison/Aurora ramps	7 months (continues in Stage 6)
North portal: Construct cut-and-cover tunnel segment	1 month (continues in Stages 6 and 7)
North portal: Close Broad Street	Permanent condition (end of Stage 5)

Note: WOSCA = Washington-Oregon Shippers Cooperative Association

The h-shaped overcrossing constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project will open in January 2014. This overcrossing will provide a bypass for S. Atlantic Street traffic when railroad cars on the BNSF tail track block the at-grade crossing. It will eventually connect Alaskan Way S. to both East Marginal Way S. and S. Atlantic Street, but the connection to Alaskan Way S. would not be open at this stage because Alaskan Way S. would still be closed north of this point to S. King Street. During the most restrictive portion of this traffic stage, the westbound lanes of Broad Street would be closed. In the eastbound direction, Broad Street would operate with one lane. There would be a connection to Mercer Street and Dexter Avenue N., allowing eastbound traffic on Broad Street to continue east on Mercer or north on Dexter. All other movements would be restricted. All other conditions would remain the same as those in

Traffic Stage 4. See Exhibits 6-7 and 6-8 for the roadway configurations in the south and north areas.

6.2.1.5.1 Traffic Stage 5 Traffic Revisions – SR 99

SR 99 would continue to operate in both directions on the WOSCA detour and new southbound SR 99 structure and WOSCA detour ramps. The speed limit on mainline SR 99 would continue to be 40 mph. North- and southbound SR 99 would continue operate with two lanes in each direction from Thomas Street to Valley Street. The southbound off-ramp to Broad Street and the northbound off-ramp to Dexter would be closed in April 2014.

6.2.1.5.2 Traffic Stage 5 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel would include the following:

- Alaskan Way S. would be closed from S. King Street to S. Atlantic Street. Alaskan Way S. traffic would continue using the detour route established in Traffic Stage 1 (see Section 6.2.1.1).

Traffic revisions near the north portal of the bored tunnel would include the following:

- Mercer Street between Fifth Avenue N. and Ninth Avenue N. would provide two eastbound lanes until April 2014. For the remainder of Traffic Stage 5, this segment Mercer Street would be two lanes in each direction.
- Broad Street would be open with two lanes in each direction until July 2013, when it would begin operating with two westbound lanes and one eastbound lane. In April 2014, Broad Street would operate with only one eastbound lane and no westbound lane. Connections would be provided from Broad Street to eastbound Mercer Street and northbound Dexter Avenue only.
- Sixth Avenue N. would be closed between Thomas and Broad Streets.
- Harrison Street would be closed between Sixth Avenue N. and SR 99.

6.2.1.6 Bored Tunnel Alternative Traffic Stage 6

Traffic Stage 6 would last approximately 9 months, from July 2014 to April 2015. Primary construction activities are shown in Exhibit 6-9. In July 2014, the south end area would operate on the revised WOSCA detour, which would operate similar to the WOSCA detour. The WOSCA detour and the revised WOSCA detour are described in Appendix B, Alternatives Description and Construction Methods Discipline Report. All other revisions would remain the same as those in Traffic Stage 5 (see Section 6.2.1.5).

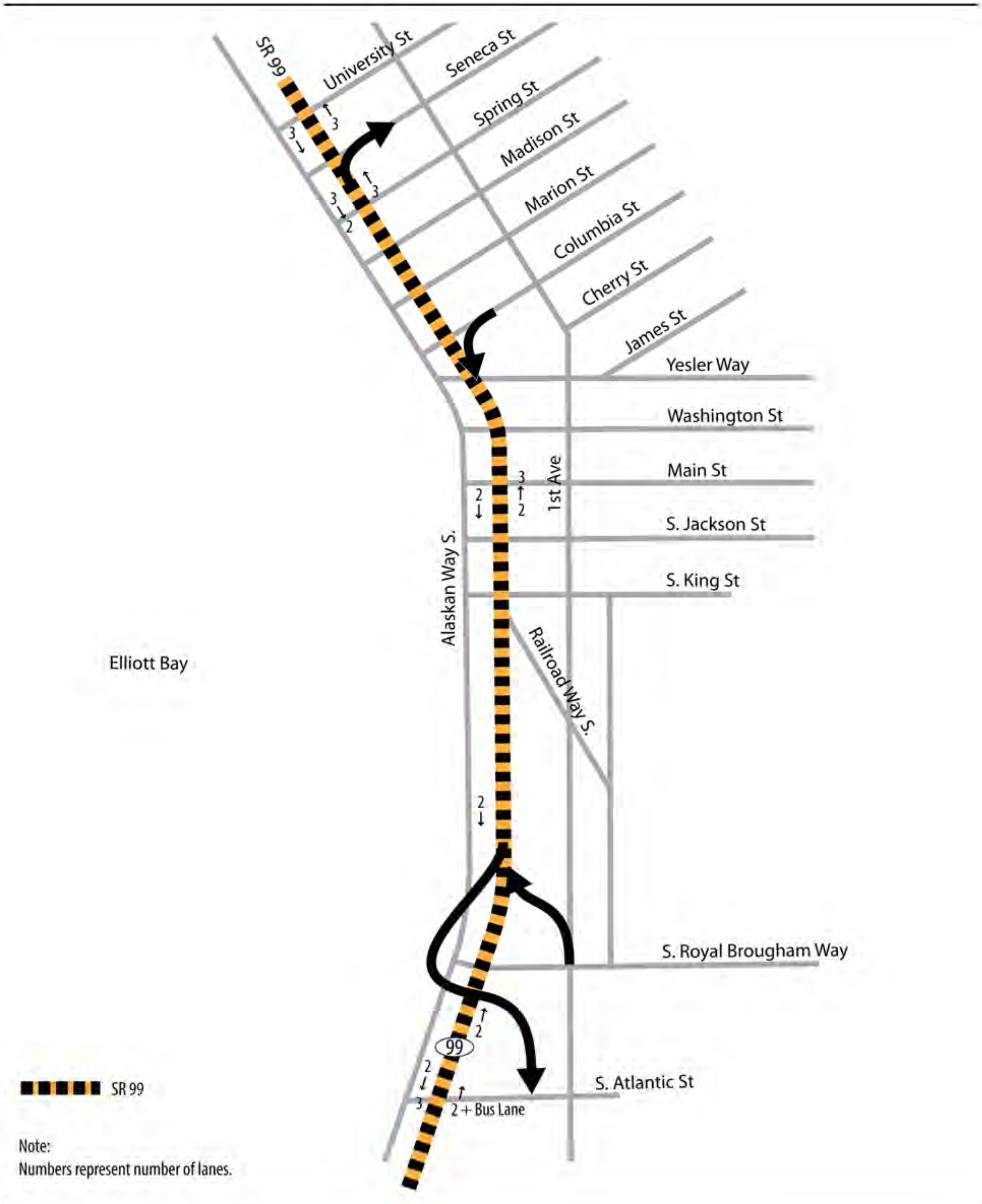


Exhibit 6-7
Bored Tunnel Alternative
Traffic Stage 5 Roadway
Configuration (South)

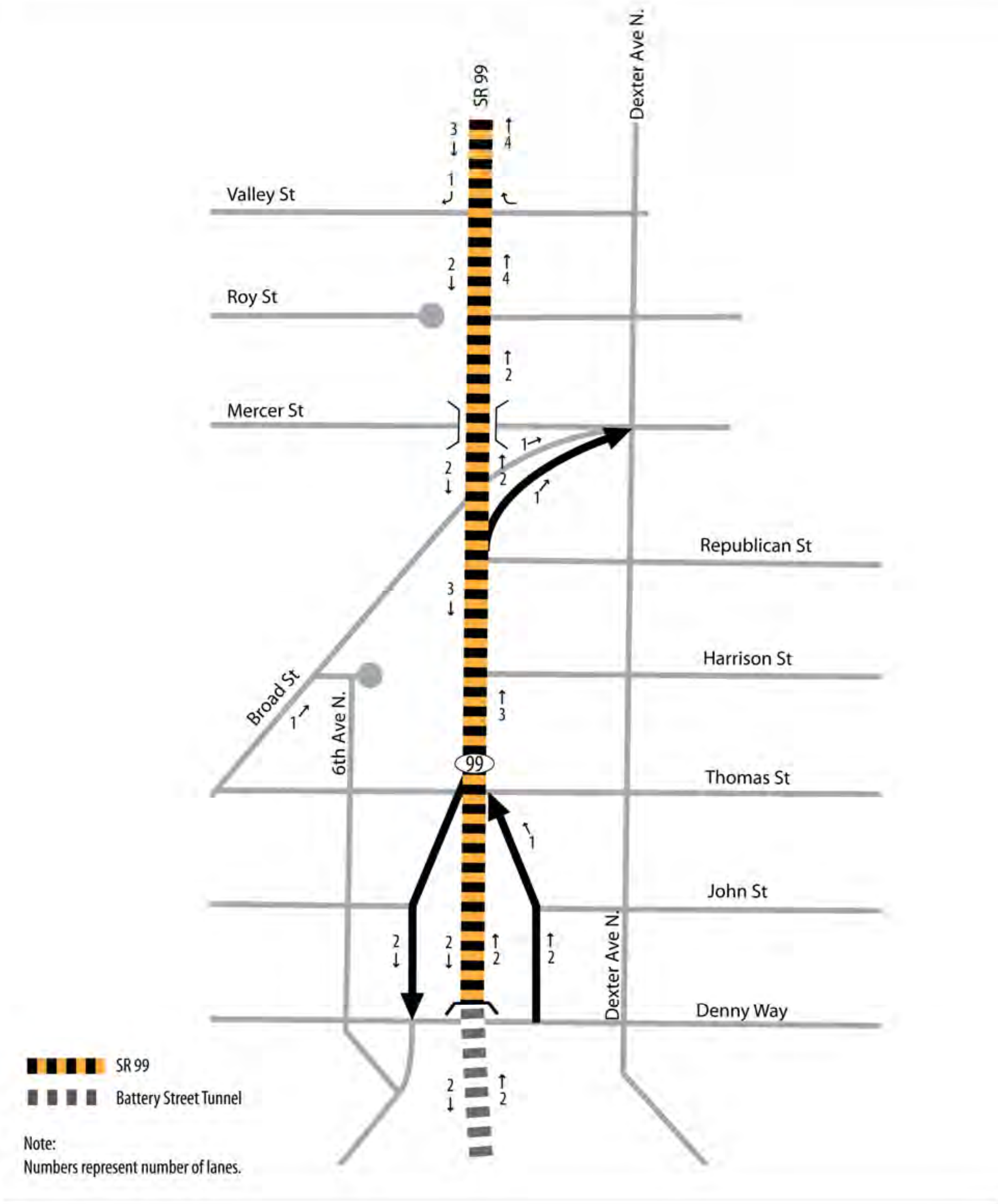


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Exhibit 6-8
Bored Tunnel Alternative
Traffic Stage 5 Roadway
Configuration (North)

Exhibit 6-9. Bored Tunnel Alternative Traffic Stage 6 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (9 months)
Bored tunnel: Drive tunnel boring machine	First 4 months
Bored tunnel: Install interior tunnel structures and systems	9 months (continues in Stage 7)
South portal: Construct tunnel operations building	9 months (continues in Stage 7)
South portal: Construct cut-and-cover tunnel and retained cut connection	9 months (continues in Stage7)
North portal: Construct tunnel operations building	9 months (continues in Stage 7)
North portal: Construct cut-and-cover tunnel segment	9 months (continues in Stage 7)
North portal: Construct shoring, excavate, and build Harrison Street ramp structures	6 months
North portal: Construct Harrison/Aurora ramps	3 months
Construct Mercer Street overcrossing and widen Mercer Street from Fifth to Ninth Avenues N.	12 months
North portal: Construct southbound and northbound SR 99 from tunnel portal at Harrison Street to meet existing grade	1 month (continues in Stage 7)
Retrieve tunnel boring machine	6 months

6.2.1.6.1 Traffic Stage 6 Traffic Revisions – SR 99

- Both directions of SR 99 would continue to operate on the revised WOSCA detour, southbound SR 99 structure, and temporary ramps in the south area.
- The speed limit on mainline SR 99 would continue to be 40 mph.
- In the north area, SR 99 would operate with two lanes in each direction from Thomas Street to Valley Street until December 2014. South of Valley Street, there would be three lanes in each direction, with the southbound lanes shifted to the newly constructed Aurora ramps in December 2014 and the northbound lanes shifted to the Aurora ramps in March 2015.

6.2.1.6.2 Traffic Stage 6 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel would include the following:

- Alaskan Way S. would be closed from S. King Street to S. Atlantic Street. Alaskan Way S. would be rerouted to the previously established detour (see Section 6.2.1.1).

Traffic revisions near the north portal of the bored tunnel would include the following:

- Broad Street would be closed permanently east of Fifth Avenue N.
- Sixth Avenue N. would be closed between Thomas and Broad Streets.
- Harrison Street would be closed from Sixth Avenue N. to SR 99.
- Mercer Street between Fifth Avenue N. and Ninth Avenue N. would be open in two directions, initially with two lanes in each direction, followed by three lanes in each direction in December 2014.

6.2.1.7 Bored Tunnel Alternative Traffic Stage 7

Traffic Stage 7 would last approximately 8 months, from April to December 2015, as shown in Exhibit 6-10. In the south area, SR 99 would continue to use the revised WOSCA detour. In the north end area, SR 99 would use the Harrison Street ramps both northbound and southbound. At the end of Traffic Stage 7, SR 99 would be closed for up to a 3- weeks closure to connect it to the bored tunnel. The cumulative list of traffic revisions for this stage follows.

Exhibit 6-10. Bored Tunnel Alternative Traffic Stage 7 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (9 months)
Bored tunnel: Install interior tunnel structures and systems	6 months
Bored tunnel: Commission interior systems	6 months
South portal: Construct tunnel operations building	6 months
South portal: Construct cut-and-cover tunnel and retained cut connection	3 months
North portal: Construct tunnel operations building	3 months
North portal: Construct both southbound and northbound SR 99 from tunnel portal at Harrison Street to meet existing grade	2 months
North portal: Construct shoring for northbound SR 99; excavate and build northbound SR 99	2 months
North portal: Construct cut-and-cover tunnel segment	2 months
North portal: Construct Republican Street and Sixth Avenue N. ramp structures	8 months
Connect SR 99 to the bored tunnel	Several weeks

6.2.1.7.1 Traffic Stage 7 Traffic Revisions – SR 99

SR 99 would continue to operate on the revised WOSCA detour. The speed limit on mainline SR 99 would continue to be 40 mph. In the north area, traffic would continue to be rerouted onto the Harrison Street ramps between Harrison and Mercer Streets. At the end of Traffic Stage 7, closure of SR 99 would be required for several weeks.

6.2.1.7.2 Traffic Stage 7 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel would include the following:

- Alaskan Way S. would be closed from S. King Street to S. Atlantic Street. Alaskan Way S. would be rerouted to the previously established detour (see Section 6.2.1.1).
- First Avenue S. would be open for north-south traffic, with two lanes in each direction.
- S. King Street would be closed between Alaskan Way S. and Railroad Way S.

Traffic revisions near the north portal of the bored tunnel would include the following:

- Sixth Avenue N. would be closed between Thomas and Broad Streets.
- Harrison Street would be closed from Sixth Avenue N. to SR 99.

6.2.1.8 Bored Tunnel Alternative Traffic Stage 8

Traffic Stage 8 would last approximately 12 months, from December 2015 to January 2017, as shown in Exhibit 6-11. When this stage starts, SR 99 traffic would begin using the newly constructed bored tunnel. In the south area, Alaskan Way would be reduced in width between S. King Street and Pike Street to allow for the demolition and removal of the viaduct structure. The new cross street(s) in the south area would be constructed. Drivers on First Avenue S. would experience lane closures necessary for street restoration. Between Railroad Way S. and S. Royal Brougham Way, traffic would be reduced to one lane in each direction. Various city streets between S. King Street and Battery Street would experience periodic street closures to facilitate the viaduct demolition.

Exhibit 6-11. Bored Tunnel Alternative Traffic Stage 8 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (12 months)
Demolish and remove existing viaduct	9 months
Decommission Battery Street Tunnel	9 months
South portal area: Remove WOSCA detour	1 month
South portal area: Restore surface streets	12 months
North portal area: Restore surface streets	12 months

Note: WOSCA = Washington-Oregon Shippers Cooperative Association

In the north area, lanes on Denny Way, Harrison Street, Sixth Avenue N., Taylor Avenue N., and Broad Street would be restricted to support utility relocation and surface street restoration activities. The Denny Way ramps would be replaced by a new intersection, and both the northbound and southbound on- and off-ramps to and from SR 99 at Harrison Street would be open. However, the new segment of surface Aurora Avenue between Thomas Street and Denny Way would not yet be open; hence, traffic on SR 99 would connect to the portion of Denny Way ramps that would remain open with reduced capacity between Thomas Street and Denny Way. Construction of the surface street connection in the north portal area would take place during this traffic stage.

6.2.1.8.1 Traffic Stage 8 Traffic Revisions – SR 99

The new SR 99 mainline would be open and using the newly constructed bored tunnel. The Battery Street Tunnel would be decommissioned.

6.2.1.8.2 Traffic Stage 8 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel would include the following:

- First Avenue S. would be closed periodically during the removal of the revised WOSCA detour.
- First Avenue S. would be reduced to one lane in each direction from Railroad Way S. to the WOSCA site.
- Alaskan Way would be reduced in width between Pike Street and S. King Street to allow for the demolition and removal of the viaduct structure, but at the current level of construction planning, there are no lane closures expected on Alaskan Way. Further details will be developed with the construction management plan for the demolition of the Alaskan Way Viaduct.

- Demolition of the viaduct would occur two blocks at a time, with the cross streets from S. King Street to Battery Street experiencing periodic closures for approximately 2 weeks when demolition is occurring over the streets.
- Alaskan Way S. would be closed from S. King Street to S. Royal Brougham Way until September 2016 and then reopened to traffic.

Traffic revisions near the north portal of the bored tunnel would include the following:

- Lanes on Denny Way, John Street, Thomas Street, and Harrison Street would be restricted to support utility relocation and surface street relocation activities. Sixth Avenue N. would also be affected.
- Traffic on Battery Street and on cross streets above the Battery Street Tunnel would be maintained during the tunnel decommissioning, although there may need to be occasional short-term lane and parking restrictions.
- The Harrison Street ramps to and from SR 99 would be open but with reduced capacity during the reconstruction of surface Aurora Avenue between Thomas Street and Denny Way.

6.2.2 Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would require about 105 months of construction, which can be divided into six traffic stages, starting with utility work and early construction activities. Construction of the Cut-and-Cover Tunnel Alternative would require a closure of SR 99 for 27 months during Traffic Stage 4. The closure during Traffic Stage 4 would continue from the 15-month closure for southbound traffic in Traffic Stage 3, and closure for northbound traffic would continue for an additional 12 months in Traffic Stage 5.

Some construction related to the S. Holgate Street to S. King Street Viaduct Replacement Project would overlap the construction of the Cut-and-Cover Tunnel Alternative. The S. Holgate Street to S. King Street Viaduct Replacement Project began construction in May 2010 and will continue through mid-2014. Construction activities associated with the Cut-and-Cover Tunnel Alternative would continue for approximately 5 years after the completion of the S. Holgate Street to S. King Street Viaduct Replacement Project. Aside from the disruptions associated with the S. Holgate Street to S. King Street Viaduct Replacement Project, the primary construction activities that would affect traffic would occur in Traffic Stage 4 when the Alaskan Way Viaduct would be closed for the construction of the cut-and-cover tunnel.

In addition, the Cut-and-Cover Tunnel Alternative assumes that both south and north pedestrian connections along First Avenue S. between S. Royal Brougham Way and S. King Street would be maintained to the maximum extent possible.

There may be short periods when some of the connections may be detoured during key construction activities.

The following subsections describe the current planning for a likely construction sequence for the elements of the Cut-and-Cover Tunnel Alternative, along with approximate construction durations. These durations have been developed as estimates based on what is known about the design of the Cut-and-Cover Tunnel Alternative at this early stage.

6.2.2.1 Cut-and-Cover Tunnel Alternative Traffic Stage 1

Traffic Stage 1 would last approximately 30 months, roughly from July 2011 through January 2014. Significant construction activities are shown in Exhibit 6-12.

Exhibit 6-12. Cut-and-Cover Tunnel Alternative Traffic Stage 1 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (30 months)
Relocate, support, or replace public and private utilities along cut-and-cover tunnel corridor (to temporary or to permanent locations)	30 months (continues in Stages 2, 3, 4, and 5)
Construct or improve secant pile tunnel/seawall in Colman Curve section (S. King Street to Pike Street)	9 months (continues in Stage 2)
Construct temporary over-water bridge from Pier 48 to Colman Dock	6 months
Construct temporary pedestrian walkways between Piers 54 and 55 and between Piers 56 and 57	6 months
Establish construction staging areas	3 months

6.2.2.1.1 Traffic Stage 1 Traffic Revisions – SR 99

During Traffic Stage 1, SR 99 would operate on the existing Alaskan Way Viaduct. The WOSCA southbound off-ramp and northbound on-ramp would be open with a posted advisory speed of 25 mph. The southbound off-ramp would consist of one lane until widening to two lanes before the terminus at S. Atlantic Street. SR 99 mainline traffic would start operating on the WOSCA detour beginning in May 2012. Northbound and southbound traffic would be reduced by one lane for some segments on the existing SR 99: two lanes would be open in each direction near S. Holgate Street to the First Avenue S. ramps, and three lanes between the First Avenue S. ramps and the Elliott/Western ramps.

6.2.2.1.2 Traffic Stage 1 Traffic Revisions – Surface Streets

Traffic revisions on surface streets would include the following:

- Parking would be removed under the Alaskan Way Viaduct.
- Alaskan Way would be reduced periodically to one lane in each direction for utility relocations.

6.2.2.2 Cut-and-Cover Tunnel Alternative Traffic Stage 2

Traffic Stage 2 would last approximately 9 months, from January 2014 to October 2014. Primary construction activities are shown in Exhibit 6-13. Traffic operations would be similar to those in Traffic Stage 1 (see Section 6.2.2.1), with the additional closure of the Western Avenue off-ramp from SR 99 and the closure of northbound and southbound Alaskan Way.

Exhibit 6-13. Cut-and-Cover Tunnel Alternative Traffic Stage 2 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (9 months)
Relocate, support or replace public and private utilities along cut-and-cover tunnel corridor (to temporary or to permanent locations)	30 months (continues in Stages 3, 4, and 5)
Construct or improve secant pile tunnel wall/seawall in Colman Curve section (S. King Street to Pike Street)	9 months
Build stacked cut-and-cover tunnel (S. Jackson Street to Seneca Street)	9 months (continues in Stage 3)
Construct BNSF Railway retaining wall (Pike Street to Battery Street Tunnel)	9 months
Start Aurora Avenue improvements – relocate utilities and temporary bridges	9 months

6.2.2.2.1 Traffic Stage 2 Traffic Revisions – SR 99

Northbound and southbound SR 99 would continue to operate on the existing viaduct and the new WOSCA detour as in Traffic Stage 1 (see Section 6.2.2.1). The Western Avenue off-ramp would be closed.

6.2.2.2.2 Traffic Stage 2 Traffic Revisions – Surface Streets

Alaskan Way would be closed to northbound and southbound traffic. East-west access would be provided to waterfront businesses and Colman Dock.

6.2.2.3 Cut-and-Cover Tunnel Alternative Traffic Stage 3

Traffic Stage 3 would last approximately 15 months, from October 2014 to January 2016. Primary construction activities are shown in Exhibit 6-14.

Exhibit 6-14. Cut-and-Cover Tunnel Alternative Traffic Stage 3 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (15 months)
Relocate, support or replace public and private utilities along cut-and-cover tunnel corridor (to temporary or to permanent locations)	30 months (continues in Stages 4 and 5)
Complete stacked cut-and-cover tunnel (S. Jackson Street to Seneca Street)	15 months
Remove existing viaduct (Pike Street to Battery Street Tunnel – southbound)	6 months
Construct partial lowered Aurora Avenue (west half) (southbound lanes)	6 months (continues to Stage 4)
Construct temporary bridges at John Street and Thomas Street	9 months
Construct southbound cut-and-cover tunnel under Elliott/Western Avenues (Lenora Street to Battery Street Tunnel)	12 months (continues in Stage 4)
Construct northbound cut-and-cover tunnel under Elliott/Western Avenues (Lenora Street to Battery Street Tunnel)	12 months (continues in Stage 4)

6.2.2.3.1 Traffic Stage 3 Traffic Revisions – SR 99

Southbound SR 99 would be closed to traffic between Denny Way and Columbia Street. Northbound SR 99 and the open southbound segment would be in the same configuration as in Traffic Stages 1 and 2.

6.2.2.3.2 Traffic Stage 3 Traffic Revisions – Surface Streets

Alaskan Way would be closed to northbound and southbound traffic. East-west access would continue to be provided to waterfront businesses and Colman Dock.

6.2.2.4 Cut-and-Cover Tunnel Alternative Traffic Stage 4 – Analyzed for Traffic Effects

Traffic Stage 4 would last up to approximately 27 months, from January 2016 to April 2018, as shown in Exhibit 6-15. The primary traffic revision would be the closure of SR 99 in both directions for the entire duration of Traffic Stage 4.

Exhibit 6-15. Cut-and-Cover Tunnel Alternative Traffic Stage 4 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (27 months)
Relocate, support or replace public and private utility relocation final location along cut-and-cover tunnel corridor (to temporary or to permanent locations)	12 months
Complete construction of partial lowered Aurora Avenue (west half) (southbound lanes)	12 months
Complete southbound cut-and-cover tunnel under Elliott/Western Avenues (Lenora Street to Battery Street Tunnel)	6 months
Complete northbound cut-and-cover tunnel under Elliott/Western Avenues (Lenora Street to Battery Street Tunnel)	18 months
Demolish existing viaduct (S. King Street to Battery Street Tunnel)	6 months
Transition tunnels from S. Royal Brougham Way to S. Jackson Street and Seneca Street to Pine Street	24 months
Lower inverts for both northbound and southbound Battery Street Tunnel portals to increase vertical clearance	12 months
Build ventilation building and install systems	27 months
Build ventilation buildings and systems for Battery Street Tunnel and install finishes; widen south portal of Battery Street Tunnel and match to lower profile	21 months
Construct lowered Aurora (east half) (northbound lanes)	12 months
Construct southbound aerial structure over BNSF Railway (Pike Street to Battery Street Tunnel)	18 months
Construct northbound aerial structure over BNSF Railway (Pike Street to Battery Street Tunnel)	12 months (continues in Stage 5)
Rebuild seawall (Pike Street to Broad Street)	3 months (continues in Stages 5 and 6)
Begin construction of Thomas and Harrison Street overpasses	9 months (continues in Stage 5)

See Exhibits 6-16 and 6-17 for the roadway configurations in the south and north areas.

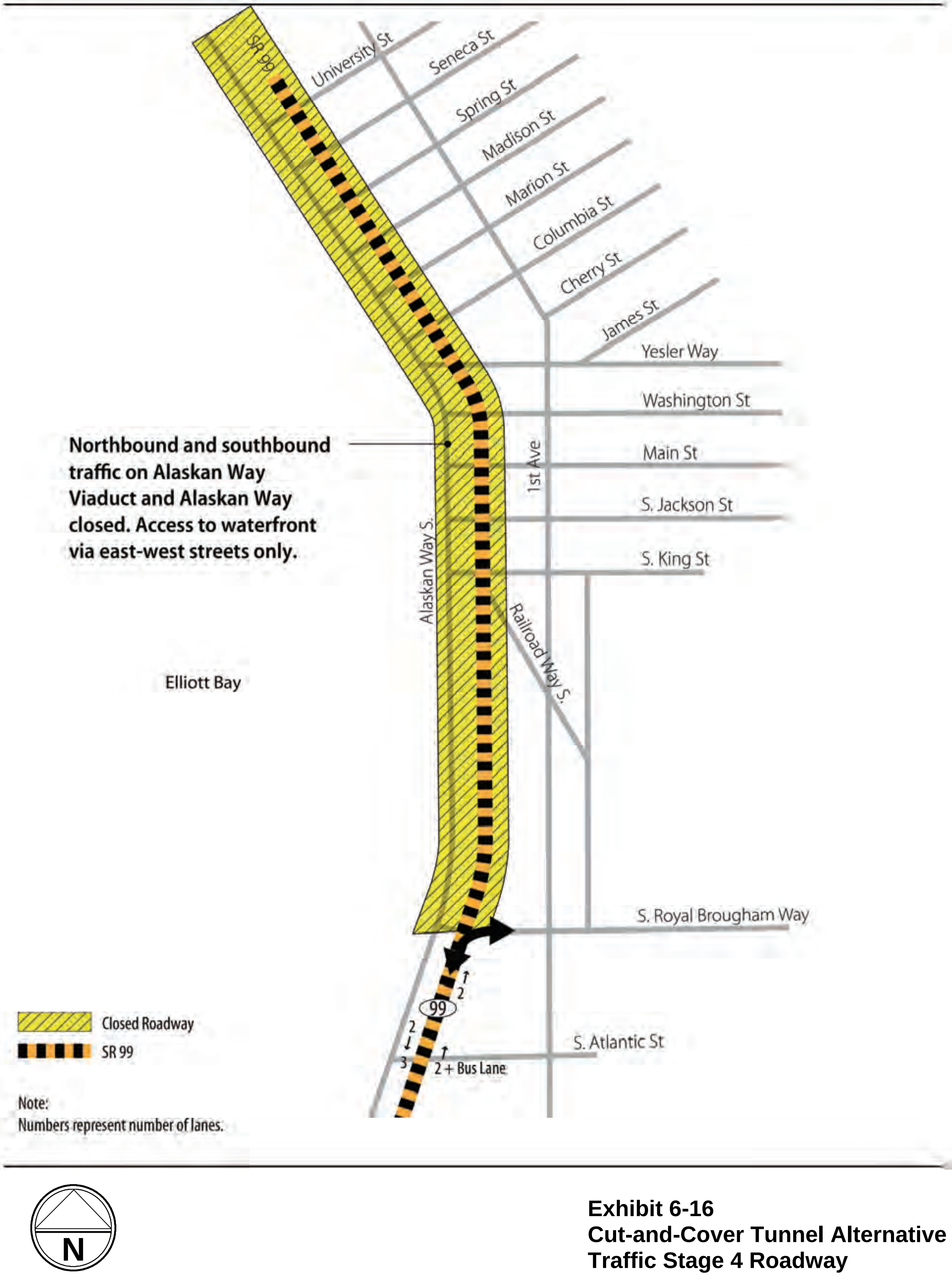

Exhibit 6-16
Cut-and-Cover Tunnel Alternative Traffic Stage 4 Roadway Configuration (South)

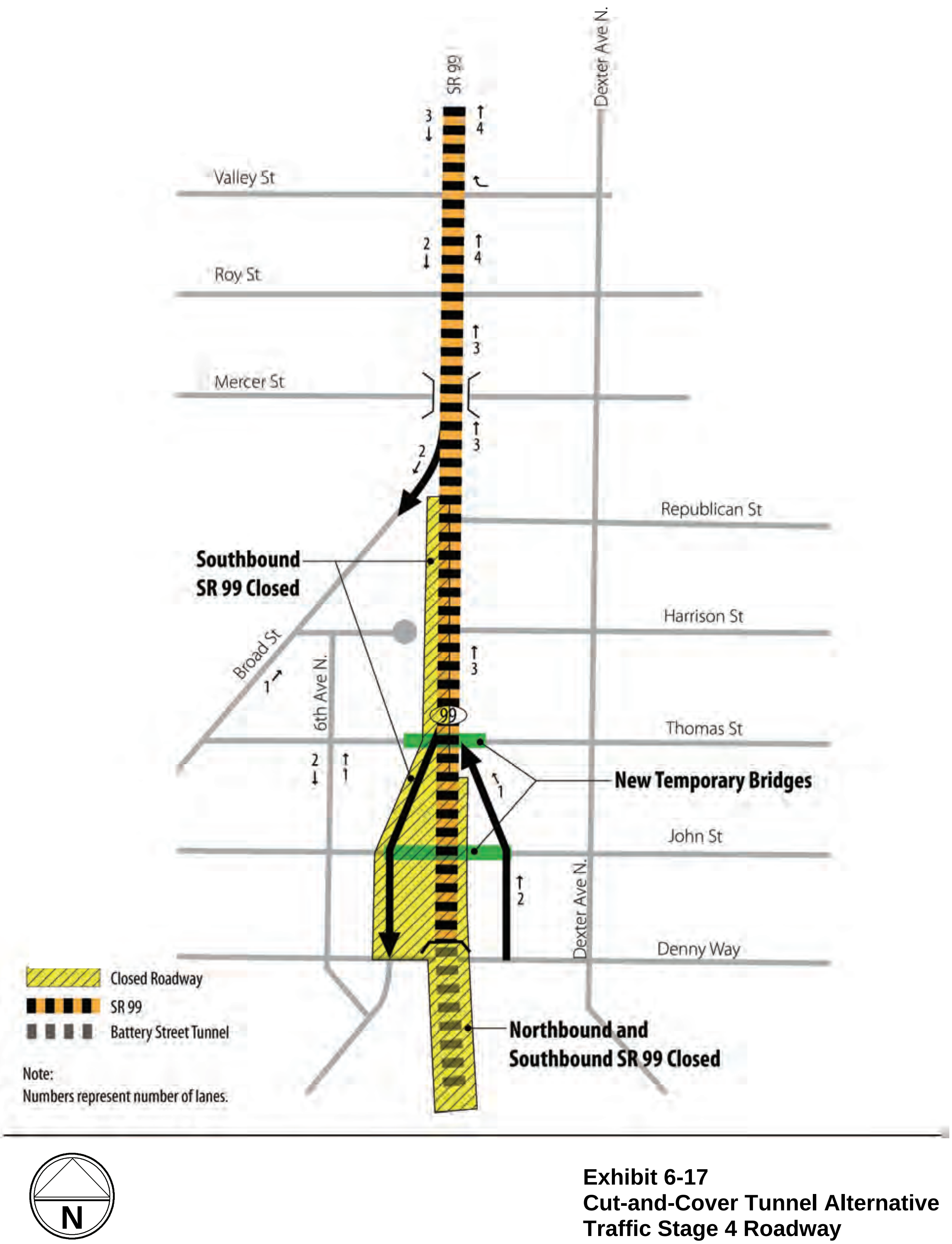

Exhibit 6-17
Cut-and-Cover Tunnel Alternative
Traffic Stage 4 Roadway
Configuration (North)

6.2.2.4.1 Traffic Stage 4 Traffic Revisions – SR 99

SR 99 would be closed in the project area. Traffic previously using the viaduct would need to use other facilities during this time period. SR 99 traffic to and from south of downtown would connect to the street grid at the intersection of S. Royal Brougham Way and the East Frontage Road. North of downtown, northbound SR 99 would be open north of Denny Way, and southbound SR 99 would be closed south of the Broad Street off-ramp.

6.2.2.4.2 Traffic Stage 4 Traffic Revisions – Surface Streets

Alaskan Way would be closed to northbound and southbound traffic. East-west access would continue to be provided to waterfront businesses and Colman Dock.

6.2.2.5 Cut-and-Cover Tunnel Alternative Traffic Stage 5

Traffic Stage 5 would last approximately 12 months, from April 2018 to April 2019. Primary construction activities are shown in Exhibit 6-18.

Exhibit 6-18. Cut-and-Cover Tunnel Alternative Traffic Stage 5 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (12 months)
Final utility relocations (S. King Street to Battery Street Tunnel)	12 months
Construct northbound aerial structure over BNSF Railway (Pike Street to Battery Street Tunnel)	6 months
Rebuild seawall (Pike Street to Broad Street)	12 months (continues in Stage 6)
Complete Thomas Street and Harrison Street overpasses	3 months
Complete northbound tunnel system and finishes	12 months
Improve surface streets in the north end	12 months

6.2.2.5.1 Traffic Stage 5 Traffic Revisions – SR 99

Southbound SR 99 would be in operation throughout the entire corridor. Northbound SR 99 would still be closed to traffic, as in Traffic Stage 4 (see Section 6.2.2.4.1).

6.2.2.5.2 Traffic Stage 5 Traffic Revisions – Surface Streets

Surface street operations would include one lane in each direction for both northbound and southbound traffic on Alaskan Way. Broad Street would be permanently closed east of Fifth Avenue N.

6.2.2.6 Cut-and-Cover Tunnel Alternative Traffic Stage 6

Traffic Stage 6 would last approximately 12 months, from May 2019 to May 2020. Primary construction activities are shown in Exhibit 6-19.

Exhibit 6-19. Cut-and-Cover Tunnel Alternative Traffic Stage 6 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (12 months)
Rebuild seawall (Pike Street to Broad Street)	3 months
Conduct project closeout and restore surface streets	12 months

6.2.2.6.1 Traffic Stage 6 Traffic Revisions – SR 99

Northbound and southbound SR 99 would operate in its final configuration.

6.2.2.6.2 Traffic Stage 6 Traffic Revisions – Surface Streets

The surface streets would operate in their final configuration.

6.2.3 Elevated Structure Alternative

The Elevated Structure Alternative would require about 120 months of construction, which can be divided into eight traffic stages, starting with utility work and early construction activities. Construction of the Elevated Structure Alternative would require the closure of SR 99 for 4 months during Traffic Stage 4 and for 3 months to connect SR 99 to the elevated structure during Traffic Stage 7.

Some construction related to the S. Holgate Street to S. King Street Viaduct Replacement Project would overlap the construction of the Elevated Structure Alternative. The S. Holgate Street to S. King Street Viaduct Replacement Project began construction in May 2010 and will continue through mid-2014. Construction activities associated with the Elevated Structure Alternative construction activities would continue for approximately 7 years after the completion of the S. Holgate Street to S. King Street Viaduct Replacement Project. Construction activities during Traffic Stage 4 would have a substantial effect on traffic operations because the Alaskan Way Viaduct would be closed for the demolition of its upper level. However, it was determined that Traffic Stage 5 would have a greater effect even though the viaduct would remain open. During Traffic Stage 5, the inability to provide southbound on-ramps to SR 99 between Denny Way and the stadium area for up to 24 months would force traffic to use other surface routes to travel south from downtown, resulting in greater overall effects than those during Stage 4.

In addition, the Elevated Structure Alternative assumes that both south and north pedestrian connections along First Avenue S. between S. Royal Brougham Way and S. King Street would be maintained to the maximum extent possible. There may be short periods when some of the connections may be detoured during key construction activities.

In general, the construction methods would keep SR 99 open with two lanes of traffic in each direction at all times except for the 2- to 4-month closure during Traffic Stage 4. Alaskan Way would operate with one lane in each direction by the use of temporary detours throughout the construction period. The primary detours are as follows:

- WOSCA detour for both northbound and southbound SR 99 traffic: 7.3 years
- Broad Street detour for southbound SR 99 traffic: 4.25 years

The following subsections describe the current planning for a likely construction sequence for the elements of the Elevated Structure Alternative, along with approximate construction durations. These durations have been developed as estimates based on what is known about the design of the Elevated Structure Alternative at this early stage.

6.2.3.1 Elevated Structure Alternative Traffic Stage 1

Traffic Stage 1 would last approximately 30 months, roughly from July 2011 through January 2014. Significant construction activities are shown in Exhibit 6-20.

Exhibit 6-20. Elevated Structure Alternative Traffic Stage 1 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (30 months)
Remove parking under existing viaduct and remove waterfront streetcar tracks	3 months
Relocate utilities	30 months
Construct seawall (S. Jackson Street to Pike Street)	9 months (continues in Stages 2 and 3)
Construct temporary pedestrian walkways between Piers 54 and 55 and Piers 56 and 57	9 months
Construct temporary over-water bridge from Pier 48 to Colman Dock	9 months

6.2.3.1.1 Traffic Stage 1 Traffic Revisions – SR 99

During Traffic Stage 1, SR 99 would operate on the existing Alaskan Way Viaduct. The WOSCA southbound off-ramp and northbound on-ramp would be open with a posted advisory speed of 25 mph. The southbound off-ramp would consist of one lane until widening to two lanes before the terminus at S. Atlantic Street. SR 99 mainline traffic would start operating on the WOSCA detour beginning in May 2012. Northbound and southbound traffic would be reduced by one lane for certain segments on the existing SR 99: two lanes would be open in each direction from near S. Holgate Street to the First Avenue S. ramps, and three lanes would be open between the First Avenue S. ramps and the Elliott/Western ramps.

6.2.3.1.2 Traffic Stage 1 Traffic Revisions – Surface Streets

Traffic revisions on surface streets would include the following:

- Parking would be removed under the Alaskan Way Viaduct.
- Alaskan Way would be reduced to one lane in each direction periodically for utility relocations.

6.2.3.2 Elevated Structure Alternative Traffic Stage 2

Traffic Stage 2 would last approximately 9 months, from January 2014 to October 2014. Primary construction activities are shown in Exhibit 6-21. Traffic operations would continue as in Traffic Stage 1, with the exception of the additional closure of the Western Avenue off-ramp from SR 99.

Exhibit 6-21. Elevated Structure Alternative Traffic Stage 2 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (9 months)
Construct seawall (S. Jackson Street to Pike Street)	9 months (continues in Stage 3)
Construct new shafts and columns alongside existing viaduct (S. Jackson Street to Pike Street)	9 months
Construct Broad Street detour	9 months
Construct BNSF Railway retaining wall (Stewart Street to Blanchard Street)	9 months

6.2.3.2.1 Traffic Stage 2 Traffic Revisions – SR 99

Northbound and southbound SR 99 would continue to operate on the existing viaduct and the new WOSCA detour as in Traffic Stage 1 (see Section 6.2.3.1.1). The Western Avenue off-ramp from northbound SR 99 would be closed.

6.2.3.2.2 Traffic Stage 2 Traffic Revisions – Surface Streets

Alaskan Way would be restricted to one lane in each direction throughout the corridor.

6.2.3.3 Elevated Structure Alternative Traffic Stage 3

Traffic Stage 3 would last approximately 27 months, from October 2014 to January 2017. Primary construction activities are shown in Exhibit 6-22.

Exhibit 6-22. Elevated Structure Alternative Traffic Stage 3 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (27 months)
Construct seawall (S. Jackson Street to Pike Street)	3 months
Construct new southbound aerial viaduct (Pike Street to Battery Street Tunnel)	24 months
Construct southbound structure for side-by-side southbound transition lanes (S. King Street to S. Jackson Street)	24 months
Widen lower level (southbound) of existing viaduct (S. King Street to Pike Street)	15 months
Aurora Avenue improvements: Construct west half (southbound lanes) of lowered Aurora Avenue	18 months
Aurora Avenue improvements: Construct east half (northbound lanes) of lowered Aurora Avenue	9 months (continues in Stage 4)
Construct Thomas and Harrison Street overpasses	3 months (continues in Stages 4 and 5)
Battery Street Tunnel: Lower inverts for northbound and southbound lanes and retrofit existing walls	24 months

6.2.3.3.1 Traffic Stage 3 Traffic Revisions – SR 99

On SR 99, the traffic revisions would consist of the following:

- From the Broad Street off-ramp to Pike Street, southbound traffic on SR 99 would be diverted to the Broad Street detour and the lower level of the existing viaduct.
- Northbound SR 99 traffic would be conveyed on the existing facility with the Bell Street overcrossing.
- North- and southbound SR 99 traffic would continue using the WOSCA detour in the south area.

6.2.3.3.2 Traffic Stage 3 Traffic Revisions – Surface Streets

- Alaskan Way south of the Railroad Avenue ramps would operate with one lane in each direction under the existing viaduct.

- North of the Railroad Avenue ramps, Alaskan Way would operate with one lane in each direction along the west side of the corridor.
- Traffic would operate with three southbound lanes and one northbound lane on the Broad Street detour.

6.2.3.4 Elevated Structure Alternative Traffic Stage 4

Traffic Stage 4 would last up to approximately 4 months, from January 2017 to April 2017, as shown in Exhibit 6-23. The primary traffic revision would be the closure of SR 99 in both directions for the duration of Traffic Stage 4.

Exhibit 6-23. Elevated Structure Alternative Traffic Stage 4 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (3 to 4 months)
Continue Aurora Avenue improvements: Construct east half (northbound lanes) of lowered Aurora Avenue	3 months
Continue construction of Thomas and Harrison Street overpasses	3 months (continues in Stage 5)
Demolish upper (northbound) level of existing viaduct (S. King Street to Pike Street)	Up to 4 months

6.2.3.4.1 Traffic Stage 4 Traffic Revisions – SR 99

SR 99 would be closed in the project area. Traffic previously using the viaduct would need to use other facilities during this time period. In the south area, SR 99 would be closed north of the East Marginal Way S ramps, located south of S. Spokane Street. In the north area, northbound SR 99 would be closed south of Denny Way, and southbound SR 99 would be closed south of Broad Street.

6.2.3.4.2 Traffic Stage 4 Traffic Revisions – Surface Streets

Between S. Holgate Street and Pike Street, Alaskan Way would operate with one lane in each direction along the west side of the corridor.

6.2.3.5 Elevated Structure Alternative Traffic Stage 5 – Analyzed for Traffic Effects

Traffic Stage 5 would last approximately 24 months, from April 2017 to April 2019. Primary construction activities are shown in Exhibit 6-24.

See Exhibits 6-25 and 6-26 for the roadway configurations in the south and north areas.

Exhibit 6-24. Elevated Structure Alternative Traffic Stage 5 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (24 months)
Complete Thomas and Harrison Street overpasses	9 months
Construct northbound structure for side-by-side northbound transition lanes (S. King Street to S. Jackson Street)	24 months
Construct upper (northbound) level of elevated structure (Pike Street to Battery Street Tunnel)	24 months
Construct upper (northbound) level of elevated structure (S. King Street to Pike Street)	18 months
Perform final utility relocations (S. King Street to Battery Street Tunnel)	12 months

6.2.3.5.1 Traffic Stage 5 Traffic Revisions – SR 99

SR 99 would be back in operation in Traffic Stage 5. Between Pike Street and the Battery Street Tunnel, the northbound lanes would operate on a widened lower level of the Alaskan Way Viaduct and through the Battery Street Tunnel. Southbound traffic in this area would use the Broad Street detour. Between S. Jackson Street and Pike Street, both northbound and southbound traffic would operate on the widened lower level, with two lanes of traffic in each direction. The Columbia on-ramp to southbound SR 99 would operate as a northbound off-ramp during this stage. From S. Royal Brougham Way to S. Jackson Street, northbound and southbound traffic would operate on the completed southbound transition, with similar operating characteristics and connectivity as the WOSCA detour. Ramps to and from the north would be provided at this location. South of S. Royal Brougham Way, northbound and southbound traffic would use the completed at-grade facility and the western half of the SR 519 interchange. There would be no access to southbound SR 99 from the Broad Street detour on-ramp to the existing viaduct at Pike Street until south of S. Spokane Street.

6.2.3.5.2 Traffic Stage 5 Traffic Revisions – Surface Streets

- Alaskan Way would operate with one lane in each direction along the west side of the corridor.
- Traffic would operate with three southbound lanes and one northbound lane on the Broad Street detour.

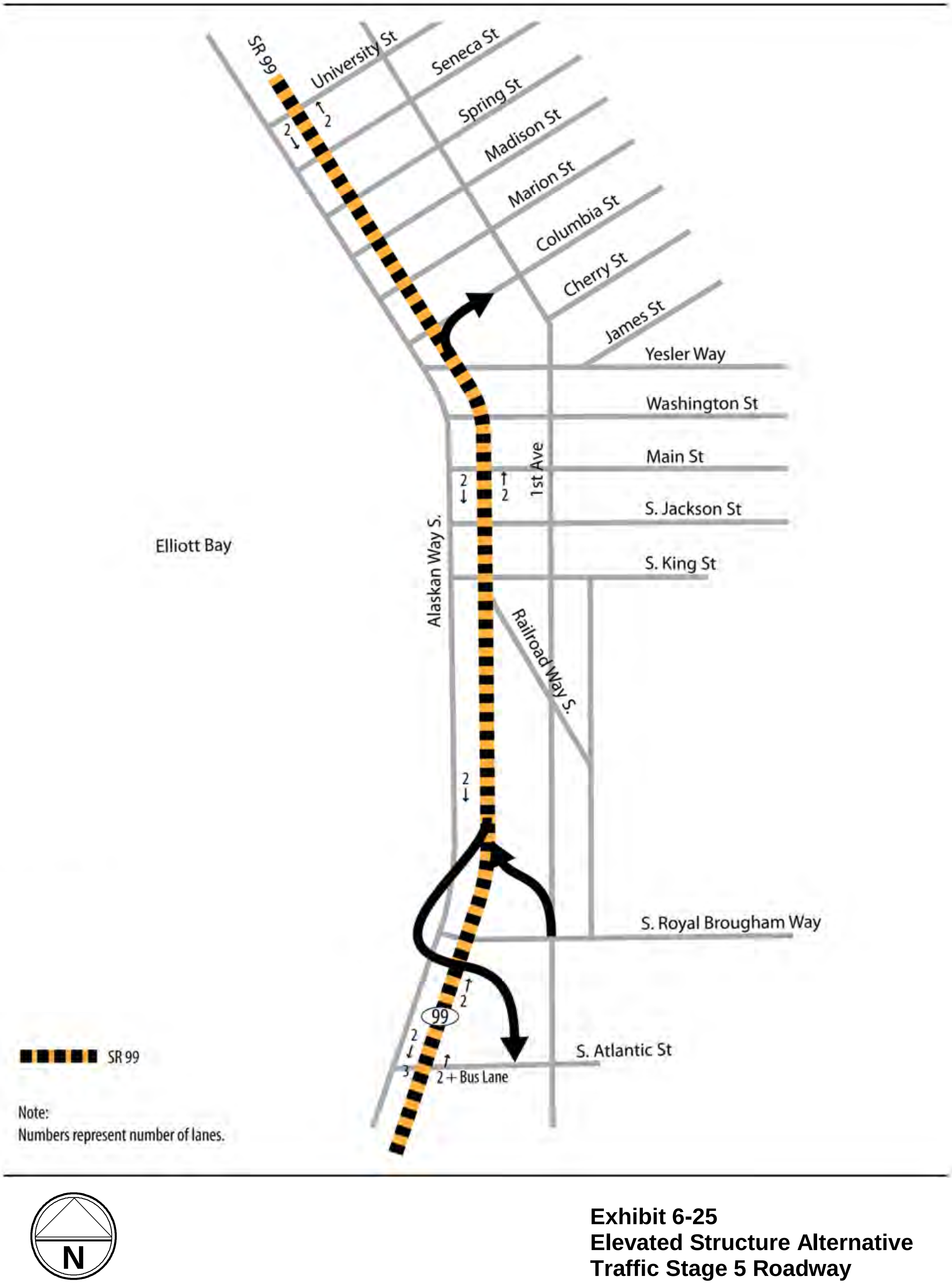

Exhibit 6-25
Elevated Structure Alternative Traffic Stage 5 Roadway Configuration (South)

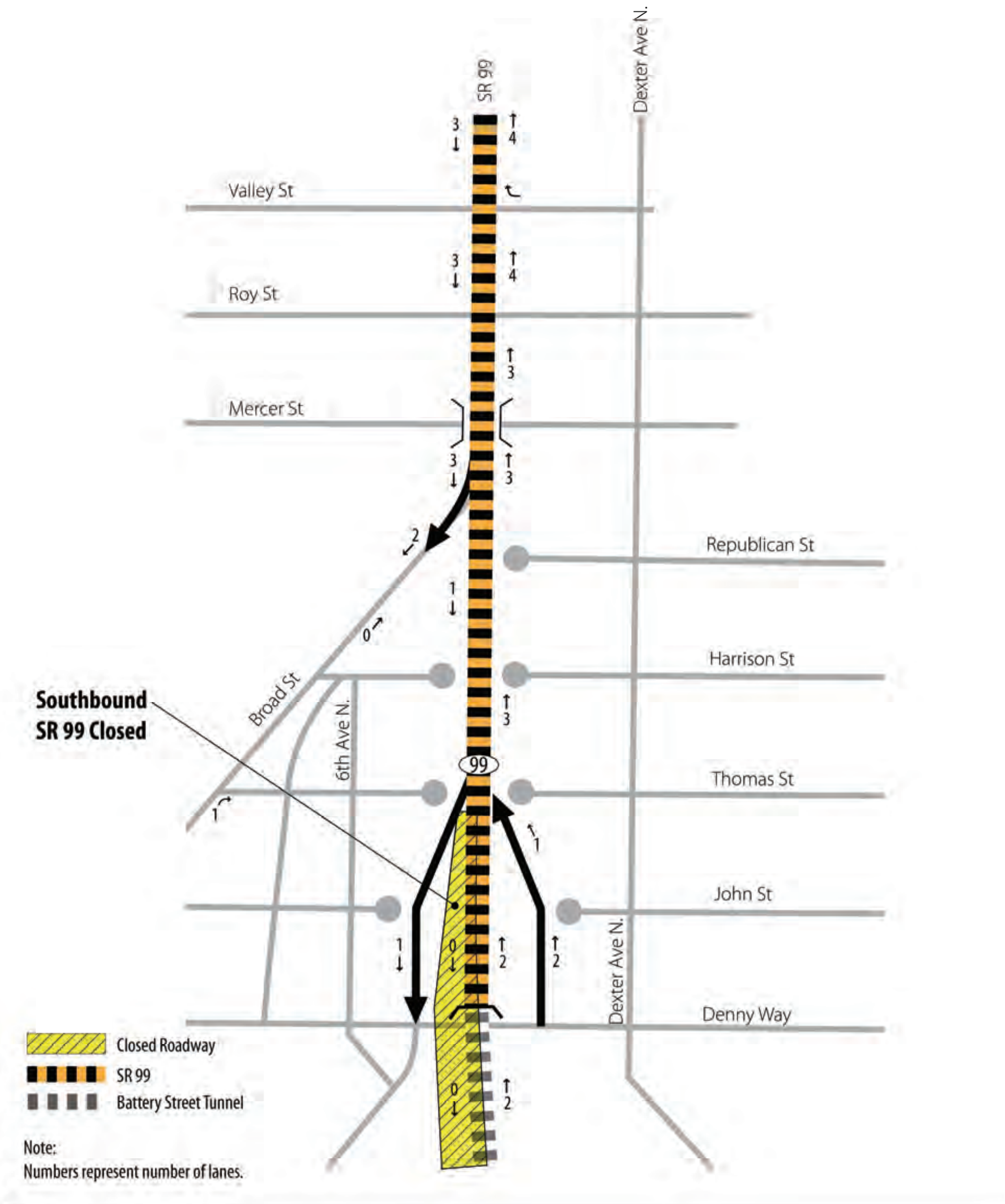

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Exhibit 6-26
Elevated Structure Alternative
Traffic Stage 5 Roadway
Configuration (North)

6.2.3.6 Elevated Structure Alternative Traffic Stage 6

Traffic Stage 6 would last approximately 21 months, from April 2019 to January 2021. Primary construction activities are shown in Exhibit 6-27.

Exhibit 6-27. Elevated Structure Alternative Traffic Stage 6 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (21 months)
Demolish lower (southbound) level of existing viaduct (S. King Street to Pike Street)	6 months
Construct lower (southbound) level of elevated structure (S. King Street to Pike Street)	18 months
Remove Broad Street detour	6 months
Improve surface streets in the north end	12 months

6.2.3.6.1 Traffic Stage 6 Traffic Revisions – SR 99

Northbound and southbound SR 99 would operate with two lanes in each direction on the completed upper level of the elevated structure. Both north- and southbound traffic would operate in the Battery Street Tunnel. The Seneca off-ramp would provide a midtown connection from SR 99 to downtown.

6.2.3.6.2 Traffic Stage 6 Traffic Revisions – Surface Streets

Between S. Holgate Street and Pike Street, Alaskan Way would operate with one lane in each direction along the west side of the Alaskan Way corridor. Broad Street would be permanently closed west of Fifth Avenue N.; the removal of the Broad Street detour would affect the rest of that street until October 2019.

6.2.3.7 Elevated Structure Alternative Traffic Stage 7

Traffic Stage 7 would last approximately 3 months, from January to April 2021, as shown in Exhibit 6-28. During this timeframe, SR 99 would be closed in the project area to remove the temporary southbound transition and construct the permanent southbound transition.

Exhibit 6-28. Elevated Structure Alternative Traffic Stage 7 Construction Activities and Approximate Durations

Primary Construction Activities	Approximate Duration (3 months)
Remove and replace temporary transition structure to completed S. Holgate Street to S. King Street roadway section	3 months
Conduct project closeout and restore surface streets	3 months (continues in Stage 8)

6.2.3.7.1 Traffic Stage 7 Traffic Revisions – SR 99

SR 99 would be closed in the project area.

6.2.3.7.2 Traffic Stage 7 Traffic Revisions – Surface Streets

Traffic would operate on the newly configured surface streets.

6.2.3.8 Elevated Structure Alternative Traffic Stage 8

Traffic Stage 8 would last approximately 3 months, from April to July 2021, as shown in Exhibit 6-29. At the beginning of this stage, SR 99 traffic would begin using the new elevated structure. Surface restoration activities would be completed in Traffic Stage 8.

Exhibit 6-29. Elevated Structure Alternative Traffic Stage 8 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (3 months)
Conduct project closeout and restore surface streets	3 months

6.2.3.8.1 Traffic Stage 8 Traffic Revisions – SR 99

The new SR 99 mainline would be open and using the new elevated structure.

6.2.3.8.2 Traffic Stage 8 Traffic Revisions – Surface Streets

Traffic would operate on newly configured surface streets.

6.3 Proposed Detours

The proposed detours discussed in this section consist of major planned detours included as part of the construction staging.

6.3.1 Bored Tunnel Alternative

Throughout the construction of the bored tunnel and the associated facilities, a number of traffic detours affecting surface streets or ramps would occur during the different construction stages. Some of the detours, such as those associated with short-duration closures of cross streets during the demolition of the Alaskan Way Viaduct, would be determined during the construction stage. Other proposed detours are more substantial.

During Traffic Stage 5, both northbound and southbound traffic would continue to travel on the WOSCA detour. This stage is considered the most disruptive of the traffic stages for the longest duration (approximately 16 months). Closure of the First Avenue S. ramps near Railroad Way S. that provide access between SR 99 and First Avenue S. is one of the factors that makes this stage more disruptive. To maintain access to and from the stadium area, a northbound on-ramp to and southbound off-ramp from SR 99 would be built to provide access to the area via S. Royal Brougham Way and S. Atlantic Street. In addition, Alaskan Way S. from S. King Street to the WOSCA site would be rerouted to a new alignment just east of SR 99. First Avenue S. would remain open, carrying two lanes of traffic in each direction.

Throughout construction in the north area, alternate travel routes may need to be designated for traffic accessing and leaving Seattle Center, especially during major events.

6.3.2 Cut-and-Cover Tunnel Alternative

Throughout the construction of the cut-and-cover tunnel and the associated facilities, a number of traffic detours affecting surface streets or ramps would occur during different stages. Some of the detours, such as those associated with short-duration closures of cross streets during the demolition of the Alaskan Way Viaduct, would be determined during the construction stage. Other proposed detours are more substantial.

During Traffic Stage 4, SR 99 would be closed to all northbound and southbound traffic from S. Royal Brougham Way to Denny Way. This stage is considered the most disruptive of the traffic stages for the longest duration (approximately 27 months). In addition, north-south traffic on Alaskan Way would also be eliminated (access to business and the ferry terminal would be provided using east-west streets only). Detours would require the use of other north-south arterials during this time period.

6.3.3 Elevated Structure Alternative

Throughout the construction of the elevated structure and the associated facilities, a number of traffic detours affecting surface streets or ramps would occur during different stages. Some of the detours, such as those associated with short-duration closures of cross streets during the demolition of the SR 99 viaduct, would be determined during the construction phase. Other proposed detours are more substantial.

During Traffic Stage 4 from February to April 2017, SR 99 would be closed, and the available detour routes would be the north-south arterials in downtown and I-5. During other traffic construction stages, other detours would include the WOSCA detour in the south area, the Broad Street detour during construction in the Battery Street Tunnel, and detours that shift traffic to different levels of the Alaskan Way Viaduct.

6.4 Traffic Congestion on SR 99

6.4.1 Bored Tunnel Alternative

This section provides a qualitative discussion of expected congestion levels on SR 99 through the project area for the Bored Tunnel Alternative construction period primarily defined by Traffic Stage 5, which would last about 16 months. A primary measure of the performance of mainline SR 99 is average speed. Vehicle delays on SR 99 in the sections south of the stadium area (northbound traffic) and north of Mercer Street (southbound traffic) during this 16-month (estimated) construction period are expected to increase somewhat compared to the delays for the 2015 Existing Viaduct. The decreases in speeds would be heavily influenced by temporary changes to the SR 99 configuration in the north and south areas, which are expected to reduce mainline capacity. Refer to Exhibits 6-7 and 6-8 for diagrams of the roadway configuration during Traffic Stage 5.

As described in the discussion of construction staging, SR 99 during Traffic Stage 5 would be reduced by one lane in certain directions for various sections of the corridor. Between S. Spokane Street and the stadium area, the outer northbound lane would be restricted to bus traffic only, effectively reducing the general-purpose capacity for northbound traffic to two lanes. In the stadium area, the WOSCA detour would provide two lanes in each direction. Through midtown from the stadium area to the Battery Street Tunnel, northbound traffic would be reduced by one lane. Finally, between Harrison and Roy Streets, SR 99 would be reduced to two lanes in each direction.

On SR 99 in the project area between the stadium area and Mercer Street, travel speeds in both directions are expected to be similar to those for the 2015 Existing Viaduct. Although it is not possible to compare identical segments due to the closure and relocation of some ramps during construction, it is possible to report general patterns.

For the PM peak hour, the SR 99 mainline northbound segments are expected to generally operate at speeds similar to or higher than those for the 2015 Existing Viaduct, except for the sections south of the stadium area off-ramp and north of the Western Avenue on-ramp. Northbound traffic in the segment between S. Spokane Street and S. King Street is predicted to experience slower speeds during construction due to the reduced SR 99 capacity. Through the Battery Street Tunnel and to the north, speeds are expected to be slower than those for the 2015 Existing Viaduct, due to the restricted capacity on the SR 99 mainline. In the southbound direction, a comparison of travel speeds between Traffic Stage 5 and the 2015 Existing Viaduct indicates similar speed patterns north of the Elliott Avenue on-ramp. South of the Elliott Avenue on-ramp, the speeds are expected to be reduced due to the reduction of capacity and the detour at the First Avenue S. ramps.

For the AM peak hour in the northbound direction, capacity would be reduced between S. Spokane Street and S. King Street during construction. As a result, northbound traffic in that segment is predicted to experience much slower speeds. However, north of the bottleneck, the speeds would increase and be similar to the speeds for the 2015 Existing Viaduct or greater through the remainder of the project area.

For the AM peak hour in the southbound direction, the speeds during construction of the Bored Tunnel Alternative are expected to be generally similar to those for the 2015 Existing Viaduct, except for the segment north of Aloha Street. Southbound traffic in the segment between the Aurora Bridge and Aloha Street is predicted to experience slower speeds during construction due to the reduced SR 99 capacity between Roy and Republican Streets.

6.4.2 Cut-and-Cover Tunnel Alternative

This section provides a qualitative discussion of expected congestion levels on SR 99 through the project area for the Cut-and-Cover Tunnel Alternative construction period primarily defined by Traffic Stage 4, which would last about 27 months. Vehicle delays on SR 99 during this 27-month (estimated) construction period are expected to increase substantially compared to those for Traffic Stage 5 of the Bored Tunnel Alternative construction. The substantial decreases in speeds would occur as a result of closing the Alaskan Way Viaduct and the Alaskan Way surface street. Refer to Exhibits 6-16 and 6-17 for diagrams of the roadway configuration during Traffic Stage 4.

As described in the discussion of construction staging, SR 99 during Traffic Stage 4 would be closed to northbound and southbound traffic for the entire 27-month duration. Alaskan Way would also be closed to all traffic. In the south area, northbound traffic on SR 99 would be diverted to surface streets at the stadium area ramps, and southbound traffic in the north area would be diverted at the Denny Way ramps.

During Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative construction, travel speeds for southbound traffic on the SR 99 mainline approaching the Broad Street exit would be similar to those expected for Traffic Stage 5 of the Bored Tunnel Alternative construction during both the AM and PM peak hours (see Section 6.2.1.5). This would result from a substantial decrease in forecasted volumes on the southbound SR 99 mainline as it approaches downtown. In addition, the Broad Street exit would be modified to two lanes; however, queue spillback from the traffic signal at Fifth Avenue N. and Broad Street would be expected, causing substantial congestion on southbound SR 99.

In the northbound direction, travel speeds on the SR 99 mainline approaching the stadium area off-ramp are expected to be substantially slower during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative than during Traffic Stage 5 of the Bored Tunnel Alternative during both the AM and PM peak hours. This would result from the substantial levels of congestion where the stadium area off-ramp connects with the local arterial street network, and the associated spillback onto the SR 99 mainline.

6.4.3 Elevated Structure Alternative

This section provides a qualitative discussion of expected congestion levels on SR 99 through the project area for the Elevated Structure Alternative construction period primarily defined by Traffic Stage 5, which would last about 24 months. Vehicle delays on SR 99 during this 24-month (estimated) construction period are expected to increase compared to those for Traffic Stage 5 of the Bored Tunnel Alternative. The decreases in speeds would be heavily influenced by temporary changes to the SR 99 configuration in the north and south areas, which are expected to reduce mainline capacity. Refer to Exhibits 6-25 and 6-26 for diagrams of the roadway configuration during Traffic Stage 5.

As described in the discussion of construction staging, SR 99 during Traffic Stage 5 would be reduced by one lane in certain directions for various sections of the corridor. Between S. Spokane Street and the stadium area, the outer northbound lane would be restricted to bus traffic only, effectively reducing the general-purpose capacity for northbound traffic to two lanes. In the stadium area, the WOSCA detour would provide two lanes in each direction. Through midtown from the stadium area to the Battery Street Tunnel, northbound traffic would be reduced to two lanes. The southbound lanes of the mainline would be closed to traffic between the Denny Way off-ramp and Pike Street.

On SR 99 in the project area between S. Atlantic Street and Mercer Street, travel speeds in both directions are expected to be generally similar to those during Traffic Stage 5 of the Bored Tunnel Alternative, with exceptions in some locations. Again, although it is not possible to compare identical segments due to the closure and relocation of some ramps during construction, it is possible to report general patterns.

For the PM peak hour, the SR 99 mainline northbound segments are expected to generally operate at speeds similar to the speeds on the same segments during Traffic Stage 5 of the Bored Tunnel Alternative. In the southbound direction, travel speeds are expected to slow substantially as traffic approaches the Broad Street and Denny Way off-ramps. This would be a result of congestion caused by all vehicles exiting the mainline, as the SR 99 mainline would be closed to traffic through the Battery Street Tunnel to approximately Pike Street. South of Pike Street, travel speeds are expected to be similar or greater than those during Traffic Stage 5 of the Bored Tunnel Alternative.

For the AM peak hour in the northbound direction, travel speeds are expected to become slower approaching the stadium area because of reduced capacity on the mainline. North of the stadium area, northbound travel speeds are expected to be similar to those during Traffic Stage 5 of the Bored Tunnel Alternative. In the southbound direction, similar to the PM peak hour, speeds during construction are expected to be slower as traffic approaches the Broad Street and Denny Way off-ramps. Again, this would be a result of congestion caused by all vehicles exiting the mainline. South of Pike Street, travel speeds for the Elevated Structure Alternative are expected to be similar or greater than those during Traffic Stage 5 of the Bored Tunnel Alternative.

6.5 Traffic Congestion on Surface Streets

6.5.1 Bored Tunnel Alternative

This section provides a qualitative discussion of expected congestion levels at intersections or intersection groupings for the construction period primarily defined by Traffic Stage 5 of the Bored Tunnel Alternative. Increased vehicle delays at intersections within the study area during this 16-month (estimated) construction period are expected, heavily influenced by temporary changes to the SR 99 configuration in the north and south area, which are expected to reduce mainline capacity, modify access at critical points along the corridor, and potentially lead to the redistribution of north-south mainline traffic demands to local arterials and other parallel regional facilities such as I-5.

Although specific technical data are not provided in this section, conclusions drawn from the results of preliminary analyses are provided to highlight areas where congestion could occur.

6.5.1.1 South Area

Traffic operations at intersections in the south portal area during critical stages of construction are likely to be congested. Intersections affected by shifts in traffic away from mainline SR 99 to local arterials may experience longer delays. As described in the discussion of construction staging in the south area, northbound and southbound traffic would use the WOSCA detour. The ramps to First Avenue S. would be closed, and traffic would continue to use the temporary northbound on-ramp and southbound off-ramp to access SR 99.

Redistribution of traffic to local arterials would potentially cause additional congestion on major north-south routes such as Second and Fourth Avenues.

Of the intersections evaluated for construction effects, it was found that construction period congestion would increase delay at the intersection of First Avenue S. at S. King Street by more than 2 minutes during the AM peak hour and by more than 1 minute during the PM peak hour. Delay at the intersection of Alaskan Way at Yesler Way is forecasted to increase by more than 1 minute during the AM and PM peak hours. Delay at the intersection of Alaskan Way S. at S. King Street is forecasted to increase by more than 2 minutes during both the

AM and PM peak hours. Additionally, delay at the intersection of Second Avenue S. at S. Jackson Street is forecasted to increase by more than 2 minutes during the PM peak hour.

6.5.1.2 Central Area

Traffic congestion at intersections in the central area is expected to increase due to increased peak hour volumes. However, although peak hour volumes are generally expected to increase at the majority of intersections along north-south arterials such as First, Second, and Fourth Avenues, the magnitude of these increases would not result in high levels of congestion in most of these locations

6.5.1.3 North Area

The primary changes to the traffic network in the north portal area during Traffic Stage 5, outside of the widening and conversion of Mercer Street to a two-way corridor from Fifth Avenue N. to Dexter Avenue N., would be the restrictions on access to and from SR 99 south of Mercer Street. These access modifications would shift a portion of peak hour traffic to upstream or downstream connections to and from the street grid. In the southbound direction, access at Roy, Republican, Harrison, and Broad Streets would be restricted, and southbound traffic would need to shift to access points to the north or south. The southbound Broad Street off-ramp would be open during Traffic Stage 5.

During Traffic Stage 5, northbound traffic would not be able to exit SR 99 to Republican Street, but all the other northbound exits (Harrison, Roy, Mercer, and Aloha Streets) should be operational.

Peak hour congestion levels at intersections near these affected on- and off-ramp connections or along affected arterials would potentially increase due to higher concentrations of peak hour traffic during construction. Also, data from preliminary analyses indicate that the Mercer Street reconstruction would result in increases in construction period congestion at the following locations:

- **Dexter Avenue N. at Denny Way.** Delay is expected to increase by more than 1 minute during the AM peak hour.
- **Dexter Avenue N./SR 99 northbound off-ramp at Mercer Street.** Delay is expected to increase by more than 5 minutes during the AM and PM peak hours.
- **Fairview Avenue N./I-5 ramps at Mercer Street.** Delay is expected to increase by more than 1 minute during the PM peak hour.

6.5.2 Cut-and-Cover Tunnel Alternative

This section provides a qualitative discussion of expected congestion levels at intersections or intersection groupings for the construction period primarily defined by Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative.

The 27-month closure of the SR 99 in both directions during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative, coupled with closure of Alaskan Way along the central waterfront, would result in the greatest magnitude of traffic disruption of all three build alternatives.

Traffic volumes on alternate routes to SR 99 and Alaskan Way, namely city surface streets and I-5, would increase. However, a net decrease in total north-south traffic volumes is expected due to capacity limitations and congestion on the alternate routes. In other words, traffic increases on alternate routes would be less than the corresponding volume of traffic displaced from SR 99. A number of changes in traveler behavior may contribute to this decrease, including changes in travel mode (carpool and transit), reductions in trip making, changes to alternative destinations, or consolidation of trips.

Even with the net decrease in total north-south traffic volumes during construction Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative, congestion on alternate routes is still expected to be severe. Because alternate roadways have a limited capacity available to accommodate additional traffic, increased demand on alternate routes during construction would greatly increase not only the magnitude of congestion but also the frequency and duration of congestion. It is difficult to precisely quantify increases in congestion, but in general, congestion would occur more frequently, with greater severity, and for longer durations during the construction of the Cut-and-Cover Tunnel Alternative compared to the other build alternatives.

Although specific technical data are not provided in this section, conclusions drawn from the results of preliminary analyses are provided to highlight areas where congestion could occur.

6.5.2.1 South Area

Traffic operations at intersections in the south area during critical stages of construction are likely to be extremely congested. All SR 99 traffic to and from the south would exit via temporary ramps at the intersection just west of S. Royal Brougham Way at First Avenue S. The volume of traffic entering and exiting via these ramps would cause the surrounding intersections to experience very long delays (approximately 10 minutes during the AM peak hour and 6 minutes during the PM peak hour). Delays at intersections in the south area during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative are expected to be much longer than those during Traffic Stage 5 of the Bored Tunnel Alternative.

In addition, Alaskan Way would be closed from University Street to S. Atlantic Street. A redistribution of traffic from SR 99 and Alaskan Way to other local arterials is expected to cause severe congestion on major north-south routes such as First and Fourth Avenues.

Of the intersections evaluated for construction, it was found that construction period congestion during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative would increase relative to the congestion during Traffic Stage 5 of the Bored Tunnel Alternative at the following intersections:

- **First Avenue S. at Yesler Way.** Delay is expected to increase by over 1 minute during the PM peak hour.
- **First Avenue S. at S. King Street.** Delay is expected to increase by almost 2 minutes during the AM and PM peak hours.
- **First Avenue S. at S. Royal Brougham Way.** Delay is expected to increase by over 8 minutes during the AM peak hour and over 6 minutes during the PM peak hour.

6.5.2.2 Central Area

During Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative, traffic diverted to downtown streets would increase congestion levels and result in extended periods of congested conditions. Under normal conditions with SR 99 open to traffic, peak congestion levels typical of a weekday commute could be expected on downtown streets and streets south of downtown for 3 to 4 hours per day. During full closure of SR 99, such conditions could occur throughout the day, with the potential to last for as many as 10 to 13 hours per day.

Additionally, north-south travel through the construction zone on the Alaskan Way surface street would not be possible. During this time, Alaskan Way along the central waterfront would be closed to traffic to facilitate construction of the cut-and-cover tunnel. Lateral connections through the construction zone (e.g., east-west connections to Western Avenue) would be established to provide pedestrian, delivery, and emergency access to waterfront businesses. Access to Colman Dock would also be maintained throughout the construction period.

Construction activities, especially along the central waterfront, would likely interfere with access to businesses and properties adjacent to the project area on either side of the right-of-way. A primary goal of construction planning is to maintain adequate access to all businesses so they can continue to operate.

As a result of all of the access changes along SR 99 and Alaskan Way, traffic congestion at the intersections evaluated in the central area is expected to increase due to increased peak hour volumes. Intersections in the central area that would operate with a substantially longer delay (1 minute or more) during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative compared to the delay during Traffic Stage 5 of the Bored Tunnel Alternative include the following:

- **Western Avenue at Broad Street**. Delay is expected to increase by over 1 minute during the AM and PM peak hours.

- **Western Avenue at Spring Street and First Avenue at Spring Street**. Delay is expected to increase by over 2 minutes during the AM peak hour and by approximately 1 minute during the PM peak hour.
- **Second Avenue at Marion Street.** Delay is expected to increase by over 1 minute during the AM peak hour.

6.5.2.3 North Area

The primary changes to the traffic network in the north area during Traffic Stage 4, outside of the widening and conversion of Mercer Street to a two-way corridor from Fifth Avenue N. to Dexter Avenue N., would be the restrictions on access to and from SR 99 south of Mercer Street and the closure of SR 99 south of Denny Way. These access modifications would require all traffic traveling southbound on Aurora Avenue to exit onto the street grid. All traffic wishing to travel northbound on Aurora Avenue would access the facility via the street gird as well, due to closure of the Battery Street Tunnel. In the southbound direction, access at Republican and Harrison Streets and Denny Way would be restricted. Traffic that currently uses the southbound Denny Way off-ramp would be directed to the Broad Street off-ramp because the Denny Way off-ramp would be closed to allow the construction of lowered Aurora Avenue.

During Traffic Stage 4, northbound traffic would not be able to exit SR 99 via the slip lane to Mercer Street, but all the other northbound exits (Harrison, Republican, Roy, and Aloha Streets) should be operational during Traffic Stage 4, including the northbound on-ramp at Denny Way.

Peak hour congestion levels at intersections near these affected on- or off-ramp connections or along affected arterials would potentially increase due to higher concentrations of peak hour traffic, similar to the Bored Tunnel Alternative. Also, data from preliminary analyses indicate that delay at the following intersections during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative would increase substantially compared to the delay during Traffic Stage 5 of the Bored Tunnel Alternative:

- **Fifth Avenue N. at Denny Way.** Delay is expected to increase by over 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Roy Street.** Delay is expected to increase by approximately 1 minute during the AM peak hour
- **Sixth Avenue N. at Denny Way and Westlake Avenue N. at Mercer Street.** Delay is expected to increase by over 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Mercer, Denny Way at Wall Street, and Dexter Avenue N. at Harrison Street.** Delay is expected to increase by approximately 2 minutes during the PM peak hour.

6.5.3 Elevated Structure Alternative

This section provides a qualitative discussion of expected congestion levels at intersections or intersection groupings for the construction period primarily defined by Traffic Stage 5 of the Elevated Structure Alternative.

Increased delay at intersections within the study area during this 24-month construction period is expected, heavily influenced by temporary changes to the SR 99 configuration in the north and south areas, specifically the Broad Street detour and the inability to provide southbound on-ramps to SR 99 between the temporary southbound connection on Alaskan Way at Pike Street and south of S. Spokane Street. These changes are expected to reduce mainline capacity, modify access at critical points along the corridor, and increase traffic volumes on north-south surface streets through downtown and on other parallel regional facilities such as I-5.

Although specific technical data are not provided in this section, conclusions drawn from the results of preliminary analyses are provided to highlight areas where congestion could occur.

6.5.3.1 South Area

Traffic operations at intersections in the south area during critical stages of construction are likely to be congested. Intersections affected by shifts in traffic demand away from mainline SR 99 to local arterials may experience longer delays. In the south area, northbound and southbound traffic would use the temporary transition structure. The ramps to First Avenue S. would be closed and traffic would continue to use the temporary northbound on-ramp and southbound off-ramp to access SR 99, similar to Traffic Stage 5 for the Bored Tunnel Alternative.

The congestion in the south area would be due to the expected redistribution of traffic to local arterials as a result of access changes on SR 99 during construction. Redistribution of traffic to local arterials would potentially cause additional congestion on major north-south routes such as Second and Fourth Avenues, similar to that during Traffic Stage 5 of the Bored Tunnel Alternative.

Most of the intersections evaluated in the south area for Traffic Stage 5 of the Elevated Structure Alternative would operate with congestion during the AM peak hour, similar to that for Traffic Stage 5 of the Bored Tunnel Alternative, with the exception of the intersection of Alaskan Way at Yesler Way. Under the Elevated Structure Alternative Traffic Stage 5, this intersection is expected to experience even more congestion due to the reduced capacity along Alaskan Way, compared to the capacity on Alaskan Way provided during construction of Bored Tunnel Alternative.

Similarly, most intersections evaluated in the south area for Traffic Stage 5 of the Elevated Structure Alternative would operate with PM peak hour congestion similar to that during Traffic Stage 5 of the Bored Tunnel Alternative, with a few exceptions. During the PM peak hour, the intersection of Alaskan Way at Yesler Way is expected to experience an increase in delay of over 8 minutes. The intersections of First Avenue S. at S. Atlantic Street and Second Avenue S. at S. Jackson Street are both expected to experience increased delays of over 1 minute, compared to those of the Bored Tunnel Alternative.

6.5.3.2 Central Area

During Traffic Stage 5 of the Elevated Structure Alternative, Alaskan Way along the central waterfront would be restricted to one lane in each direction to allow local access, deliveries, and emergency access to waterfront businesses. Access to Colman Dock would also be maintained throughout the construction period.

The Broad Street detour would still be in place during Traffic Stage 5. During this time, southbound traffic on SR 99 would be directed off Aurora Avenue to Broad Street, over a temporary overpass of the BNSF mainline and down Alaskan Way, connecting back to the lower level of the existing viaduct via a temporary structure in the vicinity of Pike Street. During this time, Broad Street would be reconfigured from two eastbound and two westbound lanes to three westbound lanes and one eastbound lane.

Additionally, the northbound Seneca off-ramp would be closed, as all traffic would be traveling on a widened lower level on the viaduct. The northbound Western off-ramp would be open. In the southbound direction, the Columbia Street southbound on-ramp would be temporarily reconfigured to a northbound on-ramp. The southbound Elliott on-ramp would be closed. Therefore, there would be no access to southbound SR 99 from the temporary ramp at Alaskan Way and Pike Street until south of S. Spokane Street.

As a result of all of the access changes along SR 99, traffic congestion at intersections evaluated in the central area during Traffic Stage 5 of the Elevated Structure Alternative is expected to increase due to increased peak hour volumes, similar to Traffic Stage 5 of the Bored Tunnel Alternative.

Most of the intersections evaluated in the central area for Traffic Stage 5 of the Elevated Structure Alternative would operate with congestion during the AM and PM peak hours similar to that for Traffic Stage 5 of the Bored Tunnel Alternative, with the exception of the intersection of Alaskan Way at Marion Street. During the Traffic Stage 5 of the Elevated Structure Alternative, this intersection is expected to experience an increase in delay of over 2 minutes during the AM peak hour compared to the delay for the Bored Tunnel Alternative due to the reduced capacity along Alaskan Way.

6.5.3.3 North Area

The primary changes to the traffic network in the north area, outside of the widening and conversion of Mercer Street to a two-way corridor from Fifth Avenue N. to Dexter Avenue N., would be the restrictions on access to and from SR 99 south of Mercer Street. These access modifications would shift a portion of peak hour traffic to upstream or downstream connections to and from the street grid.

Two southbound lanes would be directed to exit at Broad Street, and only one southbound lane would continue to Denny Way. Southbound access at Republican and Harrison Streets would be restricted, and southbound traffic would need to shift to access points to the north or south.

Northbound traffic would not be able to exit SR 99 from Denny Way to north of Mercer Street during Traffic Stage 5. Traffic would shift to the Denny Way on-ramp or arterials north of Mercer Street.

Peak hour congestion levels at intersections near these affected on- or off-ramp connections or along affected arterials would potentially increase due to higher concentrations of peak hour traffic, similar to Traffic Stage 5 of the Bored Tunnel Alternative. Also, data from preliminary analyses indicate that delay at the following intersections for the Elevated Structure Alternative would increase substantially compared to that of the Bored Tunnel Alternative:

- **Southbound Aurora Avenue at Denny Way.** Delay is expected to increase by approximately 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Mercer Street.** Delay is forecasted to increase by over 2 minutes during the PM peak hour.

6.6 AM and PM Peak Hour Travel Times

Travel time was used to gauge the potential effects of project construction activities on two typical trips that use the SR 99 corridor: between Woodland Park and S. Spokane Street and between Ballard and S. Spokane Street. These routes were deemed sufficient for describing the effects of construction activity on regional travel in the SR 99 corridor.

6.6.1 Woodland Park to S. Spokane Street

As described in Chapters 4 and 5, this route represents one of the longer travel time paths identified. It aligns directly through the study area along the SR 99 corridor and captures trips not originating or destined to the Seattle CBD. During the AM peak hour, construction-stage travel times in both the southbound and northbound directions would be shortest for the Bored Tunnel Alternative (15 to 20 minutes) and substantially longer for the Cut-and-Cover Tunnel Alternative (approximately 50 minutes). Travel times for the Elevated Structure Alternative would be similar or slightly longer than those for the Bored Tunnel Alternative but far shorter than those for the Cut-and-Cover Tunnel Alternative. The large differences in travel times between the Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative would primarily be due to the removal of the SR 99 central waterfront segment and a substantial portion of Alaskan Way during construction of the Cut-and-Cover Tunnel Alternative. During construction of the Bored Tunnel Alternative, a minimum of two lanes would be provided on SR 99 for both directions, and Alaskan Way would be fully functional.

In the PM peak hour, a similar trend in construction-stage travel times would be expected, with the shortest travel times for the Bored Tunnel Alternative and the longest travel times for the Cut-and-Cover Tunnel Alternative. Again, construction-stage travel times for the Elevated Structure Alternative would be similar to those for the Bored Tunnel Alternative.

6.6.2 Ballard Bridge to S. Spokane Street – Via Alaskan Way Viaduct and/or Alaskan Way

This route also reflects travel times for longer-distance through-trips between Ballard and S. Spokane Street connecting two neighborhoods on the edge of the project study area.

During the AM peak hour, travel times in both directions for the Bored Tunnel Alternative during construction-stage conditions are expected to be shortest compared to those of the other two build alternatives. With the SR 99 waterfront segment removed and a large portion of Alaskan Way out of commission, travel times for the Cut-and-Cover Tunnel Alternative are expected to be far longer compared to those of both the Bored Tunnel Alternative and the Elevated Structure Alternative. Travel times for the Cut-and-Cover Tunnel Alternative would range from 45 to 55 minutes compared to a range of 15 to 25 minutes for the Bored Tunnel Alternative and Elevated Structure Alternative.

During the PM peak hour, a similar although not identical pattern is expected, with the longest construction-stage travel times for the Cut-and-Cover Tunnel Alternative and much shorter travel times for the Bored Tunnel and Elevated Structure Alternatives. Travel times for the Cut-and-Cover Tunnel Alternative are expected to be within a range of 40 to 55 minutes, and travel times for the other two build alternatives would likely be between 15 and 25 minutes.

6.7 Transit Services

This section discusses the potential effects on public transit services during construction of the Bored Tunnel Alternative. Comparisons are provided between the effects worst-case construction stages of the Bored Tunnel Alternative and those of the Cut-and-Cover Tunnel and the Elevated Structure Alternatives. Construction-related effects on transit are discussed in terms of

(1) traffic conditions affecting bus operations in the south, central, and north areas and (2) travel times along major corridors connected to downtown Seattle. The traffic conditions affecting transit service are based on those presented in Sections 6.1.4 and 6.1.5, and travel times along major transit corridors were identified by means of travel demand and operations models.

6.7.1 Bored Tunnel Alternative

During Traffic Stage 5 of the Bored Tunnel Alternative, general-purpose traffic and bus operations would be maintained on SR 99. Connections to and from SR 99 would also be maintained in areas where current access exists; these locations include the Seneca Street off-ramp and the Columbia Street on-ramp in downtown Seattle. King County Metro bus services using SR 99 would be affected by the 40-mph speed limit. Added traffic volumes during the peak hour would increase travel times in the central and north areas. Also, the north area would be affected by traffic congestion related to the Mercer Street reconstruction.

6.7.1.1 South Area

In the south area, there would be a one-lane reduction of SR 99 in each direction. The reduction in speed and lane capacity would affect bus operations for West Seattle and south King County routes serving downtown Seattle. Therefore, buses using SR 99 (primarily those that travel between West Seattle/south King County and downtown) would experience slightly longer travel times. Although transit access routes would be maintained, King County Metro may decide to make some routing changes to alleviate the effects of the expected congestion.

During Traffic Stage 5 of the Bored Tunnel Alternative, Alaskan Way S. would be closed between S. King Street and S. Atlantic Street. Redistribution of traffic to local arterials would potentially cause additional congestion on major north-south transit corridors in the south area, such as Second and Fourth Avenues S. The availability of bus-only lanes on these arterials north of S. Jackson Street would help lessen the overall delays during construction. Of the intersections in the south area evaluated for construction effects, it was found that congestion would increase delay at one location served by buses. Delay at the intersection of Second Avenue S. and S. Jackson Street is forecasted to increase by more than 2 minutes during the PM peak hour.

6.7.1.2 Central Area

Although peak hour volumes are generally expected to increase for a majority of intersections along north-south transit arterials, such as Second and Fourth Avenues, the magnitude of these increases would not result in high levels of congestion in most locations.

6.7.1.3 North Area

During Traffic Stage 5, northbound traffic would not be able to exit SR 99 at Republican Street, but all the other northbound exits (Harrison, Mercer, Roy, and Aloha Streets) should be operational. Due to higher concentrations of peak hour traffic, peak hour congestion levels at intersections near these affected on- and off-ramp connections or along affected arterials would potentially increase. Also, preliminary analysis indicates that the Mercer Street reconstruction would result in increases in construction-stage congestion at the following locations that are served by public transit:

- **Dexter Avenue N. at Denny Way.** Delay is expected to increase by more than 1 minute during the AM peak hour.
- **Dexter Avenue N./SR 99 northbound off-ramp at Mercer Street.** Delay is expected to increase by more than 5 minutes during the AM and PM peak hours.

6.7.1.4 Travel Time Variations Between Bored Tunnel Alternative and 2015 Existing Viaduct

Exhibit 6-30 identifies travel time variations for general-purpose traffic and buses between Traffic Stage 5 of the Bored Tunnel Alternative and the 2015 Existing Viaduct. The assessed corridors are Elliott Avenue (south of the Ballard Bridge to Denny Way), Aurora Avenue (south of the Aurora Bridge to Denny Way), and Woodland Park to S. Spokane Street, which includes the SR 99 corridor and major north-south streets in downtown Seattle that are served by buses.

Exhibit 6-30. Construction-Related Travel Times Along Major Transit Corridors – Bored Tunnel Alternative and 2015 Existing Viaduct

	AM Peak Hour			PM Peak Hour		
	2015 Existing Viaduct (minutes)	Bored Tunnel (minutes)	Variation (minutes)	2015 Existing Viaduct (minutes)	Bored Tunnel (minutes)	Variation (minutes)
Elliott Avenue (South of Ballard Bridge to Denny Way)						
Southbound	8	8	0	8	8	0
Northbound	8	8	0	8	8	0
Aurora Avenue (South of Aurora Bridge to Denny Way)						
Southbound	7	9	2	6	6	0
Northbound	7	6	-1	6	8	2
Woodland Park to S. Spokane Street						
Southbound	16	19	3	15	18	3
Northbound	16	16	1	18	21	3

For Elliott Avenue, transit travel times for the Bored Tunnel Alternative and the 2015 Existing Viaduct would be the same. For Aurora Avenue, the variation in transit travel times would range between 0 and 2 minutes. The most extensive variation would be 2 additional minutes with the Bored Tunnel Alternative for southbound trips in the AM peak hour and northbound trips in the PM peak hour. The time variation for these trips would be attributable to buses using a single lane to access the ramps near Denny Way.

Compared to conditions with the 2015 Existing Viaduct, travel times along the Woodland Park to S. Spokane Street transit corridor would be longer with the Bored Tunnel Alternative. Except for northbound trips in the AM peak hour, the travel time variations would be approximately 3 additional minutes for the Bored Tunnel Alternative as. However, the addition of approximately 3 minutes in travel time would occur over a substantial distance between North Seattle and the south area.

6.7.2 Cut-and-Cover Tunnel Alternative

During Traffic Stage 4, the Cut-and-Cover Tunnel Alternative would require closing SR 99 to all traffic, including buses, for 27 months during construction. The total duration of construction for the Cut-and-Cover Tunnel Alternative would be 105 months. Buses operating on SR 99, including routes serving West Seattle and other locations south of downtown Seattle would have to access downtown Seattle at a temporary connection in the stadium area. In the north area, southbound buses using SR 99 would be diverted to surface streets at the Broad Street off-ramp.

Compared to the Bored Tunnel Alternative, the extent of construction-related disruptions resulting from the Cut-and-Cover Tunnel Alternative during Traffic Stage 4 would be substantially greater. Although the Bored Tunnel Alternative would result in some transit-related disruptions, SR 99 would remain open as opposed to a complete closure under the Cut-and-Cover Tunnel Alternative.

6.7.2.1 South Area

The closure of SR 99 during Traffic Stage 4 would directly affect those buses diverting to surface streets in the south area. However, other bus routes operating in the project area would be affected by the diversion of large volumes of general-purpose traffic from SR 99 to surface streets. These bus routes serve major north-south transit corridors such as First, Second, Third, and Fourth Avenues.

All SR 99 traffic to and from the south would exit via temporary ramps at the intersection just west of S. Royal Brougham Way at First Avenue S. The volume of traffic entering and exiting these ramps would cause long delays at the surrounding intersections (approximately 10 minutes during the AM peak hour and 6 minutes during the PM peak hour). In addition, Alaskan Way would be closed from University Street to S. Atlantic Street. Redistribution of traffic from SR 99 and Alaskan Way to other local arterials is expected to cause substantial congestion on major north-south routes with substantial bus volumes; examples include First and Fourth Avenues S.

Of the intersections in the south area evaluated for construction-related effects, it was found that peak period congestion resulting from the Cut-and-Cover Tunnel Alternative would increase compared to congestion resulting from the Bored Tunnel Alternative at locations with bus operations. These locations and the associated delays are the following:

- **First Avenue S. at Yesler Way.** Delay is expected to increase by over 1 minute during the PM peak hour.
- **First Avenue S. at S. King Street.** Delay is expected to increase by almost 2 minutes during the AM and PM peak hours.
- **First Avenue S. at S. Royal Brougham Way.** Delay is expected to increase by over 8 minutes during the AM peak hour and over 6 minutes during the PM peak hour.

6.7.2.2 Central Area

During Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative, traffic diverted to downtown streets would increase congestion levels and result in extended periods of congested conditions. During normal conditions with SR 99 open to traffic, peak congestion levels typical of a weekday commute, including for transit vehicles, could be expected on downtown streets and streets south of downtown for 3 to 4 hours per day. However, during full closure of SR 99, such conditions could occur throughout the day, with the potential to last for as many as 10 to 13 hours per day.

6.7.2.3 North Area

During Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative, northbound traffic would not be able to exit SR 99 at Republican Street. But the other northbound exits (Harrison, Roy, and Aloha Streets) should be operational, including the northbound on-ramp at Denny Way. Traffic would likely shift to Harrison Street south of Republican Street or Roy Street to the north. Peak hour congestion levels at intersections near these affected on- or off-ramp connections or along affected arterials would potentially increase due to higher concentrations of traffic, similar to the Bored Tunnel Alternative. Also, the results of preliminary analyses indicate that delay at the following intersections with transit service would increase for Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative as compared to Traffic Stage 5 of the Bored Tunnel Alternative:

- **Fifth Avenue N. at Denny Way.** Delay is expected to increase by over 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Roy Street.** Delay is expected to increase by approximately 1 minute during the AM peak hour
- **Sixth Avenue N. at Denny Way and Westlake Avenue N. at Mercer Street.** Delay is expected to increase by over 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Mercer, Denny Way at Wall Street, and Dexter Avenue N. at Harrison Street.** Delay is expected to increase by approximately 2 minutes during the PM peak hour.

6.7.2.4 Travel Time Variations Between Bored Tunnel Alternative and Cut-and-Cover Tunnel Alternative

Exhibit 6-31 identifies travel time variations between Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative and Traffic Stage 5 of the Bored Tunnel Alternative for general-purpose traffic and bus operations on major bus corridors. The corridors assessed are Elliott Avenue (south of the Ballard Bridge to Denny Way), Aurora Avenue (south of the Aurora Bridge to Denny Way), and the Woodland Park to S. Spokane Street corridor, which includes Aurora Avenue and major north-south streets in downtown Seattle.

Exhibit 6-31. Construction-Related Travel Times Along Major Transit Corridors – Bored Tunnel and Cut-and-Cover Tunnel Alternatives

	AM Peak Hour			PM Peak Hour		
	Bored Tunnel (minutes)	Cut-and-Cover Tunnel (minutes)	Variation (minutes)	Bored Tunnel (minutes)	Cut-and-Cover Tunnel (minutes)	Variation (minutes)
Elliott Avenue (South of Ballard Bridge to Denny Way)						
Southbound	8	8	0	8	8	0
Northbound	8	8	0	8	9	1
Aurora Avenue (South of Aurora Bridge to Denny Way)						
Southbound	9	14	5	6	5	-1
Northbound	6	8	2	8	5	-3
Woodland Park to Spokane Street						
Southbound	19	49	30	18	43	25
Northbound	16	51	35	21	49	28

For Elliott Avenue, there would be relatively small variations in transit travel time between the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. The largest variation would be for northbound trips in the PM peak hour. For the Cut-and-Cover Tunnel Alternative, these trips would take approximately

1 minute longer than for the Bored Tunnel Alternative. Most effects resulting from the Cut-and-Cover Tunnel Alternative would occur south of Denny Way.

For Aurora Avenue, southbound buses would need to exit at Broad Street, along with all general-purpose traffic, because the Battery Street Tunnel and the existing Alaskan Way Viaduct would be closed. Travel times for southbound buses were measured from south of the Aurora Bridge to the intersection of Fifth Avenue N. at Denny Way. The southbound variation in transit travel times would range between 2 and 5 minutes. The northbound transit travel times are actually forecasted to improve under the Cut-and-Cover Tunnel Alternative. This is attributable to the closure of the Battery Street Tunnel and lack of northbound traffic on Aurora Avenue.

For travel between Woodland Park and S. Spokane Street, substantial variations in travel would occur between the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. These variations would range between 25 minutes for southbound PM peak hour trips to 35 minutes for northbound AM peak hour trips. The substantial volumes of diverted trips resulting from the Cut-and-Cover Tunnel Alternative would affect the speeds of general-purpose traffic and buses and the resulting travel times in the Woodland Park to S. Spokane Street corridor, particularly in the central and south areas of downtown Seattle.

6.7.3 Elevated Structure Alternative

Construction of the Elevated Structure Alternative during Traffic Stage 5 would require a reduction in capacity on SR 99 in the project area, closures and reconfiguration of access to and from SR 99, and a reduction in surface street capacity in the vicinity of Alaskan Way. These changes would affect general-purpose traffic and bus operations. The affected bus routes would be those traveling on high volume north-south transit corridors such as First, Second, Third, and Fourth Avenues. In addition, routes that leave downtown using the Alaskan Way Viaduct would be rerouted. When compared to the Bored Tunnel Alternative, which would maintain surface street capacity along major transit corridors, construction-related disruptions resulting from the Elevated Structure Alternative would be more severe.

During Traffic Stage 5 of the Elevated Structure Alternative, King County Metro routes serving West Seattle and south King County would be affected. The Seneca ramp connecting to downtown Seattle would be closed, and the Columbia Street ramp would be restricted to traffic exiting from northbound SR 99 to downtown Seattle. Buses destined to West Seattle would have to use the ramps on First Avenue S. at S. Spokane Street, while those destined to south King County would need to use the access locations south of Spokane Street.

King County Metro may decide to make some routing changes to alleviate the expected congestion effects and to address modifications in access from SR 99 to downtown Seattle. In addition, the overall construction duration of the Elevated Structure Alternative is estimated at 120 months as compared to 65 months for the Bored Tunnel Alternative.

6.7.3.1 South Area

Traffic operations at intersections in the south area during critical stages of the Elevated Structure Alternative construction are likely to be congested. There is expected to be traffic redistribution to local arterials resulting from access changes on SR 99. Redistribution of traffic to local arterials would potentially cause additional congestion on major north-south transit routes such as Second and Fourth Avenues S., similar to Traffic Stage 5 of the Bored Tunnel Alternative (see Section 6.2.1.5).

During Traffic Stage 5 of the Elevated Structure Alternative, most intersections in the south area would operate with congestion during the PM peak hour similar to that of the Bored Tunnel Alternative, with a few exceptions. The intersection of Alaskan Way at Yesler Way is expected to experience increases in delay of more than 9 minutes during the PM peak hour. The intersections of First Avenue S. at S. Atlantic Street and Second Avenue S. at S. Jackson Street, each served by public transit, are both expected to experience increases in delay of over 1 minute, compared to the delays resulting from the Bored Tunnel Alternative.

Further travel delays affecting bus service in the PM peak hour would result from changes in SR 99 access for southbound transit operations. Added transit travel times would occur for buses destined to West Seattle because the Columbia Street ramp would be used only as a northbound off-ramp. Accordingly, buses destined to West Seattle would have to use the ramps on First Avenue S. at S. Spokane Street, while those destined to south King County would need to use the access locations south of S. Spokane Street.

6.7.3.2 Central Area

As a result of access changes along SR 99, traffic congestion at intersections in the central area is expected to increase due to greater peak hour volumes, similar to Traffic Stage 5 of the Bored Tunnel Alternative. Most intersections in the central area, including those served by public transit, would operate with congestion during the AM and PM peak hour similar to that of the Bored Tunnel Alternative. The one exception is Alaskan Way at Marion Street, at which congestion would improve compared with that of the Bored Tunnel Alternative.

6.7.3.3 North Area

With the Elevated Structure Alternative, access modifications during construction in the area of SR 99 and Denny Way would affect conditions of nearby intersections. Peak hour congestion levels at intersections near affected on- or off-ramp connections or along affected arterials would potentially increase. This would be due to higher concentrations of peak hour traffic, similar to Traffic Stage 5 of the Bored Tunnel Alternative (see Section 6.2.1.5). Results of preliminary analyses indicate that with the Elevated Structure Alternative, delay at the following intersections served by buses would increase substantially compared to the Bored Tunnel Alternative:

- **Southbound Aurora Avenue at Denny Way.** Delay is expected to increase by approximately 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Mercer Street.** Delay is forecasted to increase by over 2 minutes during the PM peak hour.

6.7.3.4 Travel Time Variations Between Bored Tunnel Alternative and Elevated Structure Alternative

Exhibit 6-32 identifies travel time variations between Traffic Stage 5 of the Elevated Structure Alternative and Traffic Stage 5 of the Bored Tunnel Alternative for major bus corridors. The corridors assessed are Elliott Avenue (south of the Ballard Bridge to Denny Way), Aurora Avenue (south of the Aurora Bridge to Denny Way), and Woodland Park to S. Spokane Street. Transit travel times are provided for the Elliott and Aurora Avenue corridors, while general-purpose travel times are provided for the Woodland Park to S. Spokane Street corridor.

Exhibit 6-32. Construction-Related Travel Times Along Major Transit Corridors – Bored Tunnel and Elevated Structure Alternatives

	AM Peak Hour			PM Peak Hour		
	Bored Tunnel (minutes)	Elevated Structure (minutes)	Variation (minutes)	Bored Tunnel (minutes)	Elevated Structure (minutes)	Variation (minutes)
Elliott Avenue (South of Ballard Bridge to Denny Way)						
Southbound	8	7	-1	8	8	0
Northbound	8	7	-1	8	7	-1
Aurora Avenue (South of Aurora Bridge to Denny Way)						
Southbound	9	11	2	6	11	5
Northbound	6	6	0	8	6	-2
Woodland Park to S. Spokane Street						
Southbound	19	25	6	18	28	10
Northbound	16	19	3	21	20	-1

Travel times between downtown Seattle and West Seattle are not available from the travel models. However, given the anticipated changes in SR 99 access ramp configurations in downtown Seattle, increases in transit travel times relative to those of the Bored Tunnel Alternative would be expected. These increases in transit travel times would affect buses destined to both West Seattle and south King County.

For Elliott Avenue, travel times for the Bored Tunnel and Elevated Structure Alternatives would be generally similar. The variations would not exceed 1 minute for either travel direction in the AM and PM peak hours.

Along Aurora Avenue, travel time variations between the Bored Tunnel and Elevated Structure Alternatives would be greater than the variations along the Elliott Avenue corridor. Southbound trips along Aurora Avenue in the PM peak hour would be 5 minutes longer for the Elevated structure Alternative than the Bored Tunnel Alternative. Travel times along Aurora Avenue would be more affected by changes in access to SR 99 in the vicinity of the Denny Way ramps.

For the Woodland Park to S. Spokane Street corridor, travel time variations between the Bored Tunnel and Elevated Structure Alternatives would range between 1 minute (northbound PM peak hour) and 10 minutes (southbound PM peak hour). The major variations in travel times would occur for southbound travel in the AM and PM peak hours. Travel times for southbound trips in the AM peak hour would be approximately 6 minutes longer for the Elevated Structure Alternative compared to the Bored Tunnel Alternative. For southbound trips in the PM peak hour, the Elevated Structure Alternative would add approximately 10 minutes in travel time compared to the Bored Tunnel Alternative. The increases would be due to the closure of southbound SR 99 between Broad Street and Pike Street, where traffic would be detoured onto the Broad Street detour.

6.8 Truck Traffic and Freight

6.8.1 Bored Tunnel Alternative

All traffic, including freight, would be affected during Traffic Stage 5 of the Bored Tunnel Alternative, which is likely to be the most disruptive stage in terms of traffic effects. Traffic Stage 5 is generally considered the most disruptive stage in terms traffic because it is expected to last for 16 months (from March 2013 to July 2014), it would have the most substantial capacity restraints on SR 99, and the construction activities would affect nearby surface roadways. In addition, the use of I-5 as an alternate route for trucks during this stage would likely involve the use of east-west city streets to access the freeway.

6.8.1.1 South Area

Freight traffic needs to access important freight facilities in the south portal area, including Port of Seattle terminals along the waterfront and the Duwamish industrial area. It also needs to access I-5 and I-90 for longer inter- and intra-region trips. The S. Holgate Street to S. King Street Viaduct Replacement Project, which is currently under construction, will improve access for freight traffic via an h-shaped overcrossing extending from the intersection of Colorado Avenue S. at S. Atlantic Street to the intersection of East Marginal Way S. at S. Atlantic Street. The h-shaped overcrossing, which is expected open in January 2014, will provide a bypass for east-west traffic when train sets on the BNSF tail track block the at-grade crossing. It will eventually connect Alaskan Way S. to both East Marginal Way S. and S. Atlantic Street, but these connections would not yet be operational during Traffic Stage 5 because Alaskan Way S. would still be closed north of this point to S. King Street. A more complete description of the overcrossing is provided in Section 4.7.4. It should be noted that as a result of S. Holgate Street to S. King Street Viaduct Replacement Project, a direct connection between Alaskan Way S. and First Avenue S. via S. Royal Brougham Way will be removed. On the east side of SR 99, S. Royal Brougham Way will be connected between First Avenue S. and the East Frontage Road.

During Traffic Stage 5, both northbound and southbound SR 99 traffic would use the WOSCA detour and new SR 99 structure. The mainline would feature two lanes in each direction (a reduction of one lane in each direction) with a 40-mph speed limit. Because of the expected congestion resulting from this temporary detour, many longer-distance freight trips may be diverted to I-5 or shifted to off-peak periods. Northbound trucks on East Marginal Way S. would be required to use S. Atlantic Street and the East Frontage Road or First Avenue S. because Alaskan Way S. would be closed from S. Atlantic Street to S. King Street. S. King Street would be closed between Alaskan Way S. and Railroad Way S. First Avenue S. would be open with two lanes in each direction. Traffic delays may also occur on those routes designated for hauling construction materials and spoils to and from the construction sites. In the south portal area, the primary City-designated construction material haul route would likely use the area around the southbound WOSCA detour off-ramp to S. Atlantic Street. Construction vehicles would enter the work area via a temporary construction road that would cross the southbound off-ramp from SR 99; the crossing would be facilitated by a temporary traffic signal. The Railroad Avenue ramps connecting First Avenue S. with SR 99 would be closed. Southbound haul egress would be provided on the existing ramp (which connects to the WOSCA detour). Northbound ingress would feature a temporary adjoining roadway from S. Atlantic Street, connecting to the southbound on-ramp at just south of S. Dearborn Street. Trucks would use Edgar Martinez Drive S. (the east extension of S. Atlantic Street) to access I-5 north and south and I-90 east and west. Over-legal loads being transported to the south area would likely travel via SR 599 to First Avenue S. to the construction site. Over-legal loads traveling within the city are required to obtain a special permit, and appropriate routes are selected by means of the permit approval process.

6.8.1.2 Central Area

Freight access to and from the Seattle Ferry Terminal at Colman Dock would be maintained during all construction stages. During Traffic Stage 5, two lanes of traffic would be maintained in each direction on the Alaskan Way Viaduct (with three northbound lanes between the First Avenue S. on-ramp and the Western Avenue off-ramp). Due to constrained capacity under this configuration, speeds for all traffic, including eligible freight vehicles, are expected to be slower than those for the 2015 Existing Viaduct. Access to the southbound viaduct structure would be provided via the temporary WOSCA detour. Access for freight would still be provided on Alaskan Way along the central waterfront; however, access at S. King Street would be eliminated due to its closure between Alaskan Way S. and Railroad Way S. Trucks seeking access to Alaskan Way S. north of S. King Street would be routed underneath the viaduct.

6.8.1.3 North Area

During Traffic Stage 5, Broad Street would be open with two lanes in each direction until July 2013, when it would operate with two westbound lanes and one eastbound lane. In April 2014, Broad Street would operate with only one eastbound lane and no westbound lane. Connections would be provided from Broad Street to eastbound Mercer Street and northbound Dexter Avenue N. only. During this stage, the effects on traffic would be compounded by the widening of Mercer Street between Fifth and Ninth Avenues N. Street closures in place during this stage would include Broad Street, Sixth Avenue N. between Thomas and Broad Streets, and Harrison Street between Sixth Avenue N. and SR 99.

Freight trips from I-5 to the central waterfront would likely use Mercer Street to Fifth Avenue N. and then continue to Broad Street. In general, it is likely that many freight vehicles would consider using alternate routes, such as I-5, to bypass the congestion and delay resulting from the major construction activities in this area.

Preliminary routes designated for hauling construction materials and spoils in the north portal area have been identified; they include I-5 to Fairview Avenue N. to Denny Way to Sixth Avenue N. to the construction zones or I-5 to Mercer Street to the construction zones. SR 99 to and from the north would also be available as a potential haul route.

Over-legal loads would likely be allowed to travel on state highways during off-peak hours, from 9:00 p.m. to 5:00 a.m., Monday through Friday, and during all hours on the weekends. As noted previously, over-legal loads traveling within the city are required to obtain a special permit, and appropriate routes are selected by means of the permit approval process.

Freight travel in the corridor may be hampered during project construction because construction activities may occur up to 24 hours per day, 7 days per week, for the entire construction period within the permitting requirements.

6.8.1.4 Travel Times for the Bored Tunnel Alternative

Exhibit 6-33 identifies travel time variations between Traffic Stage 5 of the Bored Tunnel Alternative and the 2015 Existing Viaduct for freight vehicles traveling on a major freight corridor, Ballard to S. Spokane Street.

Exhibit 6-33. Construction-Related Travel Times Along a Major Freight Corridor – Bored Tunnel Alternative and 2015 Existing Viaduct

	AM Peak Hour			PM Peak Hour		
	2015 Existing Viaduct (minutes)	Bored Tunnel (minutes)	Variation (minutes)	2015 Existing Viaduct (minutes)	Bored Tunnel (minutes)	Variation (minutes)
Ballard to S. Spokane Street						
Southbound	16	17	1	16	21	5
Northbound	19	21	2	21	23	2

During the AM peak hour, travel times on this corridor for the Bored Tunnel Alternative are generally comparable (both directions) to those of the 2015 Existing Viaduct. In the northbound direction, travel times for the Bored Tunnel Alternative would be about 2 minutes longer. In the southbound direction, travel times for the Bored Tunnel Alternative would be about 1 minute longer.

During the PM peak hour, travel times for the Bored Tunnel Alternative would increase somewhat relative to the travel times during the AM peak hour due to higher PM peak hour demand. In the southbound direction, corridor travel times for the Bored Tunnel Alternative would be about 5 minutes longer than those for the 2015 Existing Viaduct. In the northbound direction, corridor travel times would be 2 minutes longer than those for the 2015 Existing Viaduct.

6.8.2 Cut-and-Cover Tunnel Alternative

For the Cut-and-Cover Tunnel Alternative, freight travel would be most affected during Traffic Stage 4. Traffic Stage 4 would last up to 27 months, from January 2016 to April 2018. The primary traffic revision during this stage would be the closure of SR 99 for the duration of this construction stage. Freight traffic previously using the Alaskan Way Viaduct would need to use other facilities during this time period. Freight operators may decide to reschedule trips through the downtown area, particularly during the peak travel periods, or to use I-5.

6.8.2.1 Travel Times for the Cut-and-Cover Tunnel Alternative

Exhibit 6-34 identifies travel time variations between Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative and Traffic Stage 5 of the Bored Tunnel Alternative for freight vehicles traveling from Ballard to S. Spokane Street.

Exhibit 6-34. Construction-Related Travel Times Along a Major Freight Corridor (Ballard to S. Spokane Street) – Bored Tunnel and Cut-and-Cover Tunnel Alternatives

Direction of Travel	AM Peak Hour			PM Peak Hour		
	Bored Tunnel (minutes)	Cut-and-Cover Tunnel (minutes)	Variation (minutes)	Bored Tunnel (minutes)	Cut-and-Cover Tunnel (minutes)	Variation (minutes)
Southbound	17	45	28	21	42	21
Northbound	21	53	32	23	53	32

With the SR 99 waterfront segment removed and a large portion of Alaskan Way out of commission, travel times for the Cut-and-Cover Tunnel Alternative are expected to be far longer than those for the Bored Tunnel Alternative. In the southbound direction during the AM peak hour, travel times for the Cut-and-Cover Tunnel Alternative would be almost 30 minutes longer than those for Bored Tunnel Alternative. In the northbound direction, travel times are estimated to be over 30 minutes longer than those for the Bored Tunnel Alternative.

During the PM peak hour, travel times for the Cut-and-Cover Tunnel Alternative would be comparable to those in the AM peak hour. In the southbound direction, travel times for the Cut-and-Cover Tunnel Alternative would be over 20 minutes longer than those for the Bored Tunnel Alternative. In the northbound direction, travel times would be 30 minutes longer than those for the Bored Tunnel Alternative

6.8.3 Elevated Structure Alternative

For the Elevated Structure Alternative, freight travel would be most affected during Traffic Stage 5. Traffic Stage 5 would last up to 24 months, from April 2017 to April 2019. While SR 99 would be open during this stage, it would operate with reduced capacity and changed connectivity, particularly for southbound traffic. Because of the reduced capacity, freight operators may encounter longer periods of congestion, particularly during the AM and PM peak hours.

Because of increased congestion during this stage, many freight operators may choose to use I-5 as an alternate route to travel through downtown Seattle. Between Pike Street and the Battery Street Tunnel, the northbound lanes on SR 99 would operate on the lower level of the Alaskan Way Viaduct and through the

Battery Street Tunnel. Southbound traffic in this area would use the Broad Street detour. Between S. Jackson Street and the temporary on-ramp at Pike Street, both northbound and southbound traffic would operate on a widened lower level of the viaduct, with two lanes in each direction. From S. Royal Brougham Way to S. Jackson Street, northbound and southbound traffic would operate on the completed southbound transition, with similar operating characteristics and connectivity as the WOSCA detour. Ramps to and from the north would be provided at this location. The Columbia on-ramp to southbound SR 99 would operate as a northbound off-ramp during this stage. Access to southbound SR 99 would be provided north of Denny Way, on Alaskan Way at the Broad Street detour on-ramp connection, and south of S. Spokane Street.

Trucks carrying hazardous and flammable materials would be restricted all day from using the Battery Street Tunnel. Those trucks would use Alaskan Way or I-5 to travel through the downtown area.

6.8.3.1 Travel Times for the Elevated Structure Alternative

Exhibit 6-35 shows travel time variations between Traffic Stage 5 of the Elevated Structure Alternative and Traffic Stage 5 of the Bored Tunnel Alternative for freight vehicles traveling from Ballard to S. Spokane Street.

Exhibit 6-35. Construction-Related Travel Times Along a Major Freight Corridor – Bored Tunnel and Elevated Structure Alternatives

	AM Peak Hour			PM Peak Hour		
	Bored Tunnel (minutes)	Elevated Structure (minutes)	Variation (minutes)	Bored Tunnel (minutes)	Elevated Structure (minutes)	Variation (minutes)
Ballard to S. Spokane Street						
Southbound	17	18	1	21	18	-3
Northbound	21	22	1	23	22	-1

Travel times for both the northbound and southbound directions would generally be comparable between the Elevated Structure Alternative and the Bored Tunnel Alternative during the AM and PM peak hours. During the AM peak hour, travel times for the Bored Tunnel Alternative would be about 1 minute shorter than those of the Elevated Structure Alternative.

During the PM peak hour, the Elevated Structure Alternative would result in a slight improvement in travel times relative to the Bored Tunnel Alternative in both directions. Travel times for the Elevated Structure Alternative would be about 3 minutes shorter than those for the Bored Tunnel Alternative in the southbound direction and about 1 minute shorter in the northbound direction.

6.9 Parking

6.9.1 Bored Tunnel Alternative

The parking spaces that would be removed during construction generally include the spaces that would be permanently affected (as described in Chapter 5), plus spaces that would be needed for construction, staging, or demolition activities. In the whole project area, the maximum number of on-street spaces that would be affected at one time during construction and demolition would be about 1,210 on-street spaces and about 310 off-street spaces, for a total of up to about 1,520 spaces. During Traffic Stages 1 through 7, before demolition of the Alaskan Way Viaduct in Traffic Stage 8 (in early 2016), 630 to 760 on-street spaces and 50 off-street spaces would be affected. Thus, for most of the construction period, a total of 680 to 810 spaces would be affected. The Bored Tunnel Alternative construction is expected to take approximately 65 months. Viaduct demolition would not occur until about 1 year before project completion.

The locations of parking removals are shown in Exhibits 6-36 and 6-37. The amount of affected parking varies by traffic stage. Exhibit 6-38 summarizes the parking effects during Traffic Stages 1 through 7. Exhibit 6-39 summarizes the parking effects during Traffic Stage 8, which would be the stage with the greatest number of parking removals, due to the viaduct demolition. In addition to the spaces identified in the exhibits, there may be short-term (such as during peak periods of traffic) parking restrictions on some streets near the tunnel portals to help accommodate transit or general-purpose traffic during construction. Relatively short-duration parking restrictions may be needed on Battery Street and on cross-streets above the Battery Street Tunnel during the tunnel decommissioning. Utility relocations also could affect some parking spaces in the project area for a short time. There also may be short-duration parking removals adjacent to some of the buildings above the bored tunnel during the compensation grouting activities.

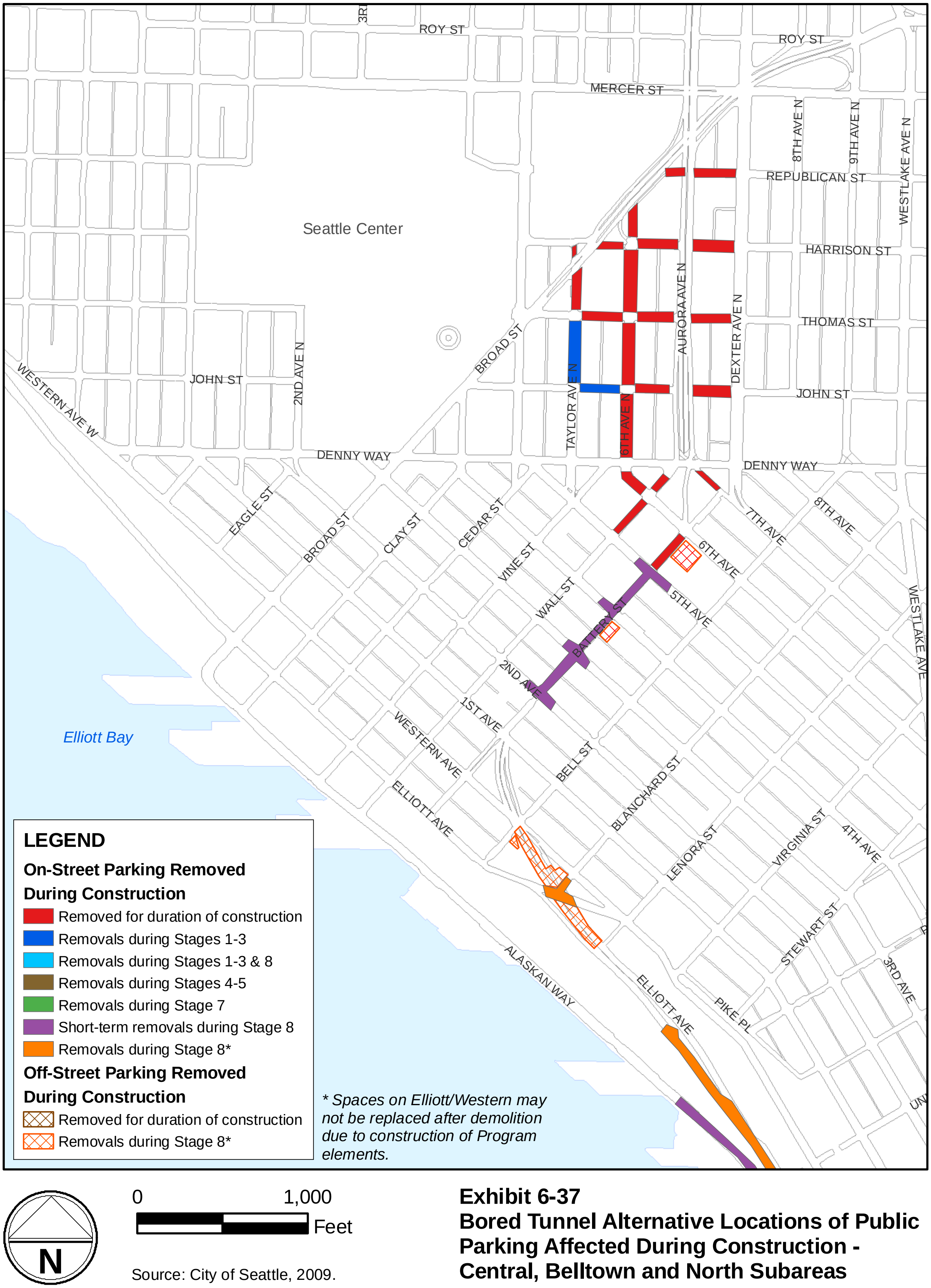
The parking effects were evaluated in five subareas: the stadium, Pioneer Square, central, Belltown, and north subareas.

6.9.1.1 Stadium Subarea

In the stadium subarea, south of S. King Street, about 230 on-street and 50 off-street spaces would be removed during construction. Of the on-street spaces, most are short-term parking, although about 50 long-term spaces would be removed as well.

Source: City of Seattle, 2009.

Exhibit 6-36
Bored Tunnel Alternative Locations of Public Parking Affected During Construction - Stadium, Pioneer Square, and Central Subareas



Source: City of Seattle, 2009.

Exhibit 6-37
Bored Tunnel Alternative Locations of Public Parking Affected During Construction - Central, Belltown and North Subareas

Exhibit 6-38. Construction Parking Effects of the Bored Tunnel Alternative, Traffic Stages 1 Through 7

Subarea	On-Street Spaces Removed			Off-Street Spaces Removed	Total Spaces Removed
	Short-Term	Long-Term	Subtotal		
Stadium	180	50	230	50	280
Pioneer Square	70 to 150	10	80 to 160	0 to 40	80 to 160
Central	0 to 90	0	0 to 90	0	0 to 90
Belltown	0	0	0	0	0
North	90 to 140	230 to 240	320 to 370	0	320 to 370
Total	350 to 470	280 to 290	630 to 760	50 to 90	680 to 810[1]

Note: [1.] The maximum number of spaces in each subarea would not be affected at the same time; therefore, the total is not a sum of all of the values at the high end of the range.

Exhibit 6-39. Construction Parking Effects of the Bored Tunnel Alternative, Traffic Stage 8

Subarea	On-Street Spaces Removed			Off-Street Spaces Removed	Total Spaces Removed
	Short-Term	Long-Term	Subtotal		
Stadium	180	50	230	50	280
Pioneer Square	170	10	180	0	180
Central	390	0	390	40	430
Belltown	80	0	80	220	300
North	90	230	320	0	320
Total	Up to 920	Up to 290	Up to 1,210	Up to 310	Up to 1,510

The majority of the on-street parking space removals would be along Railroad Way S. and under the ramps (see Exhibit 6-36). The 50 off-street spaces that would be affected are located in a public pay lot south of S. Royal Brougham Way, behind the Pyramid Alehouse.

The 200 off-street parking spaces on the WOSCA property are currently unavailable due to the construction associated with the S. Holgate Street to S. King Street Viaduct Replacement Project. Because their removal was accounted for by the S. Holgate Street to S. King Street Viaduct Replacement Project, they are not included as a construction removal for the Bored Tunnel Alternative and are not included in Exhibits 6-38 and 6-39.

The removal of about 280 parking spaces in the stadium subarea is not expected to cause a large effect, although some drivers may be slightly inconvenienced. The on-street parking removals along First Avenue S. between S. King Street and Railroad Way S. may affect customer parking for adjacent businesses. However, on-street parking would continue to be available a block to the north and along S. King Street.

Although parking would be reduced compared to current conditions, ample parking would be available in pay lots near the stadiums. Pay lots in the stadium area are abundant and underutilized on non-event days. The off-street parking utilization rate for the stadium area is about 31.1 percent on an average non-event weekday (PSRC 2007a), suggesting that it is relatively easy to find a pay parking space in the stadium area. In addition, most surface streets in the SODO area allow on-street parking, and some of it is long-term parking, particularly farther south.

During events such as Seahawks, Mariners, and Sounders games, parking is currently highly utilized, and private lots charge a premium for event parking. Only about 50 off-street parking spaces would be removed during project construction, which is not expected to noticeably affect the overall parking supply in the stadium area. Approximately 6,900 off-street parking spaces are available in the major parking facilities near the stadiums.

6.9.1.2 Pioneer Square Subarea

In Traffic Stages 1 through 7, there would be up to 150 short-term and 10 long-term spaces in the Pioneer Square subarea affected by project construction, as shown in Exhibit 6-38. These spaces are under the viaduct and along Alaskan Way S. south of Yesler Way. In addition, about 40 off-street spaces in a public pay lot at Yesler Way and Western Avenue would be affected during Traffic Stage 5. This parking lot would be affected while improvements are being made to the adjacent Western Building.

In Traffic Stage 8, in early 2016, viaduct demolition would affect several more on-street spaces in addition to those affected during the previous traffic stages, with a total of about 180 on-street spaces inaccessible due to construction and demolition. Directly after viaduct demolition and removal, the City expects to begin work on the waterfront promenade and the new Alaskan Way surface street. Construction of these projects will likely affect parking availability until they are completed in 2018. These projects, which are separate from the Alaskan Way Viaduct Replacement Project, are described in more detail in the discussion of parking in Section 6.16, Concurrent Effects During Construction.

There are about 20 on-street parking spaces along Alaskan Way between S. King Street and Columbia Street. Although on-street spaces along the Alaskan Way surface street are not under the viaduct, they would be affected because the demolition activities would likely encroach on Alaskan Way. To maintain traffic lanes, parking would need to be restricted along several blocks of Alaskan Way. The parking on Alaskan Way between S. King Street and Pine Street is expected to be affected at some point during viaduct demolition, but all of these spaces would not be removed at the same time. It is expected that two demolition crews would each work on two blocks at a time; therefore, four blocks of parking would be affected for approximately 1 month at a time during demolition.

With the parking removals during construction, it may become more difficult to find parking in Pioneer Square. This could result in drivers looking for parking spaces several blocks farther from their destinations than they would normally seek parking, or it could result in their using pay lots instead of on-street parking.

6.9.1.3 Central Subarea

In Traffic Stages 1 through 7, there would be up to 90 short-term spaces in the central subarea affected by project construction, as shown in Exhibit 6-38. These spaces are under the viaduct and along Alaskan Way S. south of Yesler Way. In Traffic Stage 8, in early 2016, viaduct demolition would begin to affect parking under the viaduct and along Alaskan Way (Exhibit 6-39). During viaduct demolition, approximately 390 on-street parking spaces would be affected; these spaces are located under the viaduct and ramps from Columbia Street to Elliott Avenue and Lenora Street and along Alaskan Way to Wall Street. Directly after viaduct demolition and removal, the City expects to begin work on the waterfront promenade and the new Alaskan Way surface street. Construction of these projects will likely affect parking availability until they are completed in 2018. These projects, which are separate from the Alaskan Way Viaduct Replacement Project, are described in more detail in the discussion of parking in Section 6.16, Concurrent Effects During Construction. Before viaduct demolition, some parking adjacent to the viaduct may be affected when existing utilities on the viaduct are being relocated to nearby areas.

There are about 30 on-street parking spaces along Alaskan Way between Columbia Street and Pine Street. Although on-street spaces along the Alaskan Way surface street are not under the viaduct, they would be affected because the viaduct demolition activities would likely encroach on Alaskan Way. To maintain traffic lanes, parking would need to be restricted along several blocks of Alaskan Way. The parking on Alaskan Way between S. King Street and Pine Street is expected to be affected at some point during viaduct demolition, but all of these spaces would not be removed at the same time. It is expected that two demolition crews would work in two block segments at a time, perhaps using one crew in the north section and one in the south section; therefore, four blocks of parking would potentially be affected for approximately 1 month at a time during demolition. Much of the on-street parking along Alaskan Way consists of loading areas and taxi queuing areas. These types of spaces could likely be accommodated within a block or two of their existing locations and would be relocated for only 1 or 2 months at a time. Up to about 560 on-street parking spaces along Alaskan Way and under the viaduct could be affected at the same time during viaduct demolition.

Portions of two off-street parking lots just east of the viaduct, one at Seneca Street and one at University Street, would result in a loss of about 40 spaces for about a month (during viaduct demolition), if they are affected at the same time.

In addition to the public parking that would be affected during viaduct demolition, there are about 140 private and reserved spaces located under or adjacent to the viaduct that are not included in Exhibit 6-39. Individual block faces have between 0 and 30 private or reserved spaces along the west side of the buildings/loading docks, with an average of about 15 of these spaces per block. Each block would experience parking removals due to viaduct demolition activities. The private and reserved spaces are primarily used by adjacent businesses for customer and employee parking and for loading in some cases. Loading zones may be temporarily relocated to adjacent side streets during viaduct demolition. This could result in the conversion of short-term parking spaces from 2-hour parking spaces to spaces that are restricted to loading and unloading during certain times of day.

Many of the piers along the central waterfront have loading spaces and employee and customer parking on the piers, with access from Alaskan Way. Although there would be on-street parking removals along Alaskan Way, access to the piers is not expected to be restricted during viaduct demolition; therefore, the parking and loading on the piers would remain available.

As discussed for the Pioneer Square subarea, with the parking removals during viaduct demolition, it may become more difficult to find parking along the central waterfront and in Pioneer Square during demolition activities. This could result in drivers looking for parking spaces several blocks farther from their destinations than might normally be available, or pay lots could be used instead of on-street parking.

There are numerous off-street parking lots near the central waterfront. Based on 2006 PSRC data for off-street parking lots and garages, over 2,700 off-street parking spaces are available within about one block of the viaduct, between S. King Street and the Battery Street Tunnel south portal (PSRC 2007a). The large parking garage across from the Bell Harbor Conference Center on Western Avenue between Wall and Bell Streets (the Pier 66/Art Institute garage) provides an additional 1,700 spaces.

The City commissioned a parking count on a Saturday in August 2006 to capture the parking demands for a busy summer weekend near the central waterfront (Nelson\Nygaard Consulting Associates 2008). The study found that surface lots were fullest, reaching close to 100 percent capacity, by 2:00 pm. The Pike Place Market garage also reached close to 100 percent capacity by 2:00 pm. Other garages farther from Pike Place Market, such as the Pier 66/Art Institute garage, were less full, filled to between 52 and 64 percent of capacity throughout the day.

6.9.1.4 Belltown Subarea

No substantial parking effects are expected for the Belltown subarea until Traffic Stage 8. Up to 220 off-street spaces in the Belltown subarea would be affected by viaduct demolition and Battery Street Tunnel decommissioning (Traffic Stage 8) along with about 80 on-street parking spaces that would be affected. Of these 80 on-street spaces, about 70 spaces would be temporarily restricted for only about 3 months during Battery Street Tunnel decommissioning.

Near Elliott and Western Avenues, up to about 140 off-street spaces in the parking lots under the viaduct between Lenora Street and Bell Street would be removed during demolition of this segment of the viaduct. Of the 140 off-street spaces, 75 are available to the public only during evening and weekend hours. There also would be two parking lots adjacent to Battery Street that would be used for construction staging during the Battery Street Tunnel decommissioning, which is expected to take about 3 months. About 90 spaces would be affected in these two public pay lots.

6.9.1.5 North Subarea

In the north subarea, up to about 370 on-street spaces would be removed during construction. The removals would be needed to accommodate new transit lanes, construction traffic, utility relocations, and other construction activities. No public pay lots would be affected in this subarea. Of the affected on-street parking spaces, the majority are long-term spaces (Exhibit 6-38).

Some private and business parking would be affected by property acquisitions; however, these are not parking lots available to the public. These properties are addressed in the discussion of property acquisitions in Appendix G, Land Use Discipline Report. They include the private parking within the fenced lot south of the existing building between Sixth Avenue N. and Harrison Street on the east side of Sixth Avenue N. and the employee parking spaces in a lot on the north side of Harrison Street, west of Aurora Avenue.

Near the north portal of the bored tunnel, on-street parking would still be available within several blocks of the removed spaces. Furthermore, there are numerous off-street lots within several blocks of the removed parking spaces. Over 3,100 pay spaces are available between Denny Way and Roy Street, and Fifth Avenue N. and Dexter Avenue N., according to 2006 PSRC data (PSRC 2007a). The 3,100 spaces take into account the removal of spaces for the Gates Foundation construction and the new Fifth Avenue Parking Garage. There are no expected direct effects on access to these garages during project construction, although there might be construction activities in the vicinity that could affect overall mobility in general. Despite the removal of 370 parking spaces, there would continue to be nearby parking options; however, it may become slightly more difficult to find parking on event days, and parking in some lots would potentially become more expensive in response to the reduction in the adjacent parking inventory. The PSRC study found that the total number of off-street parking stalls in the Uptown area totaled 18,564 in 2006, with an occupancy rate of 47.4 percent (PSRC 2007a).

6.9.2 Cut-and-Cover Tunnel Alternative

Construction of the Cut-and-Cover Tunnel Alternative would affect parking spaces that would be permanently removed (as described in Chapter 5), plus those spaces that are needed for construction, staging, or demolition activities. Construction of the Cut-and-Cover Tunnel Alternative is expected to take about 105 months, which is substantially longer than the construction duration for the Bored Tunnel Alternative (65 months). The approximately 1,800 on-street and off-street parking spaces expected to be removed or restricted during construction of the Cut-and-Cover Tunnel Alternative are summarized in Exhibit 6-40 and shown in Exhibits 6-41 and 6-42.

Exhibit 6-40. Construction Parking Effects of the Cut-and-Cover Tunnel Alternative

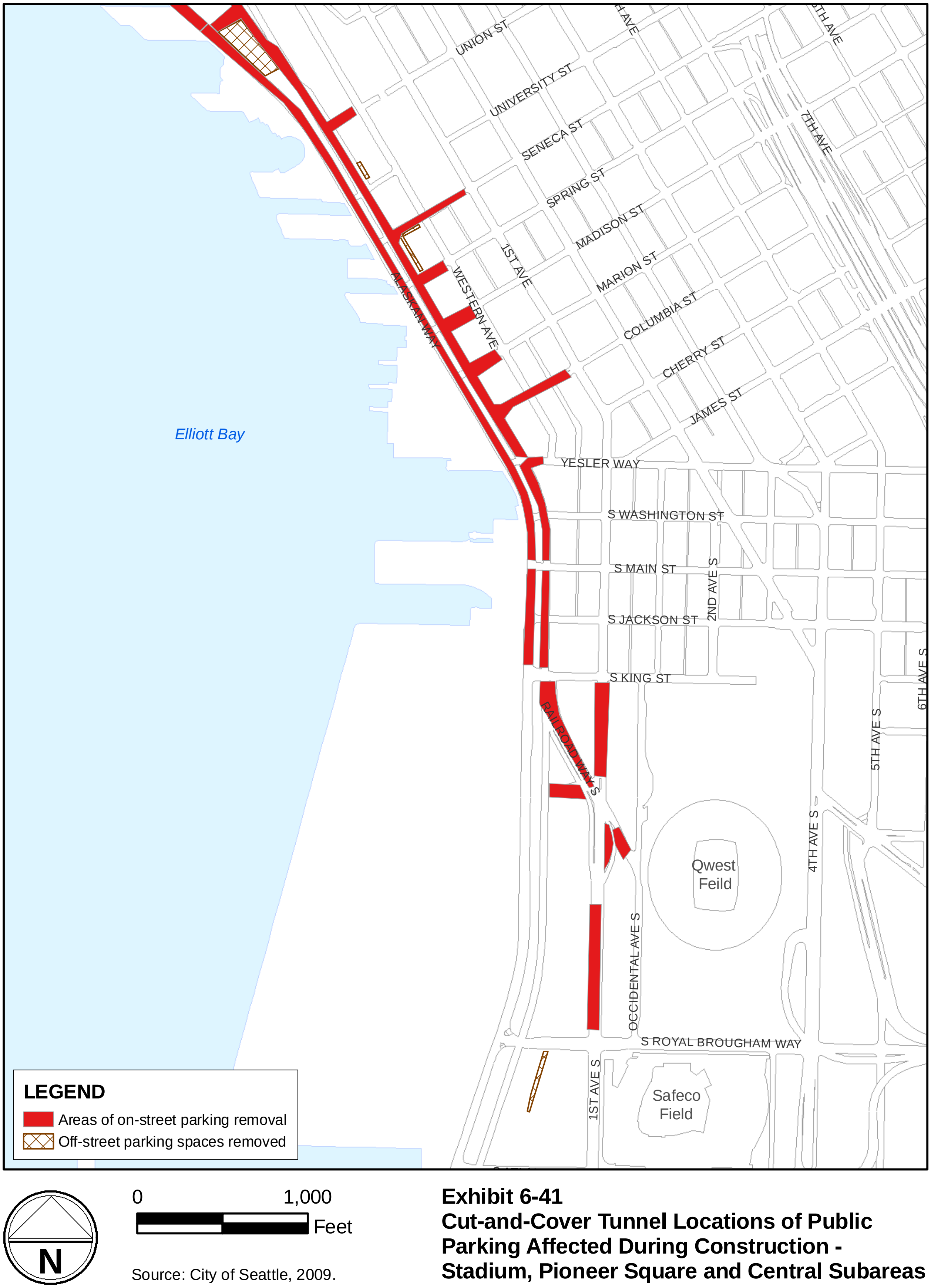
	On-Street Spaces Removed			Off-Street Spaces Removed	Total Spaces Removed
Subarea	Short-Term	Long-Term	Subtotal		
Stadium	180	50	230	50	280
Pioneer Square	170	10	180	0	180
Central	510	0	510	110	620
Belltown	150	0	150	240	390
North	80	170	250	80	330
Total	**1,090**	**230**	**1,320**	**480**	**1,800**

6.9.2.1 Stadium Subarea

In the stadium subarea, south of S. King Street, about 230 on-street and 50 off-street spaces would be removed during construction of the Cut-and-Cover Tunnel Alternative, which is the same as the number for the Bored Tunnel Alternative.

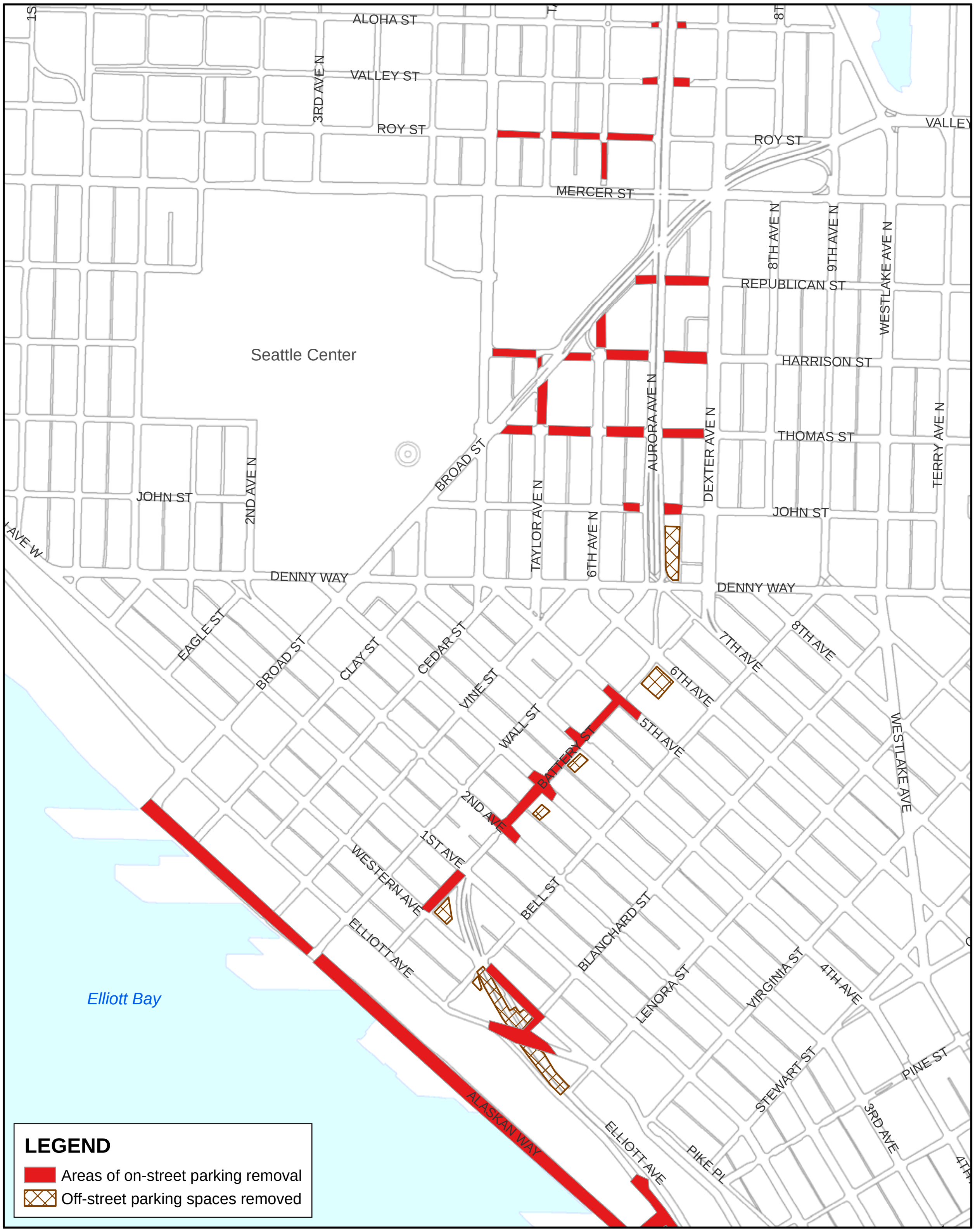
6.9.2.2 Pioneer Square Subarea

In the Pioneer Square subarea, a total of about 180 on-street spaces would be removed during construction of the Cut-and-Cover Tunnel Alternative and demolition of the viaduct. Although the number of spaces is the same as the number affected by the Bored Tunnel Alternative, the duration of the parking removal would be substantially longer for the Cut-and-Cover Tunnel Alternative.



Source: City of Seattle, 2009.

Exhibit 6-41
Cut-and-Cover Tunnel Locations of Public Parking Affected During Construction - Stadium, Pioneer Square and Central Subareas



N

0 1,000 Feet

Source: City of Seattle, 2009.

Exhibit 6-42
Cut-and-Cover Tunnel Locations of Public Parking Affected During Construction - Central, Belltown and North Subareas

With the parking removals during construction, it may become more difficult to find parking in Pioneer Square. This could result in drivers looking for parking spaces several blocks farther from their destinations than they would normally seek parking, or using pay lots instead of on-street parking.

6.9.2.3 Central Subarea

Approximately 510 on-street parking spaces would be affected during the Cut-and-Cover Tunnel Alternative construction. These spaces are located under the viaduct and ramps from Columbia Street to Elliott Avenue and Lenora Street and along Alaskan Way to Wall Street. An additional 110 off-street spaces would be removed for at least part of the construction duration.

As with the Bored Tunnel Alternative, in addition to the public parking that would be affected during viaduct demolition, about 140 private and reserved spaces under or adjacent to the viaduct would be affected. Many of the piers along the central waterfront have loading spaces and employee and customer parking on the piers, with access from Alaskan Way. Access to the piers may be periodically restricted during Cut-and-Cover Tunnel Alternative construction.

The removal of about 620 public parking spaces in the central subarea for up to 105 months of Cut-and-Cover Tunnel Alternative construction is expected to make parking substantially more difficult to find. This could result in drivers avoiding the area, looking for parking spaces several blocks farther from their destinations than they would normally seek parking, or using pay lots or garages instead of on-street parking.

6.9.2.4 Belltown Subarea

Approximately 150 on-street parking spaces in the Belltown subarea would be affected during Cut-and-Cover Tunnel Alternative construction. Additionally, up to 240 off-street spaces would be removed. About 70 spaces along and adjacent to Battery Street would be restricted for about 1 year during the Battery Street Tunnel upgrades. The parking removals along Battery Street would continue for about 9 months longer than the duration for the Bored Tunnel Alternative.

Near Elliott and Western Avenues, up to about 140 off-street spaces in the parking lots under the viaduct between Lenora Street and Bell Street would be removed during the demolition of this segment of the viaduct. Of the 140 spaces, 75 of them are available to the public only during evening and weekend hours.

6.9.2.5 North Subarea

In the north subarea, about 250 on-street spaces would be removed during construction, which would be fewer than the number for the Bored Tunnel Alternative. Of the affected on-street parking spaces, the majority are long-term spaces (Exhibit 6-40). A parking lot with about 80 spaces on the corner of

Denny Way and Aurora Avenue would be unavailable for public parking during construction.

Some private and business parking would be affected by property acquisitions in the north subarea; however, these parking lots are not available to the public. These properties are addressed in the discussion of property acquisitions in Appendix G, Land Use Discipline Report.

6.9.3 Elevated Structure Alternative

Construction of the Elevated Structure Alternative would affect the most parking spaces for the longest duration of all three build alternatives, with about 1,930 affected parking spaces. Construction of the Elevated Structure Alternative is expected to take about 120 months, which is substantially longer than the construction duration for the Bored Tunnel Alternative (65 months) and would affect substantially more parking spaces. On-street and off-street parking spaces expected to be removed or restricted during construction of the Elevated Structure Alternative are summarized in Exhibit 6-43 and shown in Exhibits 6-44 and 6-45.

Exhibit 6-43. Construction Parking Effects of the Elevated Structure Alternative

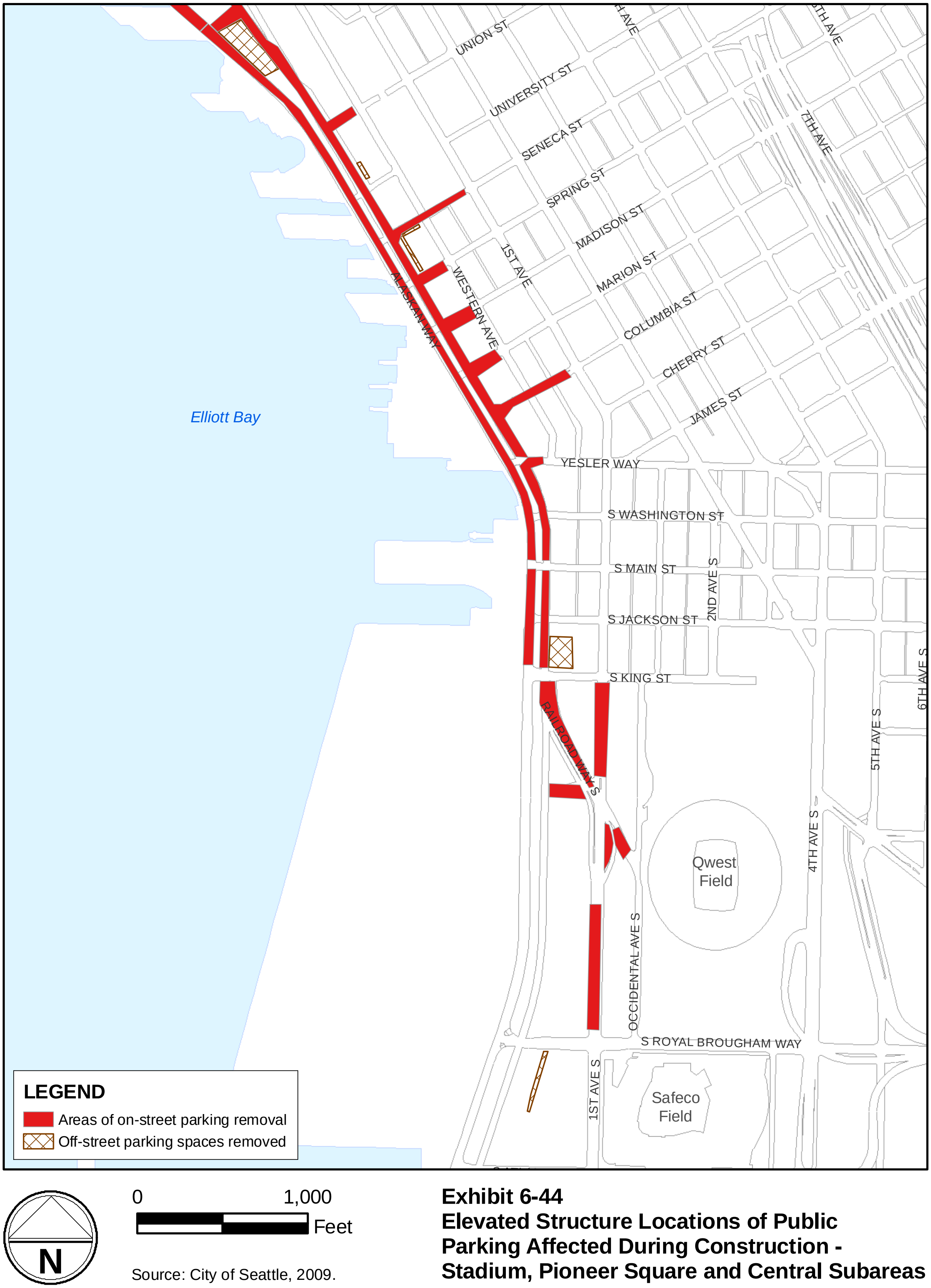
Subarea	On-Street Spaces Removed			Off-Street Spaces Removed	Total Spaces Removed
	Short-Term	Long-Term	Subtotal		
Stadium	180	50	230	50	280
Pioneer Square	170	10	180	130	310
Central	510	0	510	110	620
Belltown	150	0	150	240	390
North	80	170	250	80	330
Total	**1,090**	**230**	**1,320**	**610**	**1,930**

6.9.3.1 Stadium Subarea

In the stadium subarea, south of S. King Street, about 230 on-street and 50 off-street spaces would be removed during construction of the Elevated Structure Alternative, which is the same as for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives.

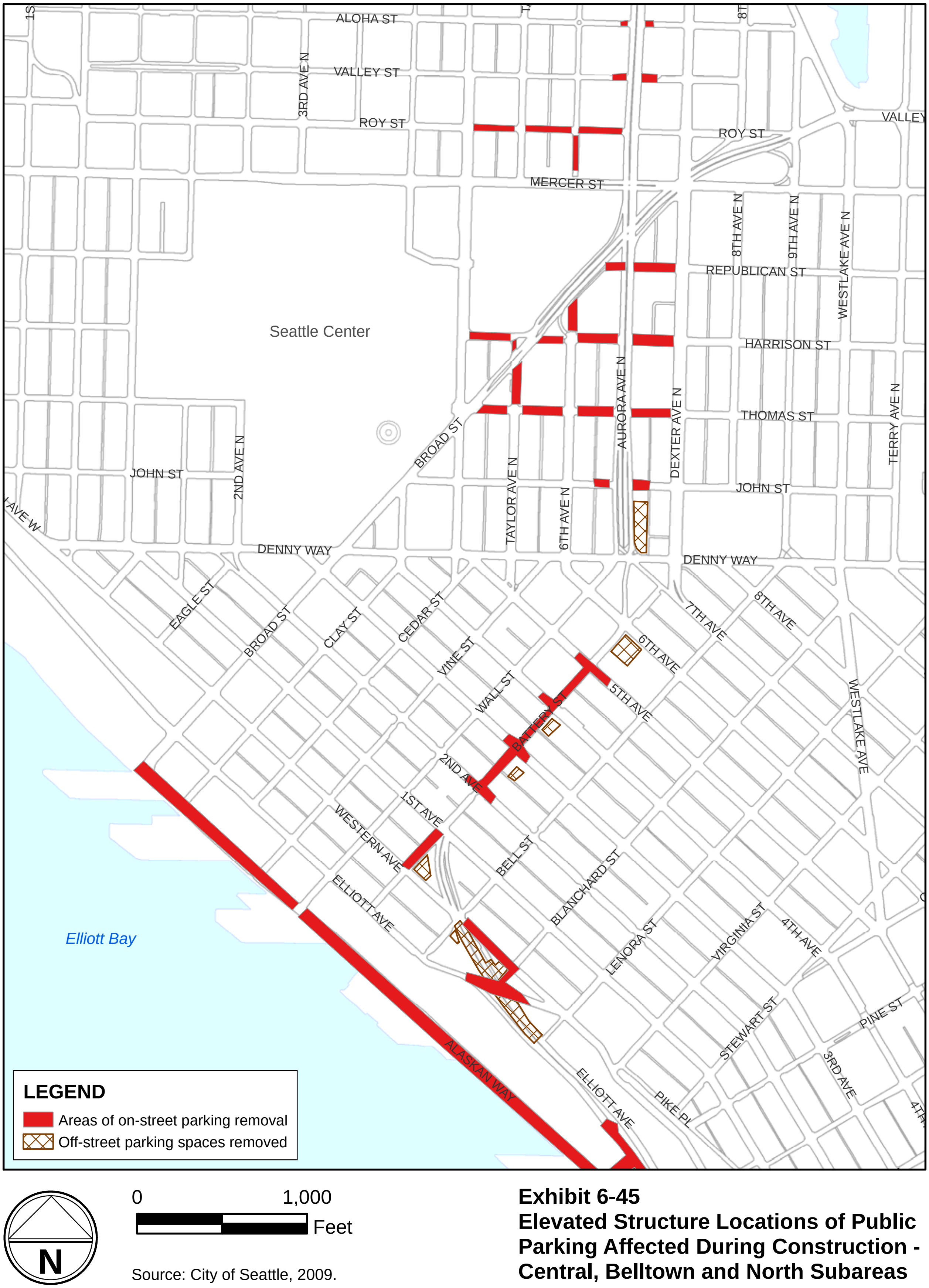
6.9.3.2 Pioneer Square Subarea

In the Pioneer Square subarea, a total of about 180 on-street spaces would be removed during construction of the Elevated Structure Alternative and demolition of the viaduct. Although the number of on-street spaces affected is



Source: City of Seattle, 2009.

Exhibit 6-44
Elevated Structure Locations of Public Parking Affected During Construction - Stadium, Pioneer Square and Central Subareas



Source: City of Seattle, 2009.

Exhibit 6-45
Elevated Structure Locations of Public Parking Affected During Construction - Central, Belltown and North Subareas

the same as the number affected by the Bored Tunnel Alternative during Traffic Stage 8, the duration of the parking removal would be substantially longer for the Elevated Structure Alternative.

With the parking removals during construction, it may become more difficult to find parking in Pioneer Square. This could result in drivers looking for parking spaces several blocks farther from their destinations than they would normally seek parking, or using pay lots instead of on-street parking. The Elevated Structure Alternative also would remove a parking garage containing about 130 parking spaces, contributing to a further adverse effect on the parking supply in Pioneer Square.

6.9.3.3 Central Subarea

Approximately 510 on-street parking spaces would be affected during Elevated Structure Alternative construction. These spaces are located under the viaduct and ramps from Columbia Street to Elliott Avenue and Lenora Street and along Alaskan Way to Wall Street. An additional 110 off-street spaces would be removed for at least part of the construction duration.

As with the Bored Tunnel Alternative, in addition to the public parking that would be affected during viaduct demolition, about 140 private and reserved spaces under or adjacent to the viaduct would be affected. Many of the piers along the central waterfront have loading spaces and employee and customer parking on the piers, with access from Alaskan Way. Access to the piers would be maintained to the degree practicable during construction of the Elevated Structure Alternative.

The removal of about 620 public parking spaces in the central subarea for up to 120 months of construction is expected to make parking substantially more difficult to find along the waterfront. This could result in drivers avoiding the area, looking for parking spaces several blocks farther from their destinations than they would normally seek parking, or using pay lots instead of on-street parking.

6.9.3.4 Belltown Subarea

Approximately 150 on-street parking spaces in the Belltown subarea would be affected during construction of the Elevated Structure Alternative. In addition, up to 240 off-street spaces would be removed. About 70 spaces along and adjacent to Battery Street would be restricted for about 1 year during the Battery Street Tunnel upgrades. The parking removals along Battery Street would continue for about 9 months longer than the duration for the Bored Tunnel Alternative.

Near Elliott and Western Avenues, up to about 140 off-street spaces in the parking lots under the viaduct between Lenora Street and Bell Street would be removed during demolition of this segment of the viaduct. Of the 140 spaces, 75 of them are available to the public only during evening and weekend hours.

6.9.3.5 North Subarea

In the north subarea, about 250 on-street spaces would be removed during construction, which would be fewer than the number for the Bored Tunnel Alternative. Of the affected on-street parking spaces, the majority are long-term spaces. A parking lot with about 80 spaces on the corner of Denny Way and Aurora Avenue would be unavailable for public parking during construction.

Some private and business parking would be affected by property acquisitions in the north subarea; however, these parking lots are not available to the public. These properties are addressed in the discussion of property acquisitions in Appendix G, Land Use Discipline Report.

6.9.4 Construction Worker Parking

The considerations related to parking for construction workers apply to all three build alternatives. For all three build alternatives, approximately 450 contractor construction personnel are anticipated on an average workday. During the periods of most intense construction, the number of construction workers could be up to 480. The work areas for these construction workers would be located in several different locations. Construction workers who are not able to park within the construction zone may seek available long-term parking in the area, first pursuing on-street spaces and then looking for pay lots. For the Bored Tunnel Alternative, contractor and construction worker parking would be accommodated at two of the construction staging areas, Terminal 106 and Pier 48, with shuttles transporting the workers to the specific construction sites.

6.9.5 Mitigation of Construction Effects on Parking

The following strategies could help minimize the use of visitor/customer parking by construction workers during project construction.

- Establish a policy for construction worker parking, implemented by the contractor, which identifies appropriate parking options for construction workers and discourages their use of short-term visitor/customer parking in the project vicinity.
- Consider changing some of the all-day metered spaces to short-term spaces, particularly those near the north end of the parking study area. Enforcement of the short-term parking regulations in the immediate project area (two- to three-block radius) would likely be needed to maintain turnover. The goal is to ensure a constant supply of short-term parking for customers and to prevent the use of these spaces by construction workers.

In addition to the strategies for addressing construction worker parking, a number of parking mitigation strategies could be implemented to address parking disruption by construction activities. These are broad strategies, such as implementing an electronic parking guidance system, that are described in more detail in the discussion of mitigation of effects on parking in Section 6.16, Concurrent Effects During Construction.

6.10 Pedestrians

6.10.1 Bored Tunnel Alternative

Major construction efforts are disruptive to all forms of transportation, and pedestrians in and around the construction zone associated with the Bored Tunnel Alternative would experience disruptions in their use of sidewalks and trail facilities. Localized sidewalk closures for utility relocation, construction, demolition, and restoration activities would require pedestrian detours of short duration and distance. However, the duration of disruption and out-of-direction travel would be minimized to the extent practicable to maintain pedestrian mobility and access.

Traffic that is diverted to arterial and local streets during construction could make it more difficult for pedestrians to cross streets. In particular, First Avenue S., Fourth Avenue S., Denny Way, and Dexter Avenue N. are expected to carry increased volumes of traffic during construction.

6.10.1.1 South Area

Pedestrian access in the south portal area would be maintained during all phases of construction via the Port Side Pedestrian/Bike Trail on the western edge of the project area, which will be adjacent to the Port of Seattle facilities. The Port Side Pedestrian/Bike Trail, part of the separate S. Holgate Street to S. King Street Viaduct Replacement Project will extend from S. King Street to S. Atlantic Street and connect to existing pedestrian facilities, requiring minimal to no out-of-direction travel.

The City Side Trail, part of the S. Holgate Street to S. King Street Viaduct Replacement Project, along the east side of SR 99, may be detoured slightly during construction of the Bored Tunnel Alternative before being constructed in its final location.

First Avenue S. from S. Royal Brougham Way to S. Jackson Street would experience intermittent sidewalk closures, as well as additional traffic due to the closures on Alaskan Way S. When a sidewalk closure is required, pedestrians would experience a limited amount of out-of-direction travel to use sidewalk facilities on the opposite side of the roadway, or they might be required to detour to parallel roadways.

East-west travel within the construction zone (S. King Street to approximately S. Royal Brougham Way) would be restricted during a majority of the traffic stages. East-west access by pedestrians would be largely restricted to S. Atlantic Street, S. Royal Brougham Way, and S. Jackson Street due to the presence of construction staging areas and the need for temporary roadway facilities in this area.

6.10.1.2 Central Area

The Bored Tunnel Alternative would require construction activities centered on the south and north portal areas. However, during viaduct demolition, pedestrian access to the waterfront could become slightly more circuitous as areas under the viaduct are temporarily closed due to demolition. East-west crossings would be provided but may periodically change due to construction needs and work locations. Demolition would likely affect several blocks of the viaduct at a time; therefore, pedestrians may have to detour for up to one block to access the waterfront if the area of the viaduct in their travel path is being demolished.

6.10.1.3 North Area

Pedestrian facilities and access east of SR 99 are not expected to be greatly affected during construction of the Bored Tunnel Alternative. Pedestrian facilities and access west of SR 99 between Mercer Street and Denny Way are expected to be affected by both construction activities and construction staging locations.

The area that would be most affected by construction staging locations is the area from Broad Street south to John Street and from SR 99 west to Taylor Avenue N. Intermittent detours and sidewalk closures are expected during Traffic Stage 1 to allow utility relocations. Sixth Avenue N. between Thomas and Broad Streets and Harrison Street between SR 99 and Sixth Avenue N. would be closed during Traffic Stages 2 through 7. These areas, along with the sidewalks immediately adjacent to SR 99 between Harrison Street and Denny Way, would experience restrictions and possible closures to complete the surface street restoration in the construction area and fill the north portal of the Battery Street Tunnel.

East-west pedestrian travel on Mercer and Broad Streets would be restricted during construction activities. East-west pedestrian mobility in this area is already challenging due to limited crossings of SR 99. Particular attention would be focused on minimizing the duration of closures and out-of-direction travel by maintaining sidewalk facilities on the opposite side of the roadway. Sidewalks on SR 99 may be closed during construction of the Mercer Street overcrossing of SR 99.

6.10.2 Cut-and-Cover Tunnel Alternative

6.10.2.1 South Area

Under the Cut-an-Cover Tunnel Alternative, construction effects on pedestrian facilities would be the same as those for the Bored Tunnel Alternative in the south area, although the roadway closures would differ. During Traffic Stage 1 of construction for the Cut-and-Cover Tunnel Alternative, Alaskan Way would be reduced periodically to one lane in each direction for utility relocations. However, beginning with Traffic Stage 2, Alaskan Way would be completely closed to north- and southbound traffic and would continue to be closed until Traffic Stage 5, when operations on one lane in each direction would be restored to the west of the Alaskan Way corridor.

Pedestrian access would be maintained during all phases of construction via the Port Side Pedestrian/Bike Trail) on the western edge of the project area. The City Side Trail, part of the separate S. Holgate Street to S. King Street Viaduct Replacement Project, along the east side of SR 99, may be detoured slightly during construction of the Cut-and-Cover Tunnel Alternative before being reconstructed in its final location. East-west travel within the construction zone would be restricted during a majority of the traffic stages.

6.10.2.2 Central Area

Although Alaskan Way would be closed for most of the construction, pedestrian access would be maintained during all phases. East-west crossings would be provided but may periodically change due to construction needs and work locations.

From Second Avenue to Sixth Avenue along both sides of Battery Street, pedestrian facilities would experience intermittent detours and sidewalk closures due to construction staging locations.

6.10.2.3 North Area

Pedestrian facilities would experience intermittent detours and sidewalk closures due to construction staging locations along both sides of SR 99, from roughly Aloha Street to Denny Way. Sixth Avenue N. between Thomas and Broad Streets and Harrison Street between SR 99 and Sixth Avenue N. would also experience interruptions and restrictions. Broad Street would be completely closed during Traffic Stage 5, and east-west pedestrian travel on Mercer and Broad Streets may also be restricted during other traffic stages.

6.10.3 Elevated Structure Alternative

6.10.3.1 South Area

Under the Elevated Structure Alternative, construction effects on pedestrian facilities would be the same as those for the Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative in the south area, although the roadway closures would differ. During Traffic Stage 1 of the Elevated Structure Alternative, Alaskan Way would be reduced periodically to one lane in each direction for utility relocations. Beginning with Traffic Stage 2, Alaskan Way would be restricted to one lane in each direction throughout the corridor. During Traffic Stage 3, Alaskan Way south of the Railroad Avenue ramps would operate with one lane in each direction under the existing viaduct, while north of the ramps it would operate in the same manner but on the west side of the corridor. During Traffic Stage 5, Alaskan Way would operate with one lane in each direction on the west side of the corridor, and during Traffic Stage 6 operations would continue on the west side of the corridor between S. Holgate and Pike Streets.

Pedestrian access would be maintained during all phases of construction via the Port Side Pedestrian/Bike Trail on the western edge of the project area, which will be constructed by the separate S. Holgate Street to S. King Street Viaduct Replacement Project. The City Side Trail, part of the S. Holgate Street to S. King Street Viaduct Replacement Project, along the east side of SR 99, may be detoured slightly during construction of the Elevated Structure Alternative before being reconstructed in its final location. East-west travel within the construction zone would be restricted during a majority of the traffic stages.

6.10.3.2 Central Area

Although there would be modifications to Alaskan Way, pedestrian access would be maintained during all phases. East-west crossings under the viaduct and across Alaskan Way would be provided but may periodically change due to construction needs and locations.

From Second Avenue to Sixth Avenue along both sides of Battery Street, pedestrian facilities would experience intermittent detours and sidewalk closures due to construction staging locations.

6.10.3.3 North Area

Pedestrian facilities and access in the north area would experience intermittent detours and sidewalk closures due to construction staging locations along both sides of SR 99, from roughly Aloha Street to John Street. Sixth Avenue N. between Thomas and Broad Streets and Harrison Street between SR 99 and Sixth Avenue N. would also experience interruptions and restrictions. East-west pedestrian travel on Mercer and Broad Streets may be restricted during construction activities as well.

6.11 Bicycles

Generally, bicyclists would experience the same lane reductions and closures as other traffic. Bicyclists riding in the street may face an increased potential for conflicts with vehicles, given the expected higher traffic volumes and limited travel lanes and reduced space to maneuver on some streets. In particular, First Avenue S., Fourth Avenue S., Denny Way, and Dexter Avenue N. are expected to carry increased volumes of traffic during construction.

6.11.1 Bored Tunnel Alternative

6.11.1.1 South Area

As noted for pedestrians, during all phases of construction, bicycle access would be maintained on the Port Side Pedestrian/Bike Trail on the western edge of the project area, which will be adjacent to the Port of Seattle facilities. The Port Side Pedestrian/Bike Trail, constructed as part of the separate S. Holgate Street to S. King Street Viaduct Replacement Project, will extend from S. King Street to S. Atlantic Street and connect to existing bicycle facilities on either end with minimal to no out-of-direction travel. The City Side Trail, also part of the S. Holgate Street to S. King Street Viaduct Replacement Project, along the east side of SR 99, may be detoured slightly during construction before being reconstructed in its final location.

First Avenue S. would operate with two lanes in each direction beginning in June 2011 and continue in that manner until the bored tunnel opens. Bicyclists would have the option of continuing to use First Avenue S., using the Port Side Pedestrian/Bike Trail on the western edge of the project area, or diverting to Occidental Avenue S. in the immediate project area. Depending on their origin or destination, bicyclists may choose to travel on Fourth Avenue S., sharing the roadway with other vehicles but avoiding the construction activities in the south portal area. The existing in-street bicycle lanes on Second and Fourth Avenues through downtown would be maintained throughout the construction period.

East-west bicycle travel between S. King Street and S. Atlantic Street would be restricted during nearly all traffic stages, but the bicycle lanes along S. Royal Brougham Way would remain accessible.

6.11.1.2 Central Area

The Bored Tunnel Alternative would require construction activities centered on the south and north portal areas. However, during viaduct demolition, bicycle access to the waterfront could become slightly more circuitous as areas under the viaduct are temporarily closed due to demolition. East-west crossings would be provided but may change periodically due to construction needs and work locations. It is expected that two demolition crews would each work on two blocks at a time; therefore, bicyclists may have to detour for up to one block to access the waterfront if the area of the viaduct in their travel path is being demolished.

6.11.1.3 North Area

Generally, bicyclists would experience the same lane reductions and closures as other traffic in the north portal area. The in-street bicycle lanes on Dexter Avenue N. would be maintained during all construction activities. However, increased traffic volumes are expected on Dexter Avenue N. and other parallel facilities, which may increase the potential for automobile and bicycle conflicts.

East-west bicycle travel on Mercer Street would experience the same lane reductions and temporary closures as those expected for automobile traffic. As noted for pedestrian travel, particular attention would be given to minimizing the duration of closures and, when possible, to scheduling closures during less disruptive times.

6.11.2 Cut-and-Cover Tunnel Alternative

6.11.2.1 South Area

Construction effects on bicycle facilities for the Cut-and-Cover Tunnel Alternative would be the same as those for the Bored Tunnel Alternative in the south area (see Section 6.11.1.2), although the roadway closures would differ as discussed for pedestrian facilities. And, as noted for pedestrians, during all phases of construction, bicycle access would be maintained on the Port Side Pedestrian/Bike Trail on the western edge of the project area, which will be adjacent to the Port of Seattle facilities. The Port Side Pedestrian/Bike Trail, part of the separate S. Holgate Street to S. King Street Viaduct Replacement Project, will extend from S. King Street to S. Atlantic Street and connect to existing bicycle facilities on either end with minimal to no out-of-direction travel. The City Side Trail, along the east side of SR 99, may be detoured slightly during construction before being reconstructed in its final location. East-west bicycle travel between S. King Street and S. Atlantic Street would be restricted during nearly all traffic stages. The bicycle lanes along S. Royal Brougham Way east of SR 99 would remain accessible.

6.11.2.2 Central Area

Alaskan Way would be closed for the majority of the construction stages in the central area, and bicycle travel would experience the same effects as those expected for automobile traffic. East-west crossings would be provided but may periodically change due to construction needs and work locations.

6.11.2.3 North Area

Construction effects on bicycle facilities for the Cut-and-Cover Tunnel Alternative would be similar to those for the Bored Tunnel Alternative in the north area (see Section 6.11.1.3). Additional east-west connections across Aurora Avenue would be provided by temporary bridges at John and Thomas Streets during portions of Traffic Stages 3 and 4.

6.11.3 Elevated Structure Alternative

6.11.3.1 South Area

Construction effects on bicycle facilities for the Elevated Structure Alternative would be the same as those for the Bored Tunnel Alternative in the south area (see Section 6.11.1.1), although the roadway closures would differ as discussed for pedestrian facilities. And, as noted for pedestrians, during all phases of construction, bicycle access would be maintained on the Port Side Pedestrian/Bike Trail on the western edge of the project area, which will be adjacent to the Port of Seattle facilities. The Port Side Pedestrian/Bike Trail, part of the separate S. Holgate Street to S. King Street Viaduct Replacement Project, will extend from S. King Street to S. Atlantic Street and connect to existing bicycle facilities on either end with minimal to no out-of-direction travel. The City Side Trail, along the east side of SR 99, may be detoured slightly during construction before being reconstructed in its final location. East-west bicycle travel between S. King Street and S. Atlantic Street would be restricted during nearly all traffic stages. The bicycle lanes along S. Royal Brougham Way east of SR 99 would remain accessible.

6.11.3.2 Central Area

Alaskan Way would have operational revisions for the majority of the construction stages in the central area, and bicycle travel would experience the same effects as those expected for automobile traffic. East-west crossings would be provided but may periodically change due to construction needs and work locations.

6.11.3.3 North Area

Construction effects on bicycle facilities for the Elevated Structure Alternative would be the same as those for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives in the north area (see Section 6.11.1.3).

6.12 Ferries

6.12.1 Bored Tunnel Alternative

The Seattle Ferry Terminal at Colman Dock at Pier 52 services the largest number of Washington State Ferries customers of any terminal in the system. More recently, the adjacent terminal at Pier 50 is also being used by passenger-only ferry service provided by King County. The Seattle-Bainbridge route carried more than 6 million passengers in 2008, with approximately 3 million of those passengers walking onto the ferry and the remainder driving or riding in a vehicle. The Seattle-Bremerton route carried approximately 2.5 million passengers in 2008, with approximately 1.5 million of them walking onto the ferry (PSRC 2009a). Ferry operations, by their nature, result in a very periodic flow of people and vehicles moving to and from the terminal and place unique demands on the surrounding transportation infrastructure.

The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Bored Tunnel Alternative are as follows:

- Alaskan Way would be closed between S. Atlantic Street and S. King Street in Traffic Stages 1 through 7 (approximately 53 months [4.4 years]). The permanent alignment would include a new connection for East Marginal Way S. between S. Dearborn Street and S. Atlantic Street.
- Alaskan Way would be reduced to one southbound lane between Yesler Way and S. King Street. To alleviate potential queuing backups on Colman Dock during peak ferry travel periods, a second northbound lane would be added between Yesler Way and Spring Street, and the signal at Yesler Way/Alaskan Way would be modified to allow left turns out of the ferry terminal.
- Demolition of the Alaskan Way Viaduct would require closing segments of Alaskan Way two blocks at a time and closing selected cross streets. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.
- Demolition of the Alaskan Way Viaduct would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level.

As planning and design of the project and construction staging progresses, coordination with Washington State Ferries staff will continue to take place to ensure that disruptions or degradations to access to and from the Seattle Ferry Terminal are minimized or avoided.

6.12.2 Cut-and-Cover Tunnel Alternative

The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Cut-and-Cover Tunnel Alternative are as follows:

- Alaskan Way would be reduced to one lane throughout the corridor for a period of 42 months (3.5 years).
- Alaskan Way would be closed to north-south traffic between S. Atlantic Street and University Street for just over 5 years (63 months).
- Demolition of the Alaskan Way Viaduct would require the closure of segments of Alaskan Way two blocks at a time and the closure of selected cross streets. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.
- Demolition of the Alaskan Way Viaduct would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level.

The 5-year closure of Alaskan Way to north-south traffic from S. Atlantic to University Streets during Traffic Stages 2 through 5 of the Cut-and-Cover Tunnel Alternative would likely affect ferry operations much more than the shorter closure of Alaskan Way from S. Atlantic to King Street for 4.4 years under the Bored Tunnel Alternative. Ferry traffic coming from the south would need to use Yesler Way via First Avenue S. to access Colman Dock. Volumes on First Avenue S. during Traffic Stage 4 of the Cut-and-Cover Tunnel Alternative are expected to be approximately 30 percent higher than those during Traffic Stage 5 of the Bored Tunnel Alternative. This added volume is expected to result in more congestion, longer delays, and longer travel times for traffic, including traffic traveling to Colman Dock.

6.12.3 Elevated Structure Alternative

The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Elevated Structure Alternative are as follows:

- Alaskan Way would be periodically reduced to one lane in each direction for a period of about 2.5 years and completely reduced to one lane in each direction for a period of about 7 years.
- Demolition of the Alaskan Way Viaduct would require the closure of segments of Alaskan Way two blocks at a time and the closure of selected cross streets. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.

- Demolition of the Alaskan Way Viaduct would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level.

Under the Elevated Structure Alternative, Alaskan Way would be reduced to one lane in each direction for almost 8 years. This would affect ferry operations more than the full closure of Alaskan Way from S. Atlantic to King Street for 4.5 years under the Bored Tunnel Alternative. The reduced capacity of Alaskan Way would most likely increase congestion and delay for traffic along the corridor, including traffic traveling to Colman Dock.

6.13 Safety

Driving in a roadway work zone is more dangerous than driving on other parts of the road. Drivers can become confused by unfamiliar traffic patterns, signage, and cones or barricades in roadway work zones.

FHWA published the Work Zone Safety and Mobility Rule on September 9, 2004, in the Federal Register (69 FR 54562). In accordance with this rule, the project would develop a temporary traffic control plan. Building from WSDOT's Work Zone Traffic Control Guidelines (2009b), this plan would address traffic safety and control throughout the work zone. Work zone management strategies may include the use of intelligent transportation systems, traveler information, real-time work zone monitoring, traffic incident management, and enforcement components. WSDOT is also likely to assign a work zone traffic control engineer to the project.

6.13.1 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, traffic disruptions of varying degrees and travel through work zones would occur for 65 months. A 3-week closure of SR 99 would require the diversion of all traffic from SR 99. Work zones would mostly be limited to those portions of SR 99 near the north and south portals of the bored tunnel, as well as the Alaskan Way surface street. Other segments of SR 99 would not be affected for much of the construction duration.

6.13.2 Cut-and-Cover Tunnel Alternative

Construction of the Cut-and-Cover Tunnel Alternative is estimated to require 105 months, including full closure of the SR 99 corridor for 27 months. Work zones would be present throughout the corridor, and traffic would be fully diverted to surface streets during the 27-month closure period.

6.13.3 Elevated Structure Alternative

The Elevated Structure Alternative would require about 120 months of construction, with closure of the SR 99 corridor for up to 4 months. Work zones would be present throughout the corridor, and traffic would be fully diverted to surface streets during the 4-month closure period.

6.14 Event Traffic

6.14.1 Bored Tunnel Alternative

6.14.1.1 South Area

Based on existing Safeco Field patronage counts, up to 47,000 attendees can be expected for a full-house baseball event, which may translate to roughly 14,000 additional vehicles on local arterials and regional facilities. Seahawks games, although typically held on Sundays, draw even larger crowds and result in greater levels of traffic demand. While a portion of the patrons for both types of events travel via ferry or public transit (5,000 to 7,000 persons), with some growth in these modes projected in the future, the majority of these event-goers are likely to continue to travel via private vehicle and/or carpool.

During construction of the Bored Tunnel Alternative roadway elements in the south area, access to and from the stadium area would be similar to preconstruction conditions, including the reconfigured access related to Phase 2 of the SR 519 project, which was completed in early 2010. For the SR 99 corridor, explicit short-term detours and temporary structures would be used while the project elements in the south portal area are being constructed. These detours would occur over several traffic stages of the construction schedule and would result in reduced capacity on SR 99. Stadium area ramps to and from the north would be maintained, allowing connections similar to those under preconstruction conditions. However, the southbound off-ramp into the area would be temporarily directed to S. Atlantic Street, which eventually converges with heavy traffic activity on First Avenue S. and regional trip activity on S. Atlantic Street/SR 519 west of First Avenue S.

The effects of construction activity and changes to ramp connections would include potentially higher levels of congestion in the immediate vicinity of the stadiums and, therefore, longer travel times into and out of parking facilities, particularly during large events. Despite the localized effects of the construction period, mainline traffic congestion would not be affected substantially, based on the results of preliminary analyses of construction effects. Specific pedestrian paths and dedicated barriers through construction zones may be needed to delineate nonmotorized routes near the stadiums. The need for temporary detours, lane closures, and general traffic management for all transportation modes before and after events would continue throughout the construction period. Particular emphasis on the intersection of S. Atlantic Street and First Avenue S. would be required, because substantial traffic conflicts and demands would occur for all approaches at this location.

6.14.1.2 North Area

Based on data collected in 2007 and 2008, over 5,000 events are documented annually at Seattle Center, with the largest concentrations of people and traffic occurring during major Key Arena events such as high-profile concerts, Seattle Storm playoff games, and large-scale weekend festivals. Attendance at regional events such as Bumbershoot, the Northwest Folklife Festival, and the Bite of Seattle has been shown to reach up to 60,000 persons per day. Peak loads may approach 17,000 person-trips for a Key Arena event and as high as 200,000 person-trips during a festival weekend such as the Northwest Folklife Festival or Bumbershoot. Such attendance levels translate fairly directly to high levels of traffic demand in terms of volumes circulating within and around the Seattle Center area.

Under the Bored Tunnel Alternative, construction activity in the north area could cause major disruptions to these large events at Seattle Center due to temporary lane closures, detours, and access modification to SR 99 ramps, especially during early stages of the Mercer Street and north portal construction. However, these disruptions should be reasonably well managed because of the temporary retention of critical access ramps and mainline SR 99 capacity. For Traffic Stage 5 (deemed the most disruptive construction stage for the SR 99 corridor), the reconfiguration of Mercer Street to a two-way arterial from Dexter Avenue N. to Fifth Avenue N. is assumed to be largely completed. However, Sixth Avenue N. would remain closed during this stage, thereby limiting any benefits of new SR 99 crossings (from Thomas Street to Broad Street) while they are under construction. SR 99 in the vicinity of Harrison Street is assumed to operate on a temporary construction-phase structure that would reduce the current cross-section of three lanes in each direction to two lanes in each direction. The horizontal geometry of this temporary structure is expected to accommodate mainline speeds of only 35 to 40 mph, thereby limiting capacity in this segment of SR 99.

Based on these Traffic Stage 5 changes, the primary effects on event traffic would likely be related to capacity reductions on mainline SR 99 and, to a lesser degree, the temporary absence of connections across SR 99 on arterials between Denny Way and Mercer Street.

A full suite of measures related to signage, signal timing and operations, road closures, and detours would be critical for maintaining reasonable levels of traffic flow and circulation near Seattle Center during major events, particularly onto and off of SR 99. Flaggers or police details at key intersections may also be needed during major events at Seattle Center to establish clear event way-finding routes and detours, including turn restrictions. In addition, Seattle Center's

Fiftieth Anniversary celebration will be held from April to October 2012 and may require additional mitigation measures due to potentially higher-than-average patronage. Ongoing coordination with Seattle Center would help identify issues and target specific potential mitigation measures.

6.14.2 Cut-and-Cover Tunnel Alternative

6.14.2.1 South Area

For the Cut-and-Cover Tunnel Alternative, the effects of construction activity on stadium area event traffic are highlighted for Traffic Stage 4 which has been identified as the most disruptive construction stage in terms of mainline capacity reductions and disruption to surface streets. Specifically with respect to event traffic for this stage of construction, substantial effects on traffic access and circulation to and from the stadiums are expected primarily because of the closure of SR 99 while the cut-and-cover tunnel is being built in segments. In addition, Alaskan Way is also assumed to be closed to all through traffic, thereby further reducing north-south capacity. Event traffic would be most affected for patrons traveling to and from the north because closure of both SR 99 and Alaskan Way would require the use of alternate downtown arterials such as First, Second, and Fourth Avenues. For event traffic to and from the south, added delays and congestion would occur as well due to higher congestion levels on surface streets such as East Marginal Way S., First Avenue S., and Fourth Avenue S.

Temporary detours, lane closures, and general traffic management for all transportation modes before and after events would be critical during the construction period for the Cut-and-Cover Tunnel Alternative. Particular emphasis on the entry points to the stadium area on First Avenue S. and S. Atlantic Street would be needed because substantial traffic conflicts and demands would occur for most, if not all, arterials leading to nearby parking garages, surface lots, and loading areas.

6.14.2.2 North Area

For the Cut-and-Cover Tunnel Alternative, the influences of construction activity on event traffic are again highlighted for Traffic Stage 4. Similar to the south area, effects on traffic access and circulation to and from Seattle Center would be substantial, primarily because of the closure of SR 99 and Alaskan Way. Seattle Center event traffic would be most affected for patrons traveling to and from the south because closure of both SR 99 and Alaskan Way would require the use of alternate downtown arterials. Event traffic to and from the north would also be affected due to added congestion levels on surface streets such as Mercer Street, Roy Street, and Fifth Avenue N.

With SR 99 closed during Traffic Stage 4, a wide range of tools related to signage, signal timing and operations, road closures, and detours would be critical for maintaining reasonable levels of traffic flow and circulation near Seattle Center during major events, particularly to and from major surface arterials. Flaggers or police details at key intersections would be mandatory during major events at Seattle Center to establish clear event way-finding routes and detours, including turn restrictions. Ongoing coordination between Seattle Center would help identify issues and target specific potential mitigation measures.

6.14.3 Elevated Structure Alternative

6.14.3.1 South Area

For the Elevated Structure Alternative, construction activity would be most pronounced during Traffic Stage 5 in terms of impacts on traffic capacity, circulation, and event traffic. Temporary ramp access for southbound off-ramp movements to the stadium area would converge at S. Atlantic Street, thereby creating high concentrations of traffic and congestion. Northbound on-ramp access to SR 99 would be constrained by the WOSCA detour geometry and design speed that would potentially lead to backups on the East Frontage Road. In addition, the reduction of Alaskan Way to a single lane in each direction would shift many event-related trips from the north to First or Second Avenues. The combination of these changes would result in longer delays before and after large events at Safeco Field and Qwest Field.

Event detour routes, lane closures, and general traffic management for all transportation modes before and after events would be critical during the construction period for the Elevated Structure Alternative. Particular emphasis on the entry points to the stadium area on First Avenue S. and S. Atlantic Street would be needed because substantial traffic conflicts and demands would occur for most, if not all, of the arterials leading to nearby parking garages, surface lots, and loading areas.

6.14.3.2 North Area

For the Elevated Structure Alternative, the effects of construction activity on event traffic in the north area would again be most noticeable for Traffic Stage 5. Impacts on traffic access and circulation to and from Seattle Center would be substantial, primarily because of the closure of southbound SR 99 into the Battery Street Tunnel and the temporary Broad Street detour. Also, Alaskan Way would be reduced to a single lane in each direction, thereby forcing some event patrons to alternate streets such as First, Second, and Fourth Avenues. The northbound Western Avenue off-ramp from SR 99 is expected to remain during this stage of construction; therefore, Seattle Center event traffic from the south would at least be provided with more than one ingress route. Post-event traffic to the south on SR 99 would be required to travel on the Broad Street detour. Event traffic to and from the north would be adversely affected because of the Broad Street detour and added congestion levels on surface streets such as Mercer Street, Roy Street, and Fifth Avenue N.

Particularly with the Broad Street detour and reduction of lanes on Alaskan Way, a number of measures related to signage, signal timing and operations, road closures, and detours would be mandatory in order to maintain reasonable levels of traffic flow and circulation near Seattle Center during major events, particularly to and from major surface arterials. Flaggers or police details at key intersections would be mandatory during major events at Seattle Center to establish clear event way-finding routes and detours, including turn restrictions. Ongoing coordination with Seattle Center would also be needed to assist in developing potential mitigation measures to counteract the high concentrations of event traffic on key routes.

6.15 Mitigation of Construction Effects

6.15.1 Bored Tunnel Alternative

WSDOT, King County, and the City have developed transportation improvements to minimize traffic effects during construction to keep people and goods moving during construction of the Program. These enhancements and improvements are independent projects that will benefit all pending Program elements. They are designed to increase transit options, shift traffic away from construction areas, and provide drivers with the information they need to choose less congested routes.

These plans include the following elements:

- Variable speed signs and travel time signs on I-5 to help maximize safety and traffic flow
- Funding for SR 519 Phase 2 to improve connections from I-5 and I-90 to the waterfront, which has been completed
- Funding for the S. Spokane Street Viaduct Widening Project, which includes a new Fourth Avenue S. off-ramp for West Seattle commuters
- Funding for some increased bus service in the West Seattle, Ballard/ Uptown, and Aurora Avenue corridors during the initial portions of the construction period, as well as a monitoring system for bus travel times
- New traffic technology on SR 99 and major routes leading to SR 99 to keep people and goods moving
- Upgraded traffic signals and driver information signs for the Elliott Avenue W./15th Avenue W., SODO, and West Seattle corridors to support transit and traffic flow

- Information about travel alternatives and incentives to encourage use of transit, carpool, and vanpool programs

Many of these elements build upon projects already underway by King County and the City to fully fund critical projects and advance elements of Metro's RapidRide services. Transit enhancements and improvements to the street system, started in 2010, are playing a major role in keeping people and goods moving during the construction of the S. Holgate Street to S. King Street Viaduct Replacement Project. These improvements will remain useful to travelers during construction of the Bored Tunnel Alternative.

In addition to the transportation improvements to minimize traffic effects during construction and the transit-related projects, more localized mitigation measures will be developed as construction details are refined. Some localized construction mitigation measures specific to the Bored Tunnel Alternative might include the following:

- Construction of temporary signals
- Provision of flaggers at certain intersections to facilitate freight and general-purpose traffic movements, as well as expedite emergency vehicles

In addition, preparation of a traffic management plan, to be accepted by the City, will be required to ensure that construction effects on local streets, property owners, and businesses are minimized. WSDOT has been coordinating with SDOT in meeting with stakeholders, including those near the south and north portals of the bored tunnel, to develop and implement the traffic management plan. The traffic management plan will include at a minimum the following measures:

- Descriptions of traffic phasing to accommodate construction staging, which will include conceptual maintenance of traffic (MOT) plans, expected general-purpose traffic restrictions by construction phase and roadway, and transportation-mode-specific effects and mitigation for the effects
- Descriptions of the requirements for temporary roadways
- Procedures for identifying and incorporating the needs of transit operators, utility owners, ferry traffic, Port of Seattle traffic, and business owners in the project area
- Procedures for identifying and incorporating the needs of and impacts on pedestrian and bicycle flow, including, for example, mitigation for sidewalk closures and requirements related to the ADA
- Procedures for obtaining the concurrence of stakeholders and implementing road and lane closures

- Procedures for identifying and incorporating the needs of local agencies affected by the work, specifically, but not limited to, the Port of Seattle and access to Terminal 46
- Processes for signing transitions during construction from one stage to the next, and from interim to permanent signing
- Procedures for identifying and incorporating the needs of emergency service providers, firefighters, law enforcement entities, and other related corridor users, as well as procedures for ensuring that all information required by these agencies to protect the public is made available
- Provisions for incident and emergency response
- Processes for identifying, producing, and obtaining acceptance for the designs of temporary traffic signals
- Methods and frequency of inspection and maintenance of all traffic control throughout the project area
- Descriptions of contact methods, personnel available to make decisions and ensure that issues are addressed in a timely and appropriate manner, and response times for any conditions requiring attention and response 24 hours a day
- Identification of measurable limits for the repair and replacement of traffic control devices, including temporary and permanent pavement markings
- Processes for determining the needs for revised traffic signal timings, and if revisions are required, detailing the procedures for the development, review and acceptance, implementation, testing, and maintenance of all affected signals
- Provisions for maintaining existing access to all properties
- Provisions for providing continuous access to established truck routes, hazardous material routes, transit routes, and school bus routes
- Procedures for modifying the plans as needed to adapt to current project circumstances
- Procedures for incorporating the needs of event traffic, including coordination with Seattle Center, Safeco Field, and Qwest Field
- Procedures for determining detour routes
- Procedures for communicating MOT information and project issues to public information personnel and the public
- Procedures for accommodating MOT plans of adjacent projects, if applicable

- Procedures for accommodating the MOT plans when the staging schedule of the project or any adjacent project changes
- Identification of temporary access connections between facilities
- Identification of haul routes

6.15.2 Cut-and-Cover Tunnel Alternative

Although the specific locations of construction mitigation actions would be different from those for the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would use mitigation strategies similar to those described in Section 6.15.1. The construction mitigation would also take place over 105 months (the duration of construction) versus 65 months for the Bored Tunnel Alternative.

6.15.3 Elevated Structure Alternative

Although the specific locations of construction mitigation actions would be different from those for the Bored Tunnel Alternative, the Elevated Structure Alternative would use mitigation strategies similar to those described in Section 6.15.1. The construction mitigation would also take place over 120 months (the duration of construction) versus 65 months for the Bored Tunnel Alternative.

6.16 Concurrent Effects During Construction

The key findings related to construction effects due to concurrent construction projects are the following:

- One of the benefits of the Bored Tunnel Alternative is that it would minimize construction effects (both project-specific and cumulative) by allowing the existing Alaskan Way Viaduct to stay in operation until the bored tunnel is completed.
- A number of other major transportation projects would occur in the vicinity during the construction period for the Bored Tunnel Alternative.
- Disruptions due to the Bored Tunnel Alternative would primarily occur at or near the tunnel portals.
- Traffic patterns in the project area would be complex, and schedule adjustments made during the construction of any of the overlapping projects would potentially affect other projects and traffic patterns.

This section qualitatively describes any notable concurrent effects that could occur during construction, considering the entire Program (in the case of the Bored Tunnel Alternative) and other projects in the general vicinity. Numerous projects underway in the Puget Sound region have the potential to affect a portion of the trips on the Alaskan Way Viaduct (e.g., the SR 520 Bridge

Replacement and HOV Program). However, this section of the Transportation Discipline Report discusses only projects that are located relatively close to the Alaskan Way Viaduct Replacement Project and also would occur during the construction period of the build alternatives.

The effects due to concurrent construction of the build alternatives and other nearby projects are best described in the following locations:

- At the south and north ends of the project area where connections need to be made to either the Battery Street Tunnel or the new cut-and-cover tunnel or the bored tunnel.
- In the central portion of the project area where the Elliott Bay Seawall replacement will take place.

6.16.1 South Area

Two projects have the potential to generate concurrent construction-related effects in the vicinity of the south portal of the bored tunnel: the S. Spokane Street Viaduct Widening Project and the S. Holgate Street to S. King Street Viaduct Replacement Project.

Although the S. Spokane Street Viaduct Widening Project is not adjacent to any of the build alternatives, it does have the potential to affect users of the SR 99 corridor. In particular, the closure of the southbound to westbound ramp from Fourth Avenue S. has the potential to divert some traffic that is currently using Fourth Avenue S. for access to West Seattle to drive through the construction zone on First Avenue S. The completion of a ramp from the eastbound lanes of the S. Spokane Street Viaduct to Fourth Avenue S. (in particular the northbound movement) could benefit traffic during construction of the build alternatives by providing a more efficient connection to Fourth Avenue S. and additional incentive for drivers to avoid the construction zone on First Avenue S.

Construction activities for the S. Holgate Street to S. King Street Viaduct Replacement Project would overlap the construction of the build alternatives from about 2011 through 2014. Although current schemes for construction staging for all the build alternatives try to minimize the potential conflicts in the area, if schedule adjustments during construction force the closure of Alaskan Way S. to occur when First Avenue S. is reduced to one lane, there would be a substantial effect on north-south traffic in the south area.

As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, S. Royal Brougham Way would be closed east of Alaskan Way S. throughout the construction period, and it would remain closed thereafter. A portion of the roadway west of First Avenue S. would remain open to provide access to adjacent businesses and the temporary on-ramp to northbound SR 99. In this way, business access would not be directly affected. Users who normally use S. Royal

Brougham Way to travel east-west between Alaskan Way S. and the stadium area, SR 519, or First Avenue S. would instead use S. King Street to the north or S. Atlantic Street one block to the south.

6.16.2 Central Area

In the central waterfront area between S. Washington Street and Pike Street, the Bored Tunnel Alternative would require detours along sections of Alaskan Way. According to the plan, construction of the Elliott Bay Seawall would be completed and the associated effects on Alaskan Way would be eliminated before the demolition of the Alaskan Way Viaduct. However, construction of the seawall would occur concurrently with the construction of the Bored Tunnel Alternative, and there would likely be both lane closures and detours or realignments of Alaskan Way between S. Washington Street and Pike Street during construction of the Bored Tunnel Alternative.

Along with affecting general-purpose traffic, project construction is expected to affect freight operations along Alaskan Way. WSDOT, the City, and the Port of Seattle will be working collectively to develop construction staging plans for the Elliott Bay Seawall Project.

The Elevated Structure Alternative and the Cut-and-Cover Tunnel Alternative were both defined such that the Elliott Bay Seawall is part of the project definition; therefore, the seawall is not considered a concurrent project for these two build alternatives.

6.16.3 North Area

The primary plan that requires discussion in the north area is the Mercer Street Corridor Improvements Project. For this project, the City would be widening and modifying Mercer Street from its current one-way configuration to a two-way operation.

The Mercer Street Corridor Improvements Project (part of the Program) consists of several major components that are scheduled to occur either near or during the same timeframe as the construction associated with the build alternatives for the Alaskan Way Viaduct Replacement Project. WSDOT and the City are in regular communication regarding construction staging and coordination of the Mercer Street Corridor Improvements Project and the build alternatives for the Alaskan Way Viaduct Replacement Project in the north area. Both entities are striving to minimize construction-related disruptions due to both projects while maintaining or increasing the construction efficiency.

6.16.4 Parking

Parking under the viaduct and along Alaskan Way, as well as parking in the north and south areas, would be affected by the construction associated with all three build alternatives for the Alaskan Way Viaduct Replacement Project. In the case of the Bored Tunnel Alternative, parking under and adjacent to the existing viaduct along the central waterfront would be affected by both the Bored Tunnel Alternative and other elements of the Program. The Program is expected to have a more substantial effect on parking than the Bored Tunnel Alternative alone. Concurrent effects of Bored Tunnel Alternative and Program construction on parking are discussed below.

A number of parking mitigation strategies could be implemented to address the parking disruption due to construction activities. These strategies could apply to any of the build alternatives.

6.16.4.1 Concurrent Effects on Parking During Program Construction

6.16.4.1.1 Elliott Bay Seawall Project

The Elliott Bay Seawall Project is not expected to permanently affect parking. However, there may be substantial effects on parking during construction, depending on a number of factors, such as whether parking on the Alaskan Way surface street would be removed, whether parking under the viaduct would need to be removed to accommodate additional travel lanes under the viaduct, and the length of the construction segments. It is likely that the seawall construction would occur in segments; therefore, parking would be affected only in the segment of construction, not the entire length of the Elliott Bay Seawall Project. The project limits for the seawall replacement are S. Washington Street in the south and Broad Street in the north. There are approximately 50 on-street parking spaces on the Alaskan Way surface street and 540 on-street parking spaces under the viaduct from S. King Street to Pike Street. Parking along the central waterfront also may be affected at times when utilities are being relocated for the seawall replacement.

In addition to the parking on Alaskan Way and under the viaduct, access to parking on the piers also could be temporarily affected during the seawall construction activities. There are about 80 parking spaces on Piers 53, 54, 56, and 57, in addition to loading zones on many of the piers. Most of these parking spaces are employee and visitor spaces for businesses on the piers.

6.16.4.1.2 Alaskan Way Surface Street Improvements – S. King to Pike Streets

Rebuilding the Alaskan Way surface street between S. King Street and Pike Street would affect parking spaces currently on Alaskan Way and under the viaduct. Directly after the viaduct demolition and removal, the City expects to begin work on the waterfront promenade and the new Alaskan Way surface street. Construction of these projects will likely affect parking availability until they are completed (in approximately 2018). There are approximately 590 on-street parking spaces on the Alaskan Way surface street and under the viaduct from

S. King Street to Pike Street. There are an additional 260 off-street parking spaces nearby that could be affected by the street reconfiguration. This totals about 850 parking spaces along the central waterfront that could be affected by the Alaskan Way surface street improvements. A number of these spaces would likely be replaced, with the number, location, and type of spaces to be determined by the City. Although the design has not been finalized, the concept for Alaskan Way is to include parallel parking on both sides of the street. The effects on parking during viaduct demolition are discussed in more detail in Section 6.9.

6.16.4.2 Concurrent Effects on Parking Due to Adjacent Projects

Construction activity related to private development may occur concurrently with construction of any of the build alternatives and could affect the supply of parking, particularly in off-street (pay) parking lots. In particular, there are several developments in the stadium area that could affect parking within the timeframe of project construction.

The Qwest Field north lot redevelopment could affect 1,100 spaces during construction, but preliminary information on the redevelopment indicates that about 950 spaces would be included in the new development. However, the number of these 950 spaces that would be available to the public is unknown at this time. If the north lot redevelopment removes parking spaces at the same time that the Program affects parking spaces along the waterfront and in Pioneer Square, there could be a noticeable reduction in parking in Pioneer Square.

The redevelopment of Home Plate Parking at S. Atlantic Street and First Avenue S. could affect 300 off-street parking spaces during construction. About 610 spaces are proposed for the new development, although not all of these spaces would be available to the public. The main effect of this redevelopment on parking would be felt during construction, when 300 spaces are removed.

In the north area, redevelopment of the Mercer Garage at Seattle Center and construction of a new underground garage at Memorial Stadium could affect up to 1,500 off-street parking spaces during construction in the north area.

6.16.4.3 Parking Mitigation During Construction

6.16.4.3.1 Potential Management Strategies

A number of parking management strategies could be implemented to address the concurrent effects of parking disruption due to construction activities. These would be applicable to any of the build alternatives under consideration. SDOT, in coordination with the project, has conducted parking studies as part of the process to develop mitigation strategies and better manage the city’s parking resources. SDOT's studies identified a number of strategies to offset the loss of short-term parking in this area, including new or leased parking and increased utilization of existing parking. Although the mitigation measures would be most needed during construction, many of them could be retained and provide benefits over the longer term. Specific parking mitigation strategies have not yet been determined, but the project has allocated $30 million for parking mitigation. The parking mitigation strategies will continue to evolve in coordination with the project and community partners. Parking measures under consideration and refinement include the following:

- Establish a parking policy for construction workers that is implemented by the contractor.
- Encourage a shift from long-term parking to short-term parking. This could involve encouraging privately held parking lots to institute measures that reward short-term parking.
- Provide short-term parking (off-street), especially serving waterfront piers, downtown retail, and other heavy retail/commercial corridors.
- Partner with private and public parking facilities to use the e-Park system, an electronic guidance system displaying real-time parking availability on right-of-way signs, facility signs, and the Seattle Parking Map website. Dynamic message signs could be located at key access points in the downtown, Pioneer Square, and the central waterfront area.
- Evaluate curb space designations and priorities to maximize and balance access needs for multiple curb space users, including commercial and delivery vehicles, taxis, and customers.
- Develop a Center City parking marketing program, which could include the following measures:
  - Provide improved access to information about parking options through e-Park and the Seattle Parking Map website for businesses to share with customers and vendors.
  - Use existing and new social media and blog outlets to provide frequent information about parking availability to create a "no surprise" environment.
  - Encourage businesses to adopt the use of parking vouchers that they could give to customers to park in designated parking lots.

6.16.4.3.2 Center City Parking Program

The Center City Parking Program is SDOT's approach for addressing changes and growing demand for short-term parking in Seattle's Center City area over the next several years. Marketing, way-finding, and technology measures aim to improve access to off-street short-term parking beginning in 2012. The approach is designed to keep the Center City area moving as more jobs and people come to Seattle and keep it viable throughout the construction of the Alaskan Way Viaduct Replacement Project.

One innovative component of the Center City Parking Program is e-Park, an electronic parking guidance system that uses signs to provide motorists with real-time information about the availability of parking spaces and directs them from primary downtown access points to parking garages. This new technology would make it easy for shoppers and visitors to find parking and reduce traffic congestion and pollution by reducing the time spent circling for vacant on-street parking spaces. In Fall 2010, the e-Park project began as a pilot project focused on the retail and Pike Place Market areas to test the technology and concept. In 2011–2012, e-Park will expand to other downtown destination areas, including Pioneer Square and the central waterfront.

In 2010, SDOT launched the Electronic Parking Guidance System in conjunction with the development of a program name and branding used on message signs, a parking locator website, printed maps, and marketing programs for participating garages, properties, and other organizations in the Center City area.

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Chapter 7 OPERATIONAL EFFECTS, MITIGATION, AND BENEFITS WITH TOLLING

The purpose of this chapter is to discuss the effect of tolling on the travel behavior and system performance for each of the three build alternatives. It compares travel patterns and traffic volumes in 2030 for the tolled Bored Tunnel Alternative, the tolled Cut-and-Cover Tunnel Alternative, and the tolled Elevated Structure Alternative with travel patterns and traffic volumes for their non-tolled counterparts.

7.1 Tolling and the Analysis of Operational Effects

This section establishes the context for the tolling analysis. Tolling can be used for different reasons; it can be a means of revenue generation, or it can be part of a facility-specific or regional demand management program, or it can be used for a combination of both. The implementation strategy, toll rates, variability of toll rates, and locations of collection (e.g., mainline only or mainline and ramps) depend on the ultimate purpose of the tolling. In the case of the Alaskan Way Viaduct Replacement Project, tolling would be implemented to generate revenue.

For the purpose of analyzing the comparison between tolled and non-tolled facilities for the same alternative, the forecasting process used for this project provided estimated volumes that are a conservative representation of the effects of implementing tolls on SR 99. The primary reasons for taking a conservative approach are as follows:

- **Financial Forecasting**. For the support of financial analysis, forecasting the tolled vehicle volumes on the low yet reasonable side reduces the chance of overestimating potential toll revenue that could be generated from the facility.
- **Estimated Effects on Traffic for Environmental Analysis**. As part of the environmental review, a reasonable, high estimate of diversion onto other parallel facilities allows the analysis of effects to consider what is likely a worst-case condition, and how that condition could affect traffic operations, travel times, and other elements in the surrounding environment.

Though diversion of a tolled facility could be as high as those presented in this chapter, actual diversion would likely be lower, given the conservative approach taken for this analysis. The demand model used to forecast the traffic volumes has several variables (such as sensitivity of arterial congestion on travel times, arterial capacity, travelers' value of time, and facility toll rates) that were used, and which work together to support this approach. Further analyses of the traffic and revenue will be conducted using refined toll rates prior to their ultimate implementation.

7.1.1 Factors Affecting Route Choice and Traffic Diversion

The primary factors affecting route choice are travel time and cost. Modeling travel behavior in a system that is introducing tolls for the first time requires an estimation of travel time for multiple routes and the amount diversion from the tolled facility, which flows from an understanding of the value of time for all modes of transportation using the facility. In the case of modeling for the Alaskan Way Viaduct Replacement Project, the tolling scenarios that were developed varied the price of a trip by direction and time of day. Specifically, seven different tolling levels were applied to the facility by direction during five separate time periods (some tolls were the same for both directions) for single-occupant vehicles (SOV), HOV 2+, and HOV 3+ vehicles. Exhibit 7-1 presents the passenger vehicle toll rates used to model the alternatives. The rates in Exhibit 7-1 correspond to Toll Scenario C included in the *Updated Cost and Tolling Summary Report to the Washington State Legislature* (WSDOT 2010).

Exhibit 7-1. Weekday Toll Rates for Single-Occupant Vehicles, HOV 2+, and HOV 3+ Under Toll Scenario C

Time of Day	Northbound	Southbound
AM peak period	$4.00	$3.00
Midday	$2.25	$2.25
PM peak period	$4.00	$5.00
Evening	$1.25	$1.25
Night	$1.00	$1.00

Note: Toll rates are expressed in 2015 dollars; values of time used in this analysis are consistent with the *Updated Cost and Tolling Summary Report to the Washington State Legislature* (WSDOT 2010).

A different set of toll levels was assumed for medium- and large-truck categories. Truck toll levels were also adjusted for the five time periods shown in Exhibit 7-1.

Travel models assume that drivers would understand the fastest route to their destination and adjust their route based on congestion levels. With tolling introduced to the system, drivers would also take into account the value of their time versus the cost of a toll and choose their routes accordingly. For example, commute trips are likely to correspond to times when most drivers value their time highly, and evening trips much less so. In order to capture revenue in the most effective way, toll systems are typically applied with toll rates varying throughout the course of the day.

7.1.2 Tolling Scenario Assumed for the Final EIS

With the potential to adjust toll rates in small increments during multiple time periods and in either travel direction, it is impossible at the EIS stage to select the final toll rates that would ultimately be implemented for the project. In fact, if tolling is implemented on the project, a series of tolling analyses would be conducted to finalize the rates and specific implementation strategies.

The tolling analysis is discussed in this discipline report to show the relative variability of each build alternative in terms of tolling as measured by the standard transportation metrics in the project area. Given the different physical configurations for the alternatives (e.g. whether or not midtown ramps or Elliott/Western ramps would be provided), the appropriate tolling scenario for each of the build alternatives would likely be different. However, in order to provide some level of consistency between the environmental analyses for the three alternatives, one fairly conservative tolling scenario was used as the basis for all the tolling analyses presented in this chapter (Toll Scenario C from the *Updated Cost and Tolling Summary Report to the Washington State Legislature* [WSDOT 2010]). In addition, it was decided to implement the tolls just north of Seneca Street for all the alternatives so that through-traffic and traffic using the Elliott/Western ramps would pay a toll, whereas traffic using the midtown ramps (only in the Elevated Structure Alternative) would not. In order to address potential questions regarding the sensitivity of each alternative to differing toll rates and the effects of tolling the midtown and Elliott/Western ramps, several additional travel demand model runs were performed to provide insight into diversion patterns under different tolling strategies. Between the detailed presentation of transportation system metrics for Toll Scenario C and the sensitivity analysis for several additional toll strategies, this chapter provides a robust set of data to inform the environmental review process.

7.1.3 Traffic Diversion

Tolling would cause vehicles to divert from SR 99 to other nearby roadways. The extent of the diversion and the travel patterns associated with the diversions would be sensitive to the configuration of the facility, the available capacity on alternate routes, and the tolling implementation strategy. Because the tolling strategies would be implemented with different rates for different times of the day, the percentage of traffic diversion would differ throughout the day based on the level of the toll for that time period and the average value of drivers' time during that time period. It is not accurate to assume that a daily diversion percentage can be applied directly to a specific time period. For example under Toll Scenario C, the bored tunnel is expected to result in a daily diversion rate of about 40 percent for all vehicle classes. However, depending on direction and time period, the diversion would vary considerably from 24 percent in the northbound direction during the AM peak hour to 75 percent in the northbound direction during the night period.

Because of their different physical configurations, the Cut-and-Cover Tunnel and the Elevated Structure Alternatives are expected to result in different diversion patterns when analyzed for the same Toll Scenario C toll levels. The daily diversion rate for all vehicle classes for these two alternatives would be about 50 and 65 percent, respectively.

7.1.4 Analysis Interpretation

Because of the number of potential variables involved, it is impossible to analyze all the potential tolling scenarios and implementation strategies. The detailed results presented in this chapter provide an indication of the relative sensitivity of each alternative to tolling under a common tolling scenario and implementation scheme. The results of the analysis of mainline and intersection LOS and the analysis of travel time provide insight into the likely range of effects on the transportation system and the locations that are most likely to be affected by diverted traffic. Because the configurations of the alternatives are so different (especially in the case of the Elevated Structure Alternative), a series of sensitivity tests was run to provide perspective regarding the relative changes in diversion rates that would be associated with either lower tolls in general or the inclusion of full or half tolls on the midtown ramps. A complete discussion of the sensitivity analysis is provided in Section 7.15. For any of the analyses discussed in this chapter, the results are best understood by focusing on the relative difference between tolled and non-tolled conditions for the same alternative.

7.2 Regional Context and Travel Patterns

The discussion of the regional context and travel patterns illustrates how travel patterns might change in the future; it includes AM and PM peak hour and daily estimates of various travel parameters (e.g., VMT and screenline volumes) as a means of quantifying the travel patterns in and around the SR 99 corridor and as a basis for comparing the different alternatives that were analyzed. The following subsections compare each tolled build alternative to its non-tolled counterpart.

The key findings of the analyses of operational effects and benefits are the following:

- VMT shows little variation between tolled and non-tolled conditions for each of the alternatives. However, VHT and VHD would be higher for each of the tolled alternatives compared to their non-tolled counterparts, with the effects most pronounced in Seattle's Center City area. These increases would be a result of longer trips and increased congestion due to traffic diversion away from the tolled SR 99 facility.
- The number of person-trips at all the screenlines would be similar regardless of tolling for each of the alternatives, demonstrating that the alternative under both non-tolled and tolled conditions would meet a similar demand in terms of person-trips.

- The projected travel patterns under tolled and non-tolled conditions indicate traffic diversion from the SR 99 facility in Seattle's Center City for each of the tolled build alternatives. Travel patterns north and south of the Center City would be less affected by diversion.
- Approximately 39 percent of SR 99 vehicle volumes through downtown are expected to divert from SR 99 with the tolled Bored Tunnel Alternative, compared to the non-tolled Bored Tunnel Alternative. Diversion from SR 99 with the tolled Cut-and-Cover Tunnel Alternative is 51 percent compared to the non-tolled Cut-and-Cover Tunnel Alternative, while diversion from SR 99 with the tolled Elevated Structure Alternative is 62 percent compared to the non-tolled Elevated Structure Alternative. These diverted vehicle trips would be distributed across Alaskan Way, parallel arterials, and I-5.

7.2.1 Bored Tunnel Alternative

This section discusses the regional context and variation in travel patterns between the tolled Bored Tunnel Alternative and its non-tolled counterpart.

7.2.1.1 Vehicle Miles of Travel

VMT is defined as the total number of miles traveled during a time period over a specified area, either Seattle's Center City or the four-county region. The discussions below describe the model-estimated VMT for AM and PM peak hours and daily totals for the Bored Tunnel Alternative with tolled and non-tolled conditions. The estimates were derived using the project's travel demand model. Exhibit 7-2 provides a summary of VMT.

Exhibit 7-2. Vehicle Miles of Travel – Bored Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Seattle's Center City			
AM peak hour	413,000	441,700	445,700
PM peak hour	521,400	554,500	559,400
Daily	2,371,400	2,521,600	2,534,400
Four-County Region			
AM peak hour	20,452,500	20,230,900	20,250,200
PM peak hour	24,263,200	23,935,700	23,962,400
Daily	110,820,300	109,471,700	109,541,400

The tolled Bored Tunnel Alternative would have slightly higher VMT than the non-tolled Bored Tunnel Alternative during all time periods in both Seattle's Center City and the four-county region. This forecasted increase is likely due to slightly longer trip lengths resulting from trips that have diverted from the bored tunnel in order to avoid the toll. In the Center City, VMT for the tolled Bored Tunnel Alternative would be about 1 percent higher than VMT for the non-tolled Bored Tunnel Alternative during the AM and PM peak hours and 0.5 percent higher over an average weekday. In the four-county region, VMT with tolled conditions would be slightly higher than VMT with the non-tolled conditions.

7.2.1.2 Vehicle Hours of Travel

VHT is defined as the calculated total number of hours traveled during a specified time period in a specified area, in this case, Seattle's Center City and the four-county Puget Sound region. The VHT estimates discussed below were derived using the project's travel demand model. The evaluation describes AM and PM peak hour VMT and daily VHT totals for the Bored Tunnel Alternative with tolled and non-tolled conditions. Exhibit 7-3 provides a summary of VHT.

Exhibit 7-3. Vehicle Hours of Travel – Bored Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Seattle's Center City			
AM peak hour	20,300	18,700	19,900
PM peak hour	33,600	30,400	32,600
Daily	107,400	101,000	107,900
Four-County Region			
AM peak hour	1,107,200	1,094,400	1,097,400
PM peak hour	1,236,400	1,221,700	1,226,400
Daily	4,436,100	4,402,800	4,415,500

Similar to VMT, during every time period, the tolled Bored Tunnel Alternative would have higher VHT than its non-tolled counterpart in both Seattle's Center City and the four-county region. This forecasted increase is again attributed to the increased length of some trips that would divert from the bored tunnel, resulting in increased hours of travel. In the Center City, VHT for the tolled Bored Tunnel Alternative would be more than 6 percent higher than VHT for the non-tolled Bored Tunnel Alternative during the AM peak hour, while PM peak hour and daily VHT would be about 7 percent higher. VHT in the four-county region for the tolled Bored Tunnel Alternative would be less than one-half of 1 percent higher in all time periods.

7.2.1.3 Vehicle Hours of Delay

VHD is defined as the calculated total number of hours of delay experienced (i.e., travel time above that experienced during free-flow operations) by traffic on roadways in a specified area during a given time period. The areas considered for VHD are the same as those considered for VMT and VHT: Seattle's Center City and the four-county Puget Sound region. This measure is often used as an indicator of overall traffic congestion. The VHD estimates were derived using the project's travel demand model. The evaluation describes AM and PM peak hour VMT and daily totals for Bored Tunnel Alternative with and without tolling. Exhibit 7-4 provides a summary of VHD.

Exhibit 7-4. Vehicle Hours of Delay – Bored Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Seattle's Center City			
AM peak hour	8,600	6,800	7,600
PM peak hour	18,500	14,900	16,800
Daily	41,300	33,300	38,700
Four-County Region			
AM peak hour	537,900	524,500	526,600
PM peak hour	553,800	540,600	544,200
Daily	1,385,800	1,355,000	1,364,400

Once again, VHD would universally increase under the tolled Bored Tunnel Alternative when compared to the non-tolled Bored Tunnel Alternative. This forecasted increase is likely due to increased congestion and delay that would result from the diversion of traffic away from the tolled bored tunnel. In the Center City, VHD with the tolled Bored Tunnel Alternative would increase nearly 12 percent over that of the non-tolled Bored Tunnel Alternative during the AM peak hour, while PM peak hour VHD would increase by almost 13 percent. Daily VHD with the tolled Bored Tunnel Alternative would be over 16 percent higher than that for the non-tolled Bored Tunnel Alternative. In the four-county region, VHD with the tolled Bored Tunnel Alternative would be less than one-half of 1 percent higher than that for the non-tolled Bored Tunnel Alternative during the AM peak hour. PM peak hour and daily VHD would be almost 1 percent higher with the tolled Bored Tunnel Alternative when compared to its non-tolled counterpart.

7.2.1.4 Person Throughput

Person throughput is a measure of the total number of persons traveling on a given transportation facility. Analysts use person-trips to measure the number of people, rather than vehicles, traveling on the transportation system. Increased use of transit or carpools can increase the overall number of people conveyed, even if vehicle traffic does not increase.

This evaluation compares the total number of persons at the same screenlines as those used in Chapters 4 and 5: a south screenline north of S. King Street, a central screenline north of Seneca Street, and a north screenline north of Thomas Street. The evaluation describes AM and PM peak hours and daily totals for the tolled Bored Tunnel Alternative and its non-tolled counterpart. Exhibit 7-5 summarizes the person throughput by screenline for the study area.

Exhibit 7-5. Model-Estimated Daily Person Throughput (Person-Trips) – Bored Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South Screenline (South of S. King Street)			
AM peak hour	61,360	65,840	66,230
PM peak hour	73,470	79,210	79,050
Daily	821,800	880,600	885,300
Central Screenline (North of Seneca Street)			
AM peak hour	53,670	60,170	60,090
PM peak hour	62,090	69,430	69,360
Daily	727,600	795,800	798,100
North Screenline (North of Thomas Street)			
AM peak hour	63,600	67,300	67,800
PM peak hour	74,900	80,020	80,120
Daily	839,900	894,700	887,200

At all the screenlines and during all the time periods, the tolled Bored Tunnel Alternative would generally serve the same number of person-trips as the non-tolled Bored Tunnel Alternative; all differences would be within 1 percent (either higher or lower) of the non-tolled Bored Tunnel Alternative. These results are attributable to the fact that although people may divert from the bored tunnel or change travel modes, these person-trips would still cross screenlines under the tolled Bored Tunnel Alternative in a manner similar to that under the non-tolled Bored Tunnel Alternative. These results also indicate that the tolled Bored Tunnel Alternative would be capable of serving the same overall person-demand regardless of tolling.

7.2.1.5 Vehicle Volumes at Screenlines

AM and PM peak hour and daily traffic volumes were assessed to gauge the general effects on parallel streets and highways. Traffic volume forecasts for the project were measured at the same four screenline locations as those used in Chapters 4 and 5. The resulting screenline volumes are presented in Exhibit 7-6 and discussed in the following subsections. Details regarding the distribution of vehicle volumes across specific highway and arterial facilities among the alternatives are discussed in Section 7.2.1.6.

For the Bored Tunnel Alternative, tolls on SR 99 would minimally change the total volume of vehicles traveling through the study area. The changes in estimated vehicle volumes at all four screenlines are expected to be less than 1 percent for all the time periods.

With and without tolling on SR 99, the entire highway and street network would support the same vehicle demand. The very slight increase in volume at some locations could be attributed to a variety of factors, including a slight mode shift and faster travel times through the bored tunnel, which could make travel between certain locations more attractive.

Exhibit 7-6. Model-Estimated Vehicle Volumes at Screenlines – Bored Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Spokane Screenline (North of S. Spokane Street)			
AM peak hour	32,020	34,590	34,850
PM peak hour	35,800	38,400	38,550
Daily	464,200	495,900	500,000
South Screenline (South of S. King Street)			
AM peak hour	34,080	37,360	37,630
PM peak hour	39,420	43,430	43,220
Daily	515,800	559,000	561,500
Central Screenline (North of Seneca Street)			
AM peak hour	29,730	33,580	33,300
PM peak hour	33,060	37,410	37,100
Daily	447,500	491,100	490,800
North Screenline (North of Thomas Street)			
AM peak hour	37,650	40,370	40,600
PM peak hour	42,510	45,880	45,970
Daily	538,000	578,000	572,200

7.2.1.6 Vehicle Volumes on Key Facilities and Arterial Screenlines

Vehicle volumes were also analyzed by separating major facility volumes from the screenlines, as shown in Exhibits 7-7 through 7-9. While a similar volume of vehicles is forecasted to travel north and south through the study area under the tolled Bored Tunnel Alternative, the facilities on which they would travel are different from the facilities that would be used under the non-tolled Bored Tunnel Alternative.

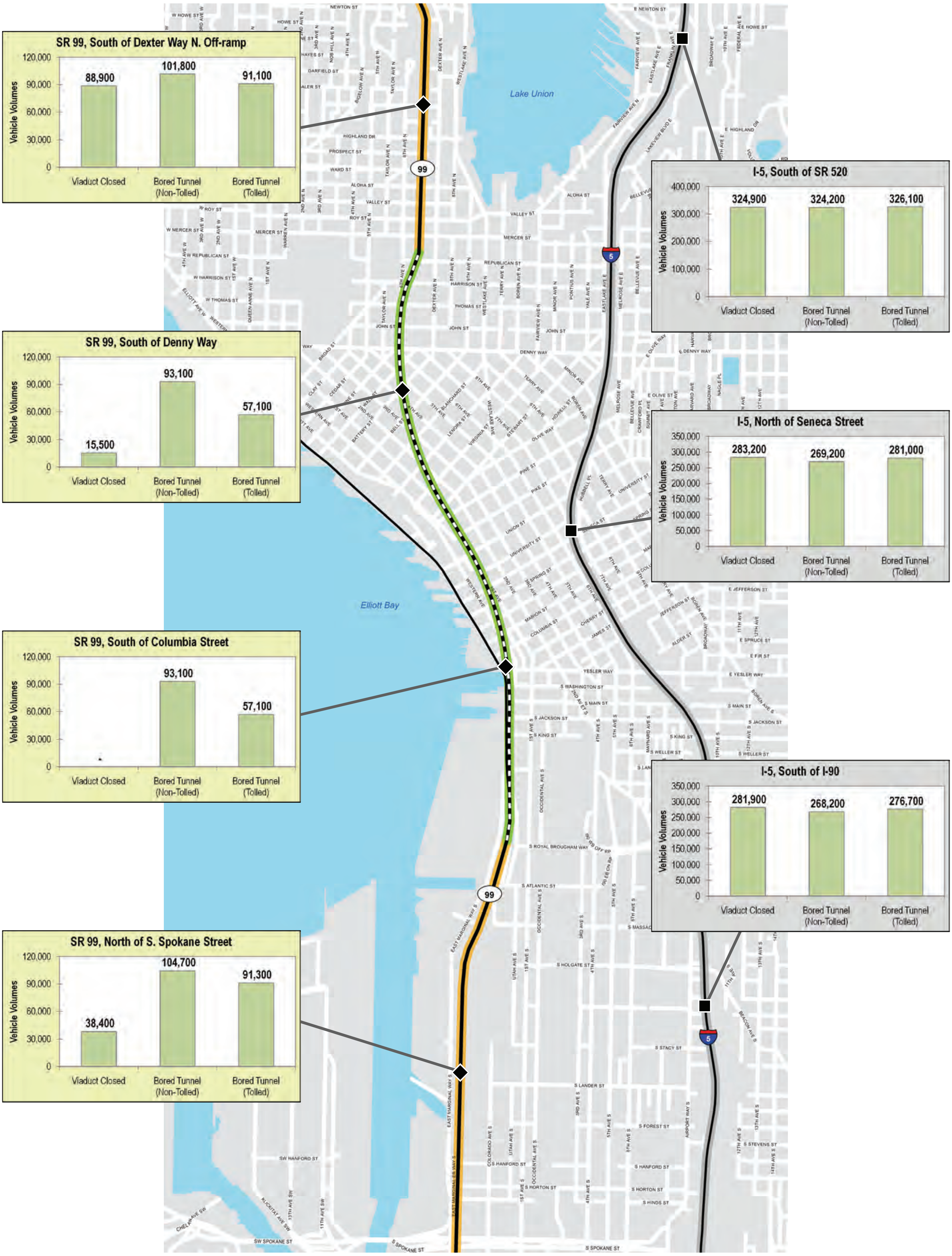
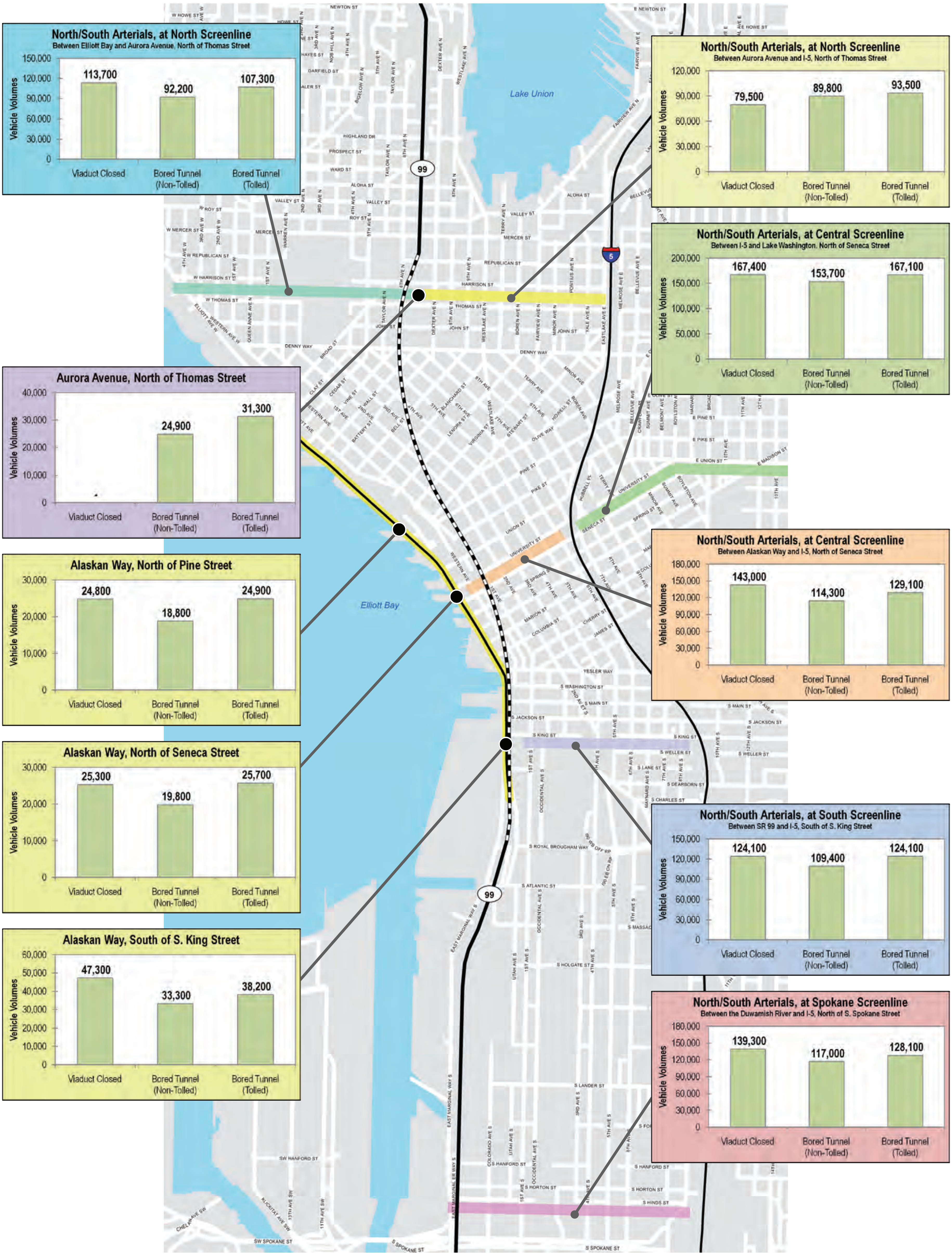


Exhibit 7-7
Daily Vehicle Volumes on SR 99 and I-5 — Tolled Bored Tunnel Alternative



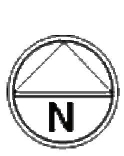


Exhibit 7-8
Daily Vehicle Volumes on Arterials — Tolled Bored Tunnel Alternative

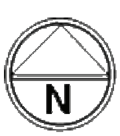


Exhibit 7-9
Daily Vehicle Volumes
on Arterials in North Seattle —
Tolled Bored Tunnel Alternative

At S. Spokane Street, daily vehicle trips on SR 99 would be about 13 percent (13,400 vehicles) lower under the tolled Bored Tunnel Alternative compared to the non-tolled Bored Tunnel Alternative. Arterials in SODO and I-5 would have higher daily vehicle volumes under the tolled Bored Tunnel Alternative, which would be caused by the diversion of vehicles from SR 99. Daily vehicle volumes on these arterials are forecasted to increase about 9 percent (11,100 vehicles), with the volumes on I-5 increasing 3 percent (8,500 vehicles) over those of the non-tolled Bored Tunnel Alternative. The overall increase in vehicle volumes at this screenline under the tolled Bored Tunnel Alternative could be attributed to a variety of factors, including mode shift, change in trip destination, and changes in travel times along the SR 99 corridor.

Farther north at S. King Street, there would be 39 percent (36,000 vehicles) fewer vehicle trips on SR 99 under the tolled Bored Tunnel Alternative compared to the non-tolled Bored Tunnel Alternative. Arterials in Pioneer Square and the International District, excluding Alaskan Way, would absorb about 14,700 of those vehicle trips, which represents an increase of 13 percent on those streets over the number for the non-tolled Bored Tunnel Alternative. Alaskan Way would experience an increased vehicle volume of about 15 percent (4,900 vehicles) over that of the non-tolled Bored Tunnel Alternative.

With the tolled Bored Tunnel Alternative vehicle volumes on SR 99 at the central screenline would be affected to the same degree as those at the south screenline because both locations would be inside the bored tunnel portion of SR 99. Alaskan Way would experience the largest percentage of increase of any facility at the central screenline; daily vehicle volumes would increase 30 percent (5,900 vehicles) over those of the non-tolled Bored Tunnel Alternative. With the tolled Bored Tunnel Alternative, volumes on arterials in the CBD and on I-5 are forecasted to increase approximately 13 percent (14,800 vehicles) and over 4 percent (11,800 vehicles), respectively, compared to volumes for the non-tolled Bored Tunnel Alternative. Increases in vehicle volumes east of I-5 are also expected as a result of vehicle volumes shifting from CBD arterials to Capitol Hill. As with the S. Spokane Street screenline, a variety of factors can influence changes in vehicle volume due to tolling conditions, including mode shift, change in trip destination, and travel time changes on SR 99.

At the north screenline, SR 99 would continue to be part of the bored tunnel facility and, therefore, experience the same decrease in volume between the tolled Bored Tunnel Alternative and the non-tolled Bored Tunnel Alternative as those at the south and central screenlines. With the tolled Bored Tunnel Alternative, daily vehicle volumes on arterials west of Aurora Avenue N. would increase about 16 percent (15,100 vehicles). With the tolled Bored Tunnel Alternative, vehicle volume increases on Aurora Avenue N. would be the highest of any other roadway compared to the non-tolled Bored Tunnel Alternative; volumes would increase 26 percent (6,400 vehicles) due to diverting vehicles at the north portal of the bored tunnel. Volumes on arterials in South Lake Union would be less affected by tolling, and are forecasted to increase 4 percent (3,700 vehicles) over the volumes under the non-tolled Bored Tunnel Alternative.

With the tolled Bored Tunnel Alternative, vehicle volumes on east-west arterials north of the Lake Washington Ship Canal would change slightly. Vehicle volumes between Aurora Avenue N. and 15th Avenue W. are forecasted to remain almost the same as those with the non-tolled Bored Tunnel Alternative. However, vehicle volumes would increase between Aurora Avenue N. and I-5, with a daily increase of about 2 percent (4,400 vehicles). This increase is expected to result from the diversion of vehicles from SR 99 to I-5 in order to access destinations south of downtown.

7.2.1.7 Daily Traffic Patterns on SR 99

Compared to the non-tolled Bored Tunnel Alternative described in Chapter 5, the tolled Bored Tunnel Alternative would result in lower overall volumes on SR 99, although the overall patterns of origin and destination would be similar. In particular, the tolled Bored Tunnel Alternative would result in increased northbound exiting vehicles at the stadium area ramps and increased southbound exiting vehicles in the South Lake Union area compared to the volumes for the non-tolled Bored Tunnel Alternative. These increases would be a result of increased traffic diversion to avoid tolling charges. Exhibit 7-10 illustrates the daily traffic patterns on SR 99 with the tolled Bored Tunnel Alternative, and a more in-depth discussion of ramp and mainline volumes is provided in Section 7.3.

7.2.2 Cut-and-Cover Tunnel Alternative

This section describes the regional context and variation in travel patterns between the tolled Cut-and-Cover Tunnel Alternative and its non-tolled counterpart.

7.2.2.1 Vehicle Miles of Travel

This section describes the differences in VMT for the Cut-and-Cover Tunnel Alternative with tolled and non-tolled conditions. A summary of VMT is provided in Exhibit 7-11. Although there would be slight variations in VMT between the tolled Cut-and-Cover Tunnel Alternative and its non-tolled counterpart, the differences would be less than one-half of 1 percent during all time periods.

Exhibit 7-10
Daily SR 99 Traffic Patterns -
Tolled Bored Tunnel Alternative

Exhibit 7-11. Vehicle Miles of Travel – Cut-and-Cover Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Seattle's Center City			
AM peak hour	413,000	447,100	446,800
PM peak hour	521,400	561,800	561,900
Daily	2,371,400	2,545,400	2,540,000
Four-County Region			
AM peak hour	20,452,500	20,238,000	20,243,500
PM peak hour	24,263,200	23,940,800	23,952,400
Daily	110,820,300	109,497,900	109,506,800

7.2.2.2 Vehicle Hours of Travel

This section describes the differences in VHT for the Cut-and-Cover Tunnel Alternative with tolled and non-tolled conditions. Exhibit 7-12 provides a summary of VHT. In the Center City, under the tolled Cut-and-Cover Tunnel Alternative, VHT would be over 8 percent higher during the AM peak hour and almost 9 percent higher during the PM peak hour when compared to VHT for the non-tolled Cut-and-Cover Tunnel Alternative. Daily VHT would be 8 percent higher with the tolled Cut-and-Cover Tunnel Alternative. The general forecasted increase in VHT in the Center City is largely attributable to increased travel time as vehicles divert from the tolled cut-and-cover tunnel to downtown streets.

Exhibit 7-12. Vehicle Hours of Travel – Cut-and-Cover Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Seattle's Center City			
AM peak hour	20,300	18,400	19,900
PM peak hour	33,600	29,500	32,100
Daily	107,400	99,500	107,500
Four-County Region			
AM peak hour	1,107,200	1,094,900	1,095,600
PM peak hour	1,236,400	1,220,900	1,223,100
Daily	4,436,100	4,402,300	4,409,500

In the four-county region, under tolled conditions, VHT would be slightly higher during all time periods (less than one-half of 1 percent) than VHT for the non-tolled Cut-and-Cover Tunnel Alternative. However, the absolute increase during each time period would be less than the comparable increase in the Center City, implying that the increase in VHT would generally be confined to the Center City.

7.2.2.3 Vehicle Hours of Delay

This section describes the differences in VHD for the Cut-and-Cover Tunnel Alternative with tolled and non-tolled conditions. Exhibit 7-13 provides a summary of VHD for the Center City and the four-county region. In the Center City, under the tolled Cut-and-Cover Tunnel Alternative, VHD would be around 18 percent higher during the AM peak hour and almost 16 percent higher during the PM peak hour compared to VHD for the non-tolled Cut-and-Cover Tunnel Alternative. Daily VHD would be over 21 percent higher with the tolled Cut-and-Cover Tunnel Alternative. Similar to VHT, the forecasted increase in VHD in the Center City is largely attributable to delay caused by traffic diversion from the tolled cut-and-cover tunnel to the arterial street network.

Exhibit 7-13. Vehicle Hours of Delay – Cut-and-Cover Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Seattle's Center City			
AM peak hour	8,600	6,300	7,400
PM peak hour	18,500	13,800	16,000
Daily	41,300	31,000	37,600
Four-County Region			
AM peak hour	537,900	524,800	524,900
PM peak hour	553,800	539,500	541,000
Daily	1,385,800	1,353,700	1,358,700

Similar to VHT in the four-county region, under the tolled Cut-and-Cover Tunnel Alternative, VHD would be slightly higher during all time periods (less than one-half of 1 percent) than VHT for the non-tolled Cut-and-Cover Tunnel Alternative. However, the absolute increase during each time period would be less than the comparable increase in the Center City, implying that the increase in VHD would generally be confined to the Center City.

7.2.2.4 Person Throughput

This section discusses the differences in person throughput for the Cut-and-Cover Tunnel Alternative with tolled and non-tolled conditions. Exhibit 7-14 provides a summary of person throughput. At the south screenline, under the tolled Cut-and-Cover Tunnel Alternative, person-trips would be slightly higher than those for the non-tolled Cut-and-Cover Tunnel Alternative during the AM peak hour and slightly lower during the PM peak hour, but the difference would be less than one-half of 1 percent in both cases. Under tolled conditions, daily person-trips would also be less than one-half of 1 percent higher (2,800 person-trips) at this location.

Exhibit 7-14. Model-Estimated Daily Person Throughput (Person-Trips) – Cut-and-Cover Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South Screenline (South of S. King Street)			
AM peak hour	61,360	66,650	66,750
PM peak hour	73,470	80,360	80,070
Daily	821,800	890,900	893,700
Central Screenline (North of Seneca Street)			
AM peak hour	53,670	61,160	60,450
PM peak hour	62,090	70,760	69,980
Daily	727,600	808,200	803,800
North Screenline (North of Thomas Street)			
AM peak hour	63,600	67,150	66,730
PM peak hour	74,900	79,420	78,670
Daily	839,900	880,700	867,800

At the central screenline, under the tolled Cut-and-Cover Tunnel Alternative, person-trips would be slightly more than 1 percent lower during the AM and PM peak hours compared to the number for the non-tolled Cut-and-Cover Tunnel Alternative. Under tolled conditions, daily person-trips at this location would be one-half of 1 percent lower (4,400 person-trips).

At the north screenline, under the tolled Cut-and-Cover Tunnel Alternative, AM and PM peak hour person-trips would be nearly 1 percent lower than the number for the non-tolled Cut-and-Cover Tunnel Alternative. However, the daily total person-trips would change the most, with 1.5 percent fewer trips (12,900 person-trips) under tolled conditions.

7.2.2.5 Vehicle Volumes at Screenlines

For the Cut-and-Cover Tunnel Alternative, the addition of tolls on SR 99 would not result in much of a change in the total volume of vehicles traveling through the study area, as shown in Exhibit 7-15.

Exhibit 7-15. Model-Estimated Vehicle Volumes at Screenlines – Cut-and-Cover Tunnel Alternative

	Viaduct Closed (No Build Alternative)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Spokane Screenline (North of S. Spokane Street)			
AM peak hour	32,020	34,790	34,880
PM peak hour	35,800	38,730	38,620
Daily	464,200	499,000	500,500
South Screenline (South of S. King Street)			
AM peak hour	34,080	37,890	37,810
PM peak hour	39,420	44,160	43,670
Daily	515,800	565,500	565,100
Central Screenline (North of Seneca Street)			
AM peak hour	29,730	34,200	33,390
PM peak hour	33,060	38,200	37,290
Daily	447,500	498,600	492,800
North Screenline (North of Thomas Street)			
AM peak hour	37,650	40,280	39,860
PM peak hour	42,510	45,510	44,910
Daily	538,000	569,200	559,200

The changes in estimated vehicle volumes for the S. Spokane Street and south screenlines are expected to be 1 percent or less during the AM and PM peak hours as well as over an entire day. At the central screenline, vehicle volumes are expected to be reduced by 2 percent during the AM and PM peak hours, with only a 1 percent reduction in daily volumes. At the north screenline, tolls would reduce AM peak hour, PM peak hour, and daily volumes by 1 to 2 percent compared to those of the non-tolled Cut-and-Cover Tunnel Alternative.

Under the tolled Cut-and-Cover Tunnel Alternative, the highway and street network in the study area would support similar vehicle demand as that under non-tolled conditions. The same or slightly lower vehicle volumes could be attributed to a variety of factors, which include a slight mode shift, diversion to the east of I-5, and changes in travel times through the cut-and-cover tunnel.

7.2.2.6 Vehicle Volumes on Key Facilities and Arterial Screenlines

Vehicle volumes were also analyzed by separating the volumes on major facilities from the volumes at the screenlines, as shown in Exhibits 7-16 through 7-18. The tolled Cut-and-Cover Tunnel Alternative is not expected to result in any noticeable overall change in volumes traveling to and through downtown, but the facilities upon which the vehicles would travel are different.

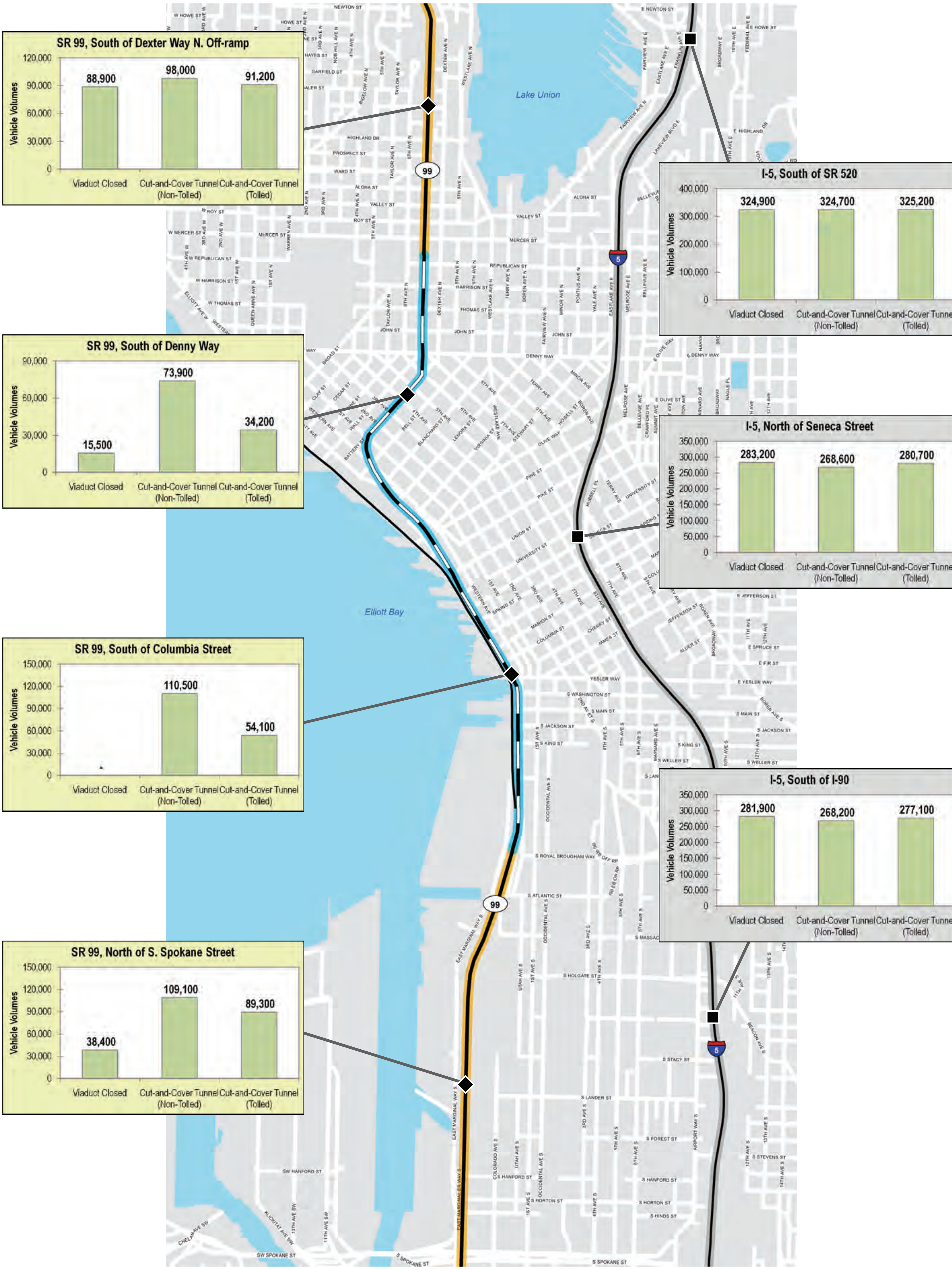


Exhibit 7-16
Daily Vehicle Volumes on SR 99 and I-5 —
Tolled Cut-and-Cover Tunnel Alternative

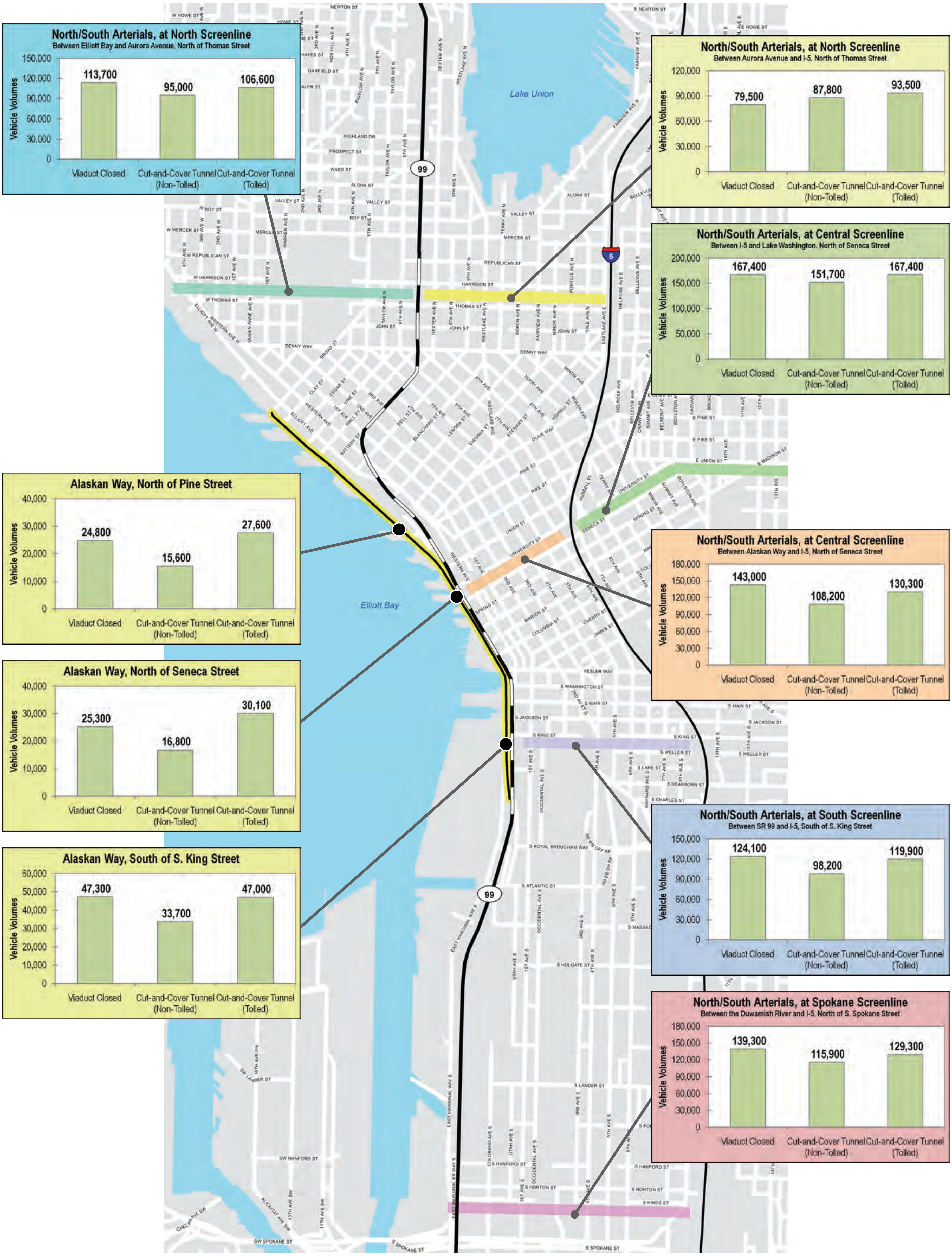


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Exhibit 7-17
Daily Vehicle Volumes on Arterials — Tolled Cut-and-Cover Tunnel Alternative

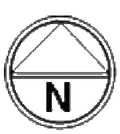

Exhibit 7-18
Daily Vehicle Volumes on Arterials in North Seattle — Tolled Cut-and-Cover Tunnel Alternative

Tolling the cut-and-cover tunnel would reduce the number of vehicles traveling on SR 99 north of S. Spokane Street by about 18 percent daily (19,800 vehicles), due to diversion in order to avoid the toll and congestion resulting from vehicles exiting to Alaskan Way. Daily volumes on I-5 are forecasted to increase 3 percent (8,900 vehicles), and volumes on SODO arterials are forecasted to increase by almost 12 percent (13,400 vehicles).

Farther north, at S. King Street, under the tolled Cut-and-Cover Tunnel Alternative, SR 99 volumes would be 51 percent (56,400 vehicles) lower than those for the non-tolled Cut-and-Cover Tunnel Alternative. Parallel arterials and Alaskan Way would handle many of the diverted vehicles, resulting in a 22 percent (21,700 vehicles) daily increase on north-south arterials in Pioneer Square and the International District and a 39 percent (13,300 vehicles) daily increase on the six-lane Alaskan Way. The increases in vehicle volumes on Alaskan Way could be attributed to diversion to avoid the toll by vehicles that would have used the Elliott/Western ramps under non-tolled conditions.

At the central screenline, under the tolled Cut-and-Cover Tunnel Alternative, the diversion rates from SR 99 would be the same as those at the south screenline because there would be no access to the facility between the stadium area ramps and the Elliott/Western ramps. The tolled Cut-and-Cover Tunnel Alternative would result in an increase in daily vehicle volumes of 20 percent (22,100 vehicles) on arterials in the CBD. I-5 vehicle volumes are forecasted to increase more than 4 percent (12,100 vehicles).

In South Lake Union and Uptown, under the tolled Cut-and-Cover Tunnel Alternative, volumes on SR 99 are expected to decrease because the tolled segment of SR 99 would begin at the north portal of the Battery Street Tunnel. The associated increase in daily vehicle volumes on arterials in Uptown due to diverted vehicles from SR 99 is forecasted to be 12 percent (11,600 vehicles), and in South Lake Union the increase would be about 6 percent (5,700 vehicles). Additional vehicle volumes would also use SR 99 until diverting at the non-tolled Denny Way ramps.

North of the Lake Washington Ship Canal, east-west arterials would experience a slight change with the tolled Cut-and-Cover Tunnel Alternative. Vehicle volumes between Aurora Avenue N. and 15th Avenue W. are forecasted to be nearly the same. However, vehicle volumes would increase east of Aurora Avenue N. to I-5, with an increase in daily volume of about 2 percent (4,200 vehicles), caused by some vehicles shifting from SR 99 to I-5 in order to access destinations south of downtown.

7.2.2.7 Daily Traffic Patterns on SR 99

Compared to the vehicle volumes on SR 99 under the non-tolled Cut-and-Cover Tunnel Alternative described in Chapter 5, the tolled Cut-and-Cover Tunnel

Alternative would result in lower overall volumes, although the overall patterns of origin and destination would be similar. In particular, the tolled Cut-and-Cover Tunnel Alternative would result in an increased number of northbound exiting vehicles at the stadium area ramps and an increased number of southbound exiting vehicles in the South Lake Union area compared to those of the non-tolled Cut-and-Cover Tunnel Alternative. These forecasted increases would be a result of increased traffic diversion to avoid the tolls. Exhibit 7-19 illustrates the daily traffic patterns on SR 99 with the tolled Cut-and-Cover Tunnel Alternative, and a more in-depth discussion of ramp and mainline volumes is provided in Section 7.3.

7.2.3 Elevated Structure Alternative

This section describes the regional context and variations in travel patterns between the tolled Elevated Structure Alternative and its non-tolled counterpart.

7.2.3.1 Vehicle Miles of Travel

This section describes the differences in VMT for the Elevated Structure Alternative with tolled and non-tolled conditions. A summary of VMT is provided in Exhibit 7-20. Although there would be slight variations in VMT between the tolled Elevated Structure Alternative and the non-tolled Elevated Structure Alternative, the differences would be less than one-half of 1 percent during all time periods.

7.2.3.2 Vehicle Hours of Travel

This section describes the differences in VHT for the Elevated Structure Alternative with tolled and non-tolled conditions. Exhibit 7-21 provides a summary of VHT. In the Center City, under the tolled Elevated Structure Alternative, VHT would be over 10 percent higher during the AM peak hour and almost 11 percent higher during the PM peak hour when compared to VHT for the non-tolled Elevated Structure Alternative. Daily VHT would be over 9 percent higher under tolled conditions. The general forecasted increase in VHT in the Center City is largely attributable to increased travel time as vehicles divert from the tolled elevated structure to downtown streets.

In the four-county region, under the tolled Elevated Structure Alternative, VHT would be slightly higher during all time periods (less than one-half of 1 percent) than VMT for the non-tolled Elevated Structure Alternative. The absolute increase during each time period in the four-county region would be more than the comparable increase in the Center City, implying that the increase in VHT would not be confined to the Center City and possibly indicating some level of trip redistribution over the network.

Exhibit 7-19
Daily SR 99 Traffic Patterns -
Tolled Cut-and-Cover Tunnel Alternative

Exhibit 7-20. Vehicle Miles of Travel – Elevated Structure Alternative

	Viaduct Closed (No Build Alternative)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Seattle's Center City			
AM peak hour	413,000	449,300	448,900
PM peak hour	521,400	564,300	563,600
Daily	2,371,400	2,556,600	2,551,200
Four-County Region			
AM peak hour	20,452,500	20,286,300	20,292,100
PM peak hour	24,263,200	23,998,200	24,014,200
Daily	110,820,300	109,668,400	109,696,600

Exhibit 7-21. Vehicle Hours of Travel – Elevated Structure Alternative

	Viaduct Closed (No Build Alternative)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Seattle's Center City			
AM peak hour	20,300	18,400	20,300
PM peak hour	33,600	29,600	32,700
Daily	107,400	99,700	109,100
Four-County Region			
AM peak hour	1,107,200	1,105,700	1,108,100
PM peak hour	1,236,400	1,231,700	1,236,600
Daily	4,436,100	4,427,900	4,440,500

7.2.3.3 Vehicle Hours of Delay

This section describes the differences in VHD for the Elevated Structure Alternative with tolled and non-tolled conditions. Exhibit 7-22 provides a summary of VHD for the Center City and the four-county region. In the Center City, under the Elevated Structure Alternative, VHD would be almost 24 percent higher during the AM peak hour and over 19 percent higher during the PM peak hour when compared to the non-tolled Elevated Structure Alternative. Daily VHD would be over 25 percent higher under tolled conditions. Similar to VHT, the forecasted increase in VHD in the Center City is largely attributable to delay caused by traffic diversion from the tolled elevated structure to the arterial street network.

Exhibit 7-22. Vehicle Hours of Delay – Elevated Structure Alternative

	Viaduct Closed (No Build Alternative)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Seattle's Center City			
AM peak hour	8,600	6,300	7,800
PM peak hour	18,500	13,900	16,600
Daily	41,300	31,100	38,900
Four-County Region			
AM peak hour	537,900	534,200	536,000
PM peak hour	553,800	548,800	552,800
Daily	1,385,800	1,374,900	1,384,900

In the four-county region, under the tolled Elevated Structure Alternative, VHD would be slightly higher during all time periods (less than 1 percent) than VHD for the non-tolled Elevated Structure Alternative. The absolute increase during each time period would be greater for the four-county region than the comparable increase in the Center City, implying that the increase in VHD would not be confined to the Center City.

7.2.3.4 Person Throughput

This section discusses the differences in person throughput for the Elevated Structure Alternative with tolled and non-tolled conditions. Exhibit 7-23 provides a summary of person throughput. In general terms, under the tolled Elevated Structure Alternative, person-trips at all screenlines would decrease modestly compared to those for the non-tolled Elevated Structure Alternative.

At the south screenline, under the tolled Elevated Structure Alternative, person-trips during the AM and PM peak hours as well as over an average weekday would decrease by less than 1 percent (4,100 person-trips daily) compared to the person-trips for the non-tolled Elevated Structure Alternative. At the central screenline, AM peak hour person-trips would decrease by 3 percent, while PM peak hour person-trips would decrease by slightly less than 3 percent. Person throughput over an average weekday would decrease by 2 percent (16,200 person-trips) compared to the non-tolled Elevated Structure Alternative. At the north screenline, under the tolled Elevated Structure Alternative, person-trips would decrease by less than 2 percent during all time periods (16,900 daily person-trips) compared to the person-trips for the non-tolled Elevated Structure Alternative.

Exhibit 7-23. Model-Estimated Daily Person Throughput (Person-Trips) – Elevated Structure Alternative

	Viaduct Closed (No Build Alternative)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South Screenline (South of S. King Street)			
AM peak hour	61,360	66,870	66,530
PM peak hour	73,470	80,860	80,290
Daily	821,800	899,800	895,700
Central Screenline (North of Seneca Street)			
AM peak hour	53,670	61,640	59,800
PM peak hour	62,090	71,340	69,590
Daily	727,600	814,900	798,700
North Screenline (North of Thomas Street)			
AM peak hour	63,600	67,410	66,350
PM peak hour	74,900	79,860	78,560
Daily	839,900	882,400	865,500

7.2.3.5 Vehicle Volumes at Screenlines

The tolled Elevated Structure Alternative is forecasted to result in a slight change in the total volume of vehicles traveling through the study area, as shown in Exhibit 7-24.

Estimated vehicle volumes for the S. Spokane Street screenline would change 1 percent or less during the AM and PM peak hours as well as over an entire day. At locations farther north, the reductions in vehicle volumes with tolled conditions would be more apparent. At the south screenline, vehicle volumes are forecasted to be about 1 to 2 percent lower during all time periods. At the central screenline, vehicle volumes would be reduced by about 5 percent during the AM peak hour, 4 percent during the PM peak hour, and 3 percent for the day. The delay caused by the expected diversion from SR 99 north of the midtown ramps may be responsible for the reduced vehicle volumes at the central screenline. At the north screenline, vehicle volumes with tolled conditions would be reduced by just over 2 percent during the AM and PM peak hours as well as for the day.

The decreases in vehicle volumes could be attributed to a variety of factors, which include lower SR 99 utilization (discussed further in Section 7.2.3.6), a slight mode shift, traffic diversion to the east of I-5, and changes in travel times.

Exhibit 7-24. Model-Estimated Vehicle Volumes at Screenlines – Elevated Structure Alternative

	Viaduct Closed (No Build Alternative)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Spokane Screenline (North of S. Spokane Street)			
AM peak hour	32,020	35,000	35,060
PM peak hour	35,800	39,090	38,980
Daily	464,200	502,600	503,500
South Screenline (South of S. King Street)			
AM peak hour	34,080	38,320	37,800
PM peak hour	39,420	44,660	43,920
Daily	515,800	572,800	566,800
Central Screenline (North of Seneca Street)			
AM peak hour	29,730	34,510	32,820
PM peak hour	33,060	38,450	36,910
Daily	447,500	502,200	487,900
North Screenline (North of Thomas Street)			
AM peak hour	37,650	40,360	39,390
PM peak hour	42,510	45,630	44,620
Daily	538,000	569,600	556,300

7.2.3.6 Vehicle Volumes on Key Facilities and Arterial Screenlines

The forecasted effect of the tolled Elevated Structure Alternative on vehicle volumes on key facilities is shown in Exhibits 7-25 through 7-27. Some vehicle trips are expected to travel on different facilities, but the overall volumes passing north and south through the study area would be slightly lower or similar to the volumes for the non-tolled Elevated Structure Alternative.

At the S. Spokane Street screenline, with the tolled Elevated Structure Alternative, the daily vehicle volume on SR 99 would be approximately 12 percent (14,000 vehicles) lower than the volume for the non-tolled Elevated Structure Alternative. Vehicle volumes on I-5 at this location in SODO would increase about 2 percent (6,300 vehicles), while the arterials would be expected to carry about 7 percent (7,600 vehicles) more vehicles over an average weekday.

Just north of the stadium area ramps, the tolled Elevated Structure Alternative would result in 47 percent (60,500 vehicles) lower vehicle volumes. Vehicle volumes traveling on SR 99 at this location would either use the non-tolled midtown ramps or travel farther north on the tolled mainline. Alaskan Way and

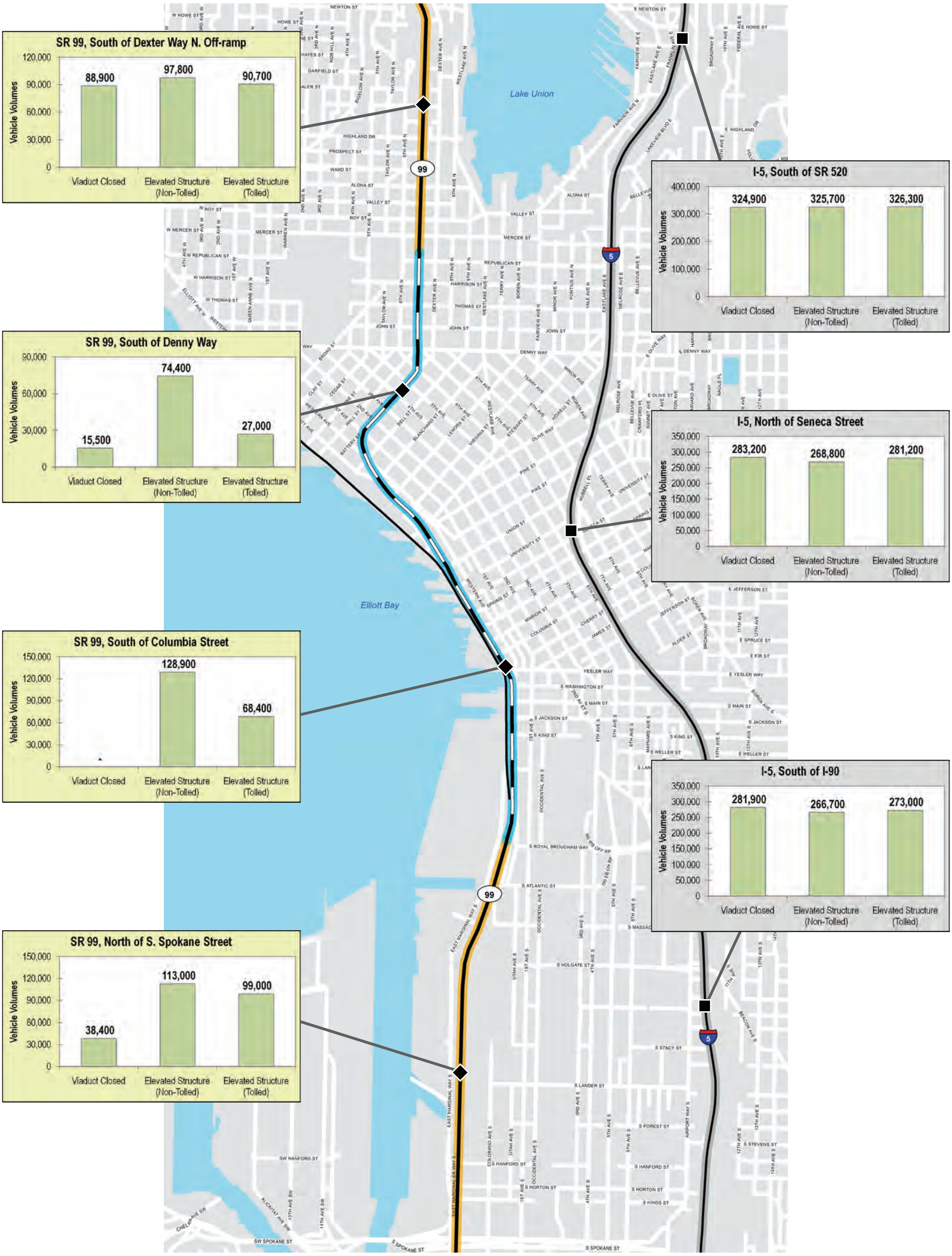

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Exhibit 7-25
Daily Vehicle Volumes on SR 99 and I-5 — Tolled Elevated Structure Alternative

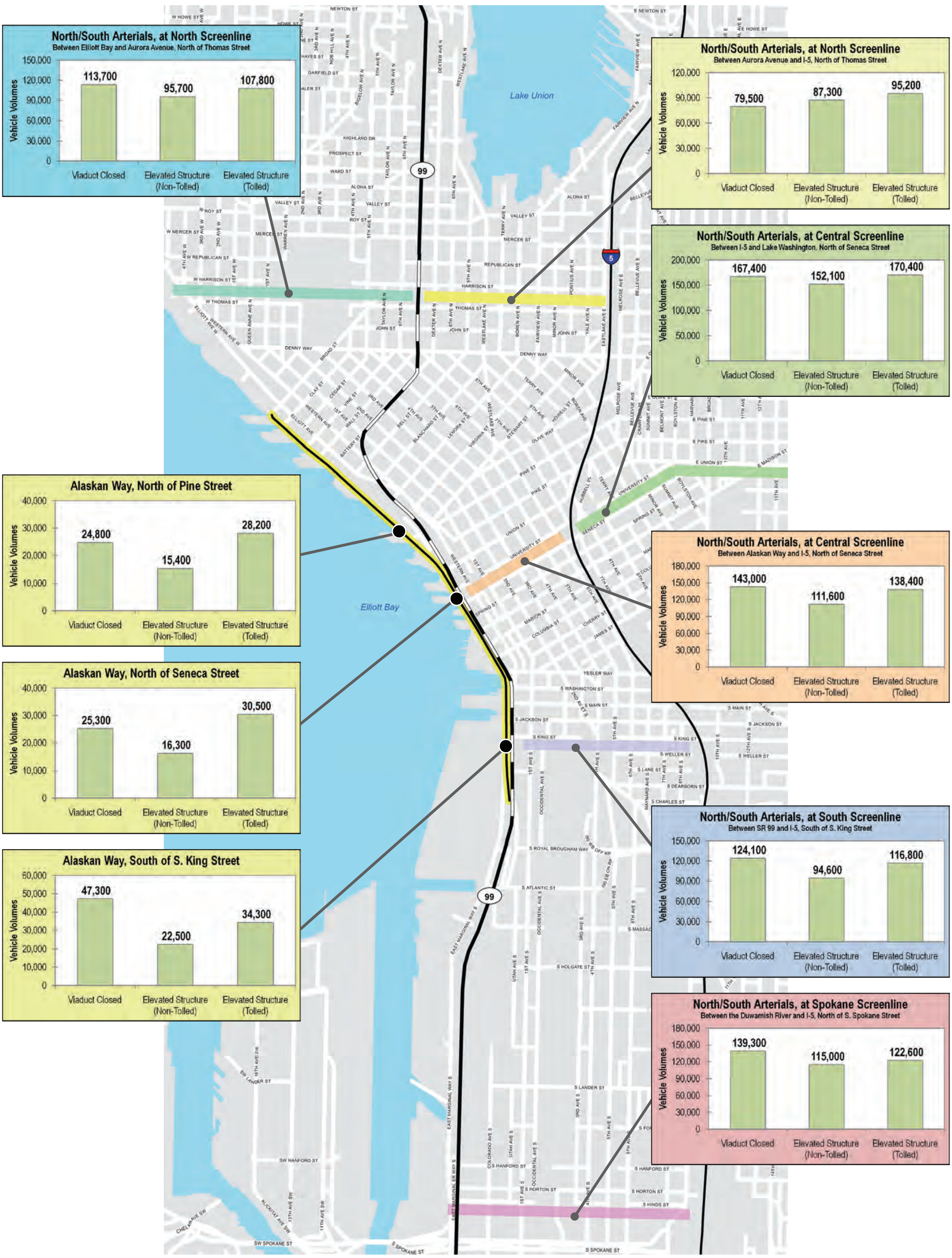

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Exhibit 7-26
Daily Vehicle Volumes on Arterials —
Tolled Elevated Structure Alternative

Exhibit 7-27
Daily Vehicle Volumes on Arterials in North Seattle — Tolled Elevated Structure Alternative

arterials in Pioneer Square and the International District would receive much of the diverted vehicles due to tolling of the elevated structure. Daily vehicle volumes on Alaskan Way are forecasted to increase 52 percent (11,800 vehicles), and volumes on other arterials are expected to increase 23 percent (22,200 vehicles). The majority of the remaining diverted traffic would be traveling on I-5 or on arterials east of I-5.

At the central screenline, vehicle volumes on SR 99 with tolled conditions would be lower than those at the south screenline because vehicles traveling to and from the south would use the non-tolled midtown ramps, both for access to downtown and for vehicle trips avoiding the tolled segment on the elevated structure. Vehicles shifting from SR 99 are expected to result in an increased daily vehicle volume of 24 percent (26,800 vehicles) on arterials between Alaskan Way and I-5. Alaskan Way itself is forecasted to experience an 87 percent (14,200 vehicles) increase in daily volume with tolling on SR 99. I-5 would also experience increased daily vehicle volume through downtown, with an increase of about 5 percent (12,400 vehicles). The magnitude of diversion from the relatively short tolled segment of SR 99 is expected to increase vehicle travel times for both mainline and arterial trips (discussed further in Section 7.5.3), which is expected to be the primary factor in reducing overall vehicle volumes at this screenline.

In South Lake Union and Uptown areas, vehicle volumes on north-south arterials are expected to increase with the tolled Elevated Structure Alternative compared to the non-tolled Elevated Structure Alternative. At the north screenline, daily vehicle volumes in the Uptown area would increase 13 percent (12,100 vehicles), and they would increase 9 percent (7,900 vehicles) in South Lake Union. These forecasted volume increases can be attributed to traffic diversion from the tolled Battery Street Tunnel, representing trips that would otherwise have taken SR 99 to the stadium area ramps or southward but instead are using the arterial street network. Additional diverted vehicles would also use the Denny Way ramps for access to and from SR 99.

North of the Lake Washington Ship Canal, vehicle volumes on the tolled Elevated Structure Alternative would change minimally relative to those under non-tolled conditions. Vehicle volumes between Aurora Avenue N. and 15th Avenue W. would decrease about one-half of 1 percent. Daily vehicle volumes between Aurora Avenue N. and I-5 are forecasted to increase by about 2 percent (3,900 vehicles). This forecasted increase is due to diversion of vehicles from SR 99 to I-5 in order to access destinations south of downtown.

7.2.3.7 Daily Traffic Patterns on SR 99

Compared to the non-tolled Elevated Structure Alternative described in Chapter 5, the tolled Elevated Structure Alternative would result in lower overall volumes on SR 99, although the overall patterns of origin and destination would be similar. In particular, the tolled Elevated Structure Alternative would result in an increased number of northbound exiting vehicles at the stadium area ramps and an increased number of southbound exiting vehicles in the South Lake Union area compared to those for the non-tolled Elevated Structure Alternative. These forecasted increases would be a result of increased traffic diversion to avoid the toll. Exhibit 7-28 illustrates the daily traffic patterns on SR 99 with the tolled Elevated Structure Alternative, and a more in-depth discussion of ramp and mainline volumes is provided in Section 7.3.

7.3 Traffic Operations on SR 99

Mainline traffic conditions and ramp interactions for the SR 99 corridor in terms of AM and PM peak hour volumes, travel speeds, and LOS are presented in this section for key mainline segments and related on- and off-ramps. This discussion focuses on the applicable modeled conditions for the operational effects of each tolled build alternative compared to its non-tolled counterpart.

The key findings of the analyses of traffic operations on SR 99 are the following:

- Mainline volumes forecasted for all three build alternatives with tolled conditions are generally expected to be lower than those with non-tolled conditions in both directions during the AM and PM peak hours. Under all three build alternatives, vehicles are expected to divert from the tolled facility to the arterial street system.
- For all three build alternatives with tolled conditions, mainline volumes would be lower than those with non-tolled conditions in the sections north and south of downtown, as well as in the mainline segment through midtown. In the south area, volumes on ramps to and from West Seattle would also be lower than those with non-tolled conditions. In the stadium area, the volumes on the northbound on-ramps and southbound off-ramps would be lower, whereas the volumes on the northbound off-ramps and southbound on-ramps would increase, with vehicles diverting from the tolled facility. For the tolled Elevated Structure Alternative, the volumes on the Columbia and Seneca Street ramps would similarly increase, with vehicles diverting from the tolled facility. Similar to the south area, under all three build alternatives with tolling, the ramp volumes in the north area would reflect vehicles diverting from the tolled facility, with increased volumes on the southbound off-ramp and northbound on-ramp, and decreased volumes on the southbound on-ramp and northbound off-ramp.

Exhibit 7-28
Daily SR 99 Traffic Patterns -
Tolled Elevated Structure Alternative

- Compared with non-tolled conditions, mainline operations for all three tolled build alternatives through midtown are projected to improve in both directions during the AM and PM peak hours. This improvement would be a result of significant decreases in traffic volumes through the midtown segment as vehicles are diverted away from the tolled facility to the arterial street system. Under the tolled Bored Tunnel Alternative, mainline SR 99 through midtown would operate at LOS C or D. Under the tolled Cut-and-Cover Tunnel Alternative, mainline SR 99 through midtown would operate between LOS A and LOS C. Under the tolled Elevated Structure Alternative, mainline SR 99 through midtown would operate between LOS A and LOS B.
- For all three build alternatives with tolled conditions, the levels of congestion are generally expected to be similar or increase on SR 99 mainline sections leading into the midtown area—southbound north of downtown and northbound south of downtown. Mainline operations on sections leading out of the midtown area are expected to remain similar or improve—southbound south of downtown and northbound north of downtown.
- For all three build alternatives with tolled conditions, mainline speeds are generally expected to reflect the forecasted levels of congestion, with increased speeds through the midtown segment in both directions during the AM and PM peak hours relative to speeds with non-tolled conditions. With mainline operations expected to be either similar or somewhat degraded on sections leading into the midtown area, speeds are similarly expected to be similar or decrease in those sections. Mainline speeds on sections leading out of the midtown are expected to be similar or increase.

7.3.1 Tolled Bored Tunnel Alternative

This section describes the forecasted traffic volumes and speeds for the tolled Bored Tunnel Alternative and compares them to those of its non-tolled counterpart.

7.3.1.1 Alaskan Way Viaduct Mainline and Ramp Volumes

This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the tolled Bored Tunnel Alternative; specifically, these estimates are for each connection to and from SR 99 (ramps or side streets) and for each mainline segment (segment of SR 99 between connections). These estimates account for all vehicle types using the corridor.

7.3.1.1.1 AM Peak Hour

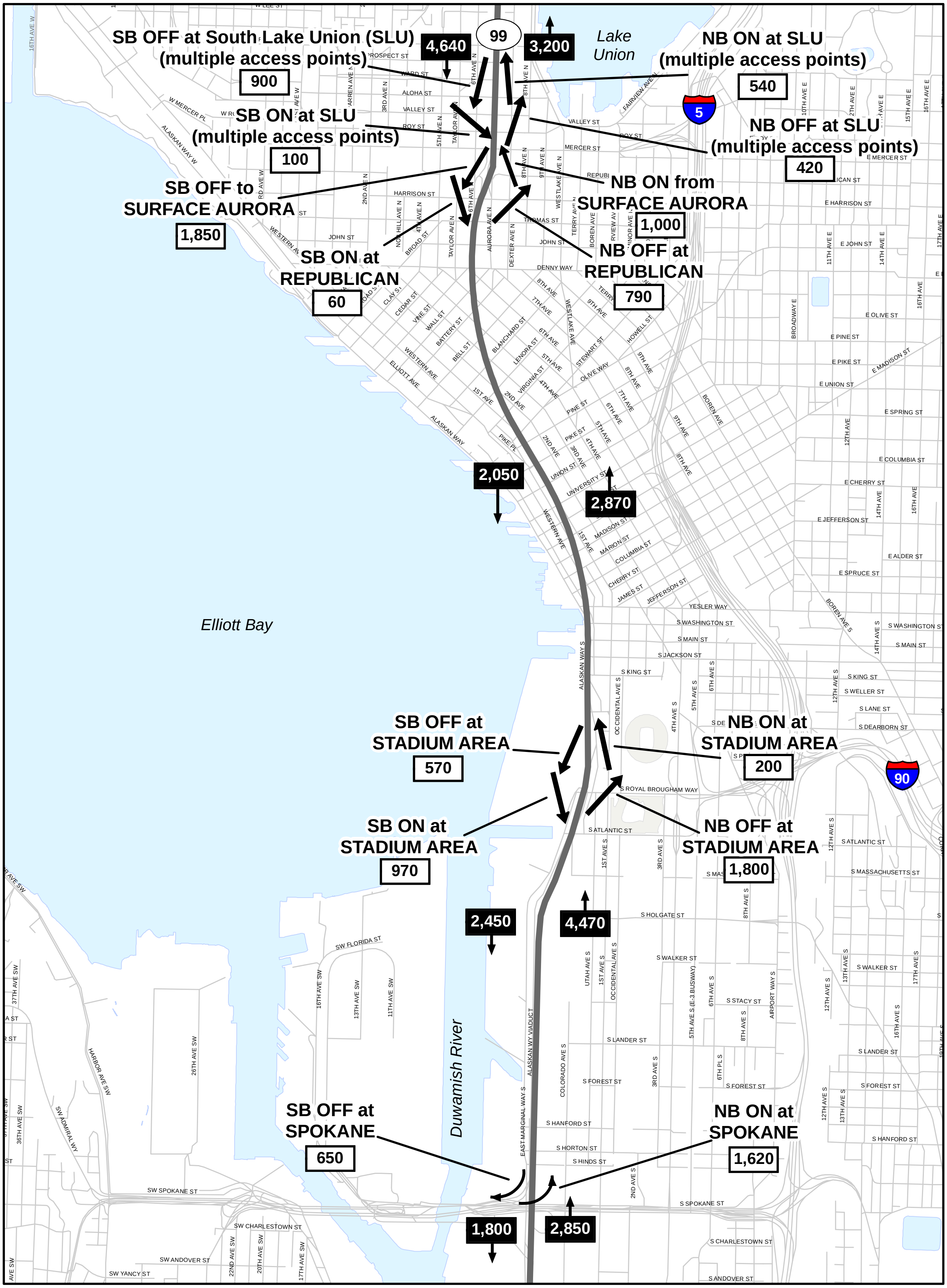
AM peak hour mainline and ramp volumes forecasted for the tolled Bored Tunnel Alternative are generally lower than those for the non-tolled Bored Tunnel

Alternative (Exhibit 7-29). At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,620 vehicles) and exiting southbound SR 99 to West Seattle (650 vehicles) are lower than those for the non-tolled Bored Tunnel Alternative. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those for the non-tolled Bored Tunnel Alternative in both the northbound direction (4,470 vehicles) and the southbound direction (2,450 vehicles). The forecasted volumes on the stadium area northbound off-ramp (1,800 vehicles) and southbound on-ramp (970 vehicles) are higher for the tolled Bored Tunnel Alternative (23 percent higher northbound and 37 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted volumes for the stadium area northbound on-ramp (200 vehicles) and southbound off-ramp (570 vehicles) are lower than those for the non-tolled Bored Tunnel Alternative, because fewer vehicles would be entering and exiting the tolled facility.

Under the tolled Bored Tunnel Alternative, the forecasted mainline volume northbound (2,870 vehicles) and southbound (2,050 vehicles) are both significantly lower than those for the non-tolled Bored Tunnel Alternative (27 percent lower northbound and 42 percent lower southbound). The forecasted northbound SR 99 off-ramp volumes (790 vehicles) and southbound on-ramp volumes (60 vehicles) at Republican Street are also lower than those for the non-tolled Bored Tunnel Alternative. North of the bored tunnel, there would be an increase in the northbound on-ramp volumes from surface Aurora Avenue (1,000 vehicles) as well as the southbound off-ramp volumes to surface Aurora Avenue (1,850 vehicles) (25 percent higher northbound and 19 percent higher southbound). The expected increases are again due to vehicles diverted away from the tolled facility. In the north area, AM peak hour mainline volumes in both the northbound (3,200 vehicles) and southbound direction (4,640 vehicles) are projected to be lower with tolled conditions than with non-tolled conditions.

7.3.1.1.2 PM Peak Hour

PM peak hour mainline and ramp volumes forecasted for the tolled Bored Tunnel Alternative are shown in Exhibit 7-30. Similar to the AM peak hour, the forecasted volumes for tolled Bored Tunnel Alternative are generally lower than those for the non-tolled Bored Tunnel Alternative. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,140 vehicles)



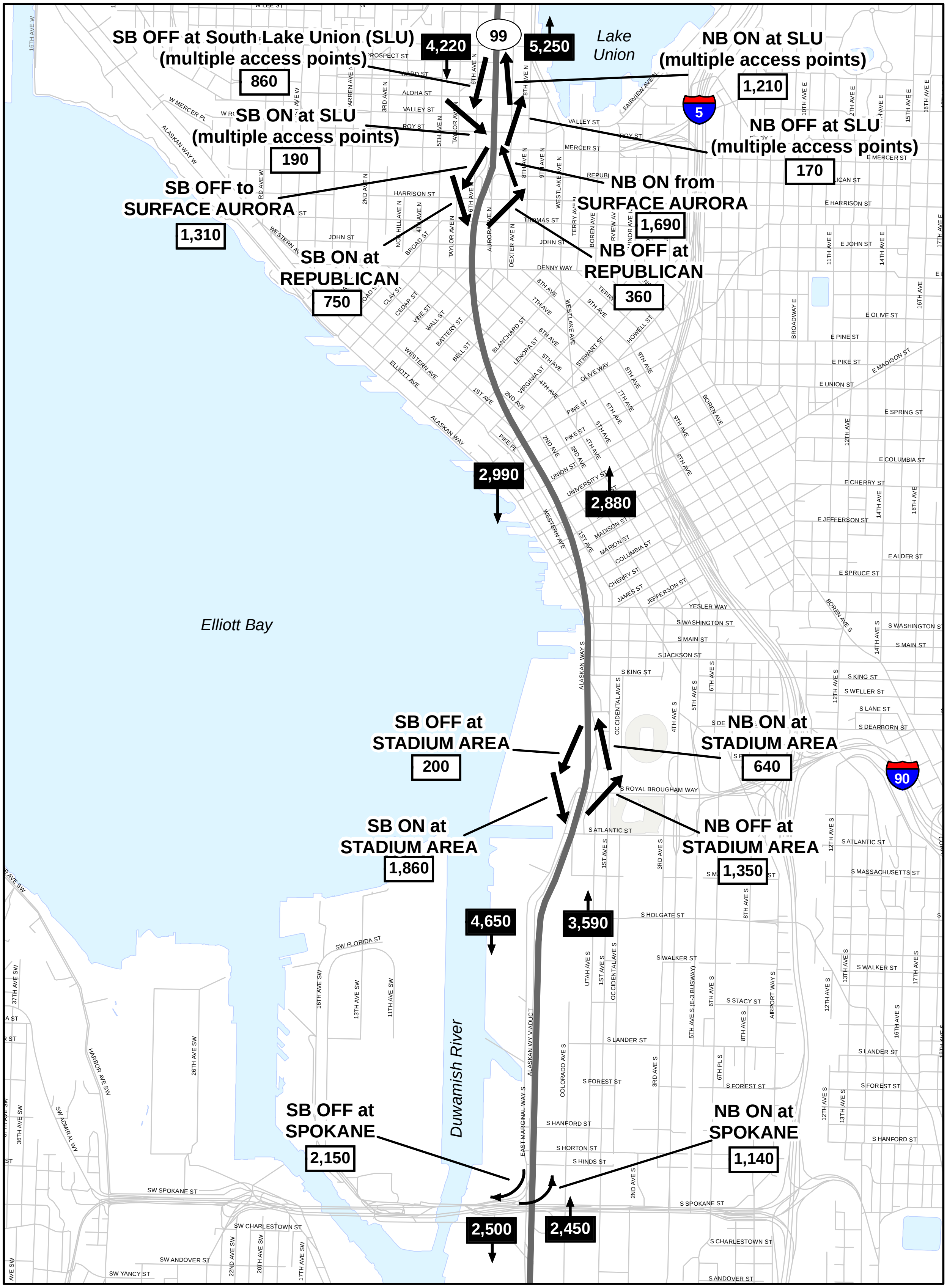
N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 7-29
AM Peak Hour Mainline and Ramp Volumes - Tolled Bored Tunnel Alternative



N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

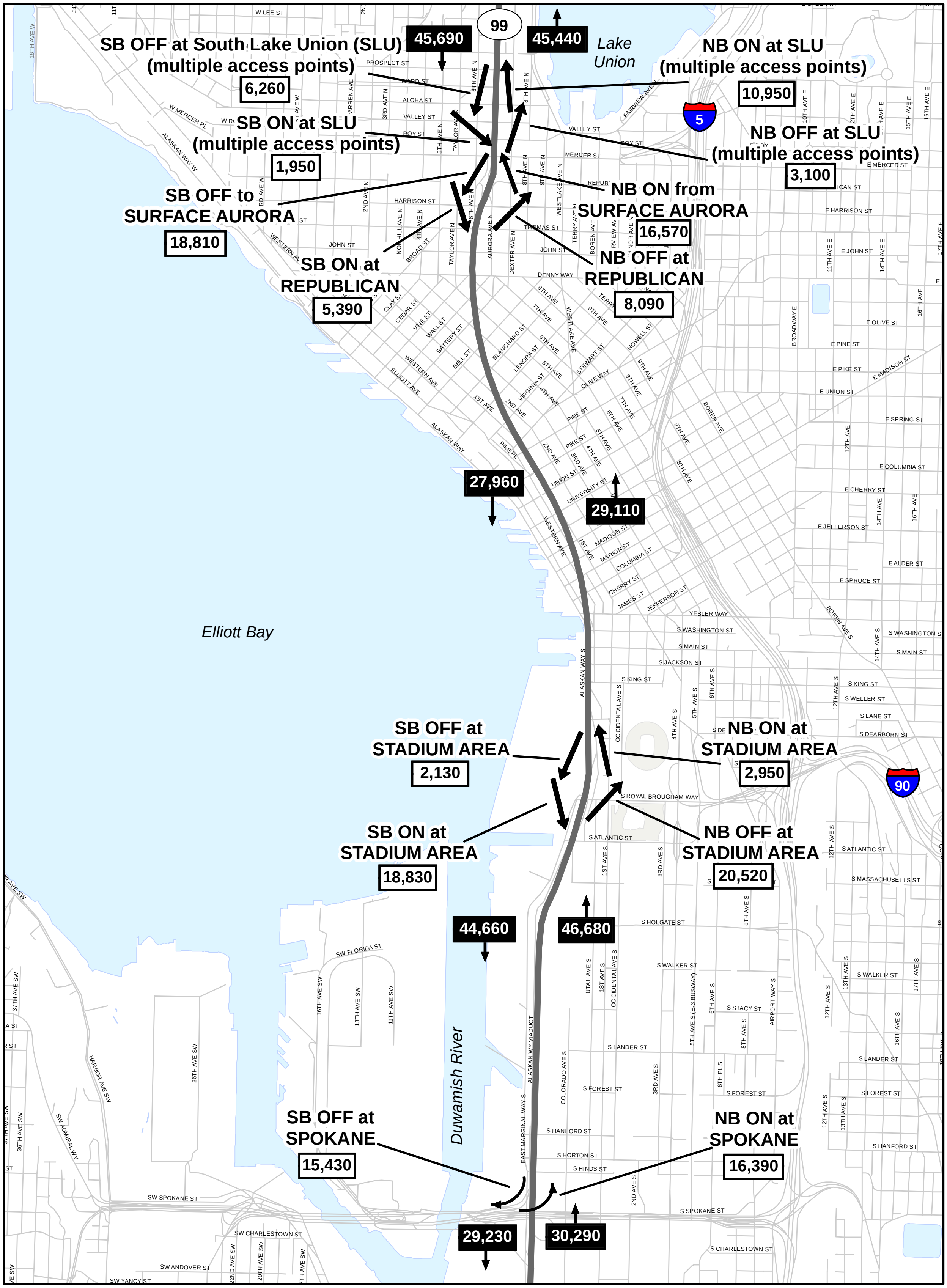
Exhibit 7-30
PM Peak Hour Mainline and Ramp Volumes - Tolled Bored Tunnel Alternative

and exiting southbound SR 99 to West Seattle (2,150 vehicles) are lower than those for the non-tolled Bored Tunnel Alternative. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those for the non-tolled Bored Tunnel Alternative in both the northbound direction (3,590 vehicles) and the southbound direction (4,650 vehicles). The forecasted volumes on the stadium area northbound off-ramp (1,350 vehicles) and the southbound on-ramp (1,860 vehicles) are higher than those with non-tolled conditions (35 percent higher northbound and 19 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted volumes for the stadium area northbound on-ramp (640 vehicles) and southbound off-ramp volumes (200 vehicles) are lower than those for non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.

In the bored tunnel with the tolled Bored Tunnel Alternative, the forecasted northbound volume (2,880 vehicles) and southbound volume (2,990 vehicles) are both significantly lower than the volumes for the non-tolled Bored Tunnel Alternative (33 percent lower northbound and 26 percent lower southbound). The forecasted northbound SR 99 off-ramp volumes (360 vehicles) and southbound on-ramp volumes (750 vehicles) at Republican Street are also lower with the tolled Bored Tunnel Alternative than with the non-tolled Bored Tunnel Alternative. North of the bored tunnel, the results indicate an increase in northbound on-ramp volumes from surface Aurora Avenue (1,690 vehicles) as well as southbound off-ramp volumes to surface Aurora Avenue (1,310 vehicles) (18 percent higher northbound and 38 percent higher southbound). These increases are again due to vehicles diverted from the tolled facility. In the north area, PM peak hour mainline volumes are projected to be slightly lower in both the northbound (5,250 vehicles) and southbound direction (4,220 vehicles) than those for non-tolled Bored Tunnel Alternative.

7.3.1.1.3 Daily

Daily mainline and ramp volumes forecasted for the tolled Bored Tunnel Alternative are shown in Exhibit 7-31. Similar to the AM and PM peak hours, the forecasted volumes for this alternative with tolled conditions are generally lower than those with non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (16,390 vehicles) and exiting southbound SR 99 to West Seattle (15,430 vehicles) are lower than those for the non-tolled Bored Tunnel Alternative. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those for non-tolled conditions in both the northbound direction (46,680 vehicles) and the southbound direction (44,660 vehicles). The forecasted volumes on the stadium area northbound off-ramp (20,520 vehicles) and southbound on-ramp



N

0 2,500

Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 7-31
Daily Mainline and Ramp Volumes - Tolled Bored Tunnel Alternative

(18,830 vehicles) are higher for the tolled Bored Tunnel Alternative (29 percent higher northbound and 21 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted volumes on the stadium area northbound on-ramp (2,950 vehicles) and southbound off-ramp volumes (2,130 vehicles) are lower than those for the non-tolled Bored Tunnel Alternative, because fewer vehicles would be entering and exiting the tolled facility.

In the bored tunnel, the forecasted northbound volume (29,110 vehicles) and southbound volume (27,960 vehicles) are both significantly lower than those for the non-tolled Bored Tunnel Alternative (38 percent lower northbound and 40 percent lower southbound). The forecasted northbound SR 99 off-ramp volumes (8,090 vehicles) and southbound on-ramp volumes (5,390 vehicles) at Republican Street are also lower than those for non-tolled conditions. North of the bored tunnel, the results indicate an increase in northbound on-ramp volumes from surface Aurora Avenue (16,570 vehicles) as well as southbound off-ramp volumes to surface Aurora Avenue (18,810 vehicles) (22 percent higher northbound and 27 percent higher southbound) for tolled conditions relative to the volumes for non-tolled conditions. These increases are again due to vehicles diverted away from the tolled facility. In the north area, daily mainline volumes are projected to be lower in both the northbound (45,440 vehicles) and southbound direction (45,690 vehicles) than those for non-tolled conditions.

7.3.1.2 SR 99 Mainline Level of Service

This section describes the AM and PM peak hour LOS for three corridor segments under the tolled Bored Tunnel Alternative. While LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing the modeled conditions on the SR 99 mainline because the ramp locations and segment arrangements may vary considerably among the modeled conditions. In addition, as described in Chapter 2, the LOS estimates presented here are based on the Transportation Research Board's HCM density ranges for freeways, which presume faster free-flow speeds than those planned for the corridor segments under any of the modeled conditions. As a result, the perceived level of traffic congestion on mainline segments may be somewhat less than the level that would typically be estimated by the HCM method. Mainline LOS results are therefore better suited to providing relative comparisons between the modeled conditions as opposed to a precise indication of congestion. Projected speeds and travel times along the facility are better indicators of expected performance. SR 99 mainline LOS is summarized by segment for the Bored Tunnel Alternative with tolled and non-tolled conditions in Exhibits 7-32 and 7-33, reflecting both directions in the AM and PM peak hours.

Exhibit 7-32. Peak Hour Northbound SR 99 Segment LOS – Bored Tunnel Alternative

Segment	AM Peak Hour		PM Peak Hour	
	Bored Tunnel Alterative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South Corridor				
S. Spokane on-ramp to stadium off-ramp	E	F	D	D
Midtown				
Stadium off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Stadium off-ramp to Seneca off-ramp	N/A	N/A	N/A	N/A
Seneca off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Bored tunnel	D	C	E	C
Battery Street Tunnel	N/A	N/A	N/A	N/A
North Corridor				
North of Battery Street Tunnel	N/A	N/A	N/A	N/A
North of bored tunnel	E	D	F	F

Notes: LOS shown for the bored tunnel was calculated using the HCM analysis method, based on 55 mph free-flow speed. The actual bored tunnel would have a lower design speed (50 mph) and posted speed (50 mph or lower); therefore, the LOS shown should be considered conservative. Actual performance is better measured by means of projected speed comparisons.
HCM = *Highway Capacity Manual*
LOS = level of service
N/A = not applicable

Exhibit 7-33. Peak Hour Southbound SR 99 Segment LOS – Bored Tunnel Alternative

Segment	AM Peak Hour		PM Peak Hour	
	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South Corridor				
Stadium on-ramp to S. Spokane off-ramp	C	B	F	F
Midtown				
Elliott on-ramp to stadium on-ramp	N/A	N/A	N/A	N/A
Columbia on-ramp to stadium on-ramp	N/A	N/A	N/A	N/A
Elliott on-ramp to Columbia on-ramp	N/A	N/A	N/A	N/A
Bored tunnel	E	C	F	D
Battery Street Tunnel	N/A	N/A	N/A	N/A
North Corridor				
North of Battery Street Tunnel	N/A	N/A	N/A	N/A
North of bored tunnel	F	F	E	E

Note: LOS shown for the bored tunnel was calculated using the HCM analysis method, based on 55 mph free-flow speed. The actual bored tunnel would have a lower design speed (50 mph) and posted speed (50 mph or lower); therefore, the LOS shown should be considered conservative. Actual performance is better measured by means of projected speed comparisons.
HCM = *Highway Capacity Manual*
LOS = level of service
N/A = not applicable

Compared with operations under non-tolled conditions, mainline tunnel operations for the tolled Bored Tunnel Alternative through midtown are projected to improve in both directions during both the AM and PM peak hours, with operations at LOS C or D. This is expected because of significant decreases in traffic volumes through the midtown tunnel segment as vehicles are diverted away from the tolled facility onto the arterial street system.

In the south area between the stadium area and S. Spokane Street, southbound operations with tolled conditions would improve to LOS B during the AM peak hour, while operations would remain at LOS F during the PM peak hour. In the northbound direction, mainline operations would degrade to LOS F during the AM peak hour, because vehicles diverting from the tolled facility to the arterial street system would cause increased congestion on the mainline upstream. During the PM peak hour, northbound operations would remain at LOS D.

In the north area, southbound mainline operations would remain at LOS F during the AM peak hour and at LOS E during the PM peak hour. In the northbound direction, operations would improve to LOS D during the AM peak hour and remain at LOS F during the PM peak hour.

7.3.1.3 SR 99 Mainline Speeds

This section discusses the AM and PM peak hour travel speeds for the corridor segments under the tolled Bored Tunnel Alternative. As with LOS, comparing travel speeds between the modeled conditions can present certain challenges because the ramp and segment arrangements vary among them. The speeds are presented in Exhibits 7-34 and 7-35. To assist in comparison, the results are presented side by side graphically in Exhibits 7-36 and 7-37.

Compared to speeds with the non-tolled Bored Tunnel Alternative, speeds in the bored tunnel under tolled conditions would increase in both directions during both the AM and PM peak hours, with speeds ranging from approximately 46 to 48 mph. This is expected because of reduced vehicle volumes in the bored tunnel. In the south area, mainline speeds would remain similar to those with non-tolled conditions in both directions during both the AM and PM peak hours, with the exception of northbound speeds during the AM peak hour, which would decrease significantly from approximately 45 to 26 mph. This would occur because of increased congestion caused by vehicles exiting the facility upstream of the tolled segment. Similarly, in the north area, mainline speeds would remain similar to those with non-tolled conditions in both directions during both the AM and PM peak hours, with the exception of southbound speeds during the AM peak hour, which would decrease from 30 to 18 mph. Again, this is expected as a result of congestion due to vehicles exiting the facility upstream of the tolled segment.

Exhibit 7-34. Peak Hour Northbound SR 99 Segment Speeds – Bored Tunnel Alternative

Segment	AM Peak Hour (miles per hour)		PM Peak Hour (miles per hour)	
	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South Corridor				
S. Spokane on-ramp to stadium off-ramp	45	26	47	45
Midtown				
Stadium off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Stadium off-ramp to Seneca off-ramp	N/A	N/A	N/A	N/A
Seneca off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Bored tunnel	44	46	41	46
Battery Street Tunnel	N/A	N/A	N/A	N/A
North Corridor				
North of Battery Street Tunnel	N/A	N/A	N/A	N/A
North of bored tunnel	33	32	26	29

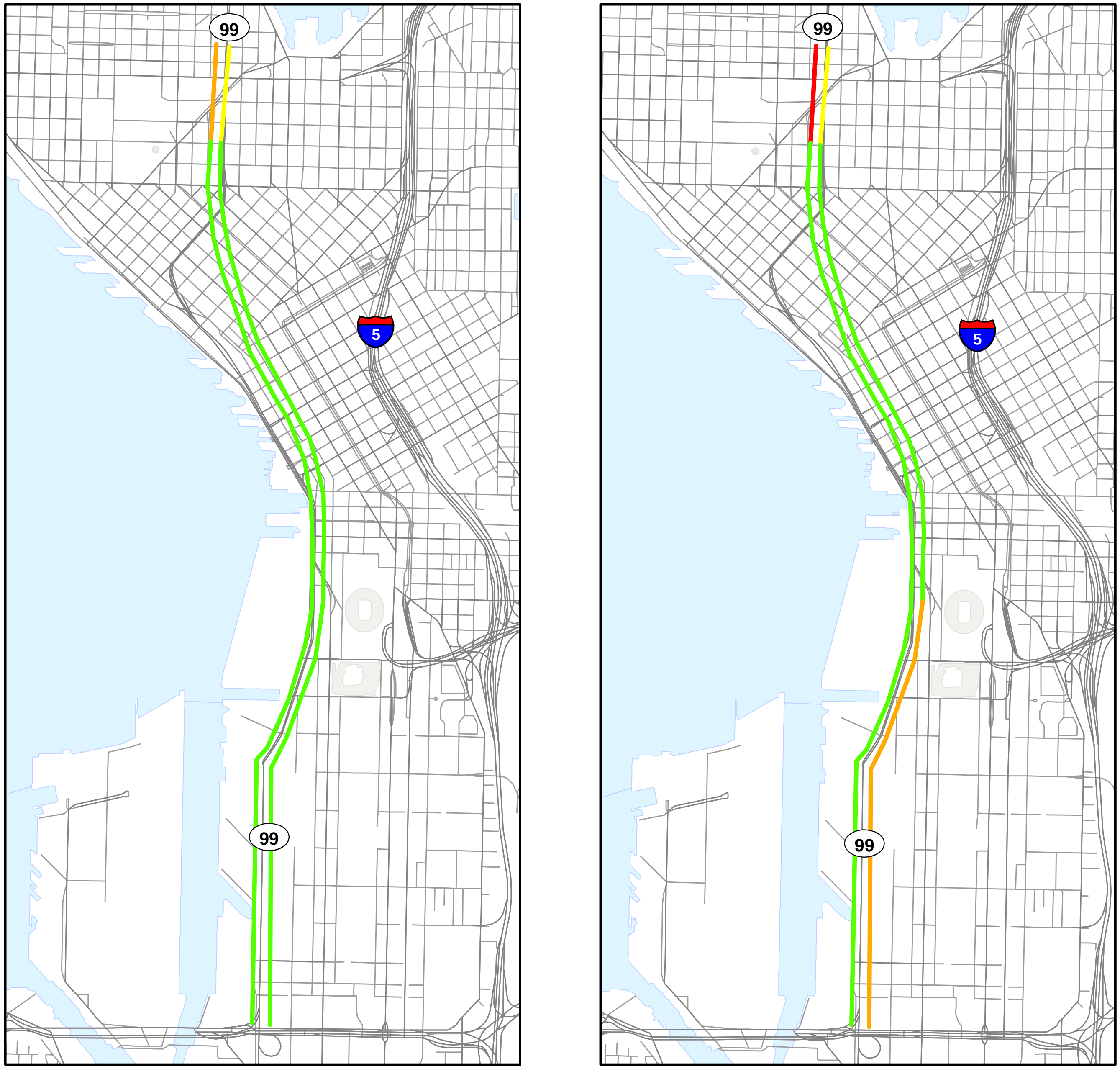
Note: N/A = not applicable

Exhibit 7-35. Peak Hour Southbound SR 99 Segment Speeds – Bored Tunnel Alternative

Segment	AM Peak Hour (miles per hour)		PM Peak Hour (miles per hour)	
	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South Corridor				
Stadium on-ramp to S. Spokane off-ramp	48	48	32	35
Midtown				
Elliott on to stadium on-ramp	N/A	N/A	N/A	N/A
Columbia on-ramp to stadium on-ramp	N/A	N/A	N/A	N/A
Elliott on-ramp to Columbia on-ramp	N/A	N/A	N/A	N/A
Bored tunnel	46	48	45	47
Battery Street Tunnel	N/A	N/A	N/A	N/A
North Corridor				
North of Battery Street Tunnel	N/A	N/A	N/A	N/A
North of bored tunnel	30	18	36	36

Note: N/A = not applicable

Non-Tolled Bored Tunnel Alternative **Tolled Bored Tunnel Alternative**



Travel Speed (mph)

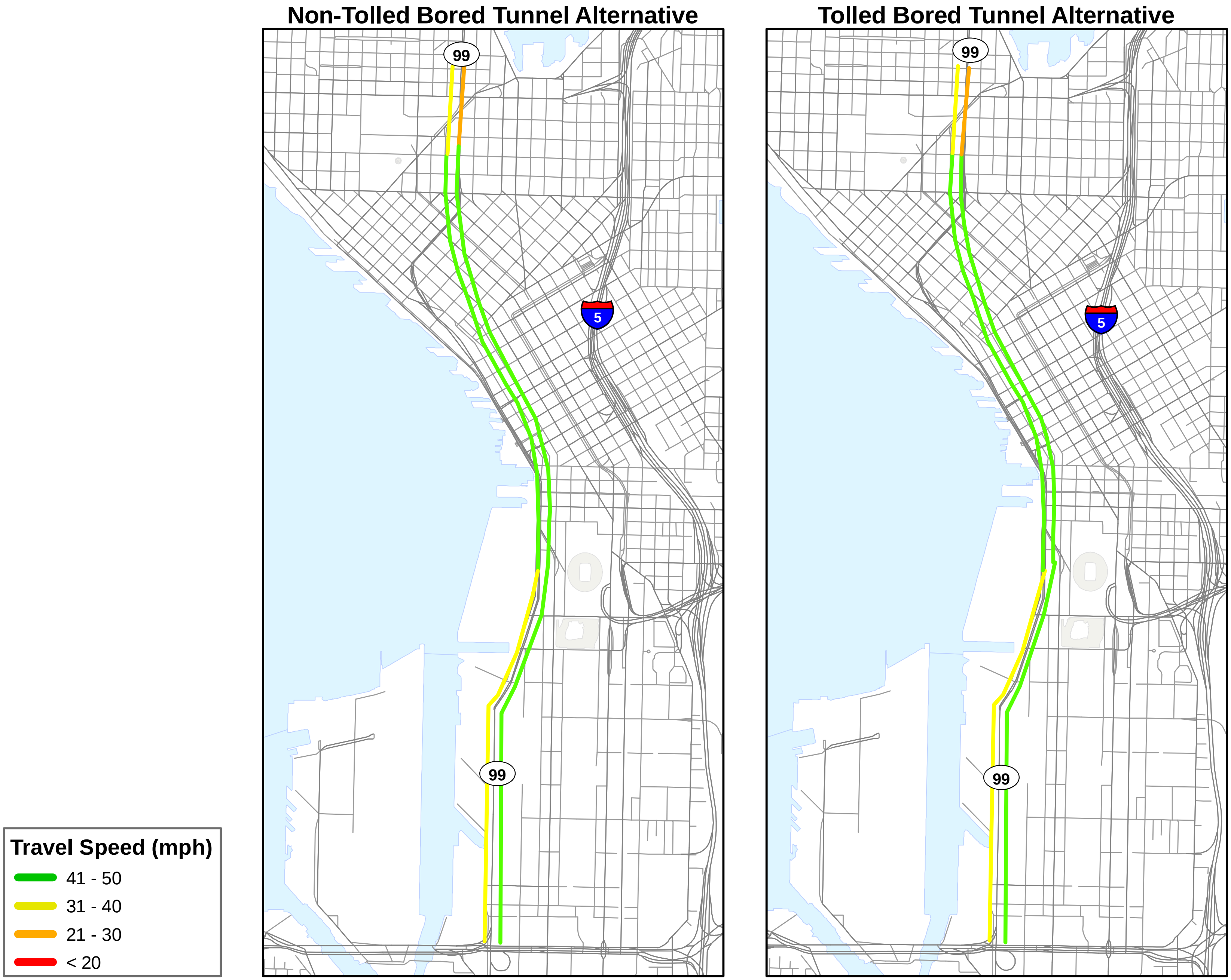
- 41 - 50
- 31 - 40
- 21 - 30
- < 20

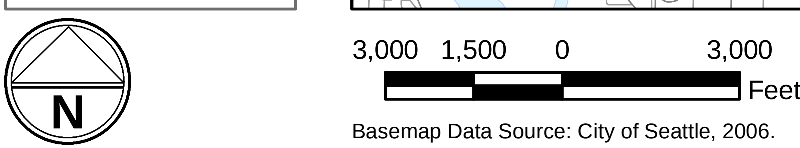
N

3,000 1,500 0 3,000
Feet

Basemap Data Source: City of Seattle, 2006.

Exhibit 7-36
Average Speed Comparison on SR 99 Segments, AM Peak Hour - Bored Tunnel Alternative





Basemap Data Source: City of Seattle, 2006.

Exhibit 7-37
Average Speed Comparison on SR 99 Segments, PM Peak Hour - Bored Tunnel Alternative

7.3.2 Tolled Cut-and-Cover Tunnel Alternative

This section describes the forecasted traffic volumes and speeds for the tolled Cut-and-Cover Tunnel Alternative in comparison with its non-tolled counterpart.

7.3.2.1 Alaskan Way Viaduct Mainline and Ramp Volumes

This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the tolled Cut-and-Cover Tunnel Alternative; specifically, these estimates are for each connection to and from SR 99 (ramps or side streets) and for each mainline segment (segment of SR 99 between connections). These estimates account for all vehicle types using the corridor.

7.3.2.1.1 AM Peak Hour

AM peak hour mainline and ramp volumes forecasted for the tolled Cut-and-Cover Tunnel Alternative are shown in Exhibit 7-38. The forecasted volumes for this alternative with tolled conditions are generally lower than those with non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,640 vehicles) and exiting southbound SR 99 to West Seattle (610 vehicles) are lower than those with non-tolled conditions. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those with non-tolled conditions in both the northbound direction (4,500 vehicles) and the southbound direction (2,370 vehicles). The forecasted volumes on the stadium area northbound off-ramp (1,820 vehicles) and southbound on-ramp (1,050 vehicles) are higher than those with non-tolled conditions (41 percent higher northbound and 78 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility.

Also, the forecasted stadium area northbound on-ramp volumes (200 vehicles) and southbound off-ramp volumes (380 vehicles) are lower than those with non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.

In the cut-and-cover tunnel through midtown, the forecasted northbound volume (2,880 vehicles) and southbound volume (1,700 vehicles) are both significantly lower than the volumes for the non-tolled Cut-and-Cover Tunnel Alternative (39 percent lower northbound and 59 percent lower southbound). The forecasted volumes on the northbound off-ramp to Western (1,010 vehicles) and the southbound on-ramp from Elliott (360 vehicles) are also lower than those with non-tolled conditions (26 percent lower northbound and 70 percent lower southbound). North of the cut-and-cover tunnel, an increase is once again seen in the forecasted northbound on-ramp volumes (1,290 vehicles) as well as southbound off-ramp volumes (2,230 vehicles) at Denny Way with tolled conditions (50 percent higher northbound and 30 percent higher southbound).

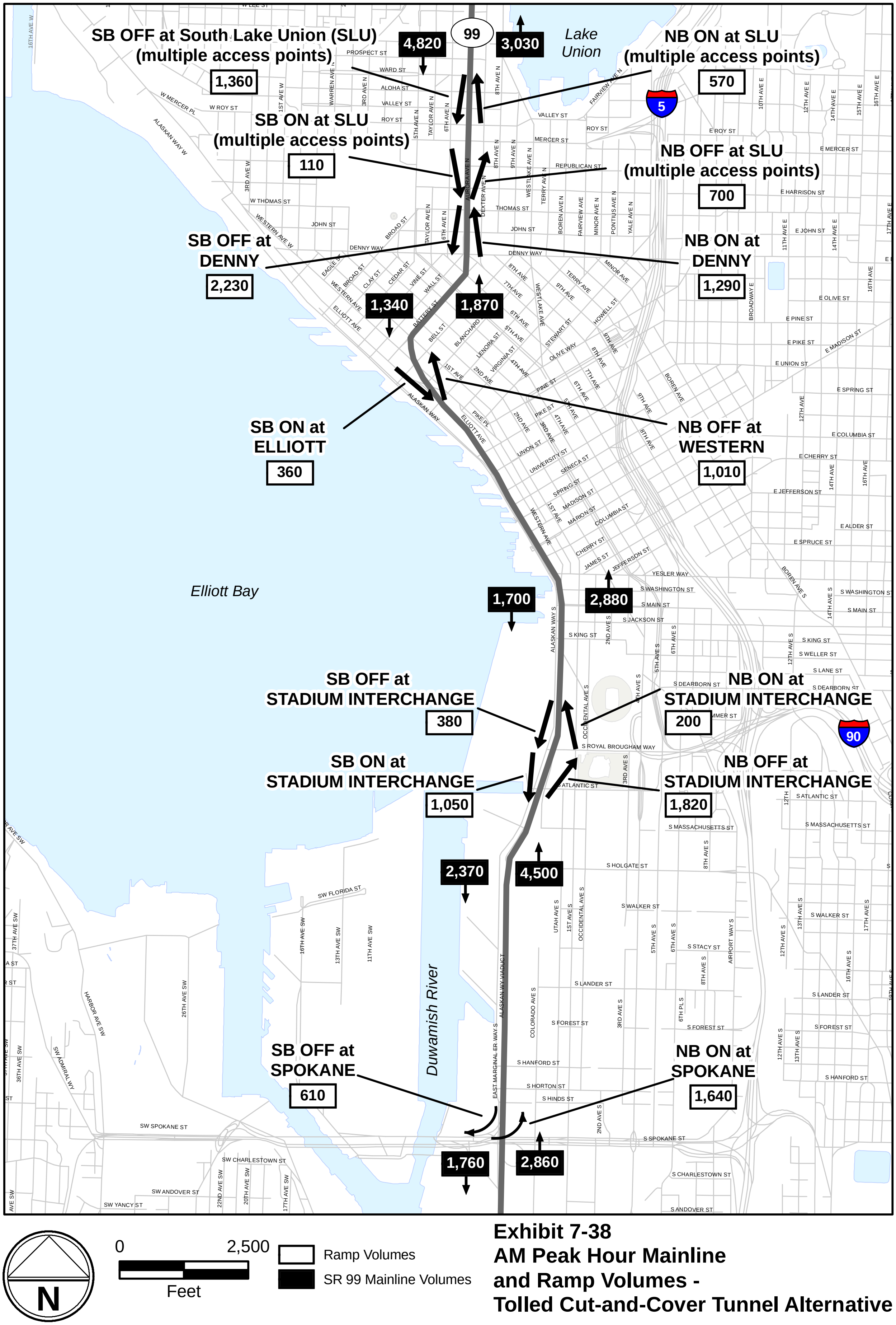


Exhibit 7-38
AM Peak Hour Mainline and Ramp Volumes - Tolled Cut-and-Cover Tunnel Alternative

The forecasted northbound SR 99 volumes exiting to South Lake Union (700 vehicles) and southbound volumes entering from South Lake Union (110 vehicles) are also lower than those with non-tolled conditions. This is again due to vehicles being diverted away from the tolled facility. In the north area, AM peak hour mainline volumes are projected to be lower in both the northbound (3,030 vehicles) and southbound direction (4,820 vehicles) than the volumes for the non-tolled Cut-and-Cover Tunnel Alternative.

7.3.2.1.2 PM Peak Hour

PM peak hour mainline and ramp volumes forecasted for the tolled Cut-and-Cover Tunnel Alternative are shown in Exhibit 7-39. Similar to the AM peak hour, the forecasted volumes for this alternative with tolled conditions are generally lower than those with non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,140 vehicles) and exiting southbound SR 99 to West Seattle (1,960 vehicles) are lower than those for the non-tolled Cut-and-Cover Tunnel Alternative. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those with non-tolled conditions in both the northbound direction (3,540 vehicles) and the southbound direction (4,510 vehicles). The forecasted volumes on the stadium area northbound off-ramp (1,550 vehicles) and southbound on-ramp (1,900 vehicles) are higher than those with non-tolled conditions (91 percent higher northbound and 28 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted stadium area northbound on-ramp volumes (550 vehicles) and southbound off-ramp volumes (200 vehicles) are higher than those with non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.

In the cut-and-cover tunnel through midtown, the forecasted northbound volume (2,540 vehicles) and southbound volume (2,810 vehicles) are both significantly lower than the volumes for the non-tolled Cut-and-Cover Tunnel Alternative (48 percent lower northbound and 40 percent lower southbound). The forecasted volumes on the northbound off-ramp to Western (470 vehicles) and the southbound on-ramp from Elliott (870 vehicles) are also lower than those with non-tolled conditions (61 percent lower northbound and 39 percent lower southbound). North of the cut-and-cover tunnel, an increase is once again seen in the forecasted northbound on-ramp volumes (2,200 vehicles) as well as southbound off-ramp volumes (1,600 vehicles) at Denny Way with tolled conditions (20 percent higher northbound and 51 percent higher southbound). The forecasted northbound SR 99 volumes exiting to South Lake Union (280 vehicles) and southbound volumes entering from South Lake Union (270 vehicles)

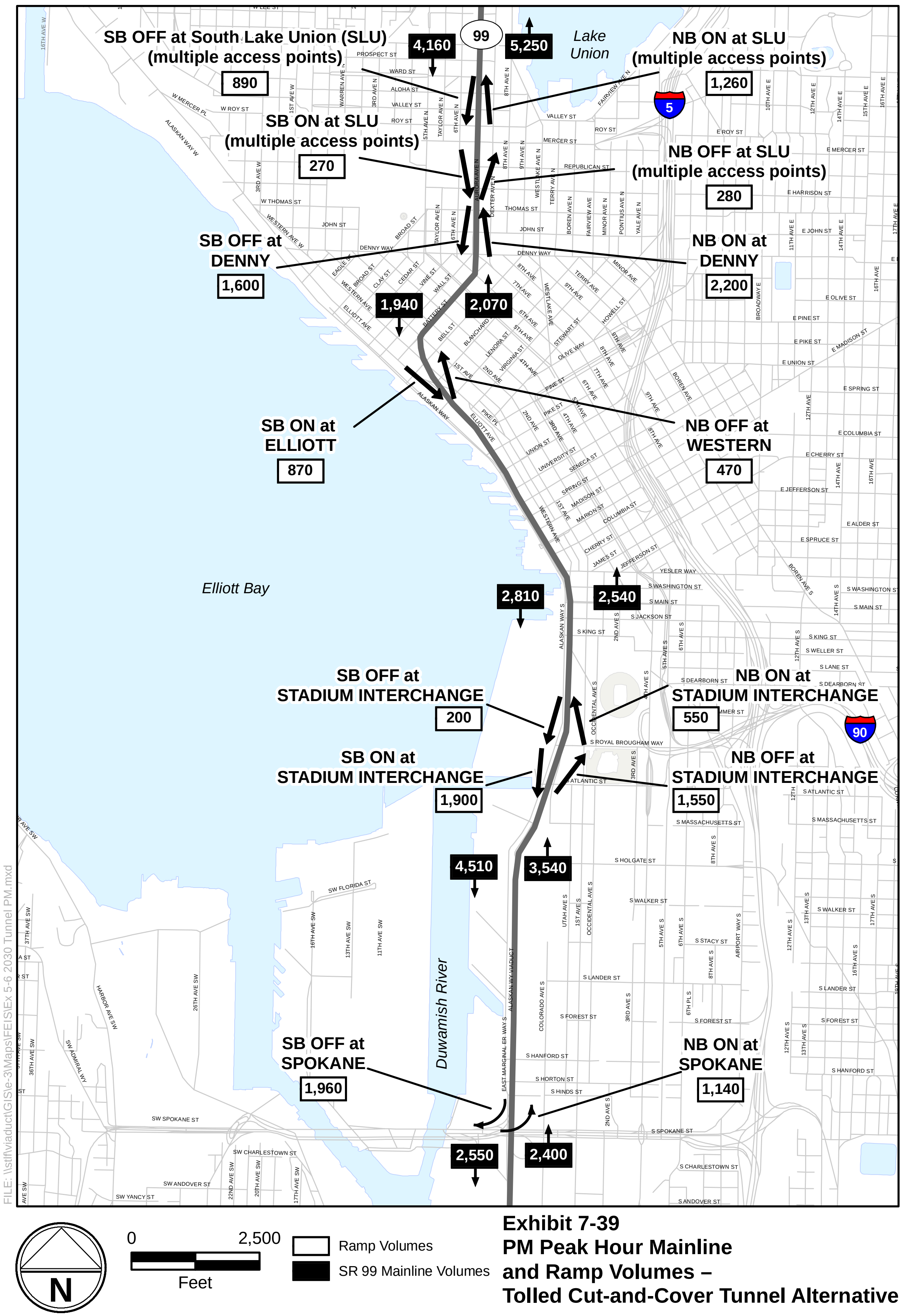


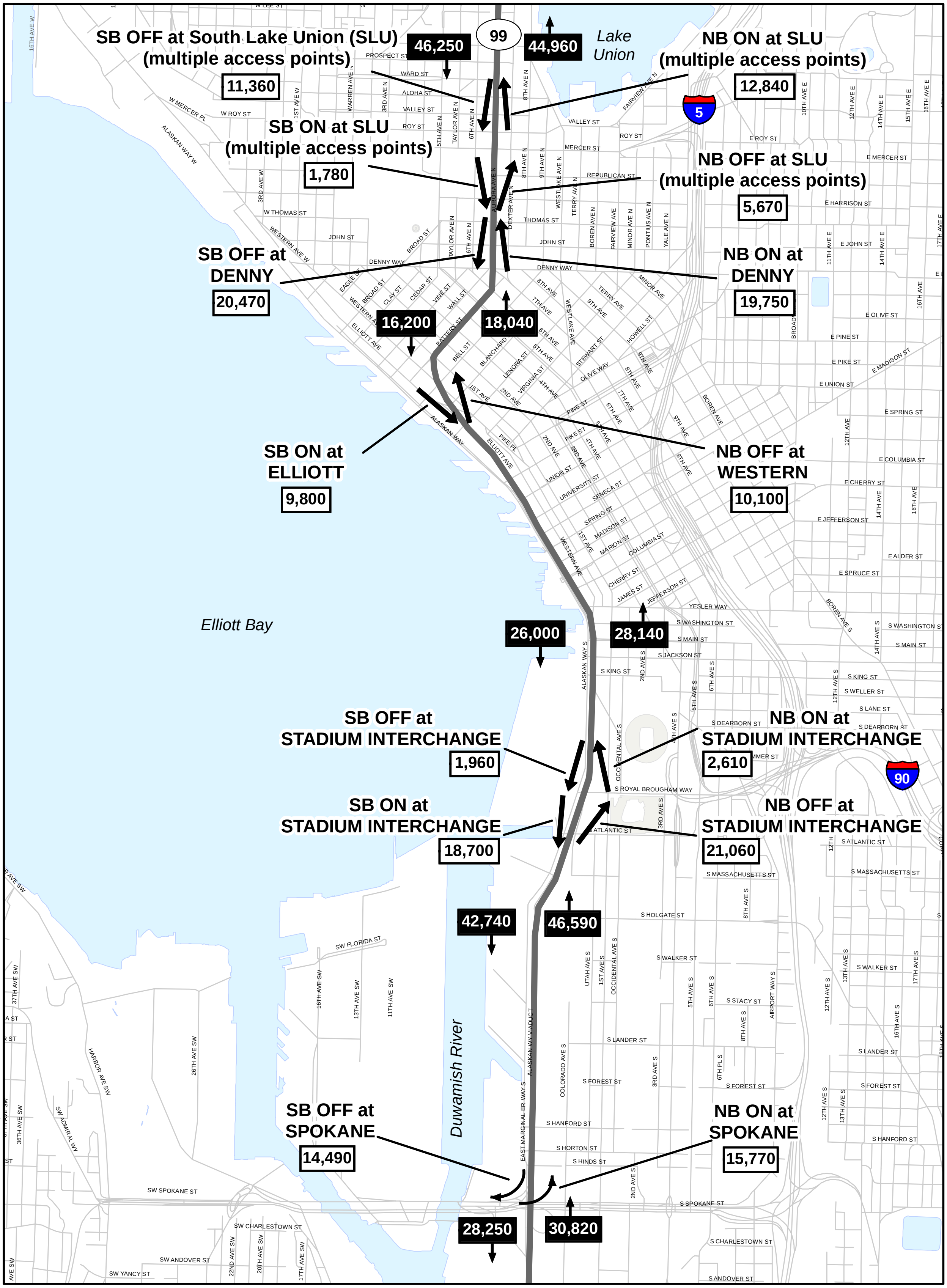
Exhibit 7-39
PM Peak Hour Mainline and Ramp Volumes – Tolled Cut-and-Cover Tunnel Alternative

are also lower than those with non-tolled conditions. This is again due to vehicles being diverted away from the tolled facility. In the north area, PM peak hour mainline volumes are projected to be slightly lower in both the northbound (5,250 vehicles) and southbound direction (4,160 vehicles) than those with non-tolled conditions.

7.3.2.1.3 Daily

Daily mainline and ramp volumes forecasted for the tolled Cut-and-Cover Tunnel Alternative are shown in Exhibit 7-40. Similar to the AM and PM peak hours, the forecasted volumes for this alternative with tolled conditions are generally lower than those with non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (15,770 vehicles) and exiting southbound SR 99 to West Seattle (14,490 vehicles) are lower than those with non-tolled conditions. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those with non-tolled conditions in both the northbound direction (46,590 vehicles) and the southbound direction (42,740 vehicles). The forecasted volumes on the stadium area northbound off-ramp (21,060 vehicles) and southbound on-ramp (18,700 vehicles) are higher than those with non-tolled conditions (60 percent higher northbound and 36 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted stadium area northbound on-ramp volumes (2,610 vehicles) and southbound off-ramp volumes (1,960 vehicles) are lower than those with non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.

In the cut-and-cover tunnel through midtown, the forecasted northbound volume (28,140 vehicles) and southbound volume (26,000 vehicles) are both significantly lower than the volumes with non-tolled conditions (50 percent lower northbound and 52 percent lower southbound). The forecasted volumes on the northbound off-ramp to Western (10,100 vehicles) and the southbound on-ramp from Elliott (9,800 vehicles) are also lower than those with non-tolled conditions (45 percent lower northbound and 46 percent lower southbound). North of the cut-and-cover tunnel, an increase is once again seen in the forecasted northbound on-ramp volumes (19,750 vehicles) as well as southbound off-ramp volumes (20,470 vehicles) at Denny Way with tolled conditions (22 percent higher northbound and 34 percent higher southbound). The forecasted northbound SR 99 volumes exiting to South Lake Union (5,670 vehicles) and southbound volumes entering from South Lake Union (2,280 vehicles) are also lower than those with non-tolled conditions. This is again due to vehicles being diverted away from the tolled facility. In the north area, daily mainline volumes are projected to be lower in both the northbound (44,960 vehicles) and southbound direction (46,250 vehicles) than those with non-tolled conditions.



N

0 2,500
Feet

Ramp Volumes

SR 99 Mainline Volumes

Exhibit 7-40
Daily Mainline and Ramp Volumes – Tolled Cut-and-Cover Tunnel Alternative

7.3.2.2 SR 99 Mainline Level of Service

This section describes the AM and PM peak hour LOS for the corridor segments under the tolled Cut-and-Cover Tunnel Alternative. While LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing the modeled conditions on the SR 99 mainline because the ramp locations and segment arrangements may vary considerably among them.

In addition, as described in Chapter 2, the LOS estimates presented here are based on the Transportation Research Board's HCM density ranges for freeways, which presume faster free-flow speeds than those planned for the corridor segments under any of the modeled conditions. As a result, the perceived level of traffic congestion on mainline segments may be somewhat less than the level that would typically be estimated by the HCM method. Mainline LOS results are therefore better suited to providing relative comparisons between the modeled conditions as opposed to a precise indication of congestion. Projected speeds and travel times along the facility are better indicators of expected performance. SR 99 mainline LOS is summarized by segment for the Cut-and-Cover Tunnel Alternative with tolled and non-tolled conditions in Exhibits 7-41 and 7-42, reflecting both directions in the AM and PM peak hours.

Exhibit 7-41. Peak Hour Northbound SR 99 Segment LOS – Cut-and-Cover Tunnel Alternative

	AM Peak Hour		PM Peak Hour	
Segment	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South Corridor				
S. Spokane on-ramp to stadium off-ramp	E	F	E	E
Midtown				
Stadium off-ramp to Western off-ramp	E	C	F	B
Stadium off-ramp to Seneca off-ramp	N/A	N/A	N/A	N/A
Seneca off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	F	C	F	D
North Corridor				
North of Battery Street Tunnel	D	C	E	E
North of bored tunnel	N/A	N/A	N/A	N/A

Notes: LOS = level of service
N/A = not applicable

Exhibit 7-42. Peak Hour Southbound SR 99 Segment LOS – Cut-and-Cover Tunnel Alternative

Segment	AM Peak Hour		PM Peak Hour	
	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South Corridor				
Stadium on-ramp to S. Spokane off-ramp	B	B	E	D
Midtown				
Elliott on-ramp to stadium on-ramp	F	A	D	C
Columbia on-ramp to stadium on-ramp	N/A	N/A	N/A	N/A
Elliott on-ramp to Columbia on-ramp	N/A	N/A	N/A	N/A
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	E	B	E	C
North Corridor				
North of Battery Street Tunnel	F	F	E	F
North of bored tunnel	N/A	N/A	N/A	N/A

Notes: LOS = level of service
N/A = not applicable

Compared with the non-tolled Cut-and-Cover Tunnel Alternative, mainline tunnel operations with tolled conditions through midtown and in the Battery Street Tunnel are projected to improve in both directions during both the AM and PM peak hours. This is expected because of significant decreases in traffic volumes through the midtown tunnel segment as vehicles are diverted away from the tolled facility onto the arterial street system. The mainline segment between the stadium area and the Elliott/Western ramps would operate between LOS A and LOS C in both directions during both the AM and PM peak hours. Operations in the Battery Street Tunnel would improve to LOS B or LOS C in all directions during both the AM and PM peak hours, with the exception of northbound operations during the PM peak hour, which would improve to LOS D.

In the south area between the stadium area and S. Spokane Street, southbound operations with tolled conditions would remain at LOS B during the AM peak hour, while operations would improve to LOS D during the PM peak hour. In the northbound direction, mainline operations would degrade to LOS F during the AM peak hour, because vehicles diverting from the tolled facility to the arterial street system would cause increased congestion on the mainline upstream. During the PM peak hour, northbound operations would remain at LOS E.

In the north area, southbound mainline operations would remain at LOS F during the AM peak hour and would degrade to LOS F during the PM peak hour. In the northbound direction, operations would improve to LOS C during the AM peak hour and remain at LOS E during the PM peak hour.

7.3.2.3 SR 99 Mainline Speeds

This section discusses the AM and PM peak hour travel speeds for the corridor segments under the tolled Cut-and-Cover Tunnel Alternative. As with LOS, comparing travel speeds between the modeled conditions can present certain challenges because the ramp and segment arrangements vary among the modeled conditions. The speeds are presented in Exhibits 7-43 and 7-44. To assist in comparison, the results are presented side by side graphically in Exhibits 7-45 and 7-46.

Exhibit 7-43. Peak Hour Northbound SR 99 Segment Speeds – Cut-and-Cover Tunnel Alternative

Segment	AM Peak Hour (miles per hour)		PM Peak Hour (miles per hour)	
	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South Corridor				
S. Spokane on-ramp to stadium off-ramp	46	17	42	35
Midtown				
Stadium off-ramp to Western off-ramp	44	48	31	48
Stadium off-ramp to Seneca off-ramp	N/A	N/A	N/A	N/A
Seneca off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	32	34	25	34
North Corridor				
North of Battery Street Tunnel	35	35	34	35
North of bored tunnel	N/A	N/A	N/A	N/A

Note: N/A = not applicable

Exhibit 7-44. Peak Hour Southbound SR 99 Segment Speeds – Cut-and-Cover Tunnel Alternative

Segment	AM Peak Hour (miles per hour)		PM Peak Hour (miles per hour)	
	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South Corridor				
Stadium on-ramp to S. Spokane off-ramp	48	48	43	44
Midtown				
Elliott on-ramp to stadium on-ramp	31	48	43	47
Columbia on-ramp to stadium on-ramp	N/A	N/A	N/A	N/A
Elliott on-ramp to Columbia on-ramp	N/A	N/A	N/A	N/A
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	34	34	34	34
North Corridor				
North of Battery Street Tunnel	16	10	33	21
North of bored tunnel	N/A	N/A	N/A	N/A

Note: N/A = not applicable

Compared with speeds under non-tolled conditions, speeds in the mainline segment through midtown with tolled conditions would increase in both directions during both the AM and PM peak hours, with speeds ranging from approximately 47 to 48 mph. This is expected because of reduced vehicle volumes in the tunnel. In the south area, mainline speeds would remain similar to those of the non-tolled Cut-and-Cover Tunnel Alternative in the southbound direction during both the AM and PM peak hours. In the northbound direction, speeds would decrease from 46 to 17 mph during the AM peak hour and from 42 to 35 mph during the PM peak hour. This would occur because of increased congestion caused by vehicles exiting the facility upstream of the tolled segment. Similarly, in the north area, mainline speeds would remain similar to those with non-tolled conditions in the northbound direction during both the AM and PM peak hours. In the southbound direction, speeds would decrease from 16 to 10 mph during the AM peak hour and from 33 to 21 mph during the PM peak hour. Again, this is expected as a result of congestion due to vehicles exiting the facility upstream of the tolled segment.

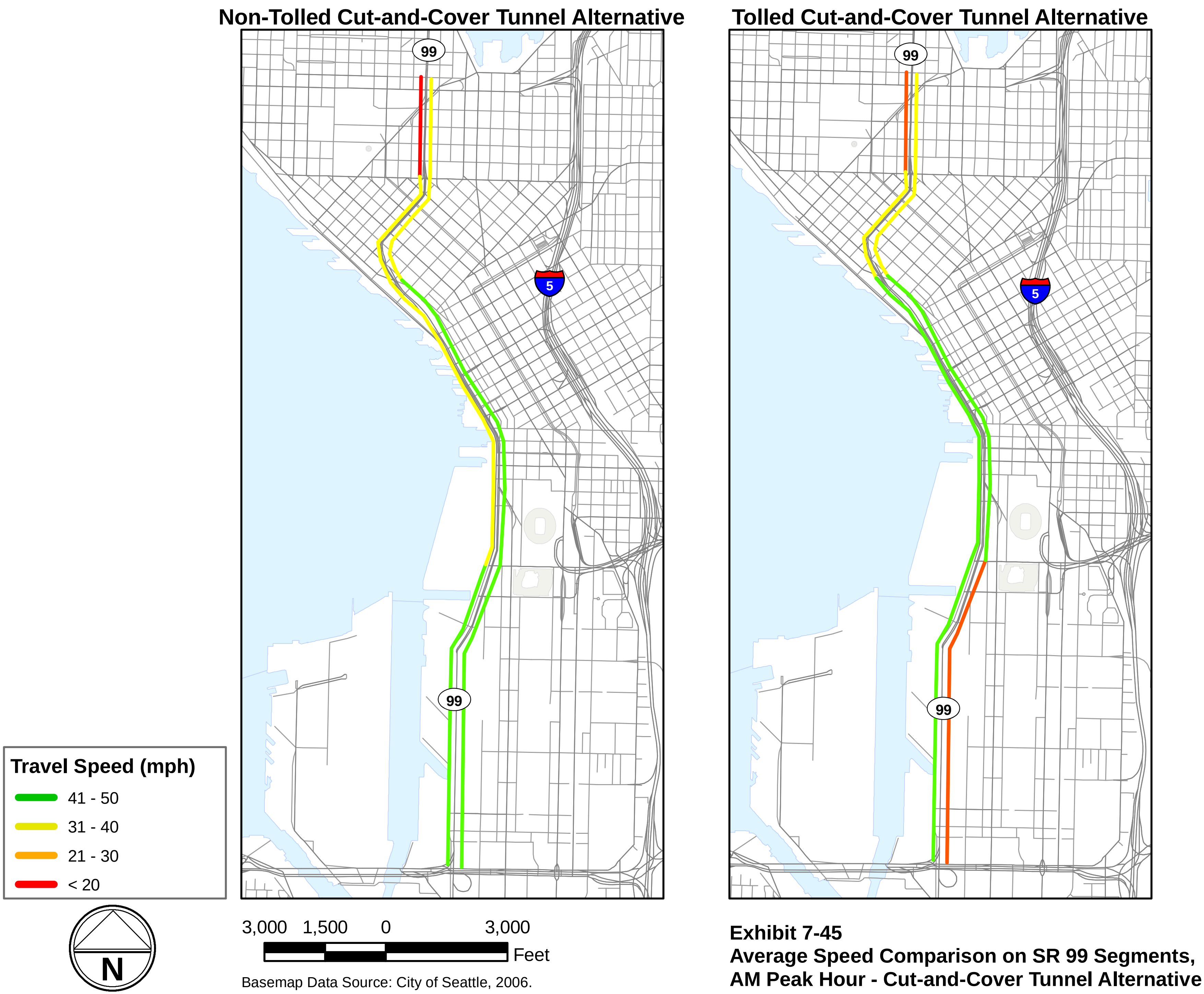
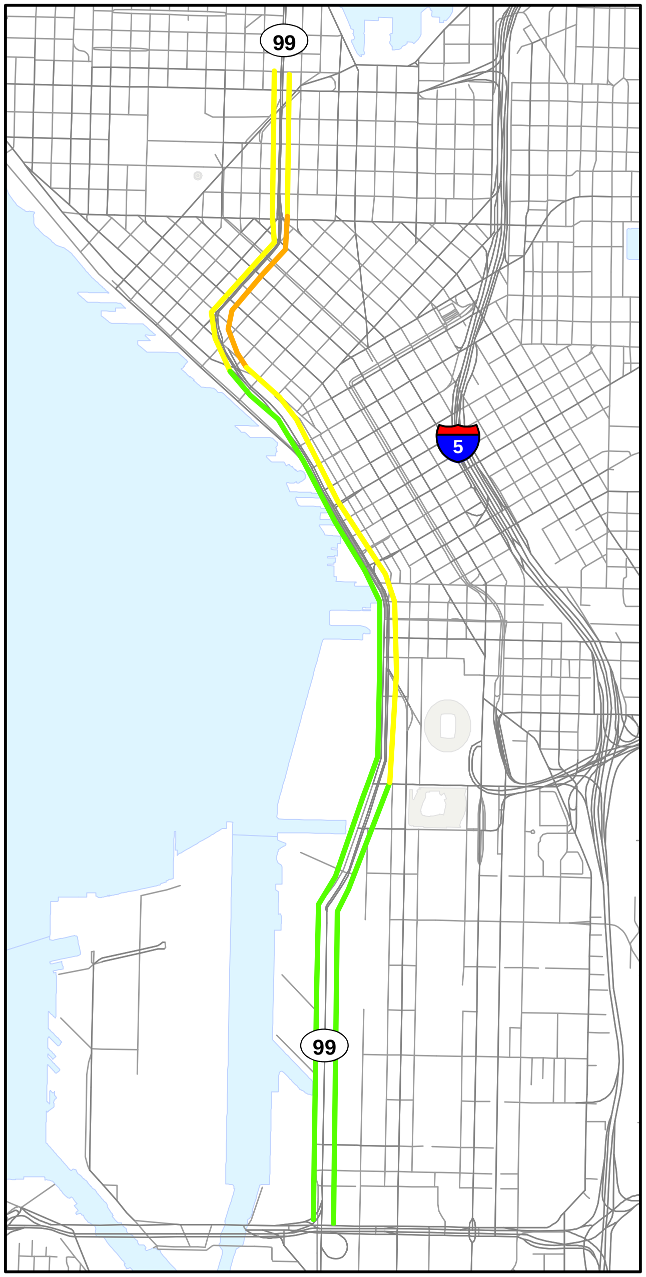
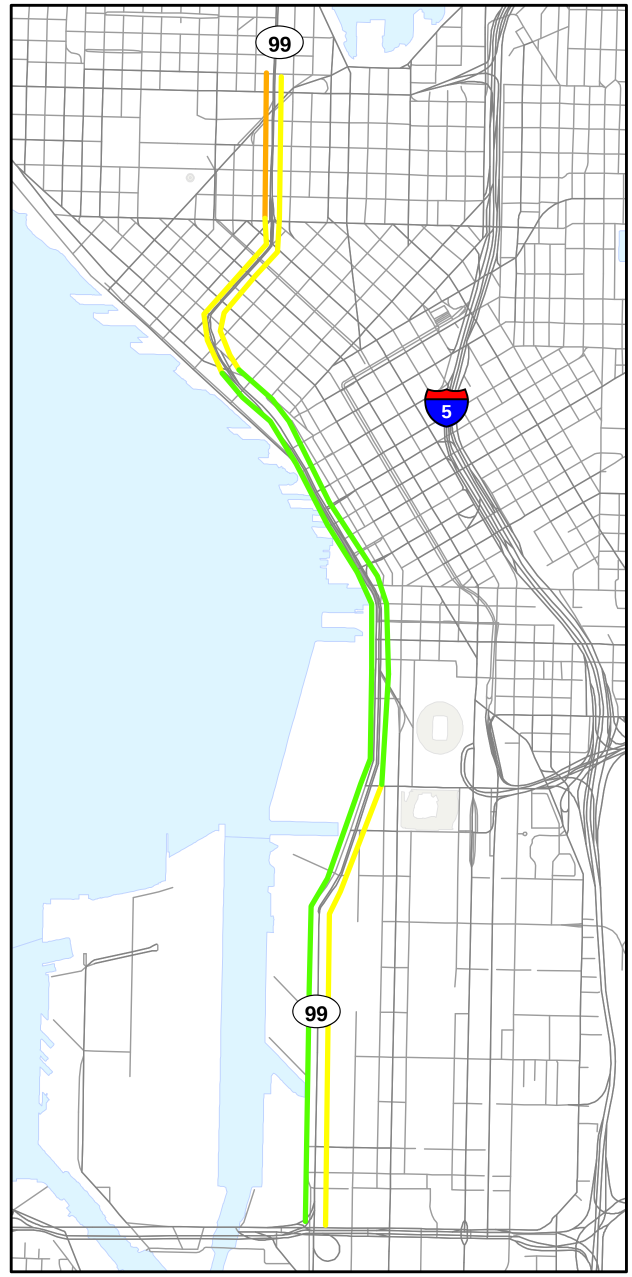


Exhibit 7-45
Average Speed Comparison on SR 99 Segments, AM Peak Hour - Cut-and-Cover Tunnel Alternative

Non-Tolled Cut-and-Cover Tunnel Alternative

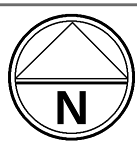


Tolled Cut-and-Cover Tunnel Alternative



Travel Speed (mph)

- 41 - 50
- 31 - 40
- 21 - 30
- < 20



Basemap Data Source: City of Seattle, 2006.

Exhibit 7-46
Average Speed Comparison on SR 99 Segments, PM Peak Hour - Cut-and-Cover Tunnel Alternative

7.3.3 Tolled Elevated Structure Alternative

This section describes the forecasted traffic volume and speeds for the tolled Elevated Structure Alternative in comparison to its non-tolled counterpart.

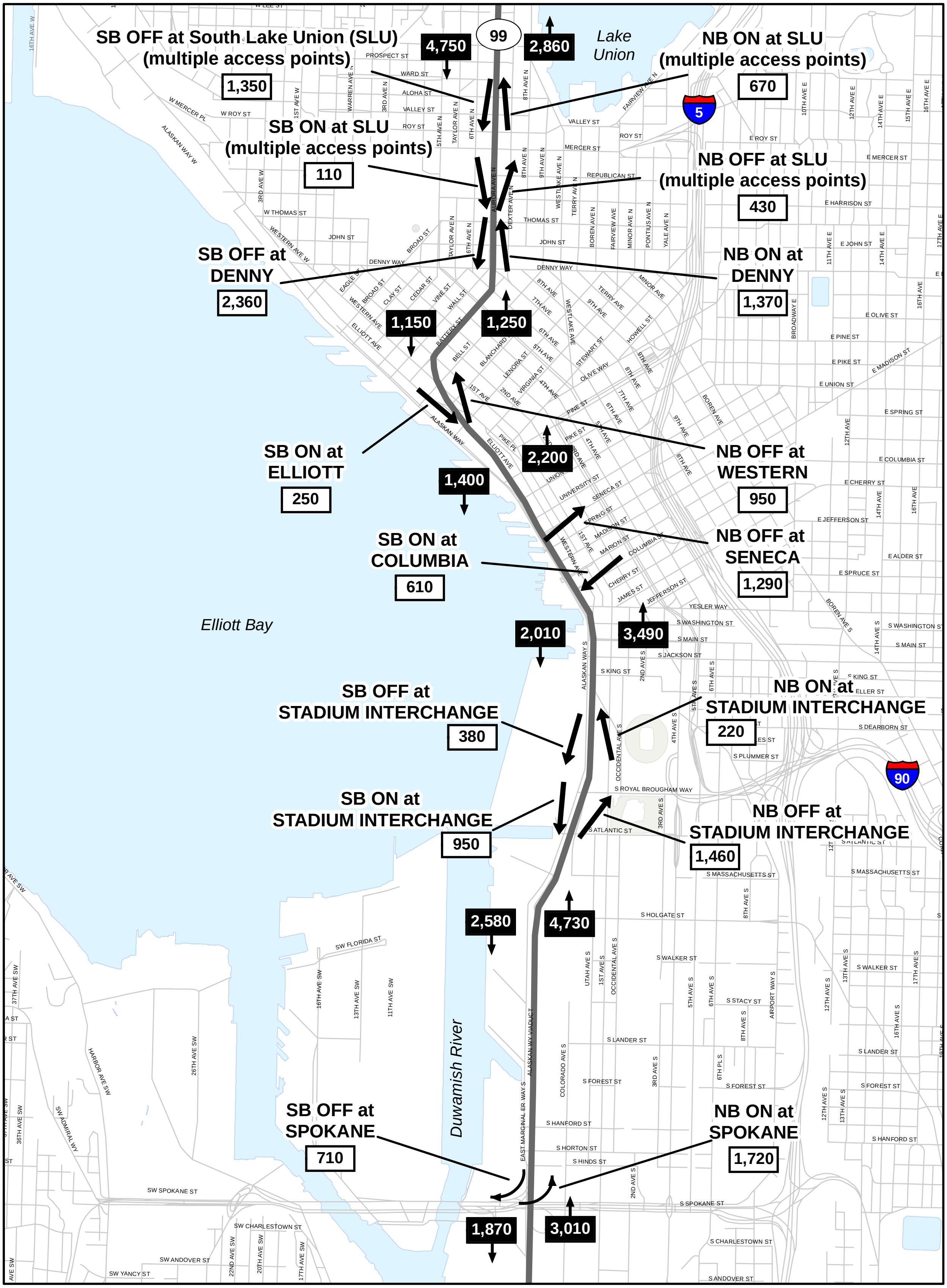
7.3.3.1 Alaskan Way Viaduct Mainline and Ramp Volumes

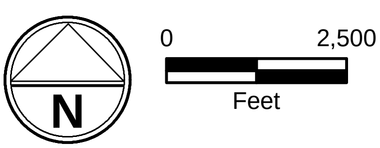
This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the tolled Elevated Structure Alternative; specifically, these estimates are for each connection to and from SR 99 (ramps or side streets) and for each mainline segment (segment of SR 99 between connections). These estimates account for all vehicle types using the corridor.

7.3.3.1.1 AM Peak Hour

AM peak hour mainline and ramp volumes forecasted for the tolled Elevated Structure Alternative are shown in Exhibit 7-47. The forecasted volumes for this alternative with tolled conditions are generally lower than those with non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,720 vehicles) and exiting southbound SR 99 to West Seattle (710 vehicles) are lower than those with non-tolled conditions. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those with non-tolled conditions in both the northbound direction (4,730 vehicles) and the southbound direction (2,580 vehicles). The forecasted volumes on the stadium area northbound off-ramp (1,460 vehicles) and southbound on-ramp (950 vehicles) are significantly higher than those with non-tolled conditions (232 percent higher northbound and 116 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted stadium area northbound on-ramp volumes (220 vehicles) and southbound off-ramp volumes (380 vehicles) are lower than those with non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.

On the SR 99 mainline south of the ramps at Columbia and Seneca Streets, the forecasted northbound volume (3,490 vehicles) and southbound volume (2,010 vehicles) are both significantly lower than those with the non-tolled conditions (40 percent lower northbound and 56 percent lower southbound). Similar to the stadium area ramps, the forecasted volumes on the northbound off-ramp to Seneca Street (1,290 vehicles) and on the southbound on-ramp from Columbia Street (610 vehicles) are higher than those with non-tolled conditions, because vehicles would be diverted from the tolled facility. The forecasted volumes on the northbound off-ramp to Western (950 vehicles) and the southbound on-ramp from Elliott (250 vehicles) are lower than those with non-tolled conditions (31 percent lower northbound and 79 percent lower





XXX (boxed)	Ramp Volumes
XXX (black)	SR 99 Mainline Volumes

Exhibit 7-47
AM Peak Hour Mainline and Ramp Volumes - Tolled Elevated Structure Alternative

southbound). North of the Battery Street Tunnel, an increase is once again seen in the forecasted northbound on-ramp volumes (1,370 vehicles) as well as southbound off-ramp volumes (2,360 vehicles) at Denny Way with tolled conditions (61 percent higher northbound and 39 percent higher southbound). The forecasted northbound SR 99 volumes exiting to South Lake Union (430 vehicles) and southbound volumes entering from South Lake Union (110 vehicles) are also lower than those with non-tolled conditions. This is again due to vehicles being diverted away from the tolled facility. In the north area, AM peak hour mainline volumes are projected to be lower in both the northbound (2,860 vehicles) and southbound direction (4,750 vehicles) than those with non-tolled conditions.

7.3.3.1.2 PM Peak Hour

PM peak hour mainline and ramp volumes forecasted for the tolled Elevated Structure Alternative are shown in Exhibit 7-48. Similar to the AM peak hour, the forecasted volumes for this alternative with tolled conditions are generally lower than those with non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (1,250 vehicles) and exiting southbound SR 99 to West Seattle (2,120 vehicles) are lower than those with non-tolled conditions. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those with non-tolled conditions in both the northbound direction (3,820 vehicles) and the southbound direction (4,860 vehicles). The forecasted volumes on the stadium area northbound off-ramp (1,280 vehicles) and southbound on-ramp (1,560 vehicles) are significantly higher than those with non-tolled conditions (220 percent higher northbound and 86 percent higher southbound), because more vehicles would be diverted to the arterial street system from the tolled facility. Also, the forecasted stadium area northbound on-ramp volumes (600 vehicles) and southbound off-ramp volumes (400 vehicles) are lower than those with non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.\

On the SR 99 mainline south of the ramps at Columbia and Seneca Streets, the forecasted northbound volume (3,140 vehicles) and southbound volume (3,700 vehicles) are both significantly lower than the volumes with non-tolled conditions (44 percent lower northbound and 37 percent lower southbound). Similar to the stadium area ramps, the forecasted volumes on the northbound off-ramp to Seneca Street (1,000 vehicles) and on the southbound on-ramp from Columbia Street (1,460) are higher than those with non-tolled conditions, because vehicles would be diverted from the tolled facility. The forecasted volumes on the northbound off-ramp to Western (420 vehicles) and the southbound on-ramp from Elliott (730 vehicles) are lower than those with non-tolled conditions (66 percent lower northbound and 49 percent lower southbound).

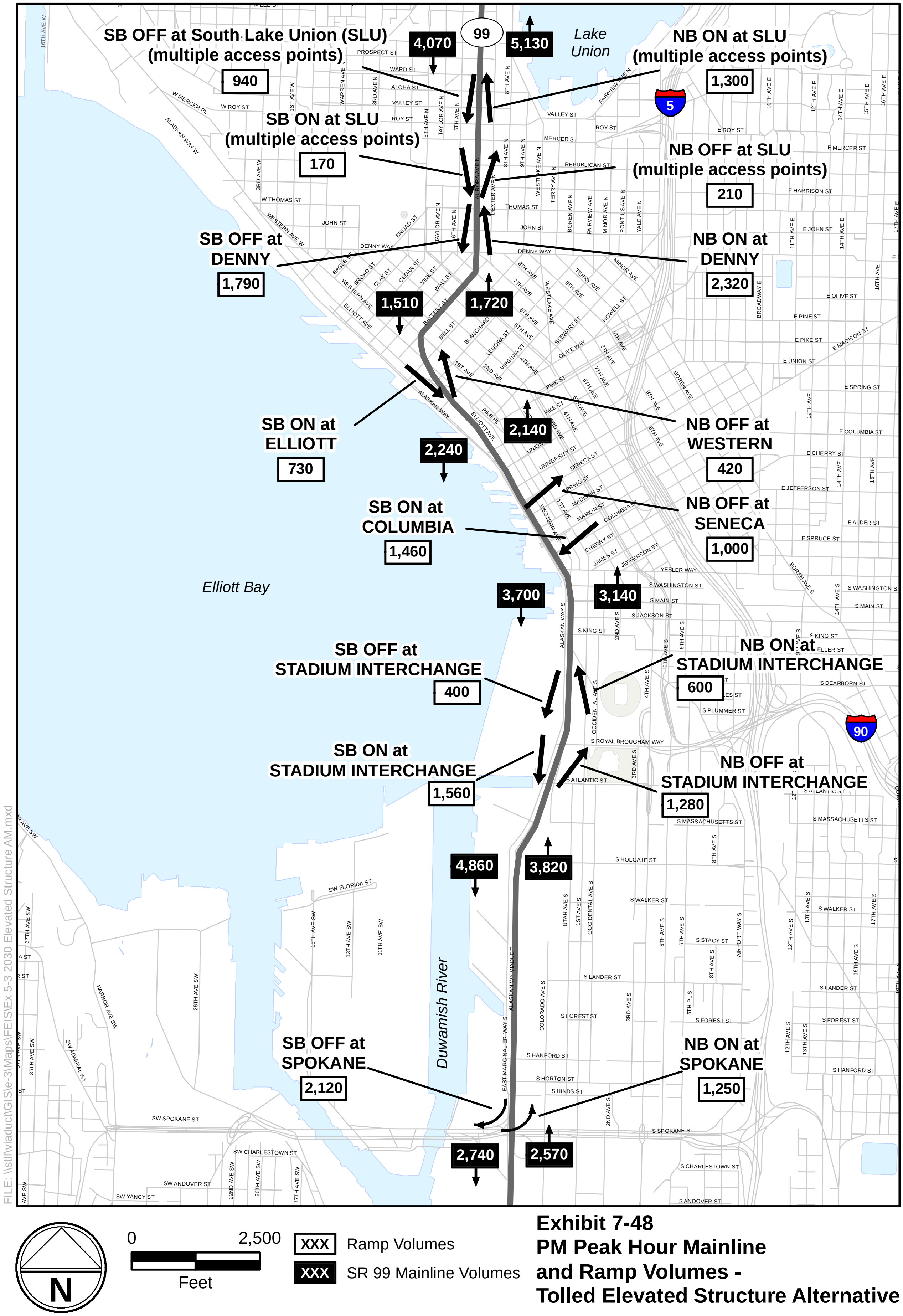


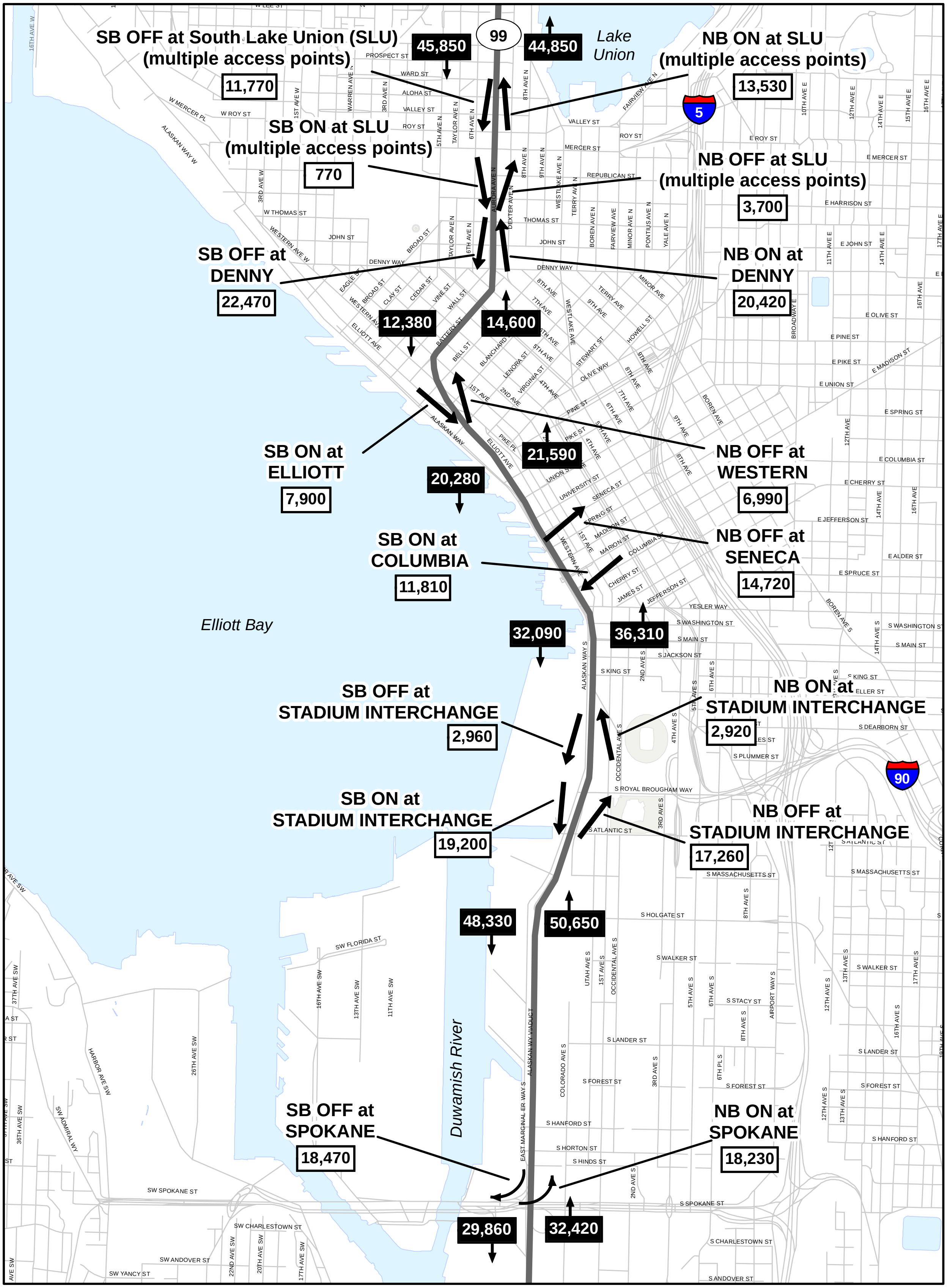
Exhibit 7-48
PM Peak Hour Mainline and Ramp Volumes - Tolled Elevated Structure Alternative

North of the Battery Street Tunnel, an increase is once again seen in the forecasted northbound on-ramp volumes (2,320 vehicles) as well as southbound off-ramp volumes (1,790 vehicles) at Denny Way with tolled conditions (109 percent higher northbound and 70 percent higher southbound). The forecasted northbound SR 99 volumes exiting to South Lake Union (210 vehicles) and southbound volumes entering from South Lake Union (170 vehicles) are also lower than those with non-tolled conditions. This is again due to vehicles being diverted away from the tolled facility. In the north area, PM peak hour mainline volumes are projected to be slightly lower in both the northbound (5,130 vehicles) and southbound direction (4,070 vehicles) than those with non-tolled conditions.

7.3.3.1.3 Daily

Daily mainline and ramp volumes forecasted for the tolled Elevated Structure Alternative are shown in Exhibit 7-49. Similar to the AM and PM peak hours, the forecasted volumes for tolled conditions are generally lower than those for non-tolled conditions. At S. Spokane Street, the forecasted volumes entering northbound SR 99 from West Seattle (18,230 vehicles) and exiting southbound SR 99 to West Seattle (18,470 vehicles) are lower than those with non-tolled conditions. South of downtown and the stadium area, the forecasted mainline SR 99 volumes are lower than those with non-tolled conditions in both the northbound direction (50,650 vehicles) and the southbound direction (48,330 vehicles). The forecasted volumes on the stadium area northbound off-ramp (17,260 vehicles) and southbound on-ramp (19,200 vehicles) are significantly higher than those with non-tolled conditions (197 percent higher northbound and 77 percent higher southbound), because more vehicles would diverted to the arterial street system from the tolled facility. Also, the forecasted stadium area northbound on-ramp volumes (2,920 vehicles) and southbound off-ramp volumes (2,960 vehicles) are lower than those with non-tolled conditions, because fewer vehicles would be entering and exiting the tolled facility.

On the SR 99 mainline south of the ramps at Columbia and Seneca Streets, the forecasted northbound volume (36,310 vehicles) and southbound volume (32,090 vehicles) are both significantly lower than those of the non-tolled Elevated Structure Alternative (45 percent lower northbound and 49 percent lower southbound). Similar to the stadium area ramps, the forecasted volumes on the northbound off-ramp to Seneca Street (14,720 vehicles) and on the southbound on-ramp from Columbia Street (11,810 vehicles) are higher than those with non-tolled conditions, because vehicles would be diverted from the tolled facility. The forecasted volumes on the northbound off-ramp to Western (6,990 vehicles) and the southbound on-ramp from Elliott (7,900 vehicles) are lower than those with non-tolled conditions (62 percent lower northbound and 56 percent lower southbound).



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Feet

XXX Ramp Volumes
XXX SR 99 Mainline Volumes

Exhibit 7-49
Daily Mainline and Ramp Volumes -
Tolled Elevated Structure Alternative

North of the Battery Street Tunnel, an increase is once again seen in the forecasted northbound on-ramp volumes (20,420 vehicles) as well as southbound off-ramp volumes (22,470 vehicles) at Denny Way with tolled conditions (30 percent higher northbound and 50 percent higher southbound). The forecasted northbound SR 99 volumes exiting to South Lake Union (3,700 vehicles) and southbound volumes entering from South Lake Union (1,270 vehicles) are also lower than those with non-tolled conditions. This is again due to vehicles being diverted away from the tolled facility. In the north area, daily mainline volumes are projected to be lower in both the northbound (44,850 vehicles) and southbound direction (45,850 vehicles) than those with non-tolled conditions.

7.3.3.2 SR 99 Mainline Level of Service

This section describes the AM and PM peak hour LOS for the corridor segments under the tolled Elevated Structure Alternative. While LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing the modeled conditions on the SR 99 mainline because the ramp locations and segment arrangements may vary considerably among them. In addition, as described in Chapter 2, the LOS estimates presented here are based on the Transportation Research Board's HCM density ranges for freeways, which presume faster free-flow speeds than those planned for corridor segments under any of the modeled conditions. As a result, the perceived level of traffic congestion on mainline segments may be somewhat less than the level that would typically be estimated by the HCM method. Mainline LOS results are therefore better suited to providing relative comparisons between the modeled conditions as opposed to a precise indication of congestion. Projected speeds and travel times along the facility are better indicators of expected performance. SR 99 mainline LOS is summarized by segment for the Elevated Structure Alternative with tolled and non-tolled conditions in Exhibits 7-50 and 7-51, reflecting both directions in the AM and PM peak hours.

Compared with operations under the non-tolled Elevated Structure Alternative, mainline operations with tolled conditions through midtown and in the Battery Street Tunnel are projected to improve in both directions during both the AM and PM peak hours. This is expected because of significant decreases in traffic volumes through the midtown mainline segment as vehicles are diverted away from the tolled facility onto the arterial street system. During the AM peak hour, operations on the mainline segment between the stadium area and the Elliott/Western ramps would improve to LOS A in the southbound direction and to LOS B in the northbound direction, while during the PM peak hour, operations would improve to LOS B or LOS C in the southbound direction and to LOS B in the northbound direction. Operations in the Battery Street Tunnel would improve to LOS B in both directions during the AM peak hour and to LOS C during the PM peak hour.

Exhibit 7-50. Peak Hour Northbound SR 99 Segment LOS – Elevated Structure Alternative

Segment	AM Peak Hour		PM Peak Hour	
	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South Corridor				
S. Spokane on-ramp to stadium off-ramp	E	F	D	F
Midtown				
Stadium off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Stadium off-ramp to Seneca off-ramp	E	B	E	B
Seneca off-ramp to Western off-ramp	F	B	F	B
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	F	B	F	C
North Corridor				
North of Battery Street Tunnel	D	C	F	E
North of bored tunnel	N/A	N/A	N/A	N/A

Notes: LOS = level of service
N/A = not applicable

Exhibit 7-51. Peak Hour Southbound SR 99 Segment LOS – Elevated Structure Alternative

Segment	AM Peak Hour		PM Peak Hour	
	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South Corridor				
Stadium on-ramp to S. Spokane off-ramp	C	B	F	D
Midtown				
Elliott on to stadium on-ramp	N/A	N/A	N/A	N/A
Columbia on-ramp to stadium on-ramp	C	A	E	C
Elliott on-ramp to Columbia on-ramp	C	A	D	B
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	E	B	E	C
North Corridor				
North of Battery Street Tunnel	F	F	E	F
North of bored tunnel	N/A	N/A	N/A	N/A

Notes: LOS = level of service
N/A = not applicable

In the south area between the stadium area and S. Spokane Street, southbound operations with tolled conditions would improve to LOS B during the AM peak hour and to LOS D during the PM peak hour. In the northbound direction, mainline operations would degrade to LOS F during the AM and PM peak hours, because vehicles diverting from the tolled facility to the arterial street system would cause increased congestion on the mainline upstream.

In the north area, southbound mainline operations would remain at LOS F during the AM peak hour and would degrade to LOS F during the PM peak hour. In the northbound direction, operations would improve to LOS C during the AM peak hour and improve to LOS E during the PM peak hour.

7.3.3.3 SR 99 Mainline Speeds

This section discusses the AM and PM peak hour travel speeds for the corridor segments with the tolled Elevated Structure Alternative. As with LOS, comparing travel speeds between the modeled conditions can present certain challenges because the ramp and segment arrangements vary among them. The speeds are presented in Exhibits 7-52 and 7-53. To assist in comparison, the results are presented side-by-side graphically in Exhibits 7-54 and 7-55.

Exhibit 7-52. Peak Hour Northbound SR 99 Segment Speeds – Elevated Structure Alternative

	AM Peak Hour (miles per hour)		PM Peak Hour (miles per hour)	
Segment	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South Corridor				
S. Spokane on to stadium off-ramp	47	9	47	10
Midtown				
Stadium off-ramp to Western off-ramp	N/A	N/A	N/A	N/A
Stadium off-ramp to Seneca off-ramp	39	44	41	47
Seneca off-ramp to Western off-ramp	31	46	36	48
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	32	35	33	35
North Corridor				
North of Battery Street Tunnel	35	35	34	35
North of bored tunnel	N/A	N/A	N/A	N/A

Note: N/A = not applicable

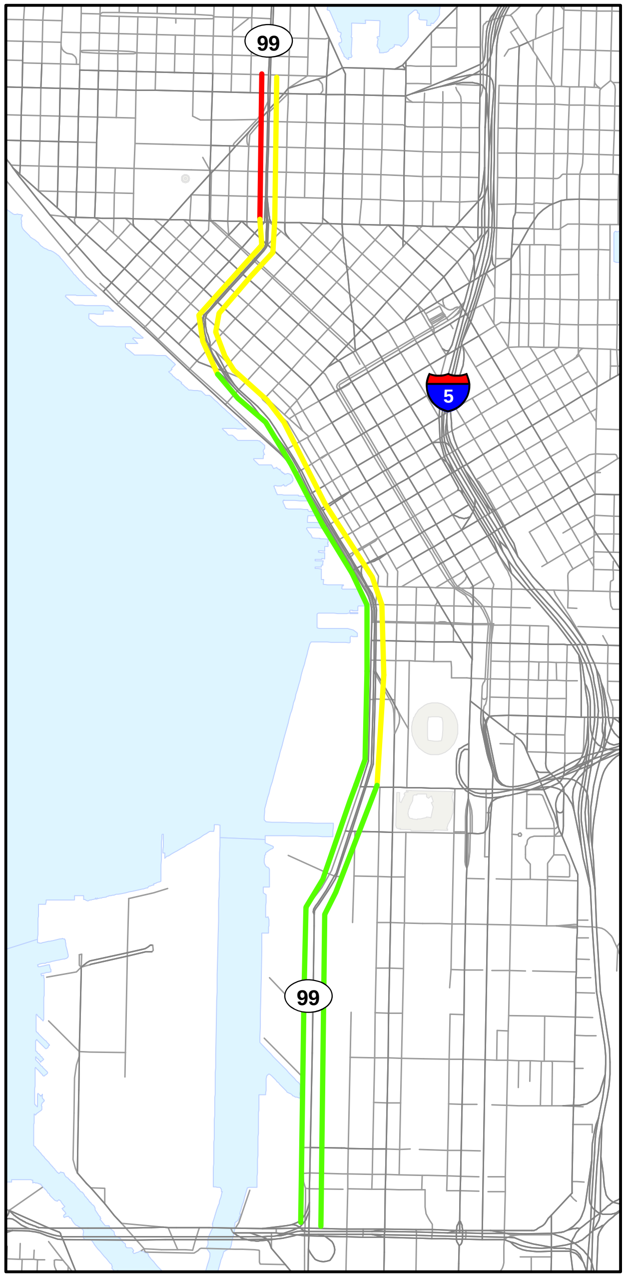
Compared with speeds under the non-tolled Elevated Structure Alternative, speeds in the mainline segment through midtown under tolled conditions would increase in both directions during both the AM and PM peak hours, with speeds ranging from approximately 44 to 48 mph. This is expected because of reduced vehicle volumes on the elevated structure. In the south area, mainline speeds would remain similar to those with non-tolled conditions in the southbound direction during the AM peak hour, while speeds would increase during the PM peak hour to 43 mph. In the northbound direction, speeds would decrease from 47 to 9 mph during the AM peak hour and from 47 to 10 mph during the PM peak hour. These speed reductions would occur because of increased congestion caused by vehicles exiting the facility upstream of the tolled segment. Similarly, in the north area, mainline speeds would remain similar to those with non-tolled conditions in the northbound direction during both the AM and PM peak hours. In the southbound direction, speeds would decrease from 16 to 10 mph during the AM peak hour and from 34 to 20 mph during the PM peak hour. Again, these speeds reductions are expected as a result of congestion from vehicles exiting the facility upstream of the tolled segment.

Exhibit 7-53. Peak Hour Southbound SR 99 Segment Speeds – Elevated Structure Alternative

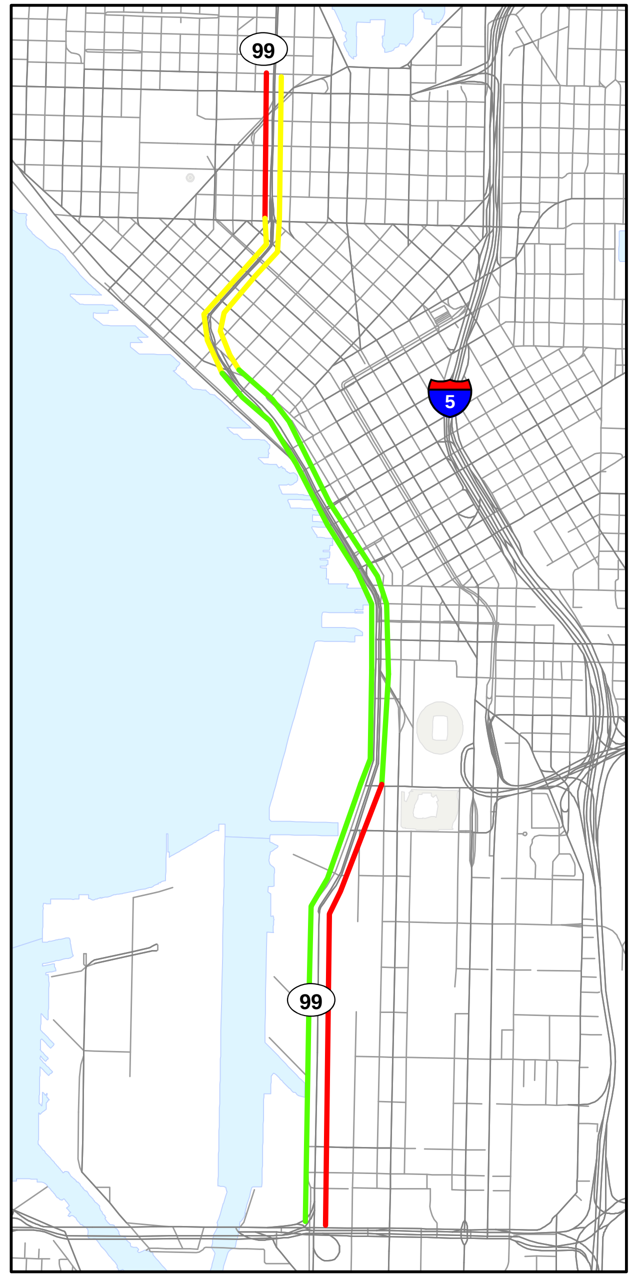
Segment	AM Peak Hour (miles per hour)		PM Peak Hour (miles per hour)	
	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South Corridor				
Stadium on-ramp to S. Spokane off-ramp	48	48	35	43
Midtown				
Elliott on to stadium on-ramp	N/A	N/A	N/A	N/A
Columbia on-ramp to stadium on-ramp	46	48	41	48
Elliott on-ramp to Columbia on-ramp	47	48	47	48
Bored tunnel	N/A	N/A	N/A	N/A
Battery Street Tunnel	34	34	34	34
North Corridor				
North of Battery Street Tunnel	16	10	34	20
North of bored tunnel	N/A	N/A	N/A	N/A

Note: N/A = not applicable

Non-Tolled Elevated Structure Alternative

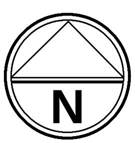


Tolled Elevated Structure Alternative



Travel Speed (mph)

- 41 - 50
- 31 - 40
- 21 - 30
- < 20

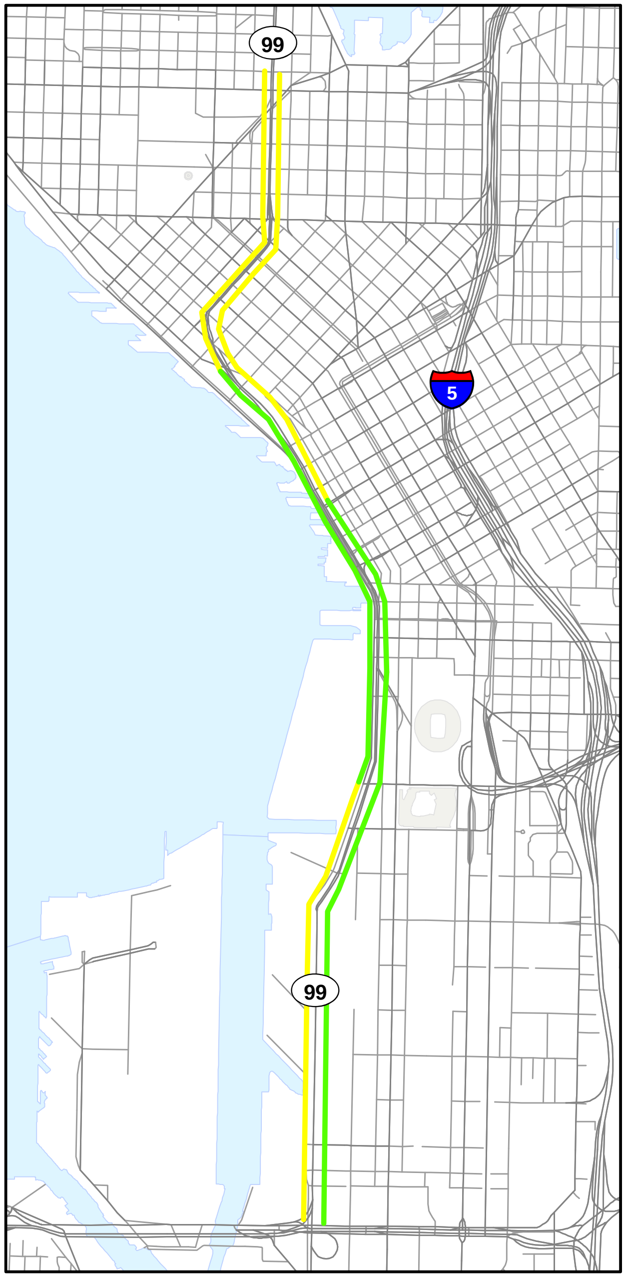


3,000 1,500 0 3,000 Feet

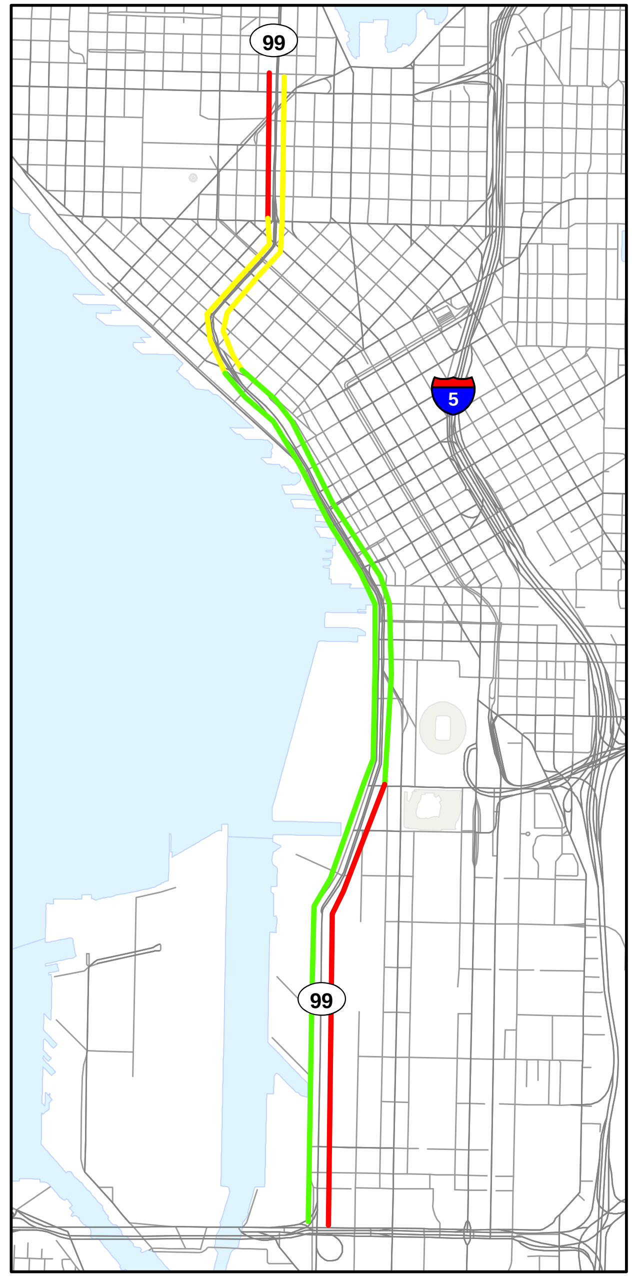
Basemap Data Source: City of Seattle, 2006.

Exhibit 7-54
Average Speed Comparison on SR 99 Segments, AM Peak Hour - Elevated Structure Alternative

Non-Tolled Elevated Structure Alternative



Tolled Elevated Structure Alternative



Travel Speed (mph)

- 41 - 50
- 31 - 40
- 21 - 30
- < 20

N

3,000 1,500 0 3,000 Feet

Basemap Data Source: City of Seattle, 2006.

Exhibit 7-55
Average Speed Comparison on SR 99 Segments, PM Peak Hour - Elevated Structure Alternative

7.4 Traffic Operations at Key Arterial Intersections

This section describes intersection operations at selected locations. The primary performance measure used for this analysis is LOS, a commonly used measure of operational effectiveness for transportation facilities. LOS is used to assess a variety of transportation facilities ranging from arterials to freeway segments.

For the evaluation of signalized intersections, LOS is specifically based on the average vehicle delay calculated for a given intersection. LOS is represented by a letter grade ranging from "A" (low delays and free-flow traffic conditions) to "F" (very congested or break-down conditions). The intersection analysis results are summarized for the south, central, and north areas. Intersections that are projected to operate at LOS E or F indicate those locations that are most likely to experience substantial congestion during the peak hour.

Intersections that operate at LOS A through D would experience little to moderate congestion levels during peak periods and generally are not of concern. While traffic congestion is a common occurrence in the urban environment, identifying LOS E and F intersections does indicate those areas that warrant consideration of how congestion may affect major travel movements and specific travel modes such as transit or freight. Another consideration is whether congestion may lead to air quality concerns. The key findings of the analyses of traffic operations at key arterial intersections are provided in the following lists, which are organized by alternative and location.

Bored Tunnel Alternative

- Implementing tolling for the bored tunnel is likely to affect LOS at intersections in each of the three areas. As discussed in previous sections, some ramp volumes are expected to increase under the tolled Bored Tunnel Alternative compared to the non-tolled Bored Tunnel Alternative. As a result, key intersections along alternate routes are expected to be affected. The south and north areas are expected to see the largest increases in congestion and delay because traffic would divert away from the SR 99 corridor to alternate routes to avoid the tolled facility. Traffic volumes on alternate routes, including Alaskan Way, Second Avenue, and Fourth Avenue are expected to experience the greatest increase under the tolled Bored Tunnel Alternative.

South Area

- In the south area, the available diversion routes for SR 99 with the tolled Bored Tunnel Alternative include First Avenue S., Second Avenue S., and Fourth Avenue S. Some traffic would exit the SR 99 corridor via the ramps at S. Royal Brougham Way, while other traffic would divert from the corridor farther south. Of the 29 intersections reported, 9 would be particularly affected by the tolled Bored Tunnel Alternative. The intersections that would experience the greatest increase in delay in the south area are located along the alternate routes: First Avenue at Yesler Way, Second Avenue S. at S. Jackson Street, Fourth Avenue S. at S. Jackson Street, Fourth Avenue S. at Airport Way S., and Fourth Avenue S. at S. Holgate Street. Operations at several intersections are expected to improve with the tolled conditions, including East Marginal Way S. at S. Atlantic Street and Colorado Avenue at S. Atlantic Street.

Central Area

- In the central area, the available diversion routes for SR 99 include north-south arterials such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. Under the tolled Bored Tunnel Alternative, additional traffic would exit SR 99 at the north and south tunnel portals and use surface streets to reach the final destination. Of the 44 intersections reported, 9 would be particularly affected by the tolled Bored Tunnel Alternative. The intersections that would experience the greatest increase in delay in the central area are on Fourth Avenue during the PM peak hour: the intersections of Fourth Avenue at Pine Street, Seneca Street, Spring Street, Madison Street, Marion Street, and Columbia Street. Fourth Avenue would operate under congested or near-congested conditions with the non-tolled Bored Tunnel Alternative; therefore, any additional volume is expected to result in increased delays and congestion along this corridor.

North Area

- The tolled Bored Tunnel Alternative is expected to affect LOS at more intersections in the north area than the central or south areas. Of the 34 intersections reported, 19 would be particularly affected.
- The north area is expected to experience greater effects on intersection LOS because drivers would have relatively few opportunities to divert away from SR 99 to alternate routes. With the tolled Bored Tunnel Alternative, drivers would divert from SR 99 to surface streets just before entering the bored tunnel. As a result, diverted traffic is forecasted to cause congested operations at three key intersections: Second Avenue at Denny Way, Fifth Avenue at Denny Way, and Dexter Avenue at Denny Way. Intersections forecasted to improve under tolling conditions include Fifth Avenue N. at Mercer Street and Westlake Avenue N. at Mercer Street.

Cut-and-Cover Tunnel Alternative

- The tolled Cut-and-Cover Tunnel Alternative is likely to affect LOS at intersections in each of the three areas. Some ramp volumes are expected to increase with tolled conditions compared to non-tolled conditions because drivers would divert away from the SR 99 corridor to alternate routes to avoid the tolled facility. In particular, with tolled conditions, a large portion of traffic that would use the Elliott/Western ramps with non-tolled conditions is expected to divert from the SR 99 corridor to surface streets. Traffic volumes on alternate routes, including Alaskan Way, Second Avenue, and Fourth Avenue are expected to increase under the tolled Cut-and-Cover Tunnel Alternative.

<u>*South Area*</u>

- In the south area, the available diversion routes for SR 99 with the tolled Cut-and-Cover Tunnel Alternative include First Avenue S., Second Avenue S., and Fourth Avenue S. Some traffic would exit the SR 99 corridor via the ramps at Alaskan Way, while other traffic would divert from the SR 99 corridor farther south. Of the 29 intersections reported, 15 would be particularly affected by the tolled Cut-and-Cover Tunnel Alternative. The intersections that would experience the greatest delay are First Avenue at Yesler Way, Alaskan Way at S. Dearborn Street, Fourth Avenue S. at S. Jackson Street, and Fourth Avenue S. at Airport Way S. Several intersection are forecasted to improve with the tolled conditions, including East Frontage Road at S. Royal Brougham Way, East Frontage Road at S. Atlantic Street, and East Marginal Way S. at S. Atlantic Street.

<u>*Central Area*</u>

- In the central area, the available diversion routes for SR 99 include north-south arterials such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. Of the 44 intersections reported, 9 would be particularly affected by the tolled Cut-and-Cover Tunnel Alternative. The intersections that would experience the greatest increase in delay in the central area during the PM peak hour are Fourth Avenue at Madison Street, Marion Street, and Columbia Street. Fourth Avenue would operate under congested or near-congested conditions with the non-tolled Cut-and-Cover Tunnel Alternative; therefore, any additional volume is expected to result in increased delays and congestion along this corridor.

<u>*North Area*</u>

- The tolled Cut-and-Cover Tunnel Alternative is expected to affect LOS at more intersections in the north area than the central or south areas. Of the 30 intersections reported, 15 would be particularly affected with tolled conditions. Drivers would have few opportunities to divert from SR 99 to alternate routes in the north. As a result, diverted traffic would tend to concentrate at a few key intersections along Dexter Avenue N., Sixth Avenue N., and Denny Way, resulting in very congested conditions.

Elevated Structure Alternative

- The tolled Elevated Structure Alternative is likely to affect LOS at intersections in each of the three areas. Some ramp volumes are expected to increase with tolled conditions compared to non-tolled conditions because drivers would divert away from the SR 99 corridor to alternate routes to avoid the toll. In particular, with tolled conditions, a large portion of traffic that would use the Elliott/Western ramps with non-tolled conditions is expected to divert from the SR 99 corridor via the midtown ramps at Seneca and Columbia Streets. The traffic volumes on alternate routes such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue are expected to increase under the tolled Elevated Structure Alternative.

South Area

- In the south area, the available diversion routes for SR 99 with the tolled Elevated Structure Alternative include First Avenue S., Second Avenue S., and Fourth Avenue S. Some traffic would exit the SR 99 corridor via the ramps at Alaskan Way, while other trips would divert from the SR 99 corridor farther south. Of the 29 intersections reported, 13 would be particularly affected by the tolled Elevated Structure Alternative. The intersections that would experience the greatest delay are First Avenue at Yesler Way, Alaskan Way S. at S. Dearborn Street, Fourth Avenue S. at S. Jackson Street, and Fourth Avenue S. at Airport Way S. The following intersections are forecasted to show improvements in delay under AM peak hour tolled conditions: East Frontage Road at S. Atlantic Street, First Avenue S. at S. Atlantic Street, and First Avenue S. at S. Holgate Street.

Central Area

- The tolled Elevated Structure Alternative is expected to affect LOS at more intersections in the central area than the north or south areas. In particular, volumes on the Columbia and Seneca ramps are expected to increase significantly (20 to 80 percent) with the tolled Elevated Structure Alternative. Of the 44 intersections reported, 16 would be particularly affected with tolled conditions. The intersections that would experience the greatest delays are the intersections along Second Avenue between University and Columbia Streets and the intersections along Fourth Avenue between Seneca and Columbia Streets.

North Area

- The tolled Elevated Structure Alternative is expected to affect LOS at 14 of the 30 intersections reported in the north area. Drivers would have few opportunities to divert from SR 99 to alternate routes in the north. As a result, diverted traffic would tend to concentrate at a few key intersections along Dexter Avenue N., Sixth Avenue N., and Denny Way, resulting in very congested conditions.

7.4.1 Tolled Bored Tunnel Alternative

The modeling results indicate that a portion of traffic projected to use the bored tunnel under the non-tolled Bored Tunnel Alternative would shift to I-5 and city streets under tolled conditions. Please see Section 7.2 for a specific discussion of the volume of traffic expected to divert from SR 99 with the tolled Bored Tunnel Alternative. The shift of traffic is likely to occur in the form of a "domino" effect. For example, with tolled conditions, some traffic would shift to city streets, which in turn may cause some traffic that previous used city streets to shift to I-5. In other words, SR 99 traffic would not be the only traffic shifting to other facilities.

The modeling results indicate that this diverted traffic may have little effect on peak hour operations on I-5, resulting in increases in travel times of 2 minutes or less (see Section 7.5 for more detail about travel times), but it would have a larger effect on trips using the north-south arterials such as Alaskan Way, Second Avenue, and Fourth Avenue. Vehicle volumes are expected to increase on these streets, resulting in increased congestion and delay at specific intersections, which are discussed in the following subsections.

7.4.1.1 South Area

In the south area, the available diversion routes for SR 99 include First Avenue S., Second Avenue S., and Fourth Avenue S. Some of this traffic would exit the SR 99 corridor via the ramps at Alaskan Way S. at S. Dearborn Street, while other trips would divert from the SR 99 corridor farther to the south.

Exhibit 7-56 shows the projected LOS at signalized intersections in the south area. Of the 29 intersections reported, 7 to 8 would be particularly affected by the tolled Bored Tunnel Alternative. During the AM peak hour, the intersections that would be most affected include:

- First Avenue at Yesler Way
- Second Avenue S. at S. Main Street
- Second Avenue S. at S. Jackson Street
- Fourth Avenue S. at S. Jackson Street
- Fourth Avenue S. at Airport Way S.

These affected intersections are all on the available diversion routes for SR 99 listed above.

LOS at several intersections is forecasted to improve under tolled conditions, including East Marginal Way S. at S. Atlantic Street and Colorado Avenue at S. Atlantic Street. These improvements in intersection delay are related to changes in travel patterns in the south area.

During the PM peak hour, the intersections that would be most affected by the tolled Bored Tunnel Alternative include First Avenue at Yesler Way, Second Avenue S. at S. Jackson Street, Fourth Avenue S. at S. Jackson Street, Fourth Avenue S. at Airport Way S., Fourth Avenue S. at S. Holgate Street, and Fourth Avenue S. at S. Lander Street.

Exhibit 7-56. Signalized Intersection Level of Service and Average Vehicle Delay, South Area – Bored Tunnel Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Alaskan Way	Yesler Way	D	42	D	39	B	18	B	13
Alaskan Way S.	S. Main Street	B	13	B	15	A	6	A	4
Alaskan Way S.	S. Jackson Street	B	10	A	8	A	4	A	3
Alaskan Way S.	S. King Street	C	28	C	28	B	19	B	15
Alaskan Way S.	S. Dearborn Street	D	41	D	55	C	24	D	39
East Frontage Road	S. Royal Brougham Way/SR 99 ramps	B	11	B	15	C	23	C	24
East Frontage Road	S. Atlantic Street	D	43	C	30	C	26	B	17
East Marginal Way S.	h-shaped overcrossing	C	28	C	26	B	18	B	16
East Marginal Way S./Terminal 46	S. Atlantic Street	E	77	C	30	D	43	D	50
East Marginal Way S.	S. Hanford Street	D	37	D	41	C	32	C	34
Colorado Avenue	S. Atlantic Street	E	56	D	46	D	49	C	26
First Avenue	Yesler Way	D	39	F	97	F	105	F	178
First Avenue S.	S. Main Street	B	13	B	17	B	10	A	8
First Avenue S.	S. Jackson Street	B	20	C	20	B	17	B	17
First Avenue S.	S. King Street	C	24	C	21	D	39	D	45
First Avenue S.	S. Dearborn Street	B	18	C	21	C	23	D	42
First Avenue S.	S. Royal Brougham Way	C	28	C	26	C	28	D	35
First Avenue S.	S. Atlantic Street	D	39	D	38	F	111	F	107
First Avenue S.	S. Holgate Street	D	47	D	48	C	33	C	33
First Avenue S.	S. Lander Street	C	20	C	20	D	38	C	29
Second Avenue.	Yesler Way	B	13	C	27	B	16	B	20
Second Avenue S.	S. Main Street	C	31	F	88	C	33	D	44

Exhibit 7-56. Signalized Intersection Level of Service and Average Vehicle Delay, South Area – Bored Tunnel Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Second Avenue S.	S. Jackson Street	D	45	F	137	F	103	F	146
Fourth Avenue S.	S. Main Street	A	8	A	6	A	6	A	6
Fourth Avenue S.	S. Jackson Street	D	41	F	86	D	52	F	130
Fourth Avenue S.	Airport Way S.	E	61	F	125	E	57	F	100
Fourth Avenue S.	S. Royal Brougham	D	36	C	30	F	82	E	77
Fourth Avenue S.	S. Holgate Street	C	28	D	45	E	57	F	154
Fourth Avenue S.	S. Lander Street	C	24	C	22	C	28	E	66

Note: LOS = level of service

7.4.1.2 Central Area

In the central area, the available diversion routes for SR 99 include north-south arterial such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. Additional traffic would exit SR 99 at the north and south portals with the tolled Bored Tunnel Alternative and use surface streets instead of SR 99 to reach the final destinations.

Exhibit 7-57 shows the projected LOS at signalized intersections in the central area. Of the 44 intersections reported, 9 would be particularly affected by the tolled Bored Tunnel Alternative. During the AM peak hour, the intersections that would be most affected are Second Avenue at Spring Street, Second Avenue at Marion Street, and Fourth Avenue at Columbia Street. These intersections are expected to operate under constrained conditions due to the greater use of Second and Fourth Avenues as routes through the CBD with tolled conditions.

During the PM peak hour, the intersections that would be most affected are First Avenue at Spring Street; Second Avenue at Marion Street; and Fourth Avenue at Pine, Seneca, Spring, Madison, Marion, and Columbia Streets. These intersections are expected to operate under constrained conditions due to the greater use of Second and Fourth Avenues as routes through the CBD with tolled conditions. The intersections affected during both the AM and PM peak hours are all on the available north-south diversion routes for SR 99 listed above.

7.4.1.3 North Area

Tolling is expected to affect LOS at more intersections in the north area than the central or south areas. Of the 34 intersections reported, 19 would be particularly affected by the tolled Bored Tunnel Alternative.

Exhibit 7-58 shows the projected LOS at signalized intersections in the north area. The north area is expected to experience greater effects on intersection LOS because drivers would have relative few opportunities to divert away from SR 99 to alternate routes. With the tolled Bored Tunnel Alternative, drivers would divert from SR 99 to surface streets just before entering the bored tunnel. As a result, diverted traffic would tend to concentrate on several key intersections, which are indicated below.

During the AM peak hour, the intersections that would be most affected by the tolled Bored Tunnel Alternative are W. Mercer Place at Elliott Avenue W., First Avenue at Denny Way, Fifth Avenue N. at Broad Street, Fifth Avenue N. at Roy Street, Dexter Avenue N. at Denny Way, Dexter Avenue N. at Aloha Street, and Ninth Avenue N. at Mercer Street. The intersections forecasted to improve under tolling conditions include Fifth Avenue N. at Mercer Street, and Westlake Avenue N. at Mercer Street.

Exhibit 7-57. Signalized Intersection Level of Service and Average Vehicle Delay, Central Area – Bored Tunnel Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Alaskan Way	Madison Street	A	6	A	6	B	14	B	14
Alaskan Way	Marion Street	B	11	C	20	B	13	B	14
Alaskan Way	Columbia Street	B	18	C	20	A	9	A	6
Elliott Avenue	Broad Street	C	25	C	39	D	39	D	44
Elliott Avenue	Wall Street	B	13	B	13	B	11	B	16
Elliott Avenue	Bell Street	A	2	A	2	A	3	A	2
Western Avenue	Broad Street	B	17	C	25	E	70	E	58
Western Avenue	Wall Street	C	27	B	19	C	28	C	27
Western Avenue	Battery Street/SR 99 off-ramp	A	2	A	2	A	3	A	3
Western Avenue	Spring Street	B	17	B	19	B	11	B	11
Western Avenue	Madison Street	B	18	B	17	B	20	C	23
Western Avenue	Marion Street	C	21	C	21	B	12	B	11
First Avenue	Seneca Street	B	19	C	25	C	23	C	28
First Avenue	Spring Street	D	40	D	43	C	32	E	59
First Avenue	Madison Street	B	10	A	7	B	12	B	13
First Avenue	Marion Street	B	17	C	33	B	15	B	17
First Avenue	Columbia Street	A	9	A	9	C	21	B	15
Second Avenue	Wall Street	B	17	C	21	B	17	C	21
Second Avenue	Battery Street	A	6	A	7	A	8	A	8
Second Avenue	Bell Street	A	6	A	5	A	10	B	14
Second Avenue	Pine Street	B	10	B	11	B	18	D	35
Second Avenue	Pike Street	B	14	B	14	B	10	B	14

Exhibit 7-57. Signalized Intersection Level of Service and Average Vehicle Delay, Central Area – Bored Tunnel Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Second Avenue	Union Street	B	15	B	17	B	17	D	51
Second Avenue	University Street	B	14	C	25	C	21	D	47
Second Avenue	Seneca Street	B	18	C	23	B	11	C	28
Second Avenue	Spring Street	D	39	F	101	B	14	D	36
Second Avenue	Madison Street	C	32	C	33	C	25	C	30
Second Avenue	Marion Street	E	60	F	142	E	72	F	139
Second Avenue	Columbia Street	A	8	A	7	C	30	A	7
Second Avenue	Cherry Street	B	11	C	35	B	13	B	12
Fourth Avenue	Wall Street	A	7	A	8	A	6	B	16
Fourth Avenue	Battery Street	B	13	B	10	C	20	C	25
Fourth Avenue	Bell Street	A	7	A	7	A	10	B	13
Fourth Avenue	Blanchard Street	A	8	A	7	A	8	B	11
Fourth Avenue	Pine Street	C	22	D	36	C	27	E	56
Fourth Avenue	Pike Street	B	18	D	42	C	33	D	48
Fourth Avenue	Union Street	B	12	B	17	B	15	D	39
Fourth Avenue	University Street	A	8	A	7	D	50	C	30
Fourth Avenue	Seneca Street	B	15	C	24	E	56	F	91
Fourth Avenue	Spring Street	D	39	C	31	D	36	E	61
Fourth Avenue	Madison Street	E	66	E	72	D	53	F	92
Fourth Avenue	Marion Street	C	20	D	50	D	46	F	124
Fourth Avenue	Columbia Street	E	79	F	111	D	42	E	61
Fourth Avenue	Cherry Street	B	16	B	17	B	12	B	18

Note: LOS = level of service

Exhibit 7-58. Signalized Intersection Level of Service and Average Vehicle Delay, North Area – Bored Tunnel Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Western Avenue W.	Elliott Avenue W.	B	15	C	23	D	48	E	58
W. Mercer Place	Elliott Avenue W.	E	68	F	115	F	103	F	156
First Avenue	Denny Way	E	67	F	129	E	64	D	51
Second Avenue	Denny Way	A	9	B	12	B	15	F	107
Broad Street	Denny Way	B	17	B	18	C	28	D	49
Fifth Avenue	Denny Way	B	15	D	50	C	33	E	69
Fifth Avenue N.	Broad Street	D	39	E	59	D	41	E	60
Fifth Avenue N.	Harrison Street	B	12	A	7	A	9	B	11
Fifth Avenue N.	Mercer Street	E	66	D	38	F	94	E	78
Fifth Avenue N.	Roy Street	E	62	F	96	D	47	F	96
Taylor Avenue N.	Mercer Street	B	20	C	35	D	35	C	21
Sixth Avenue	Battery Street	B	11	B	16	E	79	F	171
Sixth Avenue	Denny Way	C	28	D	44	C	25	E	71
Sixth Avenue N.	John Street	A	10	A	7	A	9	A	8
Sixth Avenue N.	Thomas Street	A	9	B	11	B	12	B	14
Sixth Avenue N.	Harrison Street	B	18	A	10	B	14	B	13
Sixth Avenue N.	Republican/SR 99 on-ramp	A	5	A	3	A	1	A	1
Sixth Avenue N.	Mercer Street	A	9	A	7	B	18	B	15
Aurora Avenue	Denny Way	D	40	C	34	F	82	E	75
Aurora Avenue	John Street	A	10	B	12	B	11	C	26
Aurora Avenue	Thomas Street	B	17	C	21	D	36	C	27
Aurora Avenue	Harrison Street	C	21	C	25	B	15	B	16
Dexter Avenue	Denny Way	F	137	F	182	F	81	F	246
Dexter Avenue N.	John Street	A	9	A	10	A	9	B	16
Dexter Avenue N.	Thomas Street	B	14	B	13	B	19	F	92
Dexter Avenue N.	Harrison Street	B	13	B	16	B	13	D	50

Exhibit 7-58. Signalized Intersection Level of Service and Average Vehicle Delay, North Area – Bored Tunnel Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)		Bored Tunnel Alternative (Non-Tolled)		Bored Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Dexter Avenue N.	Republican/SR 99 off-ramp	C	28	C	27	D	38	C	22
Dexter Avenue N.	Mercer Street	E	61	E	71	E	78	F	99
Dexter Avenue N.	Roy Street	C	26	C	21	C	20	E	66
Dexter Avenue N.	Aloha Street	C	35	E	73	C	25	E	56
Ninth Avenue N.	Mercer Street	C	35	E	68	F	90	F	133
Westlake Avenue N.	Mercer Street	E	79	E	58	F	171	F	185
Fairview Avenue N.	Valley Street	D	48	D	45	D	47	D	43
Fairview Avenue N./I-5 ramp	Mercer Street	E	68	E	71	F	188	F	199

Note: LOS = level of service

During the PM peak hour, the intersections that would be most affected by the tolled Bored Tunnel Alternative are Western Avenue W. at Elliott Avenue W., W. Mercer Place at Elliott Avenue W., Second Avenue N. at Denny Way, Fifth Avenue N. at Denny Way, Fifth Avenue N. at Broad Street, Fifth Avenue N. at Roy Street, Sixth Avenue N. at Battery Street, Sixth Avenue N. at Denny Way, Dexter Avenue N. at Denny Way, Dexter Avenue N. at Thomas Street, Dexter Avenue N. at Mercer Street, Dexter Avenue N. at Roy Street, Dexter Avenue N. at Aloha Street, Ninth Avenue N. at Mercer Street, Westlake Avenue N. at Mercer Street, and Fairview Avenue N at Mercer Street. The intersections forecasted to improve under tolling conditions include First Avenue at Denny Way, Fifth Avenue N. at Mercer Street, and Aurora Avenue at Denny Way.

7.4.2 Cut-and-Cover Tunnel Alternative

The modeling results indicate that some traffic projected to use the cut-and-cover tunnel under the non-tolled Cut-and-Cover Tunnel Alternative would shift to I-5 and city streets under tolled conditions. Please see Section 7.2 for a specific discussion of the volume of traffic expected to divert from SR 99 with the tolled Cut-and-Cover Tunnel Alternative. The shift of traffic is likely to occur in the form of a "domino" effect. For example, with tolled conditions, some traffic would shift to city streets, which in turn may cause some traffic that previously used city streets to shift to I-5. In other words, SR 99 traffic would not be the only traffic shifting to other facilities.

The modeling results indicate that this diverted traffic may have little effect on the peak hour operations of I-5, resulting in increases in travel times of 2 minutes or less (see Section 7.5 for more detail about travel times), but it would have a larger effect on trips using the north-south arterials such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. With the tolled Cut-and-Cover Tunnel Alternative, a large percentage of drivers who would divert from the SR 99 corridor to city streets are drivers who would use SR 99 and the Elliott/Western ramps with the non-tolled Cut-and-Cover Tunnel Alternative. With tolled conditions, many of these drivers are expected to reroute to Alaskan Way and other surface streets to avoid paying the toll. Vehicle volumes are expected to increase on these streets, resulting in increased congestion and delay at specific intersections, which discussed in the following subsections.

7.4.2.1 South Area

In the south area, the available diversion routes for SR 99 include First Avenue S., Second Avenue S., and Fourth Avenue S. Some of this traffic would exit the SR 99 corridor via the ramps at Alaskan Way, while other trips would divert from the SR 99 corridor farther to the south.

Exhibit 7-59 shows the projected LOS at signalized intersections in the south area. Of the 29 intersections reported, 15 would be particularly affected by the tolled Cut-and-Cover Tunnel Alternative. During the AM peak hour, the intersections that would be most affected are First Avenue S. at S. Holgate Street, Fourth Avenue S. at S. Jackson Street, and Fourth Avenue S. at Airport Way S. The following intersections are forecasted to show improvements in delay under tolled conditions: East Frontage Road at S. Royal Brougham Way, East Frontage Road at S. Atlantic Street, East Marginal Way S at S. Atlantic Street, Colorado Avenue at S. Atlantic Street, and First Avenue S. at S. Atlantic Street. These forecasted improvements are expected as a result of changes in travel patterns as traffic diverts away from SR 99 due to tolling.

During the PM peak hour, the intersections that would be most affected are Alaskan Way at S. Dearborn Street; First Avenue at Yesler Way; First Avenue S. at S. King Street; First Avenue S. at S Dearborn Street; and Fourth Avenue S. at S. Jackson Street, S. Royal Brougham Way, S. Holgate Street, and S. Lander Street. These affected intersections are all on the available diversion routes for SR 99 listed above. Operations at the intersection of First Avenue S. at S. Atlantic Street are forecasted to improve during 2030 PM peak hour tolled conditions.

7.4.2.2 Central Area

In the central area, the available diversion routes for SR 99 include north-south arterials such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. Under the tolled Cut-and-Cover Tunnel Alternative, additional traffic would exit SR 99 at the north and south portals of the cut-and-cover tunnel and use surface streets instead of SR 99 to reach the final destinations.

As stated previously, with the tolled Cut-and-Cover Tunnel Alternative, a large percentage of drivers who would divert from the SR 99 corridor to city streets are drivers who would use SR 99 and the Elliott/Western ramps with the non-tolled Cut-and-Cover Tunnel Alternative. With tolled conditions, many of these drivers are expected to reroute to Alaskan Way and other surface streets to avoid paying the toll. Vehicle volumes are expected to increase on these streets, resulting in increased congestion and delay at specific intersections, which are discussed below. During the AM peak hour, volumes on Alaskan Way, near Lenora Street, are forecasted to increase approximately 45 percent in the northbound direction and more than 200 percent in the southbound direction. During the PM peak hour, volumes on Alaskan Way near Lenora Street are expected to increase approximately 20 percent in the northbound direction and 45 percent in the southbound direction. However, even with the expected increase in volumes under tolled conditions, operations at signalized intersections along Alaskan Way in the central area are still forecasted to be LOS D or better.

Exhibit 7-59. Signalized Intersection Level of Service and Average Vehicle Delay, South Area – Cut-and-Cover Tunnel Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Alaskan Way	Yesler Way	C	21	B	18	B	13	C	31
Alaskan Way S.	S. Main Street	A	6	A	7	A	5	C	33
Alaskan Way S.	S. Jackson Street	B	15	B	12	A	4	C	23
Alaskan Way S.	S. King Street	C	22	B	16	A	6	D	40
Alaskan Way S.	S. Dearborn Street	C	23	D	41	C	21	E	62
East Frontage Road	S. Royal Brougham Way/SR 99 ramps	E	57	A	7	D	52	A	9
East Frontage Road	S. Atlantic Street	E	73	C	23	C	34	C	26
East Marginal Way S.	h-shaped overcrossing	C	20	C	23	B	15	C	21
East Marginal Way S./Terminal 46	S. Atlantic Street	F	119	C	23	C	29	D	43
East Marginal Way S.	S. Hanford Street	D	37	D	37	C	32	C	35
Colorado Avenue	S. Atlantic Street	F	85	E	69	C	33	D	43
First Avenue	Yesler Way	C	20	C	24	E	75	F	124
First Avenue S.	S. Main Street	B	14	B	13	B	16	C	34
First Avenue S.	S. Jackson Street	B	15	B	16	B	17	D	36
First Avenue S.	S. King Street	B	17	C	22	B	12	E	60
First Avenue S.	S. Dearborn Street	B	17	B	19	B	20	E	72
First Avenue S.	S. Royal Brougham Way	D	37	C	21	C	34	C	30
First Avenue S.	S. Atlantic Street	F	109	F	81	E	71	D	46

Exhibit 7-59. Signalized Intersection Level of Service and Average Vehicle Delay, South Area – Cut-and-Cover Tunnel Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
First Avenue S.	S. Holgate Street	E	55	E	68	C	34	C	32
First Avenue S.	S. Lander Street	C	20	B	19	D	51	C	33
Second Avenue	Yesler Way	B	16	B	14	B	13	B	19
Second Avenue S.	S. Main Street	C	32	C	34	C	35	D	40
Second Avenue S.	S. Jackson Street	D	37	D	45	D	37	D	50
Fourth Avenue S.	S. Main Street	A	4	A	4	A	10	A	8
Fourth Avenue S.	S. Jackson Street	C	30	E	57	D	54	F	86
Fourth Avenue S.	Airport Way S.	D	47	F	136	E	68	E	60
Fourth Avenue S.	S. Royal Brougham Way	D	35	D	49	D	52	E	73
Fourth Avenue S.	S. Holgate Street	C	26	D	45	D	42	E	79
Fourth Avenue S.	S. Lander Street	C	25	C	30	C	32	E	62

Note: LOS = level of service

The largest effects expected with tolled conditions would be along Second Avenue and Fourth Avenue. These arterials are forecasted to operate with high volumes under non-tolled conditions. Increased use of these streets as routes through the CBD with the tolled Cut-and-Cover Tunnel Alternative is expected to cause several intersections along these arterials to operate under constrained conditions.

Exhibit 7-60 shows the projected LOS at signalized intersections in the central area. Of the 44 intersections reported, 9 would be particularly affected by the tolled Cut-and-Cover Tunnel Alternative. During the AM peak hour, the intersections that would be most affected are First Avenue at Spring Street, Second Avenue at Spring Street, Second Avenue at Marion Street, Fourth Avenue at Madison Street, Fourth Avenue at Marion Street, and Fourth Avenue at Columbia Street.

During the PM peak hour, the intersections that would be most affected are Western Avenue at Broad Street, Second Avenue at Spring Street, Fourth Avenue at Spring Street, Fourth Avenue at Madison Street, and Fourth Avenue at Columbia Street. These intersections are expected to operate under constrained conditions due to the greater use of Second and Fourth Avenues as routes through the CBD with tolled conditions. The intersection of Fourth Avenue at Seneca Street is expected to improve from LOS E to LOS D. The intersections affected during both the AM and PM peak hours are all on the available north-south diversion routes for SR 99 listed above.

7.4.2.3 North Area

Tolling is expected to affect LOS at more intersections in the north area than the central or south areas. Of the 30 intersections reported, 15 would be particularly affected by the tolled Cut-and-Cover Tunnel Alternative.

Exhibit 7-61 shows the projected LOS at signalized intersections in the north area. The north area is expected to experience greater effects on intersection LOS because drivers would have few opportunities to divert away from SR 99 to alternate routes. With the tolled Cut-and-Cover Tunnel Alternative, drivers would divert from SR 99 to surface streets just before entering the cut-and-cover tunnel.

As a result, the large traffic diversion would tend to concentrate on a few key intersections along Dexter Avenue N. and Sixth Avenue N., causing very congested conditions. The forecasted traffic diversions due to tolled conditions would also increase volumes, congestion, and delays on other alternate routes such as Mercer Street and Denny Way.

Exhibit 7-60. Signalized Intersection Level of Service and Average Vehicle Delay, Central Area – Cut-and-Cover Tunnel Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Alaskan Way	Madison Street	B	13	B	18	B	19	B	13
Alaskan Way	Marion Street	A	10	A	7	A	6	B	17
Alaskan Way	Columbia Street	A	10	A	7	B	12	C	25
Elliott Avenue	Broad Street	C	35	C	35	D	36	D	55
Elliott Avenue	Wall Street	D	36	B	17	D	40	B	17
Elliott Avenue	Bell Street	A	5	A	3	A	4	A	3
Western Avenue	Broad Street	B	17	D	38	E	70	F	140
Western Avenue	Wall Street	C	30	C	22	C	27	D	36
Western Avenue	Battery Street/SR 99 off-ramp	A	2	A	2	A	1	A	0
Western Avenue	Spring Street	C	27	C	34	C	29	D	36
Western Avenue	Madison Street	B	18	B	20	C	24	C	20
Western Avenue	Marion Street	C	20	C	23	B	18	C	24
First Avenue	Seneca Street	B	18	B	12	C	22	D	54
First Avenue	Spring Street	C	27	E	55	C	27	D	54
First Avenue	Madison Street	A	8	A	8	A	8	A	6
First Avenue	Marion Street	B	14	B	17	B	14	B	13
First Avenue	Columbia Street	B	15	D	37	C	28	C	31
Second Avenue	Wall Street	B	19	C	27	C	25	C	22
Second Avenue	Battery Street	B	10	D	39	B	16	D	35
Second Avenue	Bell Street	A	5	A	9	A	9	B	18
Second Avenue	Pine Street	D	51	D	41	B	18	C	29
Second Avenue	Pike Street	C	22	D	37	B	10	A	8
Second Avenue	Union Street	B	14	B	12	C	25	D	46
Second Avenue	University Street	A	8	D	37	B	14	C	30

Exhibit 7-60. Signalized Intersection Level of Service and Average Vehicle Delay, Central Area – Cut-and-Cover Tunnel Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Second Avenue	Seneca Street	B	18	B	16	B	18	D	42
Second Avenue	Spring Street	C	21	E	80	D	38	E	71
Second Avenue	Madison Street	B	16	B	18	C	21	B	19
Second Avenue	Marion Street	D	43	F	99	C	26	D	48
Second Avenue	Columbia Street	B	17	B	17	B	15	B	14
Second Avenue	Cherry Street	A	7	B	11	B	16	B	18
Fourth Avenue	Wall Street	B	12	C	30	A	9	A	8
Fourth Avenue	Battery Street	B	19	B	19	C	20	B	15
Fourth Avenue	Bell Street	A	6	A	6	A	7	A	8
Fourth Avenue	Blanchard Street	A	7	A	7	A	6	B	10
Fourth Avenue	Pine Street	C	26	D	51	C	20	D	47
Fourth Avenue	Pike Street	C	26	D	50	C	29	D	40
Fourth Avenue	Union Street	B	18	C	22	B	18	C	21
Fourth Avenue	University Street	A	5	A	6	D	39	D	37
Fourth Avenue	Seneca Street	B	15	D	43	E	60	D	51
Fourth Avenue	Spring Street	C	22	C	22	C	21	F	82
Fourth Avenue	Madison Street	D	41	E	75	D	50	F	88
Fourth Avenue	Marion Street	C	27	E	66	C	22	C	22
Fourth Avenue	Columbia Street	D	39	F	110	D	40	F	82
Fourth Avenue	Cherry Street	B	11	B	17	B	13	B	13

Note: LOS = level of service

Exhibit 7-61. Signalized Intersection Level of Service and Average Vehicle Delay, North Area – Cut-and-Cover Tunnel Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Western Avenue W.	Elliott Avenue W.	B	17	C	31	D	49	E	68
W. Mercer Place	Elliott Avenue W.	F	82	F	89	F	114	F	131
First Avenue	Denny Way	D	41	D	47	C	34	D	40
Second Avenue	Denny Way	A	8	A	7	B	10	A	10
Broad Street	Denny Way	C	23	C	23	C	28	C	28
Fifth Avenue	Denny Way	B	14	C	22	C	27	D	54
Fifth Avenue N.	Broad Street	C	21	C	29	D	39	D	51
Fifth Avenue N.	Harrison Street	B	15	B	12	B	16	B	11
Fifth Avenue N.	Mercer Street	D	38	E	64	E	57	E	62
Fifth Avenue N.	Roy Street	C	23	F	116	D	39	F	171
Taylor Avenue N.	Mercer Street	B	11	A	10	A	8	A	10
Sixth Avenue	Battery Street	B	10	B	16	C	30	F	190
Sixth Avenue	Denny Way	A	10	B	15	C	23	C	34
Sixth Avenue N.	Thomas Street	B	16	B	12	B	17	B	16
Sixth Avenue N.	Harrison Street	B	14	C	30	C	23	C	21
Sixth Avenue N.	Republican/SR 99 on-ramp	A	1	A	1	A	2	A	1
Sixth Avenue N.	Mercer Street	B	18	C	23	D	53	F	118
Aurora Avenue NB	Denny Way	F	94	F	161	F	132	F	205
Aurora Avenue SB	Denny Way	D	40	E	67	E	66	F	122
Dexter Avenue	Denny Way	E	73	E	78	F	109	F	298
Dexter Avenue N.	Thomas Street	B	11	B	12	C	25	D	49

Exhibit 7-61. Signalized Intersection Level of Service and Average Vehicle Delay, North Area – Cut-and-Cover Tunnel Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)		Cut-and-Cover Tunnel Alternative (Non-Tolled)		Cut-and-Cover Tunnel Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Dexter Avenue N.	Harrison Street	B	17	C	26	C	27	D	44
Dexter Avenue N.	Republican/SR 99 off-ramp	C	29	D	52	D	49	D	43
Dexter Avenue N.	Mercer Street	D	54	F	90	F	98	F	146
Dexter Avenue N.	Roy Street	D	46	F	97	D	55	F	127
Dexter Avenue N.	Aloha Street	C	29	C	29	D	39	F	98
Ninth Avenue N.	Mercer Street	C	29	C	30	F	101	F	116
Westlake Avenue N.	Mercer Street	E	60	F	95	F	157	F	174
Fairview Avenue N.	Valley Street	D	50	D	47	D	48	D	52
Fairview Avenue N./I-5 ramp	Mercer Street	F	113	F	126	F	201	F	204

Note: LOS = level of service
NB = northbound
SB = southbound

During the AM peak hour, the intersections that would be most affected by the tolled Cut-and-Cover Tunnel Alternative are Fifth Avenue N. at Mercer Street, Fifth Avenue N. at Roy Street, Aurora Avenue (southbound) at Denny Way, Aurora Avenue (northbound) at Denny Way, Dexter Avenue N. at Mercer Street, Dexter Avenue N. at Roy Street, Westlake Avenue N. at Mercer Street, and Fairview Avenue N. at Mercer Street.

During the PM peak hour, the intersections that would be most affected by the tolled Cut-and-Cover Tunnel Alternative are Western Avenue W. at Elliott Avenue W., W. Mercer Place at Elliott Avenue W., Fifth Avenue N. at Roy Street, Sixth Avenue at Battery Street, Sixth Avenue N. at Mercer Street, Aurora Avenue (northbound) at Denny Way, Aurora Avenue (southbound) at Denny Way, Dexter Avenue at Denny Way, Dexter Avenue N. at Mercer Street, Dexter Avenue N. at Roy Street, Dexter Avenue N. at Aloha Street, Ninth Avenue N. at Mercer Street, and Westlake Avenue N. at Mercer Street

7.4.3 Elevated Structure Alternative

The modeling results indicate that some traffic projected to use the elevated structure under the non-tolled Elevated Structure Alternative would shift to I-5 and city streets under tolled conditions. For the analysis, it was assumed the tolls would be collected north of the midtown ramps for the tolled Elevated Structure Alternative. Therefore, volumes on the midtown ramps are expected to increase significantly with tolled conditions, as drivers alter their routes to avoid paying the toll.

Please see Section 7.2 for a specific discussion of the volume of traffic expected to divert from SR 99. The shift of traffic is likely to occur in the form of a “domino” effect. For example, with tolled conditions, some traffic would shift to city streets, which in turn may cause some traffic that previously used city streets to shift to I-5. In other words, SR 99 traffic would not be the only traffic shifting to other facilities.

The modeling results indicate that this diverted traffic may have little effect on peak hour operations of I-5, resulting in increases in travel times of 2 minutes or less (see Section 7.5 for more detail about travel times), but it would have a larger effect on trips using the north-south arterials such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. With the tolled Elevated Structure Alternative, a large percentage of the drivers diverting from the SR 99 corridor to city streets would be drivers who use SR 99 and the Elliott/Western ramps with the non-tolled Elevated Structure Alternative. With tolled conditions, many of these drivers are expected to reroute to use the midtown ramps or Alaskan Way and other surface streets to avoid paying the toll. Vehicle volumes are expected to increase on these streets, resulting in increased congestion and delay at specific intersections, which are discussed in the following subsections.

7.4.3.1 South Area

In the south, the available diversion routes for SR 99 include First Avenue S., Second Avenue S., and Fourth Avenue S. Some of this traffic would exit the SR 99 corridor via the ramps at Alaskan Way, while other trips would divert from the SR 99 corridor farther to the south.

Exhibit 7-62 shows the projected LOS at signalized intersections in the south area. Of the 29 intersections reported, 13 would be particularly affected by the tolled Elevated Structure Alternative. During the AM peak hour, the intersections that would be most affected are Alaskan Way at S Dearborn/SR 99 northbound off-ramp, East Marginal Way S. at S. Atlantic Street, Second Avenue S. at S. Jackson Street, Fourth Avenue S. at S. Jackson Street, and Fourth Avenue S. at Airport Way S.

The following intersections are forecasted to show improvements in delay under AM peak hour tolled conditions: East Frontage Road at S. Atlantic Street, First Avenue S. at S. Atlantic Street, and First Avenue S. at S. Holgate Street.

During the PM peak hour, the intersections that would be most affected by the tolled Elevated Structure Alternative are Alaskan Way at S. Dearborn Street; East Marginal Way S. at S. Atlantic Street; First Avenue at Yesler Way; First Avenue S. at S. King Street; First Avenue S. at S. Dearborn Street; Second Avenue S. at S. Jackson Street; and Fourth Avenue S. at S. Jackson Street, Airport Way S., S. Royal Brougham Way, and S. Holgate Street. These affected intersections are all on the available diversion routes for SR 99 listed above.

7.4.3.2 Central Area

Tolling is expected to affect LOS at more intersections in the central area than the north or south with the tolled Elevated Structure Alternative. Of the 44 intersections reported, 16 would be particularly affected by the tolled Elevated Structure Alternative.

With the tolled Elevated Structure Alternative, a large percentage of drivers who would divert from the SR 99 corridor to city streets are drivers who would use SR 99 and the Elliott/Western ramps with the non-tolled Elevated Structure Alternative. In the central area, the available diversion routes for SR 99 include north-south arterials such as Alaskan Way, First Avenue, Second Avenue, and Fourth Avenue. Additional traffic would exit SR 99 via the midtown ramps at Columbia and Seneca Streets with tolled conditions to avoid paying tolls. In particular, volumes on the Columbia on-ramp are forecasted to increase 80 percent during the AM peak and 20 percent in the PM peak hour. Volumes on the Seneca Street off-ramp are forecasted to increase 25 percent in the AM peak hour and 40 percent in the PM peak hour. Vehicle volumes are expected to increase on these streets, resulting in increased congestion and delay at specific intersections, which are discussed below.

Exhibit 7-62. Signalized Intersection Level of Service and Average Vehicle Delay, South Area – Elevated Structure Alternative

		AM Peak Hour				PM Peak Hour			
		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)	
Street	Cross Street	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Alaskan Way	Yesler Way	B	14	B	16	B	16	C	28
Alaskan Way S.	S. Main Street	A	4	B	10	A	5	D	38
Alaskan Way S.	S. Jackson Street	A	9	B	16	A	6	C	24
Alaskan Way S.	S. King Street	B	13	C	34	A	10	D	41
Alaskan Way S.	S. Dearborn Street	C	26	F	93	C	34	F	92
East Frontage Road	S. Royal Brougham Way/SR 99 ramps	C	26	B	10	D	44	B	15
East Frontage Road	S. Atlantic Street	F	83	C	22	D	47	D	36
East Marginal Way S.	h-shaped overcrossing	B	10	B	15	A	9	B	18
East Marginal Way S./ Terminal 46	S. Atlantic Street	F	95	F	112	D	47	F	88
East Marginal Way S.	S. Hanford Street	D	37	D	37	C	32	C	33
Colorado Avenue	S. Atlantic Street	D	46	D	47	D	37	D	38
First Avenue	Yesler Way	C	22	C	30	F	138	F	223
First Avenue S.	S. Main Street	B	16	B	18	C	21	D	39
First Avenue S.	S. Jackson Street	C	21	C	31	B	18	C	34
First Avenue S.	S. King Street	B	17	D	43	B	17	E	74
First Avenue S.	S. Dearborn Street	B	15	C	28	C	28	F	123
First Avenue S.	S. Royal Brougham Way	C	29	B	19	D	39	D	51
First Avenue S.	S. Atlantic Street	F	135	D	55	F	91	F	93

Exhibit 7-62. Signalized Intersection Level of Service and Average Vehicle Delay, South Area – Elevated Structure Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
First Avenue S.	S. Holgate Street	E	55	D	42	C	22	D	37
First Avenue S.	S. Lander Street	C	20	C	20	C	24	C	22
Second Avenue	Yesler Way	B	16	B	16	B	13	C	25
Second Avenue S.	S. Main Street	C	32	D	45	C	20	C	24
Second Avenue S.	S. Jackson Street	D	37	F	91	D	48	F	115
Fourth Avenue S.	S. Main Street	A	4	A	8	A	8	A	7
Fourth Avenue S.	S. Jackson Street	C	30	E	79	E	61	F	83
Fourth Avenue S.	Airport Way S.	D	47	F	143	E	62	F	89
Fourth Avenue S.	S. Royal Brougham	D	35	C	27	D	45	E	72
Fourth Avenue S.	S. Holgate Street	C	26	C	26	D	44	F	96
Fourth Avenue S.	S. Lander Street	C	25	C	21	C	22	D	53

Note: LOS = level of service

The largest effects due to the tolled Elevated Structure Alternative are expected along First Avenue, Second Avenue, and Fourth Avenue. These arterials are forecasted to operate with high volumes under the non-tolled Elevated Structure Alternative. Increased use of these streets as routes through the CBD with tolled conditions is expected to cause several intersections along these arterials to operate under constrained conditions.

Exhibit 7-63 shows the projected LOS at signalized intersections in the central area. During the AM peak hour, the intersections that would be most affected are First Avenue at Spring Street, First Avenue at Marion Street, Second Avenue at Seneca Street, Second Avenue at Spring Street, Second Avenue at Marion Street, Fourth Avenue at Pine Street, and most intersections along Fourth Avenue between Seneca Street and Columbia Street.

During the PM peak hour, the intersections that would be most affected are Western Avenue at Broad Street, First Avenue at Seneca Street, First Avenue at Spring Street, First Avenue at Columbia Street, the intersections along Second Avenue between University Street and Columbia Street, Fourth Avenue at Pine Street, Fourth Avenue at Madison Street, Fourth Avenue at Seneca Street, and Fourth Avenue at Columbia Street. These intersections are expected to operate under constrained conditions due to the increase in traffic traveling to and from the Columbia and Seneca Street ramps, as well as the greater use of First, Second, and Fourth Avenues as routes through the CBD with tolled conditions. The intersections affected during both the AM and PM peak hours are all on the available north-south diversion routes to SR 99 listed above.

7.4.3.3 North Area

Tolling is expected to affect LOS at 14 of the 30 intersections reported in the north area with the tolled Elevated Structure Alternative.

Exhibit 7-64 shows the projected LOS at signalized intersections in the north area. The north area is expected to experience significant effects on intersection LOS because drivers would have few opportunities to divert away from SR 99 to alternate routes. With the tolled Elevated Structure Alternative, drivers would divert from SR 99 to surface streets just before entering the Battery Street Tunnel. As a result, large traffic diversion would tend to concentrate on a few key intersections along Dexter and Sixth Avenues N., resulting in very congested conditions. The forecasted traffic diversions due to tolling would also increase volumes, congestion, and delays on other alternate routes such as Mercer Street and Denny Way.

During the AM peak hour, the intersections that would be most affected by the tolled Elevated Structure Alternative are W. Mercer Place at Elliott Avenue W., Fifth Avenue N. at Mercer Street, Fifth Avenue N. at Roy Street, Aurora Avenue

Exhibit 7-63. Signalized Intersection Level of Service and Average Vehicle Delay, Central Area – Elevated Structure Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Alaskan Way	Madison Street	B	13	B	14	C	21	C	29
Alaskan Way	Marion Street	A	9	A	8	A	9	B	19
Alaskan Way	Columbia Street	A	7	A	7	A	7	C	24
Elliott Avenue	Broad Street	D	46	D	40	D	46	D	44
Elliott Avenue	Wall Street	D	46	C	23	D	44	B	15
Elliott Avenue	Bell Street	A	4	A	3	A	6	A	4
Western Avenue	Broad Street	B	19	C	28	E	64	F	110
Western Avenue	Wall Street	D	38	B	19	C	33	C	24
Western Avenue	Battery Street/SR 99 off-ramp	A	2	A	0	A	4	A	3
Western Avenue	Spring Street	B	15	B	19	B	17	C	28
Western Avenue	Madison Street	B	18	B	19	C	26	D	46
Western Avenue	Marion Street	B	19	C	31	C	22	C	22
First Avenue	Seneca Street	C	29	D	55	C	28	F	92
First Avenue	Spring Street	B	13	F	85	C	21	F	108
First Avenue	Madison Street	A	7	A	8	B	11	B	11
First Avenue	Marion Street	C	26	E	76	C	25	D	55
First Avenue	Columbia Street	B	15	D	45	F	143	F	237
Second Avenue	Wall Street	C	20	C	24	B	20	C	27
Second Avenue	Battery Street	A	8	B	11	B	14	B	12
Second Avenue	Bell Street	A	10	B	13	B	15	B	15
Second Avenue	Pine Street	B	10	B	14	B	14	C	23
Second Avenue	Pike Street	C	25	D	36	B	15	B	16
Second Avenue	Union Street	B	18	C	22	C	24	D	49

Exhibit 7-63. Signalized Intersection Level of Service and Average Vehicle Delay, Central Area – Elevated Structure Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Second Avenue	University Street	B	11	C	24	C	24	E	70
Second Avenue	Seneca Street	D	43	F	155	C	27	F	121
Second Avenue	Spring Street	C	24	F	96	C	28	F	93
Second Avenue	Madison Street	B	19	C	23	B	17	E	67
Second Avenue	Marion Street	D	49	F	126	D	48	F	116
Second Avenue	Columbia Street	B	17	C	24	C	30	E	71
Second Avenue	Cherry Street	B	14	C	23	A	9	B	14
Fourth Avenue	Wall Street	A	9	C	23	B	12	B	19
Fourth Avenue	Battery Street	B	11	B	13	D	44	C	26
Fourth Avenue	Bell Street	A	8	A	8	A	9	B	12
Fourth Avenue	Blanchard Street	A	10	B	10	A	8	B	12
Fourth Avenue	Pine Street	D	36	E	69	D	42	F	109
Fourth Avenue	Pike Street	C	29	D	39	D	39	D	43
Fourth Avenue	Union Street	B	14	A	10	B	13	B	16
Fourth Avenue	University Street	A	4	B	13	D	45	C	28
Fourth Avenue	Seneca Street	A	10	E	61	E	56	E	80
Fourth Avenue	Spring Street	B	11	E	59	C	24	D	55
Fourth Avenue	Madison Street	C	34	E	69	D	41	F	93
Fourth Avenue	Marion Street	C	27	D	39	B	19	C	24
Fourth Avenue	Columbia Street	C	25	F	97	C	32	F	97
Fourth Avenue	Cherry Street	B	15	D	45	B	10	B	18

Note: LOS = level of service

Exhibit 7-64. Signalized Intersection Level of Service and Average Vehicle Delay, North Area – Elevated Structure Alternative

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Western Avenue W.	Elliott Avenue W.	D	47	D	54	D	46	E	62
W. Mercer Place	Elliott Avenue W.	E	79	F	86	F	107	F	118
First Avenue	Denny Way	D	41	D	49	D	42	D	43
Second Avenue	Denny Way	A	10	A	9	B	11	B	12
Broad Street	Denny Way	C	24	C	21	C	25	C	31
Fifth Avenue	Denny Way	B	19	D	38	B	19	D	35
Fifth Avenue N.	Broad Street	D	44	D	39	C	30	D	40
Fifth Avenue N.	Harrison Street	B	11	B	10	B	12	B	11
Fifth Avenue N.	Mercer Street	D	55	F	93	F	86	F	102
Fifth Avenue N.	Roy Street	C	23	F	91	D	36	D	52
Taylor Avenue N.	Mercer Street	B	15	B	15	A	7	B	10
Sixth Avenue	Battery Street	B	13	C	20	C	26	E	56
Sixth Avenue	Denny Way	C	25	C	22	C	34	D	41
Sixth Avenue N.	Thomas Street	B	16	B	15	C	26	C	26
Sixth Avenue N.	Harrison Street	C	23	C	22	B	18	C	21
Sixth Avenue N.	Republican/SR 99 on-ramp	A	1	A	1	A	2	A	2
Sixth Avenue N.	Mercer Street	C	21	D	36	D	45	E	79
Aurora Avenue NB	Denny Way	F	112	F	153	F	152	F	238
Aurora Avenue SB	Denny Way	D	39	E	76	F	85	F	113
Dexter Avenue	Denny Way	D	40	D	53	F	158	F	164
Dexter Avenue N.	Thomas Street	B	10	B	17	C	34	F	99
Dexter Avenue N.	Harrison Street	B	16	C	21	C	31	D	37
Dexter Avenue N.	Republican/SR 99 off-ramp	D	38	C	34	D	37	C	34
Dexter Avenue N.	Mercer Street	E	62	F	83	F	124	F	146

Exhibit 7-64. Signalized Intersection Level of Service and Average Vehicle Delay, North Area – Elevated Structure Alternative (continued)

Street	Cross Street	AM Peak Hour				PM Peak Hour			
		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)		Elevated Structure Alternative (Non-Tolled)		Elevated Structure Alternative (Tolled)	
		LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Dexter Avenue N.	Roy Street	D	36	F	119	D	55	F	131
Dexter Avenue N.	Aloha Street	C	29	C	29	D	52	D	52
Ninth Avenue N.	Mercer Street	D	38	E	70	F	93	F	109
Westlake Avenue N.	Mercer Street	E	70	F	135	F	189	F	186
Fairview Avenue N.	Valley Street	D	53	D	55	D	47	D	46
Fairview Avenue N./I-5 ramp	Mercer Street	F	81	F	107	F	220	F	213

Notes: LOS = level of service
NB = northbound
SB = southbound

(northbound) at Denny Way, Aurora Avenue (southbound) at Denny Way, Dexter Avenue N. at Mercer Street, Dexter Avenue N. at Roy Street, Ninth Avenue N. at Mercer Street, Westlake Avenue N. at Mercer Street, and Fairview Avenue N. at Mercer Street.

During the PM peak hour, the intersections that would be most affected by the tolled Elevated Structure Alternative are Western Avenue W. at Elliott Avenue W., W. Mercer Place at Elliott Avenue W., Fifth Avenue N. at Mercer Street, Sixth Avenue N. at Battery Street, Sixth Avenue N. at Mercer Street, Aurora (northbound) at Denny Way, Aurora (southbound) at Denny Way, Dexter Avenue N. at Thomas Street, Dexter Avenue N. at Mercer Street, Dexter Avenue N. at Roy Street, and Ninth Avenue N. at Mercer Street.

7.5 AM and PM Peak Hour Travel Times

Travel times are presented in this section as a comparison of performance between the non-tolled and tolled conditions for all three build alternatives. Due to the variability of tolling effects on traffic conditions and traffic diversion levels, comparisons between the non-tolled and tolled conditions are discussed for each alternative independently. For example, conditions of the tolled Bored Tunnel Alternative are compared only to those of the non-tolled Bored Tunnel Alternative. Cross-comparisons of tolled conditions among the alternatives are not provided.

The key findings related to effects on peak hour travel times are the following:

- Projected travel times for the majority of the routes targeted with tolled conditions are generally expected to be longer than those with non-tolled conditions. This increase in travel time would primarily be due to traffic diversion to surface streets and the resulting conditions at the ramp diversion points and on alternate routes such as downtown arterials.
- For the tolled Bored Tunnel Alternative, the estimated travel times are longer than those for non-tolled conditions, with the exception of the westbound Mercer Street route and the Ballard to S. Spokane Street route via Mercer Street and the bored tunnel. The routes with the greatest difference between non-tolled and tolled conditions include Second Avenue (southbound), Fourth Avenue (northbound), and Ballard to S. Spokane Street via Alaskan Way.
- For the Cut-and-Cover Tunnel Alternative with tolled conditions, the effects on travel times would be more pronounced due to the higher levels of expected diversion and capacity constraints related to the configurations on mainline SR 99. Increases in travel time for some routes such as the Woodland Park to CBD route may exceed 10 minutes.

- For the Elevated Structure Alternative, travel times with tolled conditions would be longer than those with non-tolled conditions, especially for key routes linking outlying areas with the CBD.

7.5.1 Tolled Bored Tunnel Alternative

Travel times for the tolled Bored Tunnel Alternative are compared to those of the non-tolled Bored Tunnel Alternative in Exhibit 7-65.

Exhibit 7-65. Corridor Travel Times – Bored Tunnel Alternative

	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
West Seattle to CBD (Fourth Avenue and Seneca Street)				
Southbound	-	-	27	31
Northbound	26	32	-	-
Woodland Park to CBD (Fourth Avenue and Seneca Street)				
Southbound	22	27	-	-
Northbound	-	-	18	23
Woodland Park to S. Spokane Street				
Southbound	16	16	15	14
Northbound	12	12	16	15
Ballard Bridge to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)				
Southbound	17	20	19	23
Northbound	21	27	24	27
Ballard Bridge to S. Spokane Street (via Mercer Street, Bored Tunnel)				
Southbound	17	18	22	24
Northbound	25	24	27	27
Northgate to Boeing Access Road (via I-5)				
Southbound	31	32	38	40
Northbound	32	33	35	36
Mercer Street (I-5 to Elliott Avenue W.)				
Westbound	12	12	14	13
Eastbound	8	9	13	15
Second Avenue (Wall Street to S. Royal Brougham Way)				
Southbound	15	20	16	24
Fourth Avenue (S. Royal Brougham Way to Battery Street)				
Northbound	12	21	14	21

Note: CBD = Central Business District

7.5.1.1 West Seattle to CBD

This route represents trips between West Seattle (specifically the intersection of California Avenue S.W. at S.W. Alaska Street) and the CBD (specifically at Fourth Avenue and Seneca Street) and is presented for the peak traffic flow direction only (i.e., northbound in the AM peak hour and southbound in the PM peak hour).

For the northbound direction during the AM peak hour, travel times with tolled conditions would be approximately 6 minutes longer than those with non-tolled conditions. This travel time difference is largely due to the diversion of traffic to surface streets to avoid the toll and the mainline congestion that would develop at the off-ramp area to the stadiums. Similarly for the southbound direction during the PM peak hour, travel times with tolled conditions would be longer than those with non-tolled conditions due to added traffic on surface street and longer delays in accessing the stadium area southbound on-ramp.

7.5.1.2 Woodland Park to CBD

This route covers trips between N. 50th Street/SR 99 and downtown Seattle and is again presented for the peak direction trip only (i.e., southbound in the AM peak hour and northbound in the PM peak hour).

For the southbound direction during the AM peak hour, travel times with tolled conditions would be longer than those with non-tolled conditions, primarily as a result of mainline trips diverting to surface streets as drivers avoid the toll. Such diversion would cause added friction on the SR 99 mainline, particularly at off-ramp locations, thereby affecting capacity for through-traffic paying the toll to continue along SR 99. In the northbound direction during the PM peak hour, travel times for the CBD to Woodland Park route would also be longer with tolled conditions. These increases would be due to the large number of trips diverting to surface streets to avoid paying the toll and the increased congestion and added travel time that would likely develop on arterials such as Aurora Avenue from Denny Way to the northbound on-ramp to SR 99.

7.5.1.3 Woodland Park to S. Spokane Street

This route represents one of the longer travel time paths identified that aligns directly through the study area along the SR 99 corridor and captures trips not originating or destined to the Seattle CBD. Travel times for both peak and off-peak directions are provided to gauge a wide range of users during peak hours.

During the AM peak hour, projected travel times in both the southbound and northbound directions would be similar under tolled conditions versus non-tolled conditions, because the effects of traffic diversion would be offset by faster speeds outside of the ramp exit points. However, during the PM peak hour, the projected travel times with tolled conditions are shorter than those with non-tolled conditions. Such decreases would be due in part to the directional distribution of mainline traffic, with higher volumes radiating away from the CBD. With the emphasized distribution of traffic leaving downtown Seattle, diversion at the entry points of the bored tunnel for traffic entering downtown Seattle would be far less influential on mainline traffic operations, because the overall volumes would be generally lower. For traffic leaving downtown Seattle, congestion would be more heavily concentrated on surface streets and arterials accessing the on-ramps in the stadium and South Lake Union areas as opposed to mainline SR 99.

7.5.1.4 Ballard Bridge to S. Spokane Street – Via Alaskan Way

This route reflects the travel times for longer distance through-trips on surface streets between Ballard and S. Spokane Street that connect two neighborhoods on the fringe of the study area.

During the AM peak hour, the projected travel times for both the southbound and northbound directions are longer with tolled conditions than with non-tolled conditions. These travel time increases are expected because many of the diverted trips to avoid paying the toll would use Alaskan Way as an alternative to the bored tunnel. The added volumes from this diverted traffic would result in longer delays and more congestion in both directions. The projected travel time increases are most dramatic for the northbound direction, with a difference of nearly 7 minutes expected between the tolled and non-tolled conditions. PM peak hour travel times would also be longer with tolled conditions than with non-tolled conditions due to the diverted trips on surface streets such as Alaskan Way.

7.5.1.5 Ballard Bridge to S. Spokane Street – Via Mercer Street and Bored Tunnel

This route connects Ballard with S. Spokane Street via Mercer Street and the bored tunnel. For the southbound direction, this route connects Ballard to S. Spokane Street via a combination of Elliott Avenue, W. Mercer Place, Mercer Street, Sixth Avenue N. and the bored tunnel (SR 99). The northbound routing would be via the bored tunnel (SR 99), the Republican Street off-ramp to Dexter Avenue N., Mercer Street, Fifth Avenue N., Roy Street, Queen Anne Avenue N., W. Mercer Street, W. Mercer Place, to Elliott Avenue.

During the AM peak hour, the projected travel times in the southbound direction are expected to be slightly longer with tolled conditions compared to non-tolled conditions but slightly shorter for the northbound direction. The southbound increase would likely be due to interactions between diverted traffic from southbound SR 99, which mixes with traffic on Mercer Street on the route from Ballard to S. Spokane Street. The northbound decrease in travel times can be largely attributed to the modest volumes in the bored tunnel and similarly low volumes at the Republican off-ramp.

During the PM peak hour, projected travel times are similar or slightly longer with tolled conditions compared to non-tolled conditions for both directions of travel. This is also expected because the projected volumes on the surface street network are generally higher in the PM peak hour; therefore, added trips that are diverted from SR 99 to surface arterials such as Dexter Avenue N. or Mercer Street would result in high congestion levels and long travel times overall.

7.5.1.6 Northgate to Boeing Access Road – Via I-5

This route defines the I-5 path between Northgate and the area near Boeing Field and reflects longer distance trips outside of, but parallel to, the SR 99 corridor.

The projected travel times between Northgate and Boeing Access Road are generally the highest of any route evaluated, primarily due to the physical distance covered by the route. The results of the AM and PM peak hour operational analysis indicate that travel times in both directions would generally be longer with tolled conditions compared to non-tolled conditions. Travel times during the PM peak hour would be longer than those for the AM peak hour due to higher volumes during the evening commute period. The differences in projected travel times between tolled and non-tolled conditions would mainly be due to diversion from SR 99 to alternate facilities such as I-5 and the higher volumes and congestion levels that would develop as a result of this diversion.

7.5.1.7 Mercer Street – I-5 to Elliott Avenue W.

The Mercer Street route is defined by trips along Mercer Street between Elliott Avenue and I-5 and captures traffic to and from the SR 99 and I-5 corridors. For the Bored Tunnel Alternative, the widening and two-way conversion of Mercer Street is included between Fifth Avenue N. and I-5.

During the AM peak hour, travel times in the westbound direction would be similar for tolled conditions compared to non-tolled conditions. Diversion to surface streets with tolled conditions would not affect westbound travel to any large degree because diverted trips from SR 99 would not heavily mix with westbound traffic on Mercer Street. However, travel times for the eastbound direction would be longer with tolled conditions due to direct interactions between eastbound traffic on Mercer Street and diverted trips from SR 99 heading to surface streets and I-5.

During the PM peak hour, the same general trend is apparent; travel times in the westbound direction would be slightly shorter and travel times in the eastbound direction would be longer with tolled conditions.

7.5.1.8 Second Avenue – Wall Street to S. Royal Brougham Way

The Second Avenue route represents trips made in the southbound direction within the Seattle CBD. Travel times for this route help to gauge how well the surface street network for the Bored Tunnel Alternative can accommodate toll-related diversion traffic.

During the AM peak hour, projected travel times along Second Avenue are much longer with tolled conditions compared to non-tolled conditions. These increases are expected because diversion to surface streets would occur as a large proportion of drivers seek to avoid the toll in the southbound direction, particularly during the AM peak hour. Similar to the AM peak hour, PM peak hour travel times on Second Avenue with tolled conditions are expected to be far longer compared to those with non-tolled conditions.

7.5.1.9 Fourth Avenue – S. Royal Brougham Way to Battery Street

The Fourth Avenue route represents trips made in the northbound direction within the Seattle CBD. Similar to the travel times on the Second Avenue route, travel times for the Fourth Avenue route help to gauge how well the surface street network for the Bored Tunnel Alternative can accommodate toll-related diversion traffic.

During the AM peak hour, the projected travel times along Fourth Avenue are again much longer with tolled conditions compared to non-tolled conditions, primarily due to the heavy toll diversion rates during the AM peak hour. Travel time increases on Fourth Avenue during the PM peak hour with tolled conditions (compared to non-tolled conditions) are expected to be similar to those during the AM peak hour.

7.5.2 Tolled Cut-and-Cover Tunnel Alternative

Travel times for the tolled Cut-and-Cover Tunnel Alternative are compared to those of the non-tolled Cut-and-Cover Tunnel Alternative in Exhibit 7-66. For the purposes of the forecasting and analysis work, tolling points were assumed to capture all on-ramps and off-ramps within the SR 99 study area

7.5.2.1 West Seattle to CBD

For the northbound direction during the AM peak hour, travel times with tolled conditions would be approximately 8 to 9 minutes longer than those with non-tolled conditions. This increase would mainly be the result of traffic diversion to surface streets to avoid the toll and the mainline congestion that would develop at the off-ramp to the stadium area. For the southbound direction during the PM peak hour, travel times with tolled conditions would be longer than those with non-tolled conditions due to added traffic on surface streets and longer delays in accessing the stadium area southbound on-ramp.

7.5.2.2 Woodland Park to CBD

For the southbound direction during the AM peak hour, travel times with tolled conditions would be noticeably longer than those with non-tolled conditions primarily due to mainline trips diverting to surface streets as drivers avoid paying the toll. Such diversion would cause added friction on the SR 99 mainline, particularly at the off-ramp locations at Aloha Street, Roy Street, and to Denny Way, thereby affecting capacity for through-traffic paying the toll to continue along SR 99. In the northbound direction during the PM peak hour, travel times from the CBD to Woodland Park would also be longer with tolled conditions, although there would not be as dramatic a difference as the difference in the AM peak hour (for southbound traffic). Nonetheless, this increase in northbound travel time would be due to the high large of trips diverting to surface streets to avoid paying the toll and the increased congestion and added travel time that would likely develop on arterials connecting to the various downstream SR 99 on-ramps.

Exhibit 7-66. Corridor Travel Times – Cut-and-Cover Tunnel Alternative

	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
West Seattle to CBD (Fourth Avenue and Seneca Street)				
Southbound	-	-	24	29
Northbound	23	32	-	-
Woodland Park to CBD (Fourth Avenue and Seneca Street)				
Southbound	24	35	-	-
Northbound	-	-	17	20
Woodland Park to S. Spokane Street				
Southbound	20	22	14	16
Northbound	12	14	17	15
Ballard to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)				
Southbound	16	16	21	16
Northbound	15	17	23	23
Ballard to S. Spokane Street (via Mercer Street, Bored Tunnel)				
Southbound	N/A	N/A	N/A	N/A
Northbound	N/A	N/A	N/A	N/A
Northgate to Boeing Access Road				
Southbound	31	32	38	39
Northbound	32	33	35	36
Mercer Street (I-5 to Elliott)				
Westbound	8	8	11	12
Eastbound	9	9	16	18
Second Avenue (Wall Street to S. Royal Brougham Way)				
Southbound	14	20	14	21
Fourth Avenue (S. Royal Brougham Way to Battery Street)				
Northbound	12	21	13	21

Note: CBD = Central Business District

7.5.2.3 Woodland Park to S. Spokane Street

The projected travel times during the AM peak hour in both the southbound and northbound directions are slightly longer with tolled conditions versus non-tolled conditions. This increase is expected because the greatest amount of diversion would occur during the morning commute period, thereby resulting in added levels of mainline friction at the ends of the study segment for those traveling into downtown Seattle. However, during the PM peak hour, the projected travel times for tolled conditions are longer only for the southbound direction.

Travel times in the northbound direction during the PM peak hour would be shorter than those for non-tolled conditions. The decrease in northbound travel time would generally be the result of directional distribution of mainline traffic, with higher volumes traveling out of the CBD. With the emphasized distribution of traffic leaving downtown Seattle, diversion at the entry points of the bored tunnel for traffic traveling into downtown Seattle would be far less influential on mainline traffic operations, because the overall volumes would generally be lower. Congestion for those traveling out of downtown Seattle would be more heavily concentrated on surface streets and arterials accessing the on-ramps in the stadium and South Lake Union areas, as opposed to mainline SR 99.

7.5.2.4 Ballard Bridge to S. Spokane Street – Via Alaskan Way and SR 99

During the AM peak hour, travel times in the southbound direction are expected to be similar between tolled and non-tolled conditions. The effects of fewer trips using the southbound Elliott Avenue on-ramp to avoid the toll charge are not likely be noticeable because the overall volumes would be reasonably low at the critical downstream merge point onto SR 99. In the northbound direction during the AM peak hour, travel times for tolled conditions would be longer than those for non-tolled conditions, due in large part to the mainline congestion that would occur at the stadium off-ramp. Travel times during the PM peak hour would likely reflect a reverse trend compared to the results for the AM peak hour, with shorter tolled travel times in the southbound direction (due to fewer trips using the Elliott Avenue on-ramp and more pronounced merge interactions) and similar tolled and non-tolled travel times in the northbound direction.

7.5.2.5 Northgate to Boeing Access Road – Via I-5

Travel times between Northgate and Boeing Access Road would generally be the longest of any route evaluated, due in large part to the physical distance covered by the route. The results for the AM and PM peak hours indicate that travel times in both directions would be generally longer with tolled conditions compared to non-tolled conditions. Travel times during the PM peak hour would be longer than those for the AM peak hour due to the higher volumes during the evening commute period. The travel time differences between tolled and non-tolled conditions would mainly be due to diversion from SR 99 to alternate facilities such as I-5 and the higher volumes and congestion levels due to this diversion.

7.5.2.6 Mercer Street – I-5 to Elliott Avenue W.

During the AM peak hour, travel times in both the eastbound and westbound directions would be nearly identical under tolled conditions and non-tolled conditions. Diversion from SR 99 to surface streets with tolled conditions would not affect eastbound or westbound travel to any large degree despite some increase in overall demand levels. During the PM peak hour, the travel times in both directions would be slightly longer with tolled conditions due to more intense mixing of diverted trips from SR 99 with local trips on surface arterials.

7.5.2.7 Second Avenue – Wall Street to S. Royal Brougham Way

During the AM peak hour, travel times along Second Avenue would be significantly longer with tolled conditions compared to non-tolled conditions. Such increases in travel time are expected because diversion to surface streets would occur as a large proportion of drivers seek to avoid the toll in the southbound direction, particularly during the AM peak hour. For the PM peak hour, travel times on Second Avenue are again expected to be much longer with tolled conditions, with increases similar to those in the AM peak hour. This would mainly be a result of the higher overall volumes in the PM peak hour despite the lower level of toll-related diversion (compared to the AM peak hour).

7.5.2.8 Fourth Avenue – S. Royal Brougham Way to Battery Street

The projected travel times along Fourth Avenue during the AM peak hour would also be much longer with tolled conditions compared to non-tolled conditions. This would be due to the heavy toll diversion rates during the AM peak hour. During the PM peak hour, travel times would be similarly longer with tolled conditions, again mainly due to the higher overall volumes in the PM peak hour despite the lower level of toll-related diversion (compared to the AM peak hour).

7.5.3 Elevated Structure Alternative

Travel times for the tolled Elevated Structure Alternative are compared to those of the non-tolled Elevated Structure Alternative in Exhibit 7-67. As with the Cut-and-Cover Tunnel Alternative, tolling points for the Elevated Structure Alternative were assumed to capture all on-ramps and off-ramps within the SR 99 study area.

7.5.3.1 West Seattle to CBD

During the AM peak hour in the northbound direction, travel times with tolled conditions would likely be 12 to 13 minutes longer than those with non-tolled conditions. This increase would mainly be the result of traffic diversion to surface streets to avoid the toll charge and the stadium area off-ramp congestion that would affect mainline traffic flow. During the PM peak hour in the southbound direction, travel times with tolled conditions would be about 3 to 4 minutes longer than those with non-tolled conditions due to added traffic on surface streets and longer delays in access the stadium area southbound on-ramp. Southbound mainline traffic flow during the PM peak hour would be far less affected by tolling than northbound traffic during the AM peak hour.

Exhibit 7-67. Corridor Travel Times – Elevated Structure Alternative

	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
West Seattle to CBD (Fourth Avenue and Seneca Street)				
Southbound	-	-	22	25
Northbound	20	33	-	-
Woodland Park to CBD (Fourth Avenue and Seneca Street)				
Southbound	24	32	-	-
Northbound	-	-	17	20
Woodland Park to S. Spokane Street				
Southbound	19	21	15	16
Northbound	13	22	16	19
Ballard to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)				
Southbound	15	15	20	17
Northbound	16	26	25	25
Ballard to S. Spokane Street (via Mercer Street, Bored Tunnel)				
Southbound	N/A	N/A	N/A	N/A
Northbound	N/A	N/A	N/A	N/A
Northgate to Boeing Access Road				
Southbound	31	32	38	40
Northbound	32	33	34	36
Mercer Street (I-5 to Elliott)				
Westbound	9	10	11	12
Eastbound	10	11	15	15
Second Avenue (Wall Street to S. Royal Brougham Way)				
Southbound	14	21	14	23
Fourth Avenue (S. Royal Brougham Way to Battery Street)				
Northbound	12	21	13	21

Notes: CBD = Central Business District
N/A = not applicable

7.5.3.2 Woodland Park to CBD

For the southbound direction during the AM peak hour, travel times with tolled conditions would be noticeably longer (8 to 9 minute increase) than those with non-tolled conditions, primarily due to mainline trips diverting to surface streets as drivers avoid the toll charge. Such diversion would cause added friction on the SR 99 mainline, particularly at the off-ramp locations at Aloha Street, Roy Street, and to Denny Way, thereby affecting capacity for through-traffic paying the toll to continue along SR 99. In the northbound direction during the PM peak hour, travel times from the CBD to Woodland Park are again likely to be longer with tolled conditions, although there would not be as dramatic a difference as that in the AM peak hour (for southbound traffic). Nonetheless, this northbound increase in travel time would be due to the large number of trips diverting to surface streets and the increased congestion developing on arterials that connect to the SR 99 on-ramps.

7.5.3.3 Woodland Park to S. Spokane Street

Travel times during the AM peak hour for both the southbound and northbound directions are expected to be slightly longer with tolled conditions versus non-tolled conditions. These increases are expected because the greatest amount of diversion would occur during the morning commute period, thereby resulting in added levels of mainline friction at the ends of the study segment for traffic traveling into downtown Seattle. Increases in travel time in the northbound direction would be particularly pronounced as a result of heavy backups at the SR 99 off-ramp to the stadium area. During the PM peak hour, the projected travel times with tolled conditions are slightly longer for both directions due to diversion effects at the various off-ramp locations in the north and south ends of the study segment.

7.5.3.4 Ballard Bridge to S. Spokane Street – Via Alaskan Way and SR 99

Travel times in the southbound direction during the AM peak hour with tolled conditions are expected to be similar to those with non-tolled conditions, because the diversion effects would be offset by higher speeds downstream of the Denny Way off-ramp. In the northbound direction during the AM peak hour, travel times with tolled conditions would be longer than those with non-tolled conditions, due in large part to the mainline congestion that would occur at the SR 99 stadium area off-ramp. Travel times during the PM peak hour would likely mirror the AM peak hour trend, with shorter tolled travel times in the southbound direction (again due to fewer trips using the Elliott Avenue on-ramp) and similar tolled travel times in the northbound direction.

7.5.3.5 Northgate to Boeing Access Road – Via I-5

Travel times between Northgate and Boeing Access Road would be the longest of any route evaluated, due in large part to the physical distance covered by the route. The analysis results for the AM and PM peak hours indicate that travel times in both directions would be generally similar although slightly longer with tolled conditions compared to non-tolled conditions. Similarly, the results indicate that travel times during the PM peak hour would be longer than those during the AM peak hour due to the higher volumes during the evening commute period. The travel time differences between the tolled and non-tolled conditions, although minor, would mainly be due to diversion from SR 99 to alternate facilities such as I-5 and the higher volumes and congestion levels that would develop as a result of this diversion.

7.5.3.6 Mercer Street – I-5 to Elliott Avenue W.

During the AM peak hour, travel times in the westbound direction are expected to be nearly identical under tolled and non-tolled conditions. Diversion effects from SR 99 to surface streets with tolled conditions would be minimal for westbound traffic because these trips would not interact significantly with through-traffic on Mercer Street. Travel times for the eastbound direction would be slightly longer with tolled conditions due to the direct interactions between eastbound traffic on Mercer Street and diverted trips from SR 99 heading to surface streets and farther onto I-5 at Fairview Avenue N. In the PM peak hour, the travel times for the westbound direction would be slightly longer with tolled conditions due to more intense mixing of diverted trips from SR 99 with local trips on surface arterials. However, travel times for the eastbound direction would be similar for both conditions (tolled and non-tolled) because diversion traffic would be less likely to interact with eastbound trips on Mercer Street.

7.5.3.7 Second Avenue – Wall Street to S. Royal Brougham Way

Similar to the travel times along Second Avenue for the other alternatives, the travel times during the AM peak hour under the Elevated Structure Alternative would be significantly longer with tolled conditions compared to non-tolled conditions. Such increases in travel time are expected because diversion to surface streets would occur as a large proportion of drivers seek to avoid the toll in the southbound direction, particularly during the AM peak hour. For the PM peak hour, travel times on Second Avenue are also expected to be much longer with tolled conditions, with increases similar to those in the AM peak hour. These differences would mainly be a result of the higher overall volumes in the PM peak hour despite the lower level of diversion (compared to the AM peak hour).

7.5.3.8 Fourth Avenue – S. Royal Brougham Way to Battery Street

The projected travel times along Fourth Avenue for the AM peak hour are much longer with tolled conditions compared to non-tolled conditions. These differences are again due to the heavy toll diversion expected during the AM peak hour. For the PM peak hour, travel times would be similarly longer with tolled conditions, again mainly due to the higher overall volumes in the PM peak hour despite the lower level of toll-related traffic diversion (compared to the AM peak hour).

7.6 Roadway Connectivity and Access

The effects on roadway connectivity and access would be no different between tolled and non-tolled conditions.

7.7 Transit Services

This section describes the operational effects on public transit with tolled and non-tolled conditions for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives for the horizon year (2030). Operational effects on transit would result from road network changes, priority treatments, new connections to transit service, and other characteristics associated with the alternatives. The expected effects include variations in transit ridership, changes in travel times along major transit corridors, and major changes in LOS at intersections with public transit operations.

To determine the effects of the tolled build alternatives on transit ridership, two pieces of information generated by the travel demand model were considered: (1) estimated daily transit demand at three selected screenlines: south (south of S. King Street), central (north of Seneca Street), and north (north of Thomas Street); and (2) estimated daily transit ridership by alternative for travel to, from, and within Seattle's Center City. Transit demand information was provided for each of the build alternatives with tolled and non-tolled conditions.

Peak hour travel times identified in this section include transit times where available. Transit travel times were identified for the Elliott Avenue, Aurora Avenue, Second Avenue, and Fourth Avenue corridors, which include existing and potential added bus lanes. Estimated transit travel times were identified by means of the VISSIM operations model, which can forecast travel times that take into account operating and dwell times. For the West Seattle corridor, travel times for general-purpose traffic are identified for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives with tolled and non-tolled conditions.

A third factor affecting transit operations is the LOS at those intersections served by buses. Using the results discussed in Section 7.4 for the south, central, and north areas, transit operations at intersections operating at LOS E or LOS F were evaluated. As is the case with transit travel times, LOS conditions for the Viaduct Closed (No Build Alternative) were not analyzed. However, under the Viaduct Closed (No Build Alternative), traffic conditions at intersections would be extremely congested to the point of affecting the speed and reliability of buses operating at these locations.

The key findings related to effects on transit services are the following:

- For the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, under both non-tolled and tolled conditions, transit access for buses operating between south King County/West Seattle and downtown Seattle would no longer be available at the Columbia and Seneca Street ramps. However, transit service would be provided to locations in south downtown would be provided more directly.

- For the Bored Tunnel Alternative, under both non-tolled and tolled conditions, the existing on- and off-ramps at Denny Way would be closed and replaced with downtown access ramps to and from SR 99 three blocks farther north near Republican Street.
- In the north area, transit-only lanes in both directions would be provided by the Bored Tunnel Alternative, under both non-tolled and tolled conditions, from south of Harrison Street through the Denny Way intersection.
- For the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives, transit demand and travel mode shares would generally be the same under both non-tolled and tolled conditions.
- Along the Elliott Avenue corridor, transit travel times for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives would be generally the same under both tolled and non-tolled conditions. The greatest variation would be for the Cut-and-Cover Tunnel Alternative; under tolled conditions, the transit travel time for trips traveling out of downtown Seattle during the PM peak hour would be approximately 2 minutes longer than the travel time under non-tolled conditions.
- For the Aurora Avenue corridor, the greatest variations in transit travel times would be additional time for trips traveling into downtown Seattle during the AM peak hour under tolled conditions for all three build alternatives. The increased transit travel times under tolled conditions would range between 2 minutes for the Bored Tunnel Alternative and approximately 6 minutes for the Cut-and-Cover Tunnel Alternative.
- For the Second and Fourth Avenue corridors, tolled conditions under all three build alternatives would result in some increases in transit travel times compared to those under non-tolled conditions. However, there would be a relatively narrow range of additional travel time under tolled conditions, between approximately 1 and 5 minutes for all three alternatives.
- For West Seattle to downtown Seattle trips, the greatest variations in travel times would be additional travel time for northbound trips during the AM peak hour under tolled conditions for all three build alternatives. The increased transit travel times under tolled conditions would range between approximately 6 minutes for the Bored Tunnel Alternative and approximately 13 minutes for the Elevated Structure Alternative. However, for transit trips, the availability of the northbound bus-only lane on SR 99 between S. Holgate Street and S. Dearborn Street would result in less travel time for buses than general-purpose traffic.

- For the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives, intersection operations at LOS E and F would be most prevalent in the north area. Most of these intersections would operate at LOS E or F only under tolled conditions. Traffic diversion due to tolling would result in volumes of general-purpose traffic that would affect bus operations, particularly in the area of SR 99 and Denny Way.

7.7.1 Bored Tunnel Alternative

The following subsections identify transit network changes, priority treatments, and operational effects of the Bored Tunnel Alternative with both non-tolled and tolled conditions.

7.7.1.1 Transit Network Changes and Transit Priority Treatments

With the tolled Bored Tunnel Alternative, the Columbia and Seneca Street ramps on SR 99 would be removed, and all transit vehicles currently operating on SR 99 would need to exit and enter SR 99 in the stadium area. This change in transit service coverage would increase the number of buses traveling through south downtown Seattle by approximately 520 buses per day. Northbound buses traveling on SR 99 from West Seattle and south King County would instead use the new ramps located in the stadium area, and then travel on arterials in Pioneer Square to Third and Fourth Avenues to access downtown Seattle.

Although the new stadium area ramps would result in additional transit travel time, transit vehicles traveling on SR 99 to the south end of downtown Seattle would have improved access to locations in SODO, Pioneer Square, and other locations. These markets traditionally have had transit access only via local streets.

In the north area, access changes affecting public transit include one new surface street in South Lake Union area. This street would allow added transit access along the Aurora Avenue corridor and to east-west streets in South Lake Union. This added transit access would be supported by northbound-and southbound bus-only lanes on the new Aurora Avenue surface street in the vicinity of Denny Way.

The network features described for the tolled Bored Tunnel Alternative would also apply to the non-tolled Bored Tunnel Alternative.

7.7.1.2 Modeled Transit Ridership

Exhibit 7-68 summarizes projected daily transit ridership in 2030 identified by means of the regional travel demand model at three selected screenlines for the tolled and non-tolled Bored Tunnel Alternative. The regional travel demand model also identified AM peak hour transit ridership in 2030, which is summarized in Exhibit 7-69.

Exhibit 7-68. Model-Estimated Daily Transit Ridership (Person-Trips) at Selected Screenlines – Bored Tunnel Alternative

	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South (south of S. King Street)	164,900	164,400
Central (north of Seneca Street)	178,000	177,300
North (north of Thomas Street)	168,400	168,000

Exhibit 7-69. Model-Estimated AM Peak Period Transit Ridership (Person-Trips) at Selected Screenlines – Bored Tunnel Alternative

	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
South (south of S. King Street)	56,200	56,130
Central (north of Seneca Street)	54,090	54,270
North (north of Thomas Street)	52,530	52,700

Daily transit ridership in 2030 for the non-tolled Bored Tunnel Alternative would range between 164,900 at the south screenline and 178,000 at the central screenline. In the AM peak period transit ridership for the non-tolled Bored Tunnel Alternative would range between about 52,500 at the north screenline and about 56,200 at the south screenline. Relatively small variations in both daily and AM peak period transit ridership would occur between tolled and non-tolled conditions.

These relatively small variations in AM peak period transit demand would occur even though tolled conditions would likely result in longer travel times and worse operating conditions as compared to non-tolled conditions. These travel times and operating conditions are described in Sections 7.7.1.4 and 7.7.1.5.

A measurable shift to transit by users avoiding tolls on SR 99 is not expected. Both transit users and general-purpose travel would experience longer travel times but not necessarily at equal levels. However, any resulting variations in travel times would not result in measurable shifts from general-purpose travel to transit. Also, because transit service is oriented to users traveling to and from downtown, no transit service is expected to operate in the bored tunnel.

7.7.1.3 Modeled Transit Mode Shares

Daily transit mode shares involving travel within Seattle's Center City for the Bored Tunnel Alternative with both tolled and non-tolled conditions are identified in this section. Transit mode shares are identified for home-based work (i.e., commuting to work) and non-work travel in 2030 to, from, and within the Center City. The transit shares for the Bored Tunnel Alternative with both non-tolled and tolled conditions are identified in Exhibit 7-70.

Exhibit 7-70. Model-Estimated Daily Transit Mode Shares: To, From, and Within Seattle's Center City – Bored Tunnel Alternative

	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Home-based work	41.0%	41.0%
Non-work	10.1%	9.9%

Between the tolled Bored Tunnel Alternative and the non-tolled Bored Tunnel Alternative, relatively small variations in both daily and peak period transit mode shares would occur. These relatively small variations in transit shares would occur even though conditions with tolling would likely result in longer travel times and worse operating conditions as compared to non-tolled conditions. These travel times and operating conditions are described in Sections 7.7.1.4 and 7.7.1.5. Tolling would cause little mode shift for Seattle Center City trips because trips that use the bored tunnel are forecasted to be longer than typical transit trips and would likely be passing through the Center City.

7.7.1.4 Peak Hour Travel Times for Transit Corridors

Exhibit 7-71 shows estimated peak hour travel times in 2030 for the five major transit corridors for the Bored Tunnel Alternative with both non-tolled and tolled conditions. For the Elliott Avenue and Aurora Avenue corridors, the transit travel times were estimated by the VISSIM operations model. For the Second Avenue and Fourth Avenue corridors, the travel times were estimated by the Synchro operations model. Some sections of the West Seattle to CBD corridor reflect general-purpose traffic performance captured as a mix of results from the EMME travel forecasting model, VISSIM, and Synchro. For the Bored Tunnel Alternative, a portion of the West Seattle to CBD corridor would include a northbound bus-only lane on SR 99 north of S. Holgate Street.

7.7.1.4.1 Elliott Avenue Corridor

In the AM peak hour, transit travel times for southbound trips on Elliott Avenue would be approximately the same for the tolled Bored Tunnel Alternative compared to the non-tolled Bored Tunnel Alternative. Some general-traffic diversion resulting from tolling would affect north-south corridors accessing downtown Seattle in the AM peak hour. However, the availability of the bus-only lane on Elliott Avenue would keep the change in transit travel time to a relatively small amount. For northbound trips in the AM peak hour, the travel times with both tolled and non-tolled conditions would be the same. In the PM peak hour, southbound and northbound transit trips in the Elliott Avenue corridor with non-tolled and tolled conditions would be approximately the same at 8 minutes.

Exhibit 7-71. Travel Times Along Major Transit Travel Corridors – Bored Tunnel Alternative

Segment	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Elliott Avenue (South of Ballard Bridge to Denny Way)				
Southbound	8	8	8	8
Northbound	7	7	8	8
Aurora Avenue (South of Aurora Bridge to Denny Way)				
Southbound	6	8	5	5
Northbound	7	8	7	8
Second Avenue (Wall Street to S. Royal Brougham)				
Southbound	14	13	15	17
Fourth Avenue (S. Royal Brougham Way to Battery Street)				
Northbound	14	17	14	15
West Seattle to CBD (Fourth Avenue and Seneca Street)				
Northbound	26	32	18	23
Southbound	16	16	27	31

7.7.1.4.2 Aurora Avenue Corridor

In the AM peak hour, transit travel times for southbound trips on Aurora Avenue would be approximately 2 minutes longer for the tolled Bored Tunnel Alternative compared to the non-tolled Bored Tunnel Alternative. Substantial volumes of general-purpose traffic are expected to be diverted as a result of tolling. In the AM peak hour, these diverted trips would include substantial volumes of vehicle backups for southbound general-purpose traffic exiting SR 99 at the Denny Way ramps. However, the availability of the bus-only lane on the new Aurora Avenue surface street would help to minimize the additional transit travel time associated with tolled conditions.

In the AM and PM peak hours, northbound transit trips on Aurora Avenue for the tolled Bored Tunnel Alternative would take 1 minute more than the same trips with non-tolled conditions. In the PM peak hour, southbound transit trips in the Aurora Avenue corridor for both non-tolled and tolled conditions would be approximately the same at 5 minutes.

7.7.1.4.3 Second and Fourth Avenue Corridors

The expected high volumes of diverted general-purpose traffic occurring with tolled conditions would result in higher traffic volumes affecting downtown Seattle arterials including bus operations on Second and Fourth Avenues. However, with the availability of bus-only lanes on these streets, the variations in travel time between tolled and non-tolled conditions would not be substantial.

For Second Avenue travel (southbound only), estimated transit travel times for the tolled Bored Tunnel Alternative during the AM peak hour would be similar to travel times for the non-tolled Bored Tunnel Alternative. In the PM peak hour, transit travel times on Second Avenue would be 2 minutes more than non-tolled travel times. For Fourth Avenue (northbound only), additional transit travel times in the AM peak hour under tolled conditions would be 3 minutes more than those under non-tolled conditions. In the PM peak hour, estimated travel times for Fourth Avenue would be approximately 1 minute longer under tolled conditions as compared to non-tolled conditions.

The travel times for tolled conditions represent some increases over those for non-tolled conditions; from 7 percent for PM peak hour trips on Fourth Avenue to 21 percent for AM peak hour trips on Fourth Avenue. Transit service would benefit from bus-only lanes on Second and Fourth Avenues as well as limited skip-stop (buses serving every other zone) access to bus zones along each route. While buses would need to operate in general-purpose lanes to skip alternating zones along Second and Fourth Avenues, the availability of the bus-only lanes would still provide a benefit to transit operations.

7.7.1.4.4 West Seattle to CBD Corridor

Travel times for northbound general-purpose traffic during the AM peak hour in the West Seattle to CBD corridor would be approximately 6 minutes longer for the tolled Bored Tunnel Alternative than for the non-tolled Bored Tunnel Alternative. However, with the availability of the northbound bus-only exit lane on SR 99 between S. Holgate Street and S. Royal Brougham Way, reduced transit travel times would occur as compared to general-purpose travel. The savings associated with this bus-only ramp would be approximately 2 minutes, resulting in a net additional transit travel time of 4 minutes for the tolled Bored Tunnel Alternative as compared to the non-tolled Bored Tunnel Alternative. For southbound AM peak hour trips, travel times for both tolled and non-tolled conditions would be almost the same at approximately 16 minutes.

In the PM peak hour, travel times would be approximately 4 to 5 minutes longer with tolled conditions as compared to non-tolled conditions. This additional time would apply to the southbound (PM peak demand) period as well as the lighter northbound transit demand off-peak direction.

7.7.1.5 Intersection Level of Service Changes Affecting Transit

In addition to travel time changes along key corridors, transit service also could be affected by LOS at intersections with bus operations. The following subsections describe LOS at locations with transit service for the Bored Tunnel Alternative with both tolled and non-tolled conditions. Information presented for the south, central, and north areas is based on the LOS analysis results presented in Section 7.4.

The traffic analysis indicated that several locations within the study area with transit operations would be at LOS E or LOS F during peak hours. Intersections that are projected to operate at LOS E or LOS F are most likely to experience substantial congestion. Intersections that operate at LOS A through LOS D would experience little to moderate congestion levels and are generally not of concern. Information is presented for the south, central, and north areas of the study area.

7.7.1.5.1 South Area

Under the Bored Tunnel Alternative, most intersections in the south area would operate at LOS D or better with both non-tolled and tolled conditions. However, seven intersections with bus operations would operate at LOS E or LOS F in 2030. In some locations, these LOS conditions would occur with both non-tolled and tolled conditions, but for most locations these operating conditions would occur only with tolled conditions. The LOS E and LOS F conditions with the tolled Bored Tunnel Alternative would result from higher traffic volumes associated with diverted trips from SR 99 to surface streets in the south area.

At First Avenue and Yesler Way, LOS F would occur in the PM peak hour for both non-tolled and tolled conditions. In the AM peak hour, LOS F would occur at this location only with tolled conditions. At Second Avenue S. and S. Jackson Street, LOS F would occur in the PM peak hour with both non-tolled and tolled conditions, but in the AM peak hour, LOS F would occur only with tolled conditions.

At four locations on Fourth Avenue S., LOS E or LOS F would occur only with tolled conditions:

- Fourth Avenue S. and S. Jackson Street
- Fourth Avenue S. and Airport Way S.
- Fourth Avenue S. and S. Holgate Street
- Fourth Avenue S. and S. Lander Street

Existing bus lanes on Second Avenue S. and Fourth Avenue S. (available during peak hours only) would help minimize LOS effects. Also, the Third Avenue transit corridor, which was not analyzed in terms of LOS (this major transit corridor would have peak period restrictions affecting general-purpose traffic), would help address overall transit capacity operations in the south area.

7.7.1.5.2 Central Area

Under the Bored Tunnel Alternative, most intersections evaluated in the central area, including locations with transit operations, are forecasted to operate at LOS D or better during the AM and PM peak hours. These conditions would occur with both non-tolled and tolled conditions. However, in the central area, seven intersections with bus service would operate at LOS E or LOS F in 2030. At three locations (Second Avenue and Marion Street, Fourth Avenue and Madison Street, and Fourth Avenue and Seneca Street), LOS E or LOS F conditions would occur with both non-tolled and tolled conditions. At four other locations, LOS E or LOS F conditions in the PM peak would occur only with tolled conditions:

- First Avenue and Spring Street
- Fourth Avenue and Spring Street
- Fourth Avenue and Marion Street
- Fourth Avenue and Pine Street

Traffic at these intersections would include substantial bus volumes. With tolled conditions, these volumes would result in part from the diversion of traffic from SR 99 to surface streets in the central area. Also, intersections in this area are all expected to operate under constrained conditions due to greater use of Second and Fourth Avenues as routes through the Seattle CBD as an alternative to the Elliott/Western ramp connection. This ramp connection would not be replaced by the Bored Tunnel Alternative.

Transit priority treatments along Second Avenue and Fourth Avenue would help minimize LOS effects in the central area. Also, the Third Avenue transit corridor, which was not analyzed in terms of LOS (this major transit corridor would have peak period restrictions affecting general-purpose traffic), would help address overall transit capacity operations in the central area.

7.7.1.5.3 North Area

Under the Bored Tunnel Alternative, several intersections evaluated in the north area, including locations with transit operations, are forecasted to operate at LOS E or LOS F during AM and PM peak hours with both tolled and non-tolled conditions:

- W. Mercer Place and Elliott Avenue W. (AM and PM peak hours)
- First Avenue and Denny Way (AM peak hour)
- Fifth Avenue N. and Mercer Street (PM peak hour)
- Aurora Avenue and Denny Way (PM peak hour)

- Dexter Avenue and Denny Way (AM and PM peak hours)
- Dexter Avenue N. and Mercer Street (AM and PM peak hours)
- Westlake Avenue N. and Mercer Street (AM and PM peak hours)
- Ninth Avenue N. and Mercer Street (PM peak hour)

LOS E or LOS F would occur at the following locations for the tolled Bored Tunnel Alternative only:

- Western Avenue W. and Elliott Avenue W. (PM peak hour)
- Second Avenue and Denny Way (PM peak hour)
- Fifth Avenue and Denny Way (PM peak hour)
- Fifth Avenue N. and Broad Street (AM and PM peak hours)
- Sixth Avenue and Denny Way (PM peak hour)
- Dexter Avenue N. and Thomas Street (PM peak hour)
- Dexter Avenue N. and Roy Street (PM peak hour)
- Dexter Avenue N. and Aloha Street (AM and PM peak hours)
- Ninth Avenue N. and Mercer Street (AM peak hour)
- Fairview Avenue N./I-5 ramp (AM and PM hours)

For the Bored Tunnel Alternative, changes in access between SR 99 and the local street grid in the north area would attract additional trips. As a result, some increases in local street congestion that affects transit operations are expected. However, the primary factor contributing to LOS E and LOS F at locations in the north relates to large volumes of trips diverted from SR 99 to surface streets with tolled conditions.

7.7.2 Cut-and-Cover Tunnel Alternative

The following subsections identify transit network changes, priority treatments, and operational effects of the Cut-and-Cover Tunnel Alternative with both non-tolled and tolled conditions.

7.7.2.1 Transit Network Changes and Transit Priority Treatments

For the tolled Cut-and-Cover Tunnel Alternative, the Columbia and Seneca Street ramps on SR 99 would be removed, and all transit vehicles currently operating on SR 99 would need to exit and enter SR 99 in the stadium area. This change in transit service coverage would increase the number of buses traveling through south downtown Seattle by approximately 520 buses per day. Northbound buses traveling on SR 99 from West Seattle and south King County would instead use the new ramps located at the stadium area, and then travel on arterials in Pioneer Square to Third and Fourth Avenues to access the downtown Seattle grid.

Although the new stadium area ramps would result in additional transit travel time, vehicles traveling on SR 99 to the south end of downtown Seattle would have improved access to locations in SODO, Pioneer Square, and other locations in south downtown. These markets traditionally have had transit access only via local streets.

The network features described for the tolled Cut-and-Cover Tunnel Alternative would also apply to the non-tolled Cut-and-Cover Tunnel Alternative.

7.7.2.2 Modeled Transit Ridership

Exhibit 7-72 summarizes projected daily transit ridership in 2030 at three selected screenlines for the Cut-and-Cover Tunnel Alternative. Exhibit 7-73 summarizes projected AM peak period transit ridership in 2030.

Exhibit 7-72. Model-Estimated Daily Transit Ridership (Person-Trips) at Selected Screenlines – Cut-and-Cover Tunnel Alternative

	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South (south of S. King Street)	166,500	166,900
Central (north of Seneca Street)	180,400	179,300
North (north of Thomas Street)	166,700	165,700

Exhibit 7-73. Model-Estimated AM Peak Period Transit Ridership (Person-Trips) at Selected Screenlines – Cut-and-Cover Tunnel Alternative

	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
South (south of S. King Street)	56,600	56,760
Central (north of Seneca Street)	54,690	54,770
North (north of Thomas Street)	52,300	52,360

Daily transit ridership in 2030 for the non-tolled Cut-and-Cover Tunnel Alternative would range between approximately 167,000 trips at the south and north screenlines and 180,400 at the central screenline. In the AM peak, 2030 ridership for the non-tolled Cut-and-Cover Tunnel Alternative would range between 52,300 trips at the north screenline and 56,600 at the south screenline.

Between the tolled Cut-and-Cover Tunnel Alternative and the non-tolled Cut-and-Cover Tunnel Alternative, relatively small variations in both daily and peak period transit ridership would occur. These relatively small variations in peak period transit demand would occur even though conditions with tolling would likely result in longer travel times and worse operating conditions as compared to non-tolled conditions. These travel times and operating conditions are described in Sections 7.7.2.4 and 7.7.2.5.

A shift to transit by users who are avoiding tolls on SR 99 is not expected because transit service is oriented to users traveling to and from downtown, and no transit service is expected to operate in the cut-and-cover tunnel.

7.7.2.3 Modeled Transit Mode Shares

Daily transit mode shares involving travel within Seattle's Center City for the Cut-and-Cover Tunnel Alternative with both tolled and non-tolled conditions are identified in this section. Mode shares are identified for home-based work (i.e., commuting to work) and non-work travel in 2030 to, from, and within Seattle's Center City. The transit shares for the Cut-and-Cover Tunnel Alternative with both non-tolled and tolled conditions are identified in Exhibit 7-74.

Exhibit 7-74. Model-Estimated Daily Transit Mode Shares: To, From, and Within Seattle's Center City – Cut-and-Cover Tunnel Alternative

	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Home-based work	40.9%	41.0%
Non-work	10.0%	9.8%

Between the tolled Cut-and-Cover Tunnel Alternative and the non-tolled Cut-and-Cover Tunnel Alternative, relatively small variations in both daily and peak period transit mode shares would occur. These relatively small variations in peak period transit shares would occur even though conditions with tolling would likely result in longer travel times and worse operating conditions as compared to non-tolled conditions. These travel times and operating conditions are described in Sections 7.7.2.4 and 7.7.2.5.

Tolling would cause little mode shift for Seattle Center City trips since trips that use the cut-and-cover tunnel are forecasted to be longer than typical transit trips and would likely be passing through the Center City.

7.7.2.4 Peak Hour Travel Times for Transit Corridors

Exhibit 7-75 shows estimated peak hour travel times in 2030 for the five major transit corridors for the Cut-and-Cover Tunnel Alternative with both non-tolled and tolled conditions. For the Elliott Avenue and Aurora Avenue corridors, the transit travel times were estimated by the VISSIM operations model. For the Second Avenue and Fourth Avenue corridors, the travel times were estimated by the Synchro operations model. Some sections of the West Seattle to CBD corridor reflect general-purpose traffic performance captured as a mix of results from the EMME travel forecasting model, VISSIM, and Synchro.

Exhibit 7-75. Travel Times Along Major Transit Travel Corridors – Cut-and-Cover Tunnel Alternative

Segment	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Elliott Avenue (South of Ballard Bridge to Denny Way)				
Southbound	8	8	8	8
Northbound	7	8	10	12
Aurora Avenue (South of Aurora Bridge to Denny Way)				
Southbound	9	15	5	9
Northbound	6	6	5	5
Second Avenue (Wall Street to S. Royal Brougham Way)				
Southbound	14	15	15	16
Fourth Avenue (S. Royal Brougham Way to Battery Street)				
Northbound	13	18	13	17
West Seattle to CBD (Fourth Avenue and Seneca Street)				
Northbound	23	32	19	26
Southbound	14	16	24	29

7.7.2.4.1 Elliott Avenue Corridor

In the AM peak hour, transit travel times of 7 to 8 minutes for southbound and northbound trips would be similar for the tolled and non-tolled Cut-and-Cover Tunnel Alternative. In the PM peak hour, southbound travel times for both tolled and non-tolled conditions would be generally similar, approximately 8 minutes. For northbound travel, the tolled Cut-and-Cover Tunnel Alternative would result in approximately 2 additional minutes as compared to the travel time for the non-tolled Cut-and-Cover Tunnel Alternative. These additional minutes would be a result of expected high volumes of PM peak hour trips diverted from SR 99 to alternate north-south surface streets like Elliott Avenue. The bus-only lanes on the Elliott Avenue corridor would help minimize the extent of additional travel time with tolled conditions.

7.7.2.4.2 Aurora Avenue Corridor

In the Aurora Avenue corridor, approximately 6 additional minutes in travel time would occur for trips traveling into downtown Seattle during the AM peak hour with the tolled Cut-and-Cover Tunnel Alternative as compared to non-tolled Cut-and-Cover Tunnel Alternative. Trip diversion involving AM peak hour southbound (peak direction) travel is expected to be substantial. The large volumes of diverted trips would result in traffic backups on Aurora Avenue to the point of affecting transit movements, including buses exiting at the

Denny Way ramps to complete their trips to downtown Seattle. Travel times for northbound trips in the AM peak hour would be similar between tolled and non-tolled conditions for the Cut-and-Cover Tunnel Alternative.

In the PM peak hour, southbound travel times for the tolled Cut-and-Cover Tunnel Alternative would be approximately 4 minutes longer than those for the non-tolled Cut-and-Cover Tunnel Alternative. Even though these trips would occur in the non-peak direction, the volumes diverted from SR 99 to surface streets in the area of the Denny Way ramps would still be substantial. For northbound trips in the PM peak hour, travel times would be the same for both tolled and non-tolled conditions.

7.7.2.4.3 Second and Fourth Avenue Corridors

The expected large volumes of diverted general-purpose traffic occurring with tolled conditions would result in higher volumes affecting downtown Seattle arterials, including bus operations on Second and Fourth Avenues. For Second Avenue travel (southbound only), estimated additional transit travel times for the tolled Cut-and-Cover Tunnel Alternative would be approximately 1 minute in the AM peak hour and 1 minute in the PM peak. Estimated transit travel times for Fourth Avenue travel (northbound only) would be approximately 5 minutes in the AM peak hour and 4 minutes in the PM peak hour.

The additional transit times under tolled conditions represent a broad range of increases over those of the non-tolled Cut-and-Cover Tunnel Alternative; from 7 percent for AM and PM peak hour trips on Second Avenue to 38 percent for AM trips on Fourth Avenue. Transit service would benefit from bus-only lanes on Second Avenue as well as limited skip-stop access (buses serving every other zone) to bus zones along each route.

7.7.2.4.4 West Seattle to CBD Corridor

Travel times for general-purpose northbound traffic during the AM peak hour in the West Seattle to CBD corridor would be approximately 9 minutes longer for the tolled Cut-and-Cover Tunnel Alternative than for the non-tolled Cut-and-Cover Tunnel Alternative. The additional travel time for AM northbound (peak direction) traffic would be attributable to high volumes of traffic diverting from SR 99 to north-south surface streets in the south area. However, for bus trips, the variation in travel times between tolled and non-tolled conditions would be less due to the availability of the northbound bus-only ramp on SR 99 between S. Holgate Street and S. Dearborn Street. The estimated travel time for AM peak hour northbound (peak direction) buses from West Seattle to downtown Seattle would be approximately 3 minutes less than general-purpose travel times. This reduced travel time would apply to both tolled and non-tolled conditions.

For southbound AM peak hour trips, travel times for tolled conditions would be 2 minutes longer than those for non-tolled conditions. In the PM peak hour, northbound travel times for the tolled Cut-and-Cover Tunnel Alternative would be approximately 7 minutes longer than those for the non-tolled Cut-and-Cover Tunnel Alternative. With tolled conditions, the additional travel time for PM peak southbound trips (peak direction) would be approximately 5 minutes as compared to non-tolled conditions.

7.7.2.5 Intersection Level of Service Changes Affecting Transit

In addition to travel time changes along key corridors, transit service also could be affected by LOS conditions at intersections with bus operations. The following subsections summarize results for the Cut-and-Cover Tunnel Alternative with both tolled and non-tolled conditions. Information presented for the south, central, and north areas is based on the LOS analysis results presented in Section 7.4.

The traffic analysis indicated that for the Cut-and-Cover Tunnel Alternative several locations with transit operations would be at LOS E or F during peak hours. Intersections that are projected to operate at LOS E or F are most likely to experience substantial congestion. Intersections that operate at LOS A through D would experience little to moderate congestion levels and are generally not of concern.

7.7.2.5.1 South Area

Under the Cut-and-Cover Tunnel Alternative, a substantial number of intersections in the south area would operate at LOS E or LOS F in 2030. In some locations, these LOS conditions would occur with both non-tolled and tolled conditions, but for most locations, these LOS conditions would occur with tolled conditions only. LOS E and LOS F conditions with tolled conditions would result from higher traffic volumes associated with diverted trips from SR 99 to surface streets in the south area.

LOS E or LOS F conditions affecting transit operations in the south area would all occur along First Avenue S. and Fourth Avenue S. At the intersection of First Avenue at Yesler Way, LOS E would occur in the PM peak hour for tolled conditions only. But in the AM peak hour, LOS F would occur at this location only for non-tolled conditions. Farther south on First Avenue S. at S. King and S. Dearborn Streets, LOS E would occur in the PM peak hour with tolled conditions only. At First Avenue S. and S. Atlantic Street, LOS E would occur in the PM peak hour with non-tolled conditions. The lower LOS for non-tolled conditions would be attributable to higher traffic volumes in the vicinity of the on-ramp to SR 99.

At five locations on Fourth Avenue S., LOS E or LOS F would occur only with tolled conditions:

- Fourth Avenue S. and S. Jackson Street (AM and PM peak hours)
- Fourth Avenue S. and Airport Way S. (AM peak hour)
- Fourth Avenue S. and S. Royal Brougham Way (PM peak hour)
- Fourth Avenue S. and S. Holgate Street (PM peak hour)
- Fourth Avenue S. and S. Lander Street (PM peak hour)

Transit priority treatments in the south area along Second Avenue S. and Fourth Avenue S. would help minimize LOS effects under the Cut-and-Cover Tunnel Alternative. Also, the restricted access on Third Avenue to general-purpose traffic would help address overall transit capacity operations in the south. Third Avenue was not analyzed in terms of LOS because this major transit corridor would have peak period restrictions affecting general-purpose traffic.

7.7.2.5.2 Central Area

Under the Cut-and-Cover Tunnel Alternative, most intersections evaluated in the central area are forecasted to operate at LOS D or better during peak hours. These intersections include locations with transit operations; however, eight intersections with bus service would operate at LOS E or LOS F in 2030.

At First Avenue and Spring Street, LOS E would occur in the AM peak for tolled conditions only. At Second Avenue and Marion Street, LOS E would occur in the AM peak hour with tolled conditions only. At another location on Second Avenue, at Spring Street, LOS E would occur in AM and PM peak hours for tolled conditions only.

At four locations on Fourth Avenue, LOS E or LOS F would occur only with tolled conditions:

- Fourth Avenue and Spring Street (PM peak hour)
- Fourth Avenue and Madison Street (AM and PM peak hours)
- Fourth Avenue and Marion Street (AM peak hour)
- Fourth Avenue and Columbia Street (AM and PM peak hours)

At Fourth Avenue and Seneca Street, LOS E would occur in the PM peak hour for non-tolled conditions only. Traffic at intersections along Fourth Avenue would include substantial bus volumes and would result in part from the diversion of traffic from SR 99 to surface streets in the central area.

Transit priority treatments in the central area along Second Avenue and Fourth Avenue would help minimize LOS effects from the Cut-and-Cover Tunnel Alternative. Also, the restricted access on Third Avenue to general-purpose traffic would help address overall transit capacity operations in the central area.

Third Avenue was not analyzed in terms of LOS because this major transit corridor would have peak period restrictions affecting general-purpose traffic.

7.7.2.5.3 North Area

Under the Cut-and-Cover Tunnel Alternative, most intersections evaluated in the north area are forecasted to operate at LOS E or LOS F during peak hours with both non-tolled and tolled conditions. For intersections with transit operations, LOS E or LOS F is projected for both tolled and non-tolled conditions at the following locations:

- W. Mercer Place and Elliott Avenue W. (AM and PM peak hours)
- Fifth Avenue N. and Mercer Street (PM peak hour)
- Aurora Avenue (northbound) and Denny Way (AM and PM peak hours)
- Aurora Avenue (southbound) and Denny Way (PM peak hour)
- Dexter Avenue and Denny Way (AM and PM peak hours)
- Dexter Avenue N. and Mercer Street (PM peak hours)
- Westlake Avenue N. and Mercer Street (AM and PM peak hours)
- Ninth Avenue N. and Mercer Street (PM peak hour)
- Fairview Avenue N./I-5 ramp (AM and PM peak hours)

LOS E or LOS F would occur at the following locations with tolled conditions only:

- Fifth Avenue N. and Mercer Street (AM peak hour)
- Fifth Avenue N. and Roy Street (AM and PM peak hours)
- Sixth Avenue and Battery Street (PM peak hour)
- Sixth Avenue N. and Mercer Street (PM peak hour)
- Aurora Avenue southbound and Denny Way (AM peak hour)
- Dexter Avenue N. and Mercer Street (AM and PM peak hours)
- Dexter Avenue N. and Roy Street (AM and PM peak hours)
- Dexter Avenue N. and Aloha Street (PM peak hour)

For the Cut-and-Cover Tunnel Alternative, changes in access between SR 99 and the local street grid in the north area would attract additional trips. As a result, some increases in local street congestion affecting transit operations are expected. However, the primary factor contributing to LOS E and LOS F at locations in the north area relates to large volumes of trips diverted from SR 99 to surface streets with tolled conditions. These volumes would affect LOS at locations with bus service, particularly along major transit corridors such as Aurora, Fifth, and Dexter Avenues N.

7.7.3 Elevated Structure Alternative

The following subsections identify transit network changes, priority treatments, and operational effects of the Elevated Structure Alternative with both non-tolled and tolled conditions.

7.7.3.1 Transit Network Changes and Transit Priority Treatments

For the tolled Elevated Structure Alternative, the Columbia and Seneca Street ramps on SR 99 would be maintained. Transit vehicles currently operating on SR 99 would still exit in the Seattle CBD. No major transit network changes or priority treatments are expected.

The network features described for the tolled Elevated Structure Alternative would also apply to the non-tolled Elevated Structure Alternative.

7.7.3.2 Modeled Transit Ridership

Exhibit 7-76 summarizes projected daily transit ridership in 2030 at three selected screenlines for the Elevated Structure Alternative. Exhibit 7-77 summarizes projected AM peak transit period ridership in 2030.

Exhibit 7-76. Model-Estimated Daily Transit Ridership (Person-Trips) at Selected Screenlines – Elevated Structure Alternative

	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South (south of S. King Street)	165,400	166,400
Central (north of Seneca Street)	182,100	180,300
North (north of Thomas Street)	167,600	166,800

Exhibit 7-77. Model-Estimated AM Peak Period Transit Ridership (Person-Trips) at Selected Screenlines – Elevated Structure Alternative

	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
South (south of S. King Street)	55,850	56,150
Central (north of Seneca Street)	54,950	54,740
North (north of Thomas Street)	52,670	52,770

Daily transit ridership in 2030 for the non-tolled Elevated Structure Alternative would range between approximately 165,400 at the south screenline and 182,100 at the central screenline. In the AM peak, 2030 ridership for the non-tolled Elevated Structure Alternative would range between 52,670 at the north screenline and 55,850 at the south screenline.

Between the tolled Elevated Structure Alternative and the non-tolled Elevated Structure Alternative, relatively small variations in both daily and peak period transit ridership would occur. These relatively small variations in peak period transit demand would occur even though conditions with tolling would likely result in longer travel times and worse operating conditions as compared to non-tolled conditions. These travel times and operating conditions are described in Sections 7.7.3.4 and 7.7.3.5.

A shift to transit by users who are avoiding tolls on SR 99 is not expected since transit service is oriented to users traveling to and from downtown, and no transit service is expected to operate on SR 99 between the midtown ramps and the north portal of the Battery Street Tunnel.

7.7.3.3 Modeled Transit Mode Shares

Daily transit mode shares involving travel within Seattle's Center City for the Elevated Structure Alternative with both tolled and non-tolled conditions are identified in the following subsections. Mode shares are identified for home-based work (i.e., commuting to work) and non-work travel in 2030 to, from, and within Seattle's Center City. The transit shares for the Elevated Structure Alternative are identified in Exhibit 7-78.

Exhibit 7-78. Model-Estimated Daily Transit Mode Shares: To, From, and Within Seattle's Center City – Elevated Structure Alternative

	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Home-based work	40.6%	40.6%
Non-work	10.0%	9.8%

Tolling would cause little mode shift for Seattle Center City trips because trips that use SR 99 north of the midtown ramps are forecasted to be longer than typical transit trips and would likely be passing through the Center City.

Between the tolled Elevated Structure Alternative and the non-tolled Elevated Structure Alternative, relatively small variations in both daily and peak period transit mode shares would occur. These relatively small variations in peak period transit demand would occur even though conditions with tolling would likely result in longer travel times and worse operating conditions as compared to non-tolled conditions. These travel times and operating conditions are described in Sections 7.7.3.4 and 7.7.3.5.

7.7.3.4 Peak Hour Travel Times for Transit Corridors

The following subsections describe estimated 2030 peak hour travel times for several transit corridors primarily serving downtown Seattle. These travel times, for traffic both accessing and leaving downtown Seattle, were identified for the Elevated Structure Alternative with both tolled and non-tolled conditions.

Exhibit 7-79 shows estimated peak hour travel times in 2030 for the five major transit corridors under the Elevated Structure Alternative. For the Elliott Avenue and Aurora Avenue corridors, the transit travel times were estimated by the VISSIM operations model. For the Second Avenue and Fourth Avenue corridors, the travel times were by the Synchro operations model. Some sections of the West Seattle to CBD corridor reflect general-purpose traffic performance captured as a mix of results from the EMME travel forecasting model, VISSIM, and Synchro.

Exhibit 7-79. Travel Times Along Major Transit Travel Corridors – Elevated Structure Alternative

	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
Segment	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Elliott Avenue (South of Ballard Bridge to Denny Way)				
Southbound	8	8	8	8
Northbound	7	8	9	9
Aurora Avenue (South of Aurora Bridge to Denny Way)				
Southbound	9	14	5	9
Northbound	6	6	5	5
Second Avenue (Wall Street to S. Royal Brougham Way)				
Southbound	14	16	14	15
Fourth Avenue (S. Royal Brougham Way to Battery Street)				
Northbound	14	17	13	18
West Seattle to CBD (Fourth Avenue and Seneca Street)				
Northbound	20	33	16	23
Southbound	12	14	22	25

Note: CBD = Central Business District

7.7.3.4.1 Elliott Avenue Corridor

In the AM peak hour, transit travel times for southbound trips in the Elliott Avenue corridor would be similar for the non-tolled and tolled Elevated Structure

Alternative. At approximately 7 to 8 minutes, northbound travel times in the AM peak hour would also be similar for tolled and non-tolled conditions.

In the PM peak hour, southbound and northbound travel times on Elliott Avenue with tolled and non-tolled conditions would be generally similar, approximately 8 and 9 minutes, respectively.

7.7.3.4.2 Aurora Avenue Corridor

In the Aurora Avenue corridor, approximately 5 additional minutes in transit travel time would occur for southbound trips during the AM peak hour with tolled conditions compared to non-tolled conditions. With tolled conditions, volumes of diverted trips involving southbound (peak direction) travel are expected to be substantial. The large volumes of diverted trips would result in general-purpose traffic backups on Aurora Avenue to the point of affecting transit movements, including buses exiting at the Denny Way ramps to complete their trips to downtown Seattle. Transit travel times for northbound trips in the AM peak hour with tolled and non-tolled conditions would be similar, approximately 6 minutes.

In the PM peak hour, southbound trips for the tolled Elevated Structure Alternative would be 4 minutes longer than those for the non-tolled Elevated Structure Alternative. Even though these trips would occur in the non-peak demand direction, the volumes diverted from SR 99 to surface streets in the area of the Denny Way ramps would still be substantial. For northbound trips in the PM peak hour, the travel times between tolled and non-tolled conditions would be about the same, approximately 5 minutes.

7.7.3.4.3 Second and Fourth Avenue Corridors

The expected high volumes of diverted general-purpose traffic occurring with tolled conditions would result in higher volumes affecting downtown Seattle arterials, including bus operations on Second and Fourth Avenues. For Second Avenue travel (southbound only), estimated additional transit travel time for the tolled Elevated Structure Alternative would be approximately 2 minutes in the AM peak and 1 minute in the PM peak hour. Estimated travel times for Fourth Avenue travel (northbound only) would be approximately 3 minutes in the AM peak hour and 5 minutes in the PM peak hour. The additional travel times represent a wide range of increases over non-tolled conditions: from 7 percent for PM peak hour trips on Second Avenue to 38 percent for PM peak hour trips on Fourth Avenue.

Transit service would benefit from bus-only lanes on Second Avenue as well as limited skip-stop (buses serving every other zone) access to bus zones along each route.

7.7.3.4.4 West Seattle to CBD Corridor

With approximately 13 additional minutes, travel time for northbound general-purpose traffic during the AM peak hour in the West Seattle to CBD corridor would be substantially longer for the tolled Elevated Structure Alternative than for the non-tolled Elevated Structure Alternative. The additional travel time for AM northbound (peak direction) travel would be attributable to high volumes of traffic diverting from SR 99 to north-south surface streets in the south area. However, for bus trips, the variation in travel times between tolled and non-tolled conditions would be less due to the availability of the northbound bus-only ramp on SR 99 between S. Holgate Street and S. Dearborn Street. The estimated travel time for AM peak northbound (peak direction) buses from West Seattle to downtown Seattle would be approximately 9 minutes less than travel times for general-purpose traffic.

For southbound AM peak hour trips, travel times for tolled conditions would be approximately 2 minutes longer than those for non-tolled conditions. In the PM peak hour, northbound travel times for tolled conditions would be approximately 7 minutes longer than those for non-tolled conditions. Additional travel time for PM peak southbound trips with tolled conditions would be approximately 3 minutes as compared to the travel time for non-tolled conditions. This additional time would occur in the peak transit demand direction.

7.7.3.5 Intersection Level of Service Changes Affecting Transit

In addition to travel time changes along key corridors, transit service also could be affected by LOS conditions at intersections with buses operations. The following subsections summarize results for the Elevated Structure Alternative with both tolled and non-tolled conditions. Information presented for the south, central, and north areas is based on the LOS analysis results presented in Section 7.4.

The traffic analysis indicated that for the Elevated Structure Alternative, several locations with transit operations would be at LOS E or LOS F in peak hours. Intersections that are projected to operate at LOS E or LOS F are most likely to experience substantial congestion. Intersections that operate at LOS A through LOS D would experience little to moderate congestion levels and are generally not of concern.

7.7.3.5.1 South Area

Under the Elevated Structure Alternative, a substantial number of intersections in the south area would operate at LOS E or LOS F in 2030. In some locations, these LOS conditions would occur with both non-tolled and tolled conditions, but for most locations, these conditions would occur for tolled conditions only. LOS E and LOS F conditions with tolling would result from higher traffic volumes associated with diverted trips from SR 99 to surface streets in the south area.

LOS E or LOS F conditions affecting transit operations would occur along First Avenue S., Second Avenue S., and Fourth Avenue S. At Second Avenue S. and S. Jackson Street, LOS F would occur only with tolled conditions in the AM and PM peak hours. On First Avenue S. at S. King Street and S. Dearborn Street, LOS E and LOS F would occur in the PM peak hour for tolled conditions only. But, on First Avenue S. at S. Atlantic Street and S. Holgate Street, LOS E or LOS F would occur in the AM peak hour with non-tolled conditions only. The lower LOS with non-tolled conditions would be attributable only to higher traffic volumes in the vicinity of the SR 99 ramps in the stadium area as compared to the volumes with tolled conditions.

At four locations on Fourth Avenue S., LOS E or LOS F would occur only for tolled conditions:

- Fourth Avenue S. and S. Jackson Street (AM peak hour)
- Fourth Avenue S. and Airport Way S. (AM peak hour)
- Fourth Avenue S. and S. Royal Brougham Way (PM peak hour)
- Fourth Avenue S. and S. Holgate Street (PM peak hour)

Transit priority treatments along Second Avenue S. and Fourth Avenue S. would help minimize LOS effects in the south area. Also, restricted access on Third Avenue to general-purpose traffic would help address overall transit capacity operations in the south area. Third Avenue was not analyzed in terms of LOS because this major transit corridor would have peak period restrictions affecting general-purpose traffic.

7.7.3.5.2 Central Area

Under the Elevated Structure Alternative, several intersections evaluated in the central area are forecasted to operate at LOS E or LOS F during peak hours with tolled conditions only. These intersections include locations with transit operations. With tolled conditions, traffic accessing SR 99 would not be paying tolls until the CBD area. Therefore, it is estimated that high volumes of traffic would be exiting SR 99 in the central area under tolled conditions and adding volumes to several intersections with transit operations. These intersections are located on First, Second, and Fourth Avenues.

At three locations on First Avenue, LOS E or LOS F would occur with tolled conditions only:

- First Avenue and Seneca Street (PM peak hour)
- First Avenue and Spring Street (AM and PM peak hours)
- First Avenue and Marion Street (AM peak hour)

At five locations on Second Avenue, LOS E or LOS F would occur for tolled conditions only:

- Second Avenue and Seneca Street (AM and PM peak hours)
- Second Avenue and Spring Street (AM and PM peak hours)
- Second Avenue and Madison Street (PM peak hour)
- Second Avenue and Marion Street (AM and PM peak hours)
- Second Avenue and Columbia Street (PM peak hour)

At five locations on Fourth Avenue, LOS E or LOS F would occur with tolled conditions only:

- Fourth Avenue and Pine Street (AM and PM peak hours)
- Fourth Avenue and Seneca Street (AM peak hour)
- Fourth Avenue and Spring Street (AM peak hour)
- Fourth Avenue and Madison Street (AM and PM peak hours)
- Fourth Avenue and Columbia Street (AM and PM peak hours)

Transit priority treatments along Second Avenue and Fourth Avenue would help minimize LOS effects in the central area. Also, restricted access on Third Avenue to general-purpose traffic would help address overall transit capacity operations in the central area. Third Avenue was not analyzed in terms of LOS because this major transit corridor would have peak period restrictions affecting general-purpose traffic.

7.7.3.5.3 North Area

Under the Elevated Structure Alternative, most intersections evaluated in the north area are forecasted to operate at LOS E or F during AM and PM peak hours with both non-tolled and tolled conditions. For intersections with transit operations, LOS E or LOS F is projected with both tolled and non-tolled conditions for the following locations:

- W. Mercer Place and Elliott Avenue W. (AM and PM peak hours)
- Fifth Avenue N. and Mercer Street (PM peak hour)
- Aurora Avenue (northbound) and Denny Way (AM and PM peak hours)
- Aurora Avenue (southbound) and Denny Way (PM peak hour)
- Dexter Avenue and Denny Way (PM peak hour)
- Dexter Avenue N. and Mercer Street (AM and PM peak hours)
- Westlake Avenue N. and Mercer Street (AM and PM peak hours)
- Ninth Avenue N. and Mercer Street (PM peak hour)
- Fairview Avenue N./I-5 ramp (AM and PM peak hours)

LOS E or LOS F would occur at the following locations in the north area for the tolled condition only:

- Fifth Avenue N. and Mercer Street (AM peak hour)
- Fifth Avenue N. and Roy Street (AM peak hour)
- Aurora Avenue (southbound) and Denny Way (AM peak hour)
- Sixth Avenue N. and Mercer Street (PM peak hour)
- Dexter Avenue N. and Thomas Street (PM peak hour)
- Dexter Avenue N. and Roy Street (AM and PM peak hours)
- Ninth Avenue N. and Mercer Street (AM peak hour)

For the Elevated Structure Alternative, the primary factor contributing to LOS E and LOS F at locations in the north area relates to large volumes of general-purpose trips diverted from SR 99 to surface streets with tolled conditions. These volumes would affect LOS at locations with bus service, particularly along major transit corridors such as Aurora, Fifth, and Dexter Avenues N.

7.8 Truck Traffic and Freight

This section discusses the operational effects of the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives with both tolled and non-tolled conditions truck traffic and freight.

The key findings related to the effects on truck traffic and freight are as follows:

- Under both tolled and non-tolled conditions for all three build alternatives, travel times for freight operators would generally be longer in the PM peak hour than the AM peak hour due to higher demand during the evening commute period.
- Trucks traveling on popular freight corridors in the study area would generally experience slightly longer trip times under tolled conditions versus non-tolled conditions. The increased travel time would be a result of trip diversion from the tolled facilities and the subsequent increased demand on downtown streets and I-5 that would lead to congestion and delay.
- Trucks carrying hazardous or flammable cargo would be prohibited from the bored tunnel all day and would need to travel through downtown Seattle on either Alaskan Way or I-5. This would particularly affect freight trips between Ballard and the SODO area. The same all-day restrictions would apply to the cut-and-cover tunnel for the Cut-and-Cover Tunnel Alternative and the Battery Street Tunnel for the Elevated Structure Alternative.

- For the non-tolled Cut-and-Cover Tunnel Alternative during the PM peak hour, freight operators accessing SR 99 at the Elliott Avenue on-ramp would encounter long queues, leading to longer travel times relative to those for tolled conditions. For the tolled alternatives, travel times on southbound SR 99 south of the ramp would also be much shorter than those under non-tolled conditions because fewer vehicles would be traveling on this segment of the facility.

7.8.1 Tolled Bored Tunnel Alternative

A detailed overview of freight connections and operations and the ability of the project design to facilitate freight operations is presented in Section 5.7 for the non-tolled Bored Tunnel Alternative. The description is the same for the tolled Bored Tunnel Alternative because tolling would have no effect on these considerations.

7.8.1.1 Peak Hour Travel Times for Truck Freight Routes

The following subsections discuss estimated AM and PM peak hour travel times in 2030 for common travel routes used by freight trucks under the Bored Tunnel Alternative with both tolled and non-tolled conditions. The estimated travel times are indicated in Exhibit 7-80.

Exhibit 7-80. Peak Hour Travel Times Along Major Corridors Used by Freight Trucks – Bored Tunnel Alternative (2030)

Freight Corridor	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)	Bored Tunnel Alternative (Non-Tolled)	Bored Tunnel Alternative (Tolled)
Ballard to S. Spokane Street (via Mercer Street, Bored Tunnel)				
Southbound	17	18	22	24
Northbound	25	24	27	27
Northgate to Boeing Access Road				
Southbound	31	32	38	40
Northbound	32	33	35	36
Mercer Street (I-5 to Elliott)				
Westbound	12	12	14	13
Eastbound	8	9	13	15

7.8.1.1.1 Ballard to S. Spokane Street – Via Mercer Street, Bored Tunnel

Under the Bored Tunnel Alternative, freight trucks traveling from Ballard to S. Spokane Street with the non-tolled conditions would take 17 minutes going in the southbound direction during the AM peak hour, while trucks traveling with tolled conditions would take 18 minutes to travel this segment. Trucks carrying hazardous or flammable cargo would be prohibited from the bored tunnel all day and would need to travel through downtown Seattle on either Alaskan Way or I-5. Trucks traveling with non-tolled conditions in the northbound direction would take 25 minutes to cover the length of the corridor, while trucks with tolled conditions in this direction would take slightly less time, at 24 minutes.

In the PM peak hour, truck traffic traveling in this corridor would take a little longer to cover the Ballard to S. Spokane Street corridor using the bored tunnel because the PM peak hour generally has more overall demand (and delay) than the AM peak hour. In the southbound direction, trucks traveling with non-tolled conditions would take 22 minutes, while those traveling with tolled condition would take 24 minutes. Trucks traveling with the non-tolled conditions in the northbound direction would take 27 minutes, the same as the time for tolled conditions.

7.8.1.1.2 Northgate to Boeing Access Road – Via I-5

Trucks traveling a longer distance through Seattle's Center City would likely use I-5. On the Northgate to Boeing Access Road route (via I-5), trucks traveling southbound during the AM peak hour would take 31 minutes to travel the length of the corridor with the non-tolled Bored Tunnel Alternative and 32 minutes to travel that length with tolled Bored Tunnel Alternative. Trucks operating in the northbound direction would take 32 minutes to travel the corridor with non-tolled conditions and 33 minutes to travel it with tolled conditions.

During the more congested PM peak hour, it would take trucks 38 minutes to travel the corridor with non-tolled conditions in the southbound direction, whereas it would take 40 minutes with tolled conditions. In the northbound direction, trucks would take 35 minutes to travel the length of the corridor with non-tolled conditions and 36 minutes with tolled conditions.

7.8.1.1.3 Mercer Street – Via I-5 to Elliott Avenue W.

Mercer Street provides a popular route for truck trips traveling east-west across the city. During the AM peak hour, westbound trucks would take 12 minutes to travel the corridor (I-5 to Elliott Avenue W.) with both non-tolled and tolled conditions. Trucks operating in the eastbound direction for the non-tolled Bored Tunnel Alternative would take 8 minutes to travel the corridor, while those operating with tolled conditions would take 9 minutes.

During the PM peak hour, truck trips occurring with the non-tolled Bored Tunnel Alternative would take 14 minutes to travel in the westbound direction and 13 minutes to travel in the eastbound direction. Trucks operating with the tolled Bored Tunnel Alternative would take 13 minutes in the westbound direction and 15 minutes in the eastbound direction.

7.8.2 Tolled Cut-and-Cover Tunnel Alternative

A detailed overview of freight connections and operations and the ability of the project design to facilitate freight operations is presented in Section 5.7 for the non-tolled Cut-and-Cover Tunnel Alternative. The description is the same for the tolled Cut-and-Cover Tunnel Alternative because tolling would have no effect on these considerations.

7.8.2.1 Peak Hour Travel Times for Truck Freight Routes

The following subsections discuss estimated 2030 AM and PM peak hour travel times for common travel routes used by freight trucks under the Cut-and-Cover Tunnel Alternative with both tolled and non-tolled conditions. The travel times are indicated in Exhibit 7-81.

Exhibit 7-81. Peak Hour Travel Times Along Major Corridors Used by Freight Trucks – Cut-and-Cover Tunnel Alternative

	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)	Cut-and-Cover Tunnel Alternative (Non-Tolled)	Cut-and-Cover Tunnel Alternative (Tolled)
Ballard to S. Spokane Street (via Alaskan Way, SR 99)				
Southbound	16	16	21	16
Northbound	15	17	23	23
Northgate to Boeing Access Road				
Southbound	31	32	38	39
Northbound	32	33	35	36
Mercer Street (I-5 to Elliott)				
Westbound	8	8	11	12
Eastbound	9	9	16	18

7.8.2.1.1 Ballard to S. Spokane Street – Via Alaskan Way, Alaskan Way Viaduct

Under the Cut-and-Cover Tunnel Alternative, travel times for freight vehicles on the Ballard to S. Spokane Street corridor would be slightly different for tolled and non-tolled conditions. For tolled conditions, the travel time in the southbound direction during the AM peak hour would be the same as that for the non-tolled conditions at 16 minutes. In the northbound direction, the travel time for tolled conditions would be slightly longer than that for non-tolled conditions (17 minutes compared to 15 minutes). During the AM peak hour, tolled conditions would result in longer travel times due to trip diversion onto city streets, which would tend to slow down traffic on some northbound segments of the trip between Ballard and S. Spokane Street.

In the PM peak hour, the results are somewhat different. Because of long queues at the southbound Elliott Avenue on-ramp to SR 99 for non-tolled conditions, travel times would be longer than those for tolled conditions (21 minutes compared to 16 minutes). Travel times on southbound SR 99 south of the ramp would also be much shorter than those for non-tolled conditions, because fewer vehicles would be traveling on this segment of the facility due to toll restrictions. Northbound travel times for both tolled and non-tolled conditions would be the same (23 minutes) during the PM peak hour.

7.8.2.1.2 Northgate to Boeing Access Road – Via I-5

Freight vehicles traveling on the Northgate to Boeing Access Road (via I-5) corridor would experience fairly comparable travel times in AM peak hour for both tolled and non-tolled conditions. Southbound travel times would be slightly longer with tolled conditions (32 minutes) compared to non-tolled conditions (31 minutes). Projected northbound travel times during the AM peak hour show a pattern similar to that of the southbound traffic, where tolled conditions would result in slightly longer travel times (33 minutes) compared to those for non-tolled conditions (32 minutes).

In the PM peak hour, travel times in both the southbound and northbound directions would be longer with tolled conditions (39 and 36 minutes, respectively) in comparison to non-tolled conditions (38 and 35 minutes, respectively).

7.8.2.1.3 Mercer Street – Via I-5 to Elliott Avenue W.

Freight vehicles traveling on Mercer Street are expected to experience comparable travel times regardless of condition (tolled or non-tolled). In the AM peak hour, the westbound travel time would 8 minutes for both tolled and non-tolled conditions. In the eastbound direction, the travel time would be 9 minutes for both non-tolled and tolled conditions.

In the PM peak hour, while travel times would be longer than those of the AM peak hour, tolled and non-tolled conditions would not result in a significant difference. In the westbound direction, non-tolled conditions would result in a travel time of 11 minutes, while tolled conditions would result in a travel time of 12 minutes. In the eastbound direction, freight trips traveling with non-tolled conditions would take 16 minutes to travel the corridor, while those traveling with tolled conditions would take slightly longer, 18 minutes. Again, trip diversion on city streets due to tolling would increase the delay on them, thereby reducing travel speeds and increasing travel times in the corridor.

7.8.3 Tolled Elevated Structure Alternative

A detailed overview of freight connections and operations and the ability of the project design to facilitate freight operations is presented in Section 5.7 for the non-tolled Elevated Structure Alternative. The description is the same for the tolled Elevated Structure Alternative because tolling would have no effect on these considerations.

7.8.3.1 Peak Hour Travel Times for Truck Freight Routes

The following subsections discuss estimated 2030 AM and PM peak hour travel times for common travel routes used by freight trucks under the Elevated Structure Alternative with both tolled and non-tolled conditions. The travel times are indicated in Exhibit 7-82.

Exhibit 7-82. Peak Hour Travel Times Along Major Corridors Used by Freight Trucks – Elevated Structure Alternative

	AM Peak Hour (minutes)		PM Peak Hour (minutes)	
	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)	Elevated Structure Alternative (Non-Tolled)	Elevated Structure Alternative (Tolled)
Ballard to S. Spokane Street (via Alaskan Way, SR 99)				
Southbound	15	15	20	17
Northbound	16	26	25	25
Northgate to Boeing Access Road				
Southbound	31	32	38	40
Northbound	32	33	34	36
Mercer Street (I-5 to Elliott)				
Westbound	9	10	11	12
Eastbound	10	11	15	15

7.8.3.1.1 Ballard to S. Spokane Street – Via Alaskan Way, Alaskan Way Viaduct

Under the Elevated Structure Alternative, freight vehicles traveling the Ballard to S. Spokane Street corridor would experience slight differences in travel times with tolled conditions and non-tolled conditions. For tolled conditions, the travel time in the southbound direction during the AM peak hour would be the same as the time for non-tolled conditions (15 minutes). In the northbound direction, the travel time for tolled conditions would be substantially longer than the travel time for non-tolled conditions (26 minutes compared to 16 minutes). The reason for the significant increase in travel time for tolled conditions is major trip distribution on local streets, which would increase delay, particularly for trips coming from the south.

During the PM peak hour, freight operators traveling in the southbound direction would take 20 minutes with non-tolled conditions, while those operating with tolled conditions would take 17 minutes. For operators traveling in the northbound direction, it would take 25 minutes to travel the corridor with both tolled and non-tolled conditions.

7.8.3.1.2 Northgate to Boeing Access Road – Via I-5

Freight operators traveling the I-5 corridor between Northgate and Boeing Access Road would likely experience very little difference between tolled and non-tolled conditions. In the AM peak hour, freight trips traveling in the southbound direction would take 31 minutes with non-tolled conditions and 32 minutes with tolled conditions. Freight trips traveling in the northbound direction would take 32 minutes with non-tolled conditions and 33 minutes with tolled conditions.

In the PM peak hour, while travel times would be slightly longer than those in the AM peak hour, the differences between tolled and non-tolled conditions would be slight. In the southbound direction, freight trips would take 38 minutes with non-tolled conditions and 40 minutes with tolled conditions. In the northbound direction, travel times for non-tolled conditions are estimated to be 34 minutes and 36 minutes for tolled conditions.

7.8.3.1.3 Mercer Street – Via I-5 to Elliott Avenue W.

For freight vehicles operating on Mercer Street, travel times would be about the same with both tolled and non-tolled conditions. In the AM peak hour, westbound freight vehicles are forecasted to take 9 minutes with non-tolled conditions and 10 minutes with tolled conditions. In the eastbound direction, they would take 10 minutes for non-tolled conditions and 11 minutes for tolled conditions.

During the PM peak hour, freight vehicles would take slightly longer to travel the corridor because the PM peak hour generally operates with higher demand than the AM peak hour. Still, the travel patterns during the AM peak hour for tolled and non-tolled conditions would be similar in the PM peak hour. Freight vehicles traveling in the westbound direction would take 11 minutes with non-tolled conditions and 12 minutes for tolled conditions. In the eastbound direction, they would take 15 minutes with both non-tolled and tolled conditions.

7.9 Parking

The conditions with tolling are no different from those with non-tolled conditions when considering parking effects.

7.10 Pedestrians

The conditions with tolling are no different from those with non-tolled conditions when considering pedestrian facilities. However, tolled conditions are associated with more traffic on surface streets, which could increase the risk of conflicts between vehicles and pedestrians.

7.11 Bicycles

The conditions with tolling are no different from those with non-tolled conditions when considering bicycle facilities. However, tolled conditions are associated with more traffic on surface streets, which could increase the risk of conflicts between vehicles and bicyclists.

7.12 Ferries

Colman Dock, located on Piers 50 and 52 on Seattle's downtown waterfront, is the Seattle terminus for the Washington State Ferries. The passenger-only service from Vashon Island and West Seattle, operated by King County, also uses Colman Dock. Access to Colman Dock is provided from Alaskan Way at Yesler Way, with exits provided to Alaskan Way at Yesler Way for southbound travel and at Marion Street for northbound travel.

The Seattle-Bainbridge route carried over 6 million passengers in 2008, with approximately 3 million of those passengers walking onto the ferry and the remainder driving or riding in a vehicle. The Seattle-Bremerton route carried approximately 2.5 million passengers in 2008, with approximately 1.5 million of them walking onto the ferry (PSRC 2009a). Ferry operations, by their nature, result in a very sporadic flow of people and vehicles moving to and from the terminal and put unique demands on the surrounding transportation infrastructure.

The key findings related to effects on users of the ferries are the following:

- Under tolled conditions for all three of the build alternatives, volumes and congestion along Alaskan Way are expected to increase because traffic would divert away from SR 99 to alternate routes to avoid the toll. Increased delays and congestion along surface streets surrounding Colman Dock, especially Alaskan Way S. south of Yesler Way, could affect ferry traffic destined for Colman Dock.
- Under tolled conditions for all three of the build alternatives, increased congestion and decreased travel speeds for northbound traffic on SR 99, resulting from traffic exiting SR 99, would likely also increase travel times and delay for ferry traffic destined for Colman Dock.

7.12.1 Tolled Bored Tunnel Alternative

Compared to vehicle volumes for the non-tolled Bored Tunnel alternative, volumes on Alaskan Way S., south of Yesler Way for the tolled Bored Tunnel Alternative are forecasted to increase approximately 35 percent (AM peak hour) and 10 percent (PM peak hour) in the southbound direction. In the northbound direction, volumes are forecasted to increase 15 percent (AM peak hour) and 20 percent (PM peak hour).

For the non-tolled Bored Tunnel Alternative, service disruptions due to issues with vessels, terminals, or demand spikes associated with peak summer holiday traffic would likely cause some disruption of traffic operations along Alaskan Way near Marion Street and Yesler Way. Additional volume along Alaskan Way would result in more congestion, longer delays, and longer travel times, which would affect traffic traveling to Colman Dock.

Also, modeling results indicate that vehicle queues would back up onto the SR 99 mainline from the off-ramps (such as the northbound off-ramp at Alaskan Way S. at S. Dearborn Street) degrading SR 99 operations and decreasing speeds. These changes would increase travel times and delay for ferry traffic traveling to Colman Dock from the south.

7.12.2 Tolled Cut-and-Cover Tunnel Alternative

Compared to vehicle volumes for the non-tolled Cut-and-Cover Tunnel Alternative, volumes on Alaskan Way S. south of Yesler Way for the tolled Cut-and-Cover Tunnel alternative are forecasted to increase 70 percent (AM peak) and 10 percent (PM peak) in the southbound direction. In the northbound direction volumes are forecasted to increase 30 percent (AM peak) and 45 percent (PM peak).

For the non-tolled Cut-and-Cover Tunnel Alternative, service disruptions due to issues with vessels, terminals, or demand spikes associated with peak summer holiday traffic would likely cause some disruption of traffic operations along Alaskan Way near Marion Street and Yesler Way. Additional volume along Alaskan Way would result in more congestion, longer delays, and longer travel times, which would affect traffic traveling to Colman Dock.

Also, modeling results indicate that vehicle queues would back up onto the SR 99 mainline from the off-ramps (such as the northbound off-ramp at Alaskan Way S. at S. Dearborn Street) degrading SR 99 operations and decreasing speeds. These changes would increase travel times and delay for ferry traffic traveling to Colman Dock from the south.

7.12.3 Tolled Elevated Structure Alternative

Compared to the vehicle volumes for non-tolled Elevated Structure Alternative, volumes on Alaskan Way S. south of Yesler Way for the tolled Elevated Structure Alternative are forecasted to increase 50 percent (AM peak) and 25 percent (PM peak) in the southbound direction. In the northbound direction volumes are forecasted to increase 50 percent (AM peak) and 45 percent (PM peak).

For the non-tolled Elevated Structure Alternative, service disruptions due to issues with vessels, terminals, or demand spikes associated with peak summer holiday traffic would likely cause some disruption of traffic operations along Alaskan Way near Marion Street and Yesler Way. Additional volume along

Alaskan Way would result in more congestion, longer delays, and longer travel times, including traffic traveling to Colman Dock.

Also, modeling results indicate that vehicle queues would back up onto the SR 99 mainline from the off-ramps (such as the northbound off-ramp at Alaskan Way S. at S. Dearborn Street) degrading SR 99 operations and decreasing speeds. These changes would increase travel times and delay for ferry traffic traveling to Colman Dock from the south.

7.13 Safety

While tolling SR 99 would not change the physical characteristics of the corridor, it would affect traffic patterns. Traffic diversion to surface streets and congestion resulting from such diversion could have potential adverse effects on traffic safety under any of the build alternatives.

The key findings related to traffic safety are the following:

- Under all three build alternatives, implementing a toll on SR 99 would result in diverted trips from the corridor to other routes. The traffic diversion could increase conflicts between vehicles, pedestrians, and bicycles on alternate routes. Increased congestion is expected at exit points north and south of downtown, including the northbound off-ramp to Alaskan Way (south of downtown) and the southbound on-ramp to Harrison Street (north of Denny Way). Congestion at these locations would be more severe and last longer than the congestion under non-tolled conditions. Increased rates of congestion-related collision types (e.g., rear-end collisions) could occur at these locations under tolled conditions.
- The degree of traffic diversion would be related to the tolling rates. See Section 7.2, Regional Context and Travel Patterns, for more information on traffic diversion.

7.14 Event Traffic

The key findings related to effects on event traffic are the following:

- Under tolled conditions for all three build alternatives, additional traffic would be drawn to surface streets through the downtown core, leading to higher levels of congestion on most arterials in the CBD.
- Under tolled conditions for all three build alternatives, event traffic on surface streets would experience longer travel times than those resulting from non-tolled conditions.

- Under tolled conditions for all three build alternatives, event-related delays and congestion would likely be less for through-trips on SR 99 for those paying the toll due to lower SR 99 volumes and modest traffic levels at destination off-ramps.

7.14.1 Tolled Bored Tunnel Alternative

7.14.1.1 South Area

The roadway network in the south area for the Bored Tunnel Alternative assumes completion of the S. Holgate Street to S. King Street Viaduct Replacement Project. With tolled conditions, diversion of southbound traffic to surface streets (away from the bored tunnel) would likely occur. This shift to surface arterials would lead to longer delays and travel times for event patrons who divert to local streets. For drivers who choose to use the bored tunnel in the southbound direction, event travel times with tolled conditions would likely be shorter due to the lower volumes on SR 99 and modest demand on the off-ramp to the stadium area. Event traffic from the south may also be affected to some degree because these trips would mix with non-event, toll-diverted trips at the SR 99 off-ramp to the stadium area. Additional delays beyond those for non-tolled conditions would likely occur for event traffic from the south.

7.14.1.2 North Area

The proposed roadway elements for the Bored Tunnel Alternative represent substantial changes to the street network near Seattle Center and areas adjacent to the South Lake Union neighborhood. Key elements associated with the Bored Tunnel Alternative were described in previous chapters. With tolled conditions, diversion of northbound traffic to surface streets (away from the bored tunnel) would likely occur. This shift to surface arterials would lead to longer delays and travel times for patrons of Seattle Center events who divert to local streets. For event-goers who choose to use the bored tunnel through downtown (northbound), travel times with tolled conditions would likely be shorter due to the lower volumes on SR 99 and low demand at the Republican Street off-ramp. Event traffic from the north may also be affected because these Seattle Center trips would be required to mix with non-event, toll-diverted trips at the SR 99 off-ramps to Aloha Street, Roy Street, and Aurora Avenue. Additional delays beyond those for non-tolled conditions would likely occur for event traffic from the north.

7.14.2 Tolled Cut-and-Cover Tunnel Alternative

7.14.2.1 South Area

Similar to the Bored Tunnel Alternative, the roadway network in the south area for the Cut-and-Cover Tunnel Alternative assumes completion of the S. Holgate Street to S. King Street Viaduct Replacement Project. With tolled conditions, southbound through-traffic diversion to surface arterials would likely occur. This shift to local streets would lead to longer delays and travel times for event patrons who choose to circumvent the SR 99 segment through downtown. For drivers who pay the toll and remain on SR 99 in the southbound direction, event travel times with tolled conditions would likely be shorter due to the lower volumes on SR 99 and modest demand on the off-ramp to the stadium area. Event traffic from the south may also be affected to some degree because these trips would mix with non-event, toll-diverted trips at the SR 99 off-ramp to the stadium area. Additional delays beyond those for non-tolled conditions would likely occur for event traffic from the south.

7.14.2.2 North Area

The proposed roadway elements in the north area for the Cut-and-Cover Tunnel Alternative represent major revisions to the street network near Seattle Center and the adjacent neighborhoods. Key arterial changes for the Cut-and-Cover Tunnel Alternative were described in previous chapters. With tolled conditions, diversion of northbound SR 99 traffic to surface streets (away from the Battery Street Tunnel and the cut-and-cover tunnel) would likely occur. The increased traffic demand on surface arterials would lead to longer delays and travel times for patrons of Seattle Center events who divert to local streets.

Travel times for event-goers remaining on northbound SR 99 through downtown with tolled conditions would likely be shorter than those with non-tolled conditions due to the lower volumes on SR 99 and low demand at the Western Avenue and Republican Street off-ramps. Event traffic from the north would be affected as well because trips bound for Seattle Center would be required to mix with non-event, toll-diverted trips at the SR 99 off-ramps to Aloha Street, Roy Street, and Aurora Avenue. Additional delays beyond those for non-tolled conditions would likely occur for event traffic from the north.

7.14.3 Tolled Elevated Structure Alternative

7.14.3.1 South Area

As with the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, the south area roadway network for the Elevated Structure Alternative includes the S. Holgate Street to S. King Street Viaduct Replacement Project and the SR 519 Intermodal Access Project, Phase 2. With tolled conditions, southbound through-traffic diversion to surface arterials would likely occur, resulting in longer vehicle delays and travel times for event patrons who opt for arterial routes through the downtown core. For drivers who pay the toll and remain on SR 99 in the southbound direction, event travel times with tolled conditions would likely be shorter compared to travel times for non-tolled conditions due to the lower volumes on SR 99 and modest demand on the off-ramp to the stadium area. Event traffic from the south (in the northbound direction) would likely be affected by tolling to some degree because these trips would mix with non-event, toll-diverted trips at the stadium area off-ramp.

7.14.3.2 North Area

The roadway changes in the north area for the Elevated Structure Alternative are similar to those described for the Cut-and-Cover Tunnel Alternative near Seattle Center and the adjacent neighborhoods. Key arterial changes would include new arterial extensions across SR 99 and modified access to and from SR 99. With tolled conditions, diversion of some northbound SR 99 traffic to surface streets would likely occur. The increased traffic demand on surface arterials would lead to longer delays and travel times for patrons of Seattle Center events from the south. Travel times for drivers remaining on northbound SR 99 through downtown would likely be shorter than those for non-tolled conditions due to the reduced volumes on SR 99 and low demand on the Western Avenue and Republican Street off-ramps. Event traffic from the north would be affected in terms of travel time increases and general delays due to traffic interactions between trips bound for Seattle Center and non-event, toll-diverted trips at the SR 99 off-ramps to Aloha Street, Roy Street, and Aurora Avenue.

7.15 General Diversion Patterns and Sensitivity to Toll Rates

The detailed analysis of the effects of tolling described in the previous sections applied to one tolling scenario (referred to as Scenario C in previous studies). Scenario C was applied consistently for all three build alternatives. Additional sensitivity analysis at the demand-model level was performed to show the variability of travel patterns under different tolling scenarios. The results of the analysis provide insight into a variety of topics such as the following:

- What type of tolling strategy adjustment is required to cause the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative to experience diversion patterns similar to those of the Bored Tunnel Alternative as projected under Scenario C?
- How much effect does tolling the midtown ramps under the Elevated Structure Alternative have on diversion?
- What is the general sensitivity of diversion on all alternatives with respect to toll rates?
- What are the anticipated patterns of diversion throughout the course of a normal weekday?

The tolling scenarios that were used in the sensitivity analysis were adjusted in two ways. First, the overall mainline toll rates were reduced in three increments (Toll Tests 1.1, 2.1, and 3.1), which are shown in Exhibit 7-83. Second, because the Elevated Structure Alternative would maintain ramps at Columbia and Seneca Streets south of the assumed tolling location, ramp tolls were tested at those locations as well. The assumed locations used for the toll sensitivity analysis are shown in Exhibits 7-84 through 7-86.

Exhibit 7-83. Toll Rates Used for Sensitivity Testing

	Scenario C	Toll Test 1.1[1]	Toll Test 2.1[1]	Toll Test 3.1[1]
Northbound				
AM peak hour	$4.00	$3.50	$3.00	$2.00
Midday	$2.25	$2.00	$1.75	$1.25
PM peak hour	$4.00	$3.25	$3.00	$2.00
Evening	$1.25	$1.25	$1.00	$0.75
Night	$1.00	$1.00	$0.75	$0.50
Southbound				
AM peak hour	$3.00	$2.75	$2.50	$2.00
Midday	$2.25	$2.00	$1.75	$1.25
PM peak hour	$5.00	$4.00	$3.50	$2.50
Evening	$1.25	$1.25	$1.00	$0.75
Night	$1.00	$1.00	$0.75	$0.50

Notes: 1. For the Elevated Structure Alternative, additional tests were performed with the additional tolls on the midtown ramps, equal to one-half of the mainline toll rate or the full mainline toll rate.

Some general conclusions can be drawn based on the sensitivity analysis performed for the toll rates presented Exhibit 7-83:

- Under tolled conditions, the Bored Tunnel Alternative would result in less traffic diversion than the Cut-and-Cover Tunnel Alternative or the Elevated Structure Alternative with the same tolling rates. With Scenario C, the Bored Tunnel Alternative is estimated to cause a diversion rate of 37 percent for daily traffic, followed by the Cut-and-Cover Tunnel Alternative with a 50 percent diversion rate, and the Elevated Structure Alternative with a 64 percent diversion rate.
- With Scenario C, the Bored Tunnel Alternative would carry the most traffic (57,100 vehicles per day) versus a non-tolled forecasted daily traffic volume of 93,100. The Cut-and-Cover Tunnel Alternative would carry 54,100 daily vehicles compared to a non-tolled forecast of 110,500. The Elevated Structure Alternative would carry 41,900 vehicles per day compared to a non-tolled forecast of 128,900.
- The tolling rates would need to be reduced by roughly 25 percent for the Cut-and-Cover Tunnel Alternative and 50 percent for the Elevated Structure Alternative to reach rates of traffic diversion similar to those of the Bored Tunnel Alternative under Scenario C.

- The distribution of traffic diversion over the course of the day would vary greatly, even with reduced toll rates during off-peak periods. The toll rates of Scenario C are shown in Exhibit 7-83. The rate of diversion for the Bored Tunnel Alternative would vary from a low of 29 percent during the PM peak period to a high of 69 percent in the late night period. The diversion rate for the Cut-and-Cover Tunnel Alternative would vary from a low of 43 percent during the PM peak period to a high of 76 percent during the late night period. The diversion rate for the Elevated Structure Alternative would vary from a low of 54 percent during the PM peak period to a high of 92 percent during the late night period. The percentages of traffic diversion for each of the three build alternatives during the five time periods are shown in Exhibit 7-87.
- The response of traffic to the different alternatives with respect to tolling would be directly related to the facility configuration. The more access and egress points provided by the facility, the more short-distance trips would be attracted to the facility. This pattern is demonstrated by estimates of daily traffic volume for the non-tolled alternatives. The Elevated Structure Alternative with two sets of ramps (midtown and Elliott/Western) would result in the highest daily non-tolled volumes, followed by the Cut-and-Cover Tunnel Alternative with only the Elliott/Western ramps, and then by the Bored Tunnel Alternative, which would provide no intermediate access or egress points. These shorter distance trips would be the most sensitive to tolling because the time penalty for diversion would be less.
- Sensitivity tests using full and half tolls at the midtown ramps for the Elevated Structure Alternative indicate that ramp tolling can have a strong influence on diversion patterns. The effect of midtown ramp tolling on mainline volumes is shown in Exhibit 7-88.
- The expected traffic diversion due to tolling the Bored Tunnel Alternative shows little sensitivity to the inclusion of the Program elements discussed in Chapter 8. The slight increase in diversion associated with the Program is related to the improved Elliott/Western connections to Alaskan Way, providing an improved alternate route for some trips that might otherwise use the bored tunnel. Exhibit 7-89 presents the daily diversion percentages for the three build alternatives, as well as the Bored Tunnel Alternative with the inclusion of additional roadway improvements included in the Program. These Program-related improvements are described in Chapter 8.

Exhibit 7-84. Toll Locations – Bored Tunnel Alternative

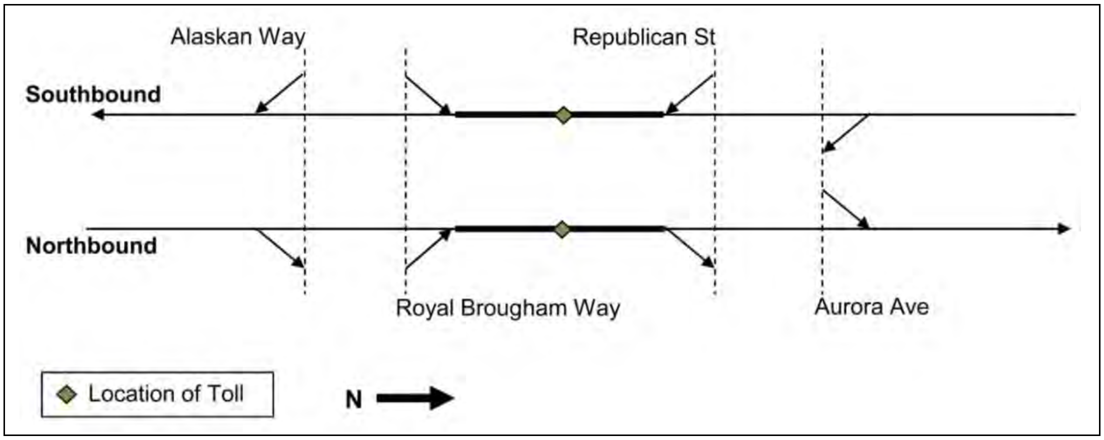


Exhibit 7-85. Toll Locations – Cut-and-Cover Tunnel Alternative

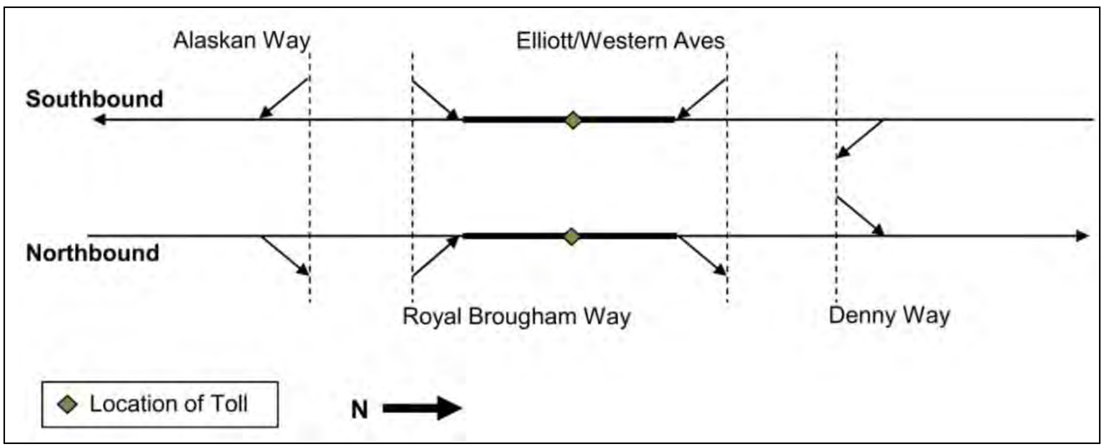


Exhibit 7-86. Toll Locations – Elevated Structure Alternative

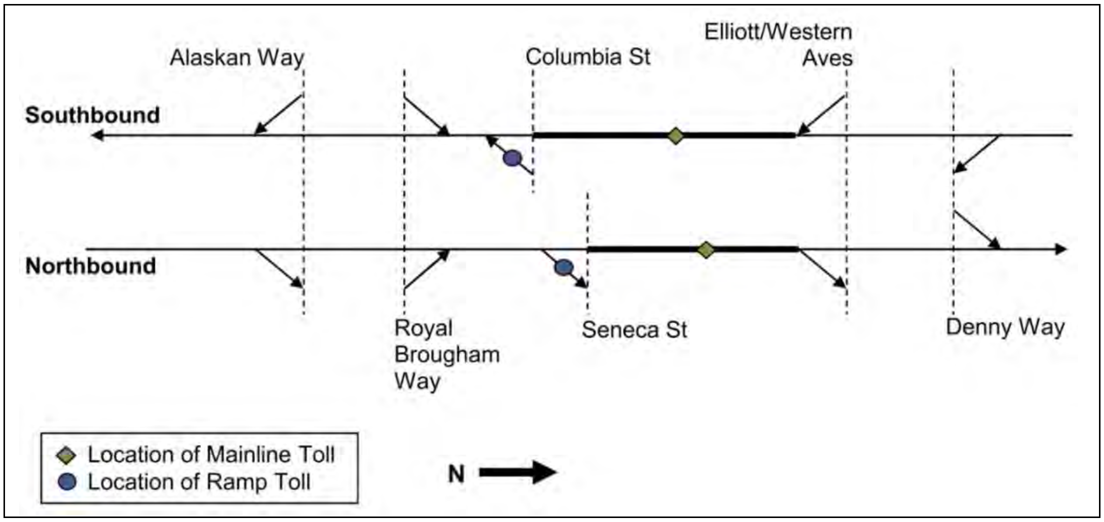


Exhibit 7-87. Estimated Percentage of Traffic Diversion Due to Tolling by Time Period

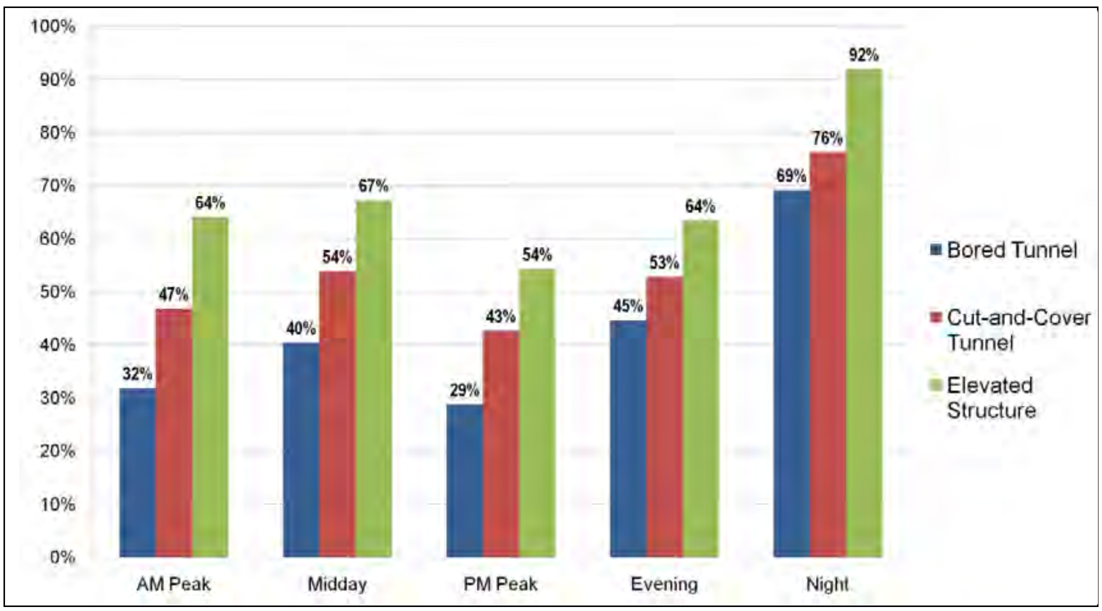


Exhibit 7-88. Daily Percentage of Traffic Diversion by Toll Location and Toll Rate – Elevated Structure Alternative

	Toll Test 1.1	Toll Test 2.1	Toll Test 3.1
Mainline toll only	58%	51%	37%
Mainline toll plus half toll on midtown ramps	53%	47%	33%
Mainline toll plus full toll on midtown ramps	46%	40%	29%

Exhibit 7-89. Daily Percentage of Traffic Diversion by Alternative and Toll Rate

	Toll Scenario C	Toll Test 1.1	Toll Test 2.1	Toll Test 3.1
Bored Tunnel Alternative	37%	33%	28%	19%
Cut-and-Cover Tunnel Alternative	50%	46%	40%	28%
Elevated Structure Alternative	64%	58%	51%	37%
Program	40%	35%	30%	20%

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Chapter 8 CUMULATIVE EFFECTS

Cumulative effects are effects on the environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions.

Section 8.1 discusses the combined effects of closing the viaduct with other past, present, and future projects that are anticipated to add to the transportation effects in the study area.

The Bored Tunnel Alternative complements a number of other independent projects that would improve safety and mobility along SR 99 and the Seattle waterfront, from the SODO area to Seattle Center. Collectively, these individual projects are often referred to as the Alaskan Way Viaduct and Seawall Replacement Program (Program). This collection of projects is categorized into three groups: roadway elements, non-roadway elements, and projects under construction. At this stage, the roadway and non-roadway elements are conceptual in nature and will be the subject of separate environmental processes. The effects of the Program are described in Section 8.2. Data are provided where available.

The analysis of cumulative effects discussed in Section 8.3 includes the combined effect of the Program and other past, present, and future projects that are anticipated to add to the transportation effects in the study area. Section 8.4 discusses the cumulative effects of the Cut-and-Cover Tunnel Alternative, and Section 8.5 discusses the cumulative effects of the Elevated Structure Alternative. The discussions in Sections 8.3, 8.4, and 8.5 are qualitative.

8.1 Viaduct Closed (No Build Alternative)

Traffic projections for 2030 are based on adopted local and regional land use and transportation plans, which include SR 99. Simply closing the viaduct and expecting all other assumptions about future development patterns to remain unchanged creates an unrealistic scenario with transportation demand that far exceeds the capacity of I-5 and streets through downtown Seattle. When the viaduct was suddenly closed following the Nisqually earthquake in 2001, congestion spread through the area and lasted throughout the day. These effects spread to other highways in the region as travelers tried to avoid I-5 and downtown Seattle. Faced with these conditions over the long term, some businesses and people would likely move. Over time, transportation agencies serving the Seattle area would modify or develop new facilities and systems as independent projects under additional environmental review. Eventually, over many years, land use and transportation systems would reach a new equilibrium that is currently difficult to quantify.

8.2 Alaskan Way Viaduct and Seawall Replacement Program

This section assesses the effects of the Program and discusses the same performance measures as those discussed in Chapter 5, but it focuses on the differences between the Program and the Bored Tunnel Alternative.

The Program elements, which are described in Section 8.2.1, are categorized into roadway elements, non-roadway elements, and projects under construction, which are conceptual at this time.

8.2.1 Description of Program Elements

8.2.1.1 Roadway Elements

The roadway elements continue to be refined; therefore, the following project descriptions are conceptual. These roadway program elements augment the transportation network described for the Bored Tunnel Alternative.

8.2.1.1.1 Alaskan Way Surface Street Improvements – S. King Street to Pike Street

The new Alaskan Way surface street will be the subject of a separate environmental review process and design effort. The new Alaskan Way surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), transitioning to four lanes between Marion and Pike Streets. Generally, the new Alaskan Way surface street would be located on the east side of the right-of-way where the Alaskan Way Viaduct is located today. The new street would include new sidewalks, a bicycle facility, parking and loading zones, and signalized pedestrian crossings at cross streets.

8.2.1.1.2 Elliott/Western Connector – Pike Street to Battery Street

The Elliott/Western Connector will be the subject of a separate environmental review process. The new roadway connecting Alaskan Way to Elliott and Western Avenues (in the area between Pike and Battery Streets) would be four lanes wide and would provide a grade-separated crossing of the BNSF mainline railroad tracks. The Elliott/Western Connector would provide a connection from the Alaskan Way surface street to the Elliott/Western corridor that provides access to and from BINMIC and neighborhoods north of downtown Seattle (including Ballard and Magnolia). The new roadway would include bicycle and pedestrian facilities. The grade would be a maximum of about 6 percent. The Lenora Street pedestrian bridge would connect to an at-grade pedestrian crossing of this new connector arterial, whereas today it is a grade-separated crossing.

8.2.1.1.3 Mercer West Project – Fifth Avenue N. to Elliott Avenue W.

Mercer Street would be restriped and signalized between Fifth Avenue N. and Second Avenue W. to create a two-way street with two lanes in each direction and left turn pockets. The improvements would also include the restriping and resignalization necessary to convert Roy Street to two-way operations from Fifth Avenue N. to Queen Anne Avenue N. The City refers to this project as the Mercer West Two-Way Conversion to distinguish it from the underpass, which is part of the Bored Tunnel Alternative.

8.2.1.2 Non-Roadway Elements

The non-roadway elements continue to be refined; therefore, the following project descriptions are conceptual.

8.2.1.2.1 First Avenue Streetcar Evaluation

The First Avenue streetcar is currently planned to run along First Avenue between S. Jackson Street and Republican Street and would include an extension, via Stewart Street, to the South Lake Union streetcar line. The First Avenue streetcar would connect to the First Hill streetcar line. The maintenance base would likely be either at the extension of the South Lake Union line or at a new maintenance base that would be built as part of the First Hill streetcar line.

8.2.1.2.2 Transit Enhancements

A variety of transit enhancements would be provided to support planned transportation improvements associated with the Program and accommodate future demand. These include (1) the Delridge RapidRide line, (2) additional service hours on the West Seattle and Ballard RapidRide lines, (3) peak-hour express routes added to South Lake Union and Uptown, (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes, (5) transit priority on S. Main and/or S. Washington Streets between Alaskan Way and Third Avenue, and (6) simplification of the electric trolley system. RapidRide transit along the Aurora Avenue corridor would also be provided.

8.2.1.2.3 Elliott Bay Seawall Project

The Elliott Bay Seawall is at risk of failure due to seismic and storm events and needs to be replaced to protect the shoreline along Elliott Bay, including Alaskan Way. The seawall currently extends from S. Washington Street in the south to Bay Street in the north, a distance of about 8,000 feet. The Elliott Bay Seawall Project limits extend from S. Jackson Street in the south to Broad Street in the north (also known as the central seawall).

8.2.1.2.4 Alaskan Way Promenade/Public Space

A new central waterfront promenade and public space, which is being designed separately by the City, would be located west of the new Alaskan Way surface street between S. King Street and Pike Street. Between Marion and Pike Streets, the promenade would be approximately 70 to 80 feet wide. Access to the piers would be provided by service driveways. Other potential open spaces include a triangular space north of Pike Street and east of Alaskan Way, as well as parcels created by the removal of the Alaskan Way Viaduct between Lenora and Battery Streets.

8.2.1.3 Projects Under Construction

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

The S. Holgate Street to S. King Street Viaduct Replacement Project will replace this seismically vulnerable portion of SR 99 with a seismically sound structure that is designed to current roadway and safety standards. An Environmental Assessment for this project was completed in June 2008 (FHWA and WSDOT 2008), and the FONSI was published in February 2009 (FHWA and WSDOT 2009). Construction began in mid-2009 with early utility relocations, and project construction is expected to be completed at the end of 2014.

8.2.1.3.2 Transportation Improvements to Minimize Traffic Effects During Construction

Several transportation improvements are underway to help offset traffic effects during construction of the projects included in the Program:

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

8.2.2 Regional Context and Travel Patterns

The discussion of the regional context and travel patterns illustrates how travel patterns might change in the future; it includes AM and PM peak hour and daily estimates of various travel parameters (e.g., VMT and screenline volumes) as a means of quantifying the travel patterns in and around the SR 99 corridor and as a basis for comparing the different alternatives. In the following subsections, the Program is compared to the Bored Tunnel Alternative.

The key findings of the analyses of operational effects and benefits are the following:

- With the Program, VMT would increase in the Center City while VHT and VHD would decrease when compared to these parameters for the non-tolled Bored Tunnel Alternative. VMT, VHT, and VHD in the four-county region (King, Pierce, Snohomish, and Kitsap) would be similar for the non-tolled Program and the non-tolled Bored Tunnel Alternative.
- Person-trip and vehicle volume estimates for the Program are generally similar to those for the Bored Tunnel Alternative in most locations within the study area. Vehicle volume decreases on north-south arterials are expected in the Uptown area because of improved connectivity with the competition of a two-way Mercer Street from Fifth Avenue N. to Second Avenue W.
- Improvements to Alaskan Way and the addition of the Elliott/Western Connector in the Program are expected to increase the vehicle volumes along that corridor compared to those for the Bored Tunnel Alternative. These capacity and connectivity improvements would also facilitate more diversion from SR 99 for the tolled Program than the tolled Bored Tunnel Alternative.

8.2.2.1 Vehicle Miles of Travel

VMT is defined as the total number of miles traveled during a time period over a specified area, in this case either Seattle's Center City or the four-county Puget Sound region. The discussions below describe estimated VMT for AM and PM peak hours and over an average weekday for the Program and the Bored Tunnel Alternative, presenting estimates that are derived by means of the project's travel demand model. Exhibit 8-1 provides a summary of VMT.

In the Center City, the Program would have slightly higher VMT than the non-tolled Bored Tunnel Alternative in all time periods, although in all cases the difference would be less than one-half of 1 percent. The slight increase would likely be due to improvements in mobility and capacity in the Center City area. In the four-county region, volumes with the Program would be effectively the same as those with the non-tolled Bored Tunnel Alternative. The tolled Program would result in a similar slight increase in the Center City compared to the tolled Bored Tunnel Alternative. VMT in the four-county region with the tolled Program would decrease compared to VMT with the tolled Bored Tunnel Alternative, but the difference would be negligible.

Exhibit 8-1. Vehicle Miles of Travel

	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Seattle's Center City					
AM peak hour	413,000	441,700	442,500	445,700	446,100
PM peak hour	521,400	554,500	555,600	559,400	559,800
Daily	2,371,400	2,521,600	2,523,200	2,534,400	2,535,000
Four-County Region					
AM peak hour	20,452,500	20,230,900	20,230,300	20,250,200	20,242,800
PM peak hour	24,263,200	23,935,700	23,933,600	23,962,400	23,952,700
Daily	110,820,300	109,471,700	109,469,400	109,541,400	109,512,300

8.2.2.2 Vehicle Hours of Travel

VHT is defined as the calculated total number of hours traveled in an area, in this case either Seattle's Center City or the four-county Puget Sound region, for a given time period. The VHT estimates discussed below were derived by means of the project's travel demand model. The evaluation describes AM and PM peak hour and daily VHT totals for the Program and the Bored Tunnel Alternative. Exhibit 8-2 provides a summary of VHT.

Exhibit 8-2. Vehicle Hours of Travel

	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Seattle's Center City					
AM peak hour	20,300	18,700	18,400	19,900	19,600
PM peak hour	33,600	30,400	30,000	32,600	32,200
Daily	107,400	101,000	99,900	107,900	106,600
Four-County Region					
AM peak hour	1,107,200	1,094,400	1,094,800	1,097,400	1,095,700
PM peak hour	1,236,400	1,221,700	1,222,100	1,226,400	1,224,900
Daily	4,436,100	4,402,800	4,403,300	4,415,500	4,411,600

In the Center City, the non-tolled Program would result in lower VHT in all time periods compared to VMT for the non-tolled Bored Tunnel Alternative. AM peak hour VHT would decrease by more than 2 percent, while PM peak hour VHT and daily VHT would decrease by more than 1 percent. These decreases would result from increased mobility due to improvements in the Center City area. Similar to VMT, VHT in the four-county region would not show any appreciable difference between the non-tolled Program and the non-tolled Bored Tunnel Alternative in any time period.

With the tolled Program, VHT in the Center City would decrease compared to VHT with the tolled Bored Tunnel Alternative in the same manner as for non-tolled conditions. However, in the four-county region, there would be a slightly greater decrease in VHT, although in every time period the difference would be less than one-half of 1 percent.

8.2.2.3 Vehicle Hours of Delay

VHD is defined as the calculated total number of hours of delay experienced (i.e., travel time above that experienced during free-flow operations) by traffic on roadways in an area for a given time period. The areas considered for VHD are the same as those considered for VMT and VHT, Seattle's Center City and the four-county Puget Sound region. This measure is often used as an indicator of overall traffic congestion. The VHD estimates were derived using the project's travel demand model. The evaluation describes AM and PM peak hours and daily totals for the Program and the Bored Tunnel Alternative. Exhibit 8-3 provides a summary of VHD.

Exhibit 8-3. Vehicle Hours of Delay

	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Seattle's Center City					
AM peak hour	8,600	6,800	6,500	7,600	7,300
PM peak hour	18,500	14,900	14,600	16,800	16,300
Daily	41,300	33,300	32,300	38,700	37,500
Four-County Region					
AM peak hour	537,900	524,500	524,900	526,600	525,200
PM peak hour	553,800	540,600	541,100	544,200	543,000
Daily	1,385,800	1,355,000	1,355,800	1,364,400	1,361,400

The overall differences in VHD mirror those for VHT. In the Center City, VHD with the non-tolled Program would decrease more than 4 percent during the AM peak hour and 2 percent during the PM peak hour compared to VHD with the non-tolled Bored Tunnel Alternative. Average weekday VHD with the non-tolled Program would decrease by 3 percent compared to VHD with the non-tolled Bored Tunnel Alternative. Similar to VHT, these decreases would be attributable to Program elements that would improve mobility in the Center City area. In the four-county region, VHD with the non-tolled Program would be similar to that for the non-tolled Bored Tunnel Alternative.

With tolling, VHD in the Center City would respond in a similar manner between the Program and the Bored Tunnel Alternative as without tolls. Also, similar to VHT, the tolled Program would result in a slightly greater decrease in VHD compared to VHD with the tolled Bored Tunnel Alternative, although the decrease would be less than one-half of 1 percent in each time period.

8.2.2.4 Person Throughput

Person throughput is a measure of the total number of persons traveling on a given transportation facility. Analysts use person-trips to measure the number of people, rather than vehicles, traveling on the transportation system. Increased use of transit or carpools can increase the overall number of people conveyed, even if vehicle traffic does not increase.

This evaluation compares the total number of persons crossing the same screenlines as those used in Chapter 4: a south screenline north of S. King Street, a central screenline north of Seneca Street, and a north screenline north of Thomas Street. The evaluation describes AM and PM peak hour and daily screenline person throughput for the Program and the Bored Tunnel Alternative. Exhibit 8-4 provides a summary of person throughput by screenline.

Exhibit 8-4. Model-Estimated Daily Person Throughput (Person-Trips)

	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South Screenline (South of S. King Street)					
AM peak hour	61,360	65,840	66,400	66,230	66,780
PM peak hour	73,470	79,210	79,920	79,050	80,110
Daily	821,800	880,600	886,600	885,300	892,200
Central Screenline (North of Seneca Street)					
AM peak hour	53,670	60,170	60,850	60,090	60,970
PM peak hour	62,090	69,430	70,280	69,360	70,430
Daily	727,600	795,800	804,100	798,100	807,900
North Screenline (North of Thomas Street)					
AM peak hour	63,600	67,300	66,990	67,800	67,260
PM peak hour	74,900	80,020	79,450	80,120	79,500
Daily	839,900	894,700	880,200	887,200	875,000

At the south screenline, the non-tolled Program would generally serve the same number of person-trips as the non-tolled Bored Tunnel Alternative; all differences would be less than 1 percent higher (6,000 person-trips daily) than the non-tolled Bored Tunnel Alternative. The central screenline would result in a similar increase with the non-tolled Program, resulting in about a 1 percent increase (8,300 person-trips daily) in person-trips in each time period compared to those with the non-tolled Bored Tunnel Alternative.

In contrast to the other screenlines, person-trips at the north screenline with the Program would decrease compared to the non-tolled Bored Tunnel Alternative. AM and PM peak hour person-trips would decrease less than 1 percent, while daily person-trips with the non-tolled Program would decrease almost 2 percent (14,500 person-trips) at this screenline compared to the number of person-trips with the non-tolled Bored Tunnel Alternative. The decrease in person-trips at this screenline would be attributable to the increased directness of trips resulting from the completion of a two-way Mercer Street between Fifth Avenue N. and First Avenue N.

With tolling, the difference between the Program and the Bored Tunnel Alternative would be similar to the difference between the non-tolled Program and non-tolled Bored Tunnel Alternative, with the changes amounting to less than one-half of 1 percent in every time period.

8.2.2.5 Vehicle Volumes on Screenlines

Traffic volume forecasts for the Program were measured at the same four screenline locations as those used in Chapters 4, 5, and 7. The results for screenline vehicle volumes are presented in Exhibit 8-5 and discussed below. These vehicle volumes provide a gauge of the general impacts on parallel streets and highways. Details regarding the distribution of vehicle volumes across specific highway and arterial facilities among the alternatives are discussed in Section 8.2.2.6.

For the non-tolled Program, vehicle volumes at the S. Spokane, south, and central screenlines would be similar to those for the non-tolled Bored Tunnel Alternative. While vehicle volumes would be higher during the AM and PM peak hours as well as over an average weekday, the vehicle volumes for the non-tolled Program at these three screenlines would all be within 1 percent of the volumes for the non-tolled Bored Tunnel Alternative.

The north screenline in South Lake Union and Uptown would experience vehicle volume reductions of 1 to 2 percent in the peak hours and more than 2 percent on an average weekday with the non-tolled Program compared to the non-tolled Bored Tunnel Alternative. These reductions in vehicle volumes at the north screenline do not represent an expected decrease in total vehicles traveling through these neighborhoods; instead they represent improved directness of trips near Seattle Center. Details regarding changes in vehicle travel patterns in the Uptown area are discussed in Section 8.2.2.6.

For the tolled Program, vehicle volumes at all four screenlines would change less than 1 percent compared to those for the non-tolled Program. For a discussion of the effects of tolling on changes in screenline-level vehicle volumes for the Program, refer to the discussion of the tolled Bored Tunnel Alternative in Section 7.2.1.5.

Exhibit 8-5. Model-Estimated Vehicle Volumes at Screenlines

	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Spokane Screenline (North of S. Spokane Street)					
AM peak hour	32,020	34,590	34,660	34,850	34,920
PM peak hour	35,800	38,400	38,530	38,550	38,600
Daily	464,200	495,900	496,900	500,000	500,600
South Screenline (South of S. King Street)					
AM peak hour	34,080	37,360	37,600	37,630	37,800
PM peak hour	39,420	43,430	43,780	43,220	43,710
Daily	515,800	559,000	562,000	561,500	564,700
Central Screenline (North of Seneca Street)					
AM peak hour	29,730	33,580	33,900	33,300	33,750
PM peak hour	33,060	37,410	37,830	37,100	37,590
Daily	447,500	491,100	494,900	490,800	495,500
North Screenline (North of Thomas Street)					
AM peak hour	37,650	40,370	39,700	40,600	39,740
PM peak hour	42,510	45,880	45,110	45,970	45,130
Daily	538,000	578,000	564,400	572,200	560,000

8.2.2.6 Vehicle Volumes on Key Facilities and Arterial Screenlines

Vehicle volumes were also analyzed by separating major facility volumes from the screenlines, as shown in Exhibits 8-6 through 8-8. The number of vehicles expected to travel through the study area with the non-tolled Program is similar to that with the non-tolled Bored Tunnel Alternative. Any notable differences in the Program are discussed below.

At the S. Spokane screenline, daily vehicle volumes are expected to be similar to those for the non-tolled Bored Tunnel Alternative, with arterial vehicle volumes increasing less than 1 percent (100 vehicles), SR 99 vehicle volumes increasing

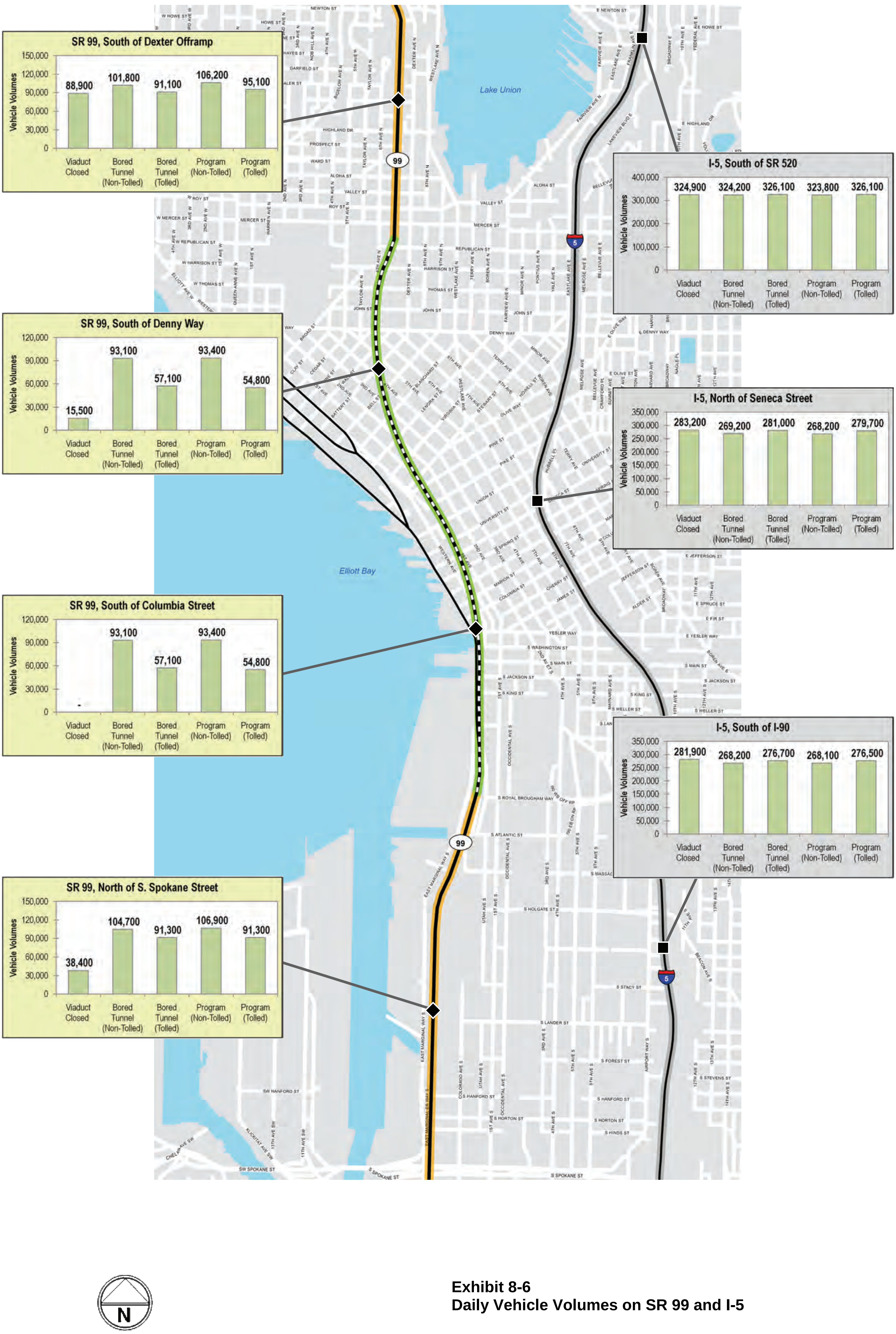

Exhibit 8-6
Daily Vehicle Volumes on SR 99 and I-5

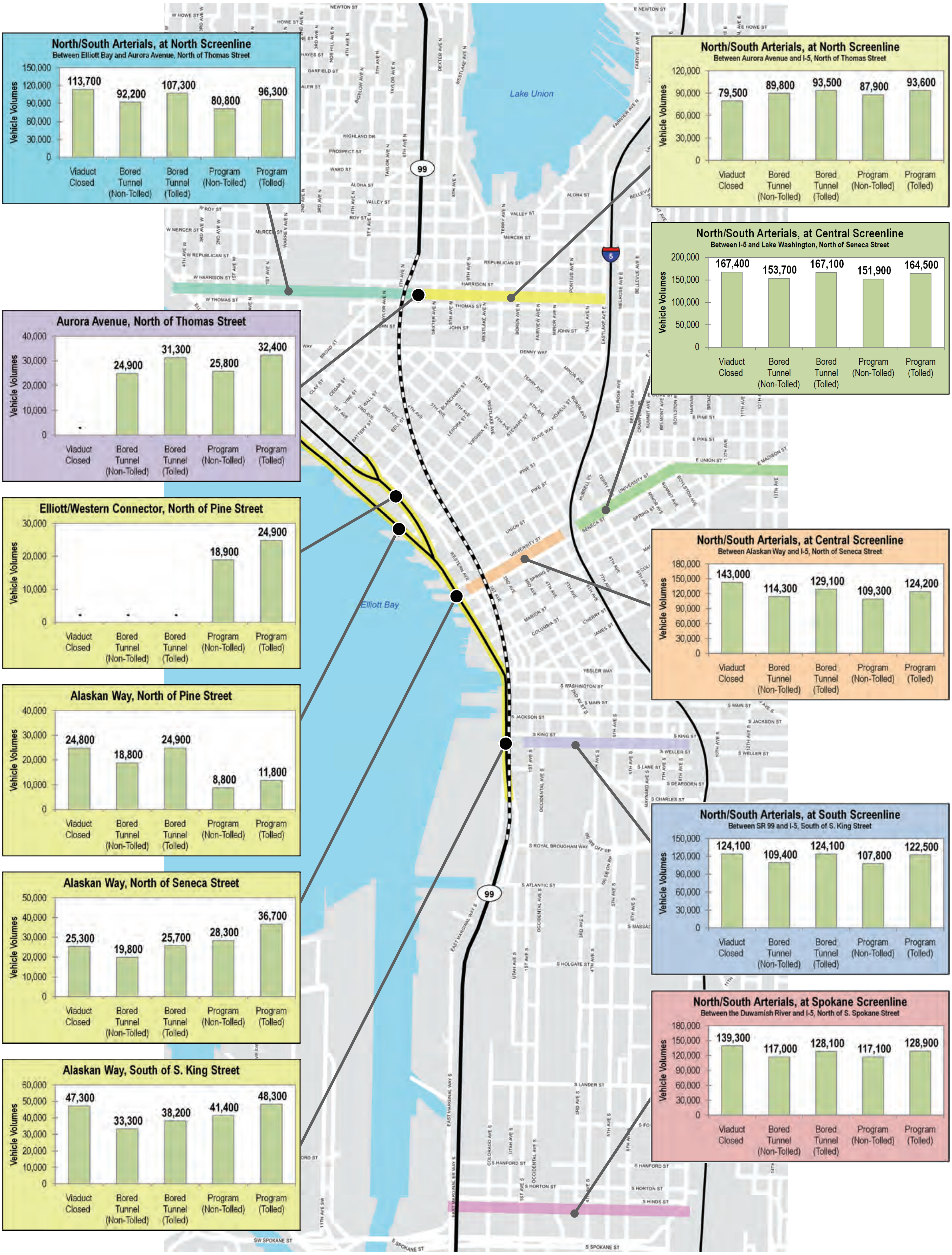

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Exhibit 8-7
Daily Vehicle Volumes on Arterials

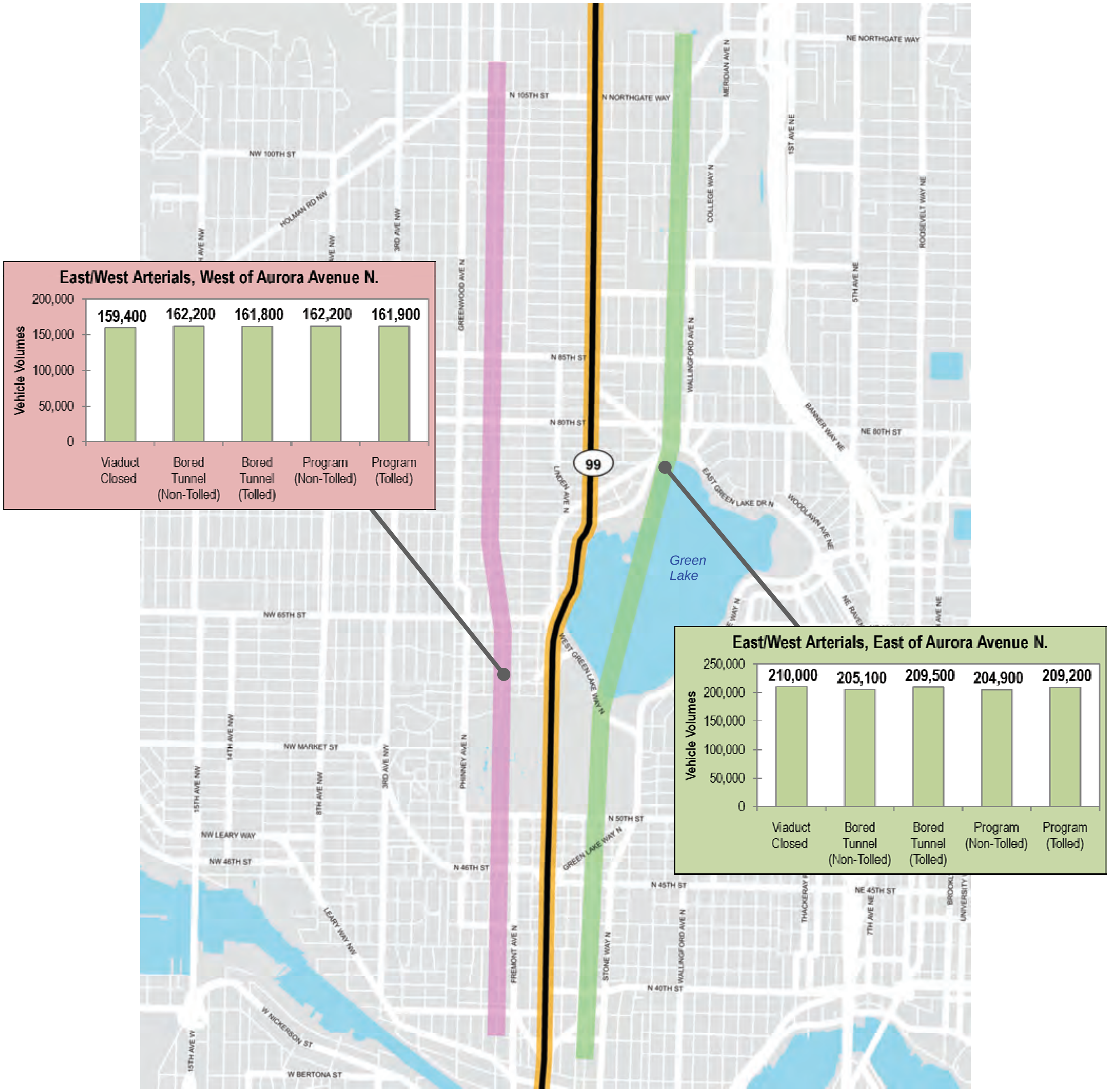

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Exhibit 8-8
Daily Vehicle Volumes
on Arterials in North Seattle

about 2 percent (2,200 vehicles), and I-5 vehicle volumes staying virtually the same.

Farther north at the south screenline, a shift of vehicles to Alaskan Way would be apparent, with 24 percent (8,100 vehicles) more vehicles traveling on that facility. With the Program, the widened Alaskan Way in Pioneer Square would allow easier access between SR 99 and downtown and areas northward. The widened Alaskan Way facility would attract vehicle trips from other parallel arterials in Pioneer Square and the International District, leading to an expected daily decrease of just over 1 percent (1,600 vehicles) on those facilities.

At the central screenline, vehicle volumes on SR 99 and I-5 are expected to remain relatively the same, but the Alaskan Way volumes with the Program would noticeably increase, amounting to a daily increase of 43 percent (8,500 vehicles). This increase can be attributed to the widened Alaskan Way facility in Pioneer Square as discussed previously, in addition to the Elliott/Western Connector. The Elliott/Western Connector is expected to encourage more through vehicle trips along Alaskan Way in downtown, while reducing vehicle trips on Alaskan Way north of the Elliott/Western Connector in Belltown.

At the north screenline, compared to the non-tolled Bored Tunnel Alternative, vehicle volumes with the non-tolled Program are forecasted to increase slightly along arterial Aurora Avenue, representing a daily increase of almost 4 percent (900 vehicles). Vehicle volumes on other parallel arterials in South Lake Union and Uptown are expected to decrease 2 percent (1,900 vehicles) and 12 percent (11,400 vehicles), respectively. These decreases, particularly west of Aurora Avenue, are expected to be primarily due to changes in traffic patterns near Seattle Center and along the Mercer corridor, as a result of the completion of a two-way Mercer Street from west of Fifth Avenue N. to west of First Avenue N. A continuous two-way corridor along Mercer Street is expected to encourage east-west trips to stay on the north side of Seattle Center. This reduction in the number of vehicles that use Fifth Avenue N. and Broad Street to go to Denny Way to travel east-west reduces the number of vehicles measured at the screenline. However, while not captured at the north screenline, the total number of vehicle trips traveling through Uptown and South Lake Union is expected to be similar to the number for the non-tolled Bored Tunnel Alternative.

Tolling the bored tunnel in the Program is expected to result in similar changes in travel patterns as tolling the Bored Tunnel Alternative (see Section 7.2.1.6). In addition to the effects of the tolled Bored Tunnel Alternative, the tolled Program is expected to result in a 4 percent (2,300 vehicles) decrease in daily vehicle volumes through the bored tunnel relative to the volumes with the tolled Bored Tunnel Alternative. While the non-tolled Program would be similar to the non-tolled Bored Tunnel Alternative, the traffic diversion from SR 99 with the tolled Program would be higher because of the additional capacity for the diverted traffic due to the Program elements, particularly the six-lane section of Alaskan Way in Pioneer Square and the new Elliott/Western Connector.

8.2.2.7 Daily Traffic Patterns on SR 99

Compared to the non-tolled Bored Tunnel Alternative described in Chapter 5, the non-tolled Program would result in similar vehicle volumes and traffic patterns. The only notable increase would be south of downtown, where more vehicle trips would be accommodated as they connect to the widened Alaskan Way facility. Traffic patterns with the tolled Program would be similar to those described for the tolled Bored Tunnel Alternative in Chapter 7, again with the exception that more vehicles would exit to the widened Alaskan Way facility. A more in-depth discussion of ramp and mainline volumes is provided in Section 8.2.3.

8.2.3 Traffic Operations on SR 99

The key findings of the analyses of traffic operations on SR 99 are the following:

- Volumes estimated for the Program are generally similar to those for the Bored Tunnel Alternative, with modest increases on most mainline and ramp segments south of downtown, modest decreases in the bored tunnel, and increases north of downtown.
- The mainline LOS projected for the Program is generally expected to be similar to that for the Bored Tunnel Alternative. For the Program with tolled conditions, changes in mainline LOS from that with non-tolled conditions are similar to those described for the tolled Bored Tunnel Alternative in Chapter 7.
- Travel speeds for the Program corroborate the LOS findings. Projected speeds for the Program are similar to those for the Bored Tunnel Alternative, with the exception of decreases in northbound speeds in the south area during the AM peak hour and decreases in speeds in the northbound bored tunnel during the PM peak hour. For the Program with tolled conditions, changes in mainline speeds from non-tolled conditions are similar to those described for the tolled Bored Tunnel Alternative in Chapter 7.

8.2.3.1 SR 99 Mainline and Ramp Traffic Volumes

This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the Program with both the non-tolled and tolled conditions. Expected changes between the Bored Tunnel Alternative and the Program with both non-tolled and tolled conditions are also discussed in detail in the following subsections.

8.2.3.1.1 AM Peak Hour Traffic Volumes

Exhibits 8-9 and 8-10 show the traffic volumes in the AM peak hour for the non-tolled Program and the tolled Program, respectively. Exhibit 5-12 illustrates the AM peak hour volumes for the non-tolled Bored Tunnel Alternative, and Exhibit 7-29 illustrates them for the tolled Bored Tunnel Alternative.

Volume estimates for the non-tolled Program are generally similar to those for the non-tolled Bored Tunnel Alternative, with modest changes. Slight increases in vehicle volumes are expected south and north of the bored tunnel (with the exception of southbound mainline volumes entering the corridor, which are expected to decrease) due to additional connectivity provided by the new Elliott/Western Connector. With the non-tolled Program, volumes in the bored tunnel would be similar to those for the Bored Tunnel Alternative, with increased volumes exiting northbound in the stadium area and entering southbound in South Lake Union. For the tolled Program, changes in vehicle volumes from those for non-tolled Program would be similar to those described for the tolled Bored Tunnel Alternative in Chapter 7.

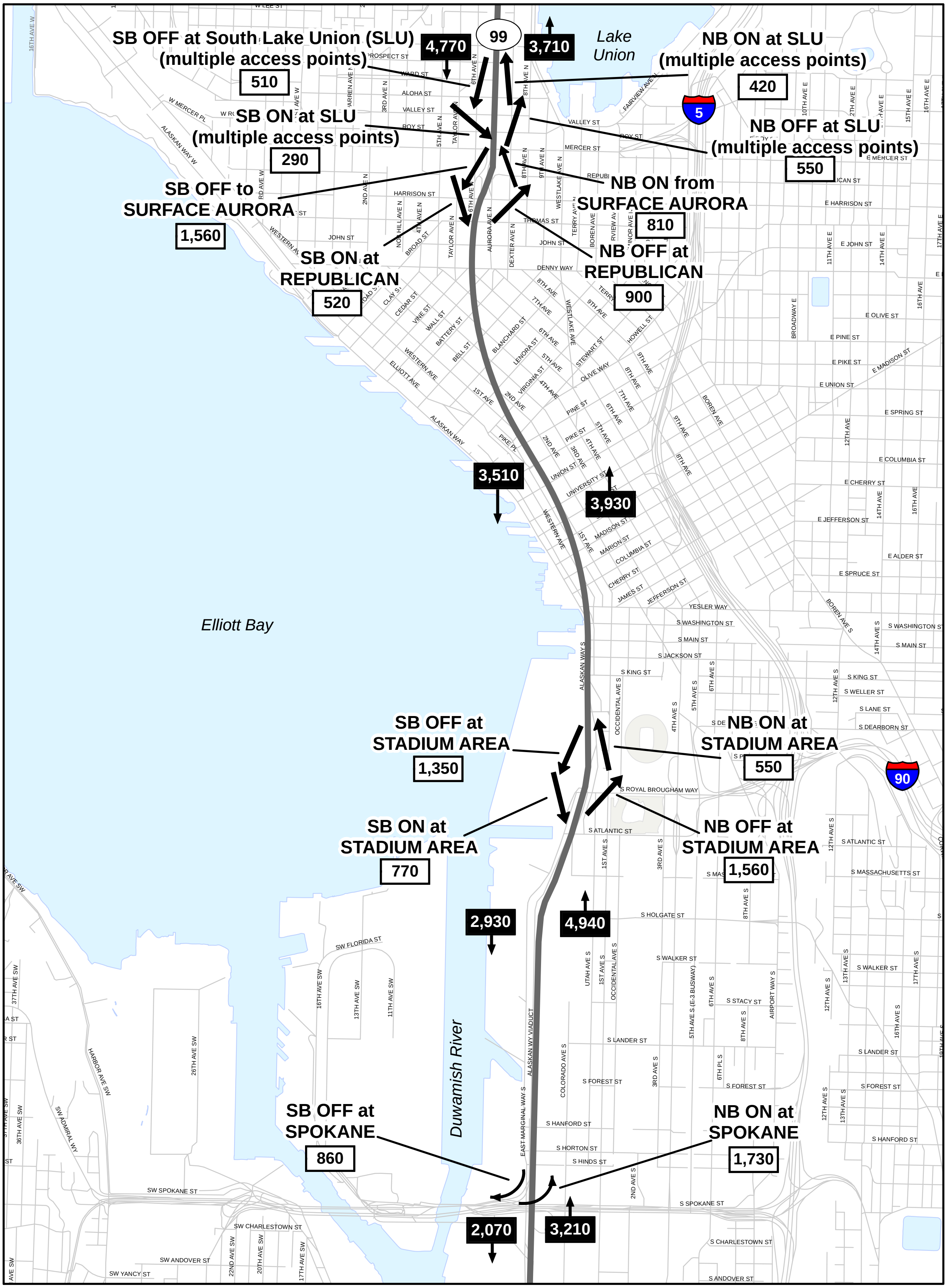
8.2.3.1.2 PM Peak Hour Traffic Volumes

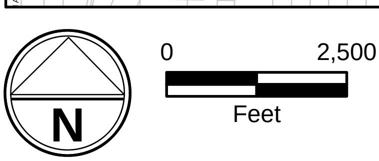
Exhibits 8-11 and 12 show the traffic volumes in the PM peak hour for the non-tolled Program and tolled Program, respectively. Exhibit 5-15 shows the traffic volumes in the PM peak hour for the non-tolled Bored Tunnel Alternative, and Exhibit 7-30 them for the tolled Bored Tunnel Alternative.

As in the AM peak hour, volume estimates for the non-tolled Program are generally similar to those for the non-tolled Bored Tunnel Alternative, with modest changes. Slight increases in vehicle volumes are expected on the mainline in the corridor, including in the bored tunnel, due to additional connectivity provided by the new Elliott/Western Connector. Similar to the AM peak hour, volumes would increase on some ramps, including those exiting northbound in the stadium area and entering southbound in South Lake Union. For the tolled Program, changes in vehicle volumes from those of the non-tolled Program would be similar to those described for the tolled Bored Tunnel Alternative in Chapter 7.

8.2.3.1.3 Daily Traffic Volumes

Exhibits 8-13 and 8-14 show the daily traffic volumes for the non-tolled Program and the tolled Program, respectively. Exhibit 5-18 shows the daily traffic volumes for the non-tolled Bored Tunnel Alternative, and Exhibit 7-31 shows them for the tolled Bored Tunnel Alternative.





XXX	Ramp Volumes
XXX	SR 99 Mainline Volumes

Exhibit 8-9
AM Peak Hour Mainline and Ramp Volumes - Non-Tolled Program

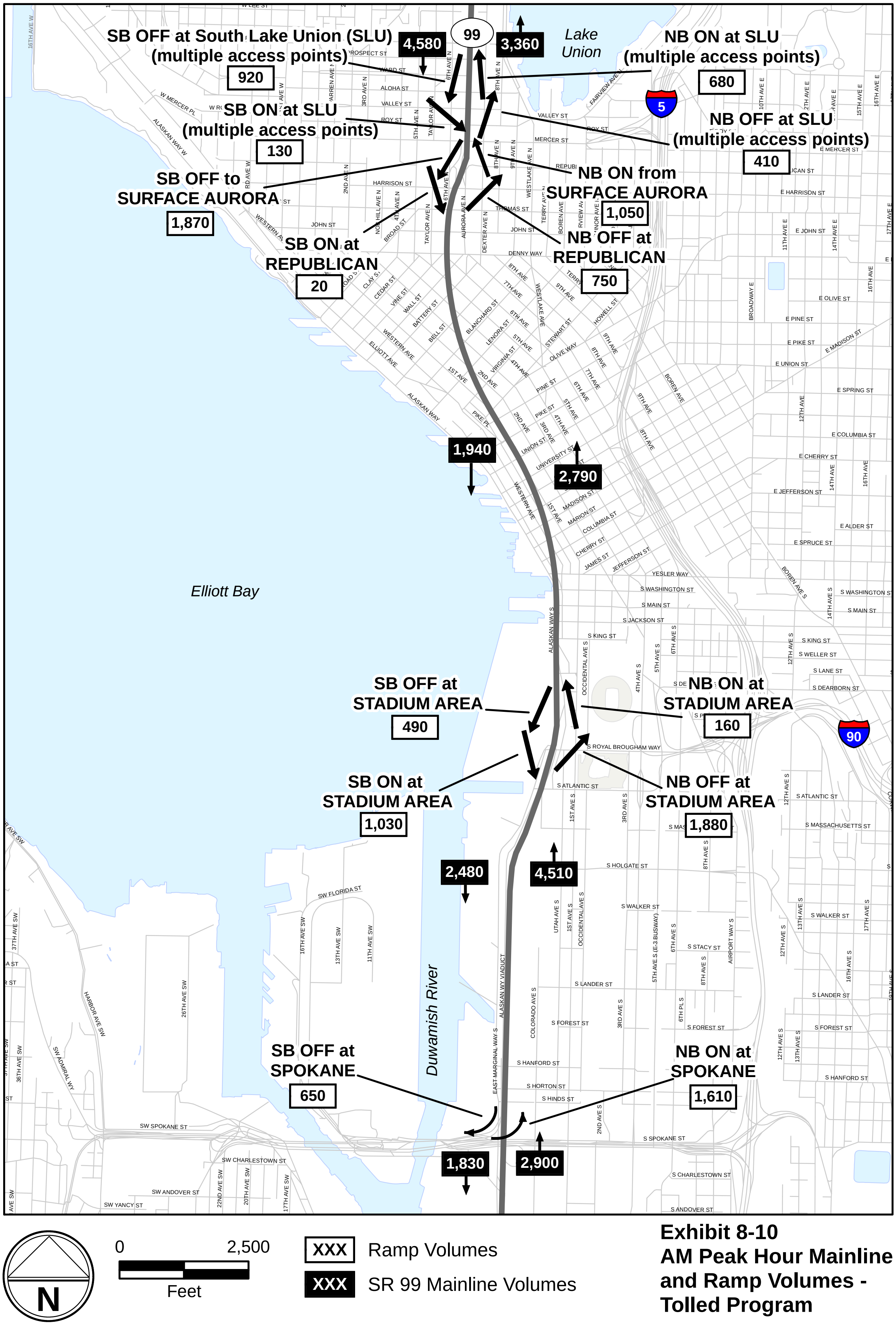
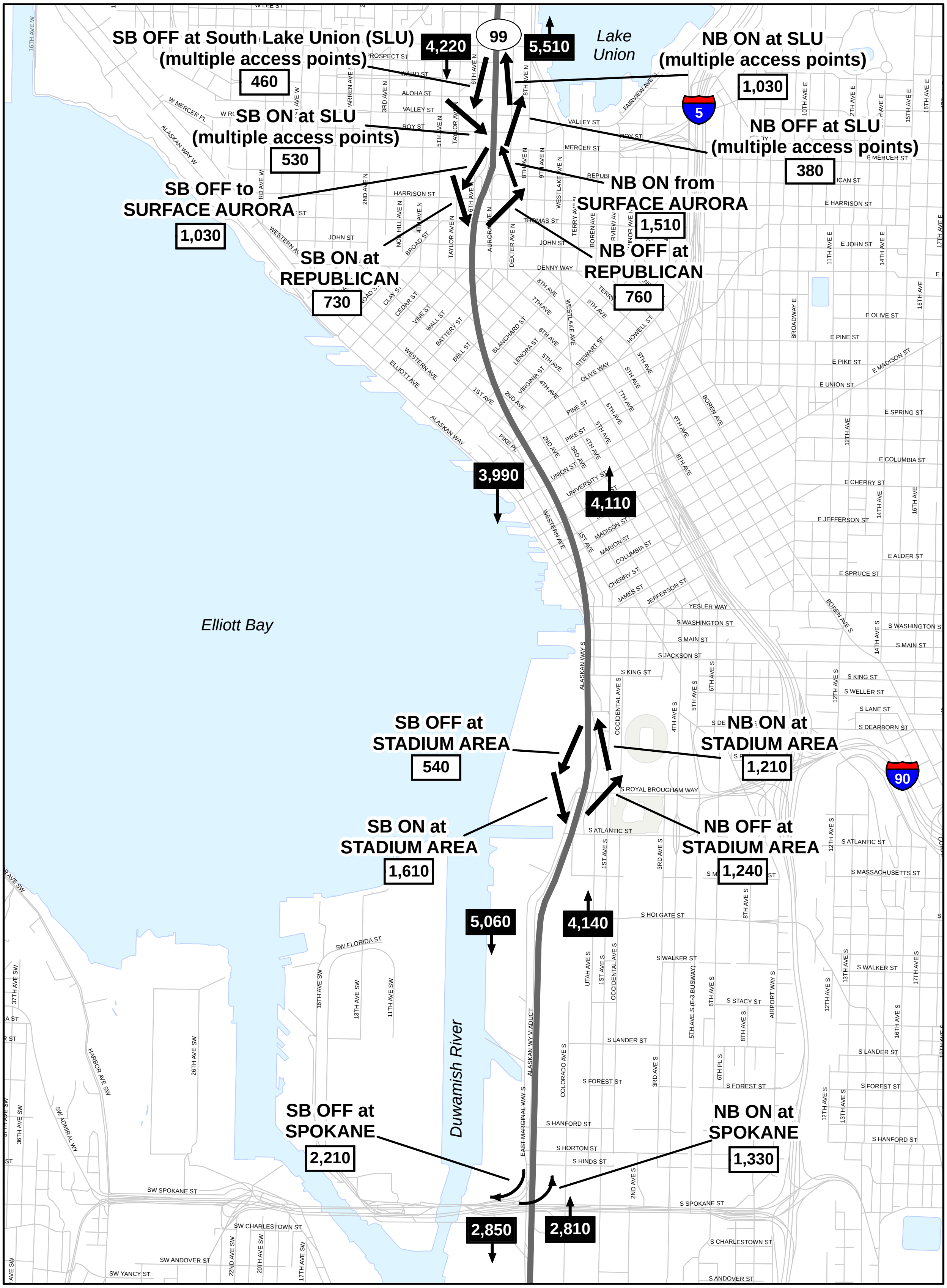


Exhibit 8-10
AM Peak Hour Mainline and Ramp Volumes - Tolled Program



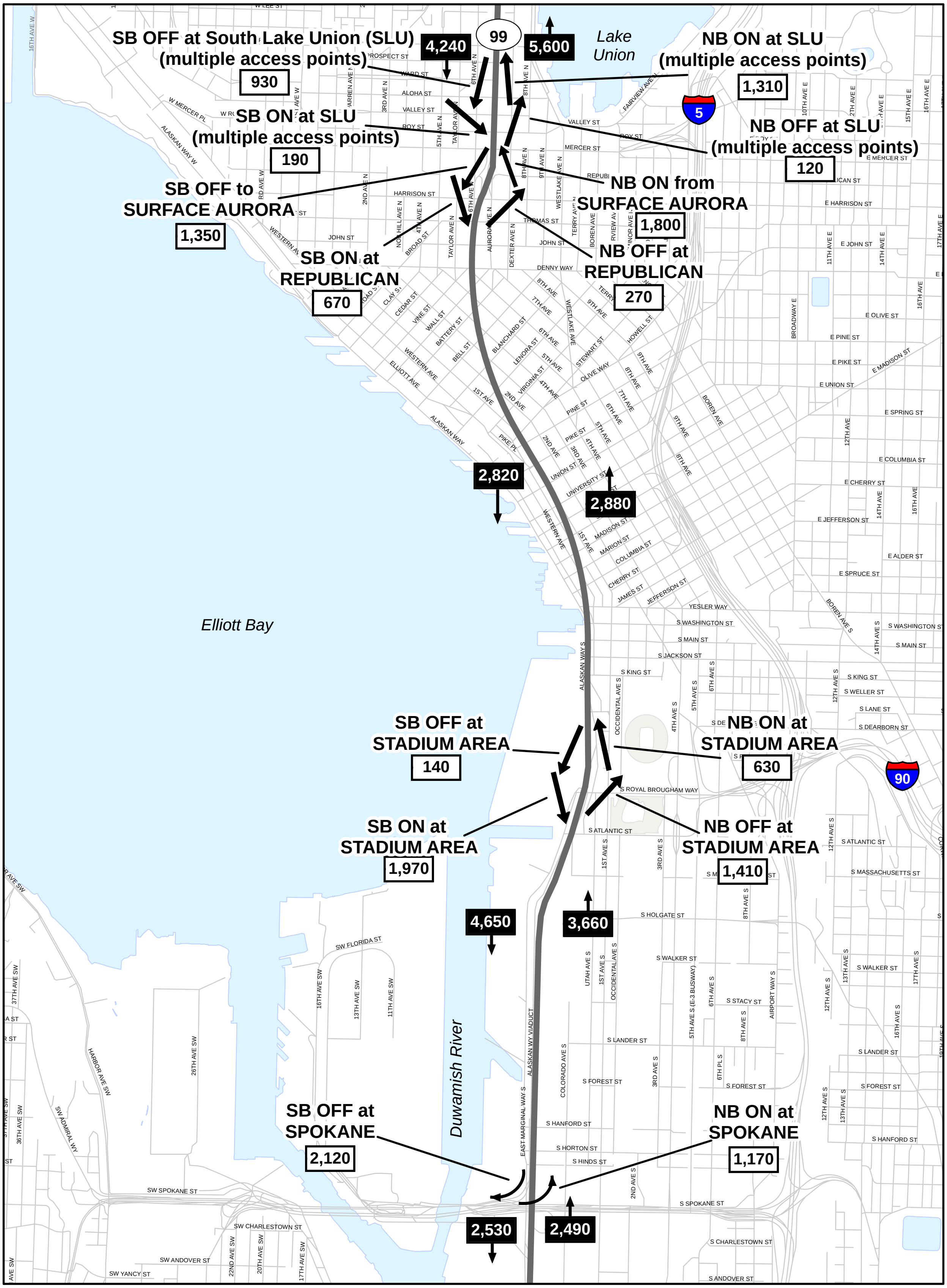
N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 8-11
PM Peak Hour Mainline and Ramp Volumes - Non-Tolled Program



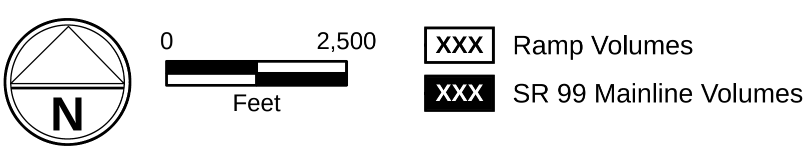
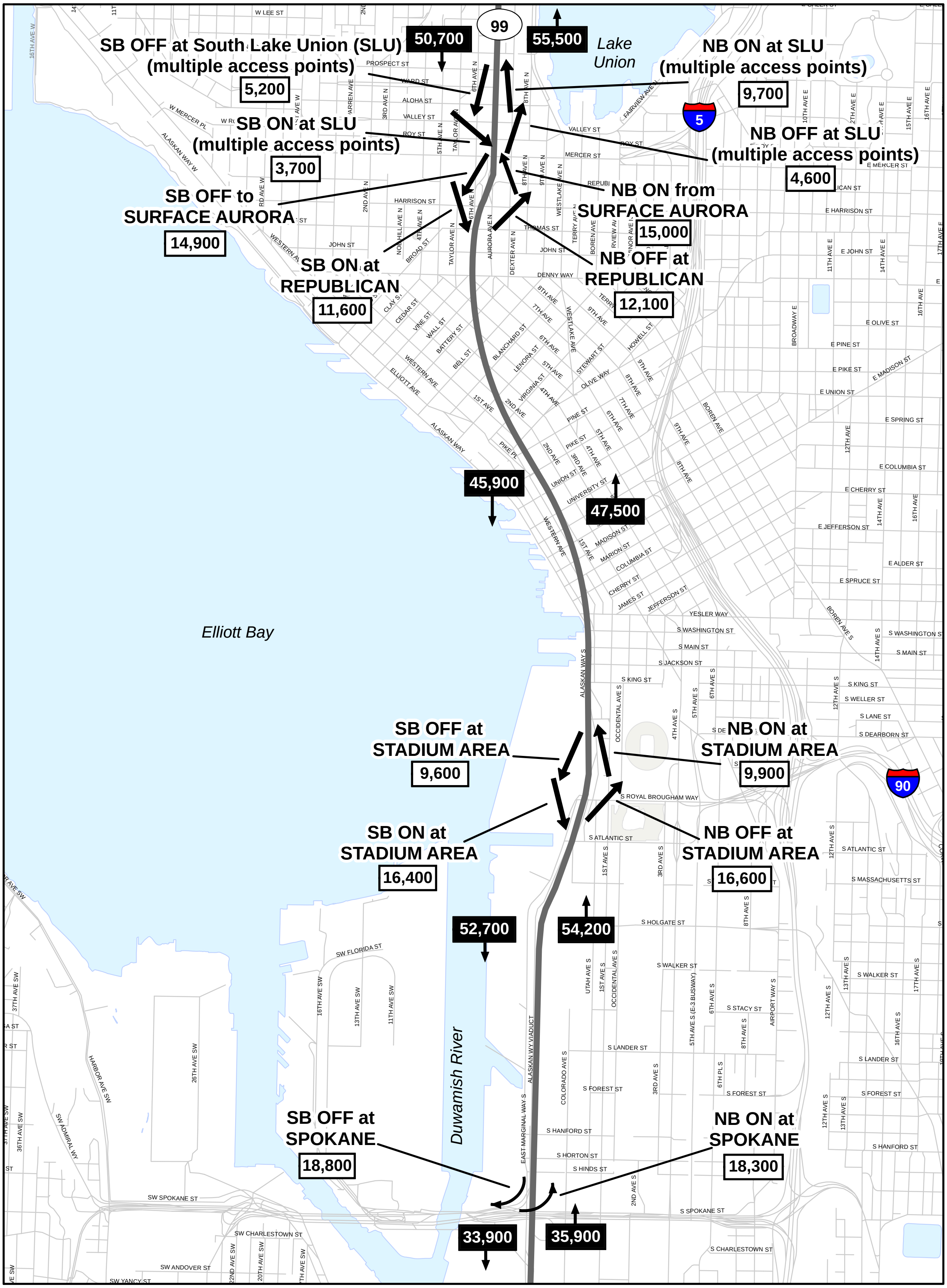


Exhibit 8-12
PM Peak Hour Mainline and Ramp Volumes - Tolled Program



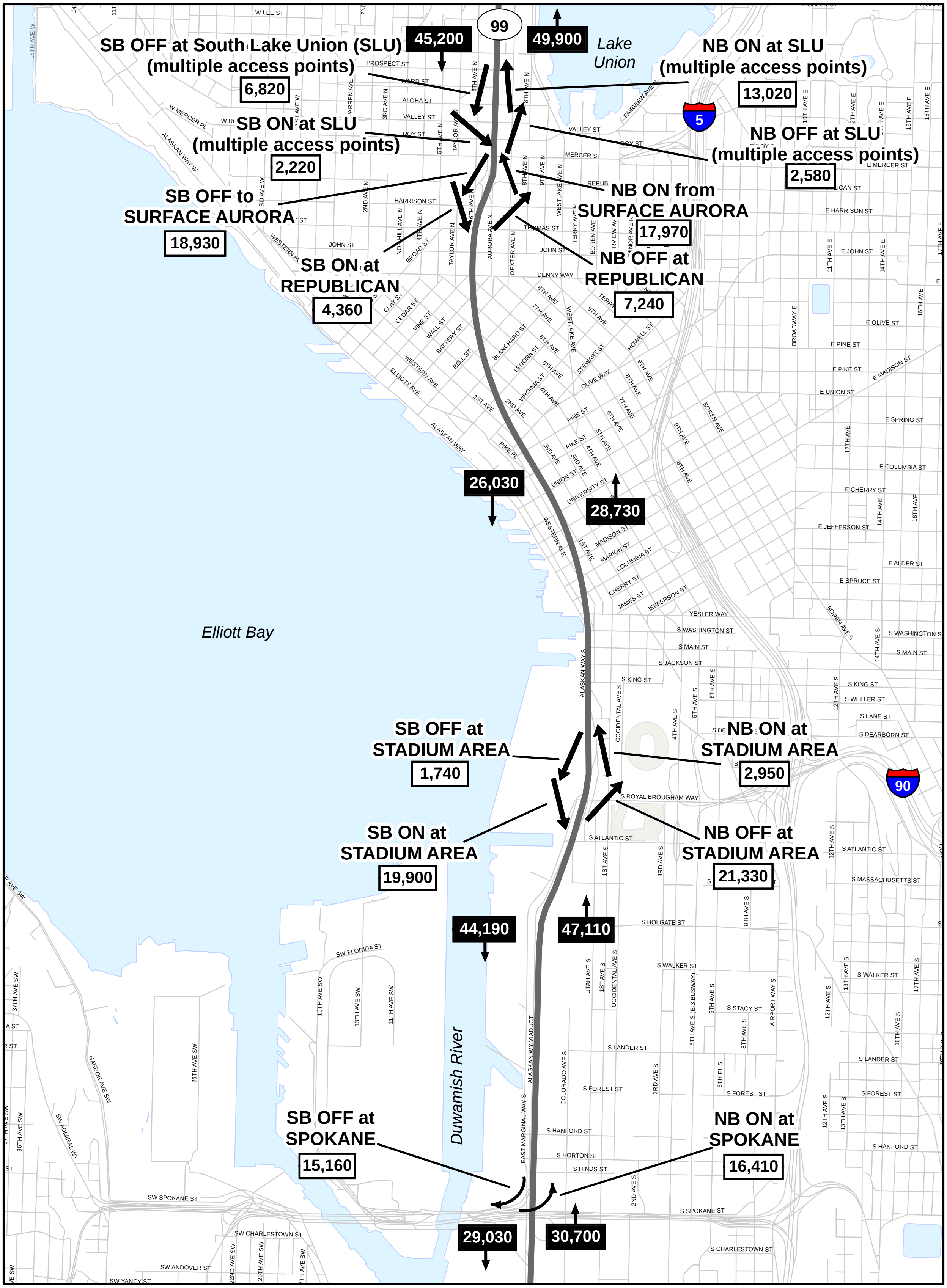
N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 8-13
Daily Mainline and Ramp Volumes - Non-Tolled Program



N

0 2,500
Feet

XXX Ramp Volumes
XXX SR 99 Mainline Volumes

Exhibit 8-14
Daily Mainline and Ramp Volumes - Tolled Program

As in the AM peak hour, volume estimates for the non-tolled Program are generally similar to those for the non-tolled Bored Tunnel Alternative, with modest changes. Slight increases in vehicle volumes are expected on the mainline in the corridor, including in the bored tunnel, due to additional connectivity provided by the new Elliott/Western Connector. Similar to the AM peak hour, volumes would increase on some ramps, including those exiting northbound in the stadium area and entering southbound in South Lake Union. For the tolled Program, changes in vehicle volumes from those for the non-tolled Program would be similar to those described for the tolled Bored Tunnel Alternative in Chapter 7.

8.2.3.2 SR 99 Mainline Level of Service

This section describes the AM and PM peak hour LOS in three corridor segments for the Bored Tunnel Alternative and the Program with both non-tolled and tolled conditions. While LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing the modeled conditions on the SR 99 mainline, because the ramp locations and segment arrangements may vary considerably among the modeled conditions. In addition, as indicated in Chapter 2, the posted speeds along SR 99 are less than the speeds on a typical freeway; therefore, the LOS as based on the HCM density ranges for freeways would likely be lower than the actual speeds on the facility. The mainline LOS results are therefore better suited for a relative comparison between the modeled conditions as opposed to a true indication of operating performance. Projected speeds and travel times along the facility are better indicators of expected performance. The SR 99 mainline LOS is summarized by segment for the Bored Tunnel Alternative and the Program in Exhibits 8-15 and 8-16, reflecting both directions in the AM and PM peak hours.

For the non-tolled Program, the mainline LOS is generally expected to be similar to that projected for the non-tolled Bored Tunnel Alternative. During the AM peak hour, the bored tunnel segment of the mainline is projected to operate at LOS E in the southbound direction and at LOS D in the northbound direction, similar to the non-tolled Bored Tunnel Alternative. During the PM peak hour, operations are projected to improve from LOS F for the non-tolled Bored Tunnel Alternative to LOS E for the non-tolled Program in the southbound direction and remain at LOS E in the northbound direction.

Exhibit 8-15. Peak Hour Northbound SR 99 Segment Level of Service

Segment	AM Peak Hour				PM Peak Hour			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South Corridor								
S. Spokane Street to stadium off-ramp	E	E	F	F	D	D	D	D
Midtown								
Bored tunnel	D	D	C	C	E	E	C	C
North Corridor								
North of bored tunnel	E	E	D	D	F	F	F	F

Notes: LOS shown for the bored tunnel was calculated using HCM analysis methodology, based on 55 mph free-flow speed. The actual bored tunnel facility would have a lower design speed (50 mph) and posted speed (50 mph or lower); therefore, LOS shown should be considered conservative. Actual performance is better measured through projected speed comparisons.
HCM = *Highway Capacity Manual*
LOS = level of service

Exhibit 8-16. Peak Hour Southbound SR 99 Segment Level of Service

Segment	AM Peak Hour				PM Peak Hour			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South Corridor								
Stadium on-ramp to S. Spokane Street	C	C	B	B	F	F	F	D
Midtown								
Bored tunnel	E	E	C	C	F	E	D	D
North Corridor								
North of bored tunnel	F	F	F	F	E	F	E	F

Notes: LOS shown for the bored tunnel was calculated using HCM analysis methodology, based on 55 mph free-flow speed. The actual bored tunnel facility would have a lower design speed (50 mph) and posted speed (50 mph or lower); therefore, LOS shown should be considered conservative. Actual performance is better measured through projected speed comparisons.
HCM = *Highway Capacity Manual*
LOS = level of service

In the south area from approximately S. Spokane Street to the off-ramp in the stadium area, the speeds and densities on southbound SR 99 would remain at LOS C levels during the AM peak hour and LOS F during the PM peak hour. Mainline performance in the northbound direction would remain at LOS E in the AM peak hour and LOS D in the PM peak hour.

In the north area, southbound conditions are expected to remain at LOS F during the AM peak hour and degrade to LOS F during the PM peak hour. Northbound conditions would remain at LOS E in the AM peak hour and LOS F in the PM peak hour.

For the Program with tolled conditions, changes in mainline LOS from that with non-tolled conditions would be similar to that described for the Bored Tunnel Alternative with tolled conditions in Chapter 7, with LOS generally remaining similar or improving in both directions during both the AM and PM peak hours. The exception to this would be northbound traffic approaching the stadium area during the AM peak hour, for which LOS is expected to degrade from LOS E to LOS F with tolled conditions. This degradation is expected to occur due to congestion resulting from the high volume of vehicles exiting the facility upstream of the tolled segment.

8.2.3.3 SR 99 Mainline Speeds

This section discusses the AM and PM peak hour travel speeds in the corridor segments for the Bored Tunnel Alternative and the Program with both non-tolled and tolled conditions. As with LOS, comparing travel speeds between the modeled conditions can present certain challenges because the ramp and segment arrangements vary among them. The speeds are presented in tabular format in Exhibits 8-17 and 8-18. To assist in this comparison, the results are also presented side by side graphically in Exhibits 8-19 and 8-20.

The results for the segment travel speed for the non-tolled Program corroborate the LOS findings, with speeds on most segments projected to be generally similar to those projected for the non-tolled Bored Tunnel Alternative. Southbound speeds in the bored tunnel are expected to remain at approximately 45 to 46 mph in both the AM and PM peak hours for the non-tolled Program. Likewise, in the northbound direction, speeds in the tunnel are expected to remain at approximately 44 mph during the AM peak hour and approximately 39 to 41 mph during the PM peak hour.

Exhibit 8-17. Peak Hour Northbound SR 99 Segment Speeds

Segment	AM Peak Hour (miles per hour)				PM Peak Hour (miles per hour)			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South Corridor								
S. Spokane Street to stadium off-ramp	45	40	26	23	47	47	45	43
Midtown								
Bored tunnel	44	44	46	47	41	39	46	46
North Corridor								
North of bored tunnel	33	33	32	32	26	29	29	29

Exhibit 8-18. Peak Hour Southbound SR 99 Segment Speeds

Segment	AM Peak Hour (miles per hour)				PM Peak Hour (miles per hour)			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South Corridor								
Stadium on-ramp to S. Spokane Street	48	48	48	48	32	35	35	45 [1]
Midtown								
Bored tunnel	46	46	48	48	45	46	47	47
North Corridor								
North of bored tunnel	30	34	18	19	36	28	36	29

Note: 1. Consistent traffic modeling methodology was used to analyze this segment of SR 99 as in all other cases. Under Program conditions, this section of SR 99 is expected to operate under congested conditions with the projected traffic volumes, which are similar to those of the tolled Bored Tunnel Alternative. However, the analysis showed more free-flow conditions due to the modeled traffic volumes actually getting to this segment of SR 99. Operations on this segment are expected to be similar to those of the other alternatives presented in this table.

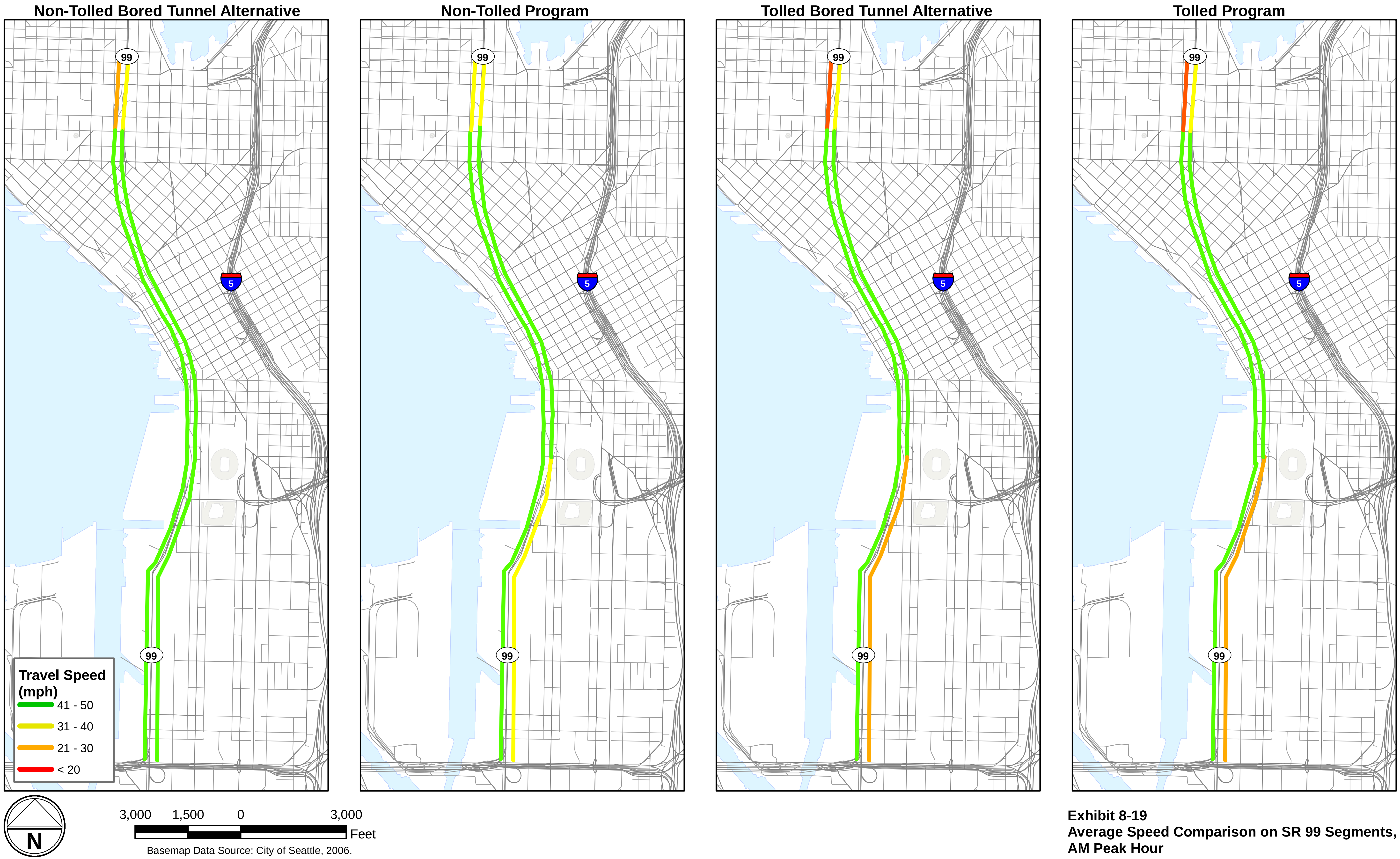
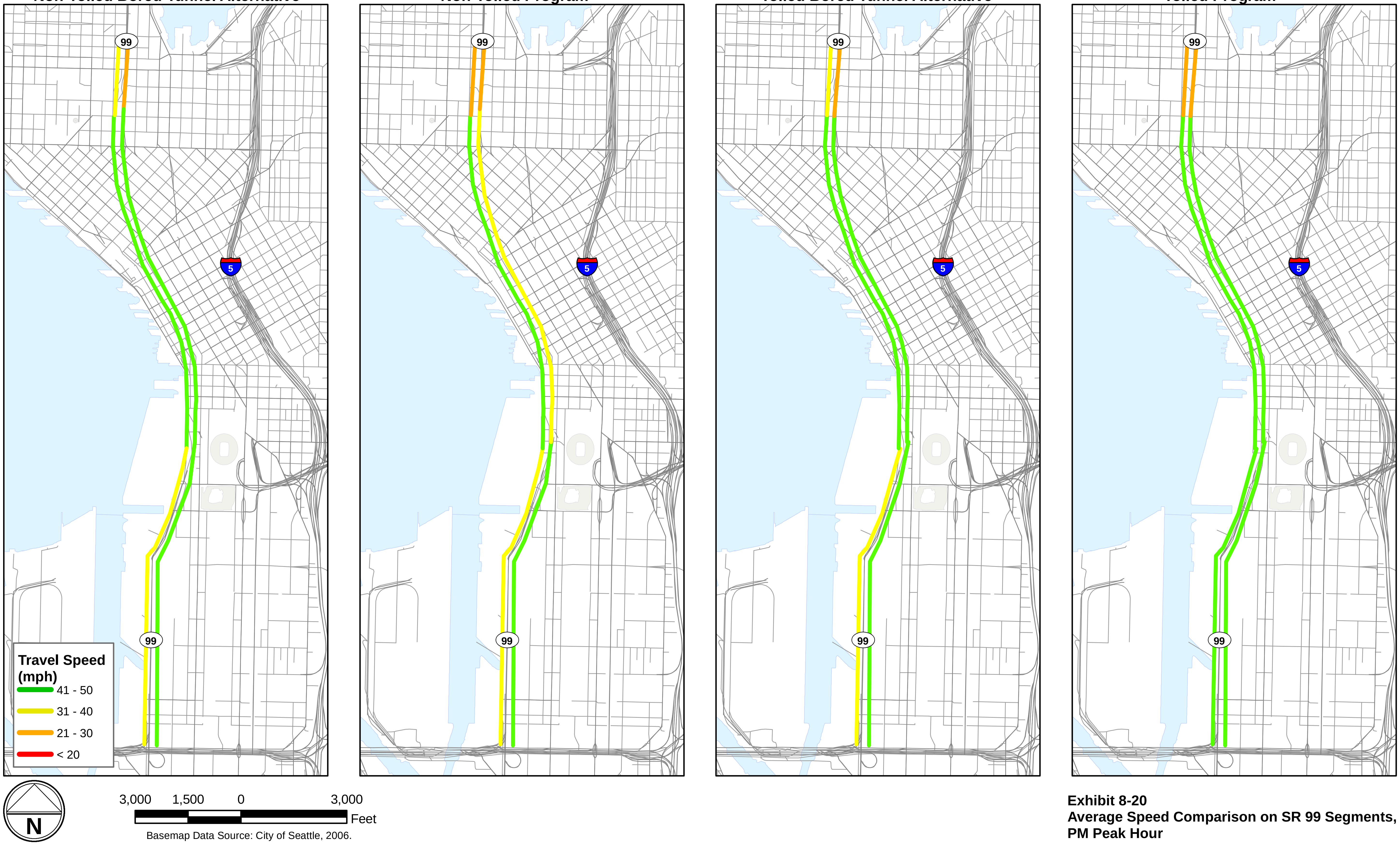


Exhibit 8-19
Average Speed Comparison on SR 99 Segments, AM Peak Hour



Basemap Data Source: City of Seattle, 2006.

Exhibit 8-20
Average Speed Comparison on SR 99 Segments, PM Peak Hour

In the south area from S. Spokane Street to the off-ramp in the stadium area, speeds on SR 99 in both directions with the non-tolled Program are expected to be similar to the those with the non-tolled Bored Tunnel Alternative in the AM and PM peak hours, with the exception of a decrease in northbound speeds during the AM peak hour from 45 mph for the Bored Tunnel Alternative to 40 mph for the Program and a slight increase in southbound speeds during the PM peak hour from 32 to 35 mph. Northbound speeds are expected to be slower for the non-tolled Program because of increased off-ramp volumes in the stadium area, resulting in some queue spillback from the ramp termini intersection that would affect the mainline traffic.

In the north area, southbound speeds are expected to increase from 30 to 34 mph during the AM peak hour and decrease from 36 to 28 mph during the PM peak hour. Speeds during the AM peak hour would increase due to decreased volumes entering the corridor, while speeds during the PM peak hour would decrease sue to increased volumes entering in the South Lake Union area and exiting to surface Aurora Avenue. In the northbound direction, speeds are expected to remain similar during the AM peak hour and to increase slightly from 26 to 29 mph during the PM peak hour because of increased volumes entering from surface Aurora Avenue and in the South Lake Union area.

For the Program with tolled conditions, changes in mainline speeds from those with non-tolled conditions would be similar to those described for the tolled Bored Tunnel Alternative in Chapter 7. Travel speeds would generally remain similar or decrease in both directions during both the AM and PM peak hours. Similar to the results of the LOS analysis, the exception to this is northbound traffic approaching the stadium area during the AM peak hour, for which travel speeds are expected to decrease from 40 to 23 mph, and southbound traffic approaching the bored tunnel during the AM peak hour, for which speeds are expected to decrease from 34 to 19 mph. In both cases, speeds are expected to decrease due to congestion resulting from the high volume of vehicles exiting the facility upstream of the tolled segment.

8.2.4 Traffic Operations at Key Arterial Intersections

The key findings of the analyses of traffic operations at key arterial intersections are the following:

- Average intersection delays and LOS for the Program would generally be similar to those for the Bored Tunnel Alternative.
- In the south area, no substantial changes in channelization are expected for the Program aside from enhanced transit service. Therefore, intersection operations would likely be similar to those for the Bored Tunnel Alternative.

- In the central area, the Elliott/Western Connector to and from the Alaskan Way surface street is expected to draw greater north-south peak hour volumes to the waterfront area and away from Alaskan Way, north of Pike Street, Denny Way, west of Sixth Avenue N. and Mercer Street, and west of Fifth Avenue N..
- The Elliott/Western Connector would provide more direct access between the Alaskan Way surface street and the Elliott/Western one-way couplet and would allow north-south traffic to avoid the railroad conflicts at the north end of Alaskan Way near Elliott Avenue at Broad Street. Congestion levels along Alaskan Way, south of Madison Street, are projected to improve with the Program as a result of the additional lanes along Alaskan Way.
- In the north area, the changes to Mercer Street with the Mercer West Project would not substantially affect intersection delays for the Program compared to the Bored Tunnel Alternative. However, the Elliott/Western Connector may draw some traffic away from the SR 99 and Mercer Street corridors, potentially reducing intersection delays at locations near or west of the SR 99 mainline.
- Intersection operations with the Program are expected to remain similar to those with the Bored Tunnel Alternative.

8.2.4.1.1 South Area

This section does not provide detailed results of the intersection analysis for the south area. Instead it provides a qualitative discussion of potential congestion hot spots and general comparisons of intersection operations for the Program to those for the Bored Tunnel Alternative are provided. Intersection performance for a selected number of study locations was evaluated using Synchro and VISSIM traffic analysis software.

For the Program, the street network in the south area would be similar to that for the Bored Tunnel Alternative, which includes the full range of planned improvements included in the 2015 Existing Viaduct (S. Holgate Street to S. King Street Viaduct Replacement Project and SR 519 Intermodal Access Project, Phase 2) as well as the replacement of the stadium area ramps and the introduction of several new intersections along the East Frontage Road. Also included as part of the Program are transit service enhancements, the First Avenue streetcar, and increases across the King Country Metro bus system.

With little to no change in the street network between the Bored Tunnel Alternative and the Program, but with the proposed transit service enhancements incorporated, delays and LOS for the Program are expected to be similar to those of the Bored Tunnel Alternative, if not slightly improved.

Specific hot spots during the AM peak hour identified for the Bored Tunnel Alternative that would operate at high levels of congestion with the Program include East Marginal Way S. (Terminal 46 driveway) at S. Atlantic Street, Colorado Avenue at S. Atlantic Street, and Fourth Avenue S. at Airport Way S. Specific hot spots during the PM peak hour include the intersections of Fourth Avenue S. at Airport Way S., Fourth Avenue S. at S. Holgate Street, First Avenue at Yesler Way, First Avenue S. at S. Atlantic Street, Second Avenue S. at S. Jackson Street, and Fourth Avenue S. at S. Royal Brougham Way. Delays may also increase at the intersections of Second Avenue S. at S. Jackson Street and Fourth Avenue S at S. Jackson Street due to changes in channelization resulting from the First Hill streetcar.

The modeling results show that for the tolled Program, intersection operations in the south area are projected to be similar to the forecasted operations for the tolled Bored Tunnel Alternative. Detailed results for the tolled Bored Tunnel Alternative are summarized in Chapter 7. In fact, operations at the intersections along Alaskan Way in the south area are expected to operate with less delay for the tolled Program than for the tolled Bored Tunnel Alternative because of increased capacity on Alaskan Way as part of the Program.

8.2.4.1.2 Central Area

As with the south area, no specific technical results or tables are provided in this discussion of intersection operations in the central area. However, congestion levels at intersections for the Program are qualitatively compared to those described for the Bored Tunnel Alternative to highlight the similarities between the modeled conditions.

With the Program, removal of the downtown SR 99 on- and off-ramps would be identical to the network changes described for the Bored Tunnel Alternative. As previously discussed, the affected ramps would include the Columbia Street southbound on-ramp, the Seneca Street northbound off-ramp, the Western Avenue northbound off- and on-ramps, the Battery Street Tunnel off-ramp, and the Elliott Avenue on-ramp. Traffic would use the stadium area ramps in the south area or the interchange in the north area and take surface streets into downtown.

The Elliott/Western Connector would be introduced in the Program (versus the Bored Tunnel Alternative). This new connection is expected to draw additional traffic to Alaskan Way and Elliott and Western Avenues compared to conditions with the Bored Tunnel Alternative. Congestion levels along Alaskan Way, south of Madison Street, are projected to improve with the Program as a result of the additional lanes along Alaskan Way.

For the Program, the majority of intersections are expected to operate similarly to their operation for the Bored Tunnel Alternative in the central area. During the

AM peak hour, critical hot spots identified for the Bored Tunnel Alternative include Second Avenue at Marion Street and Fourth Avenue at Columbia Street; similar delays could be expected at these locations for the Program. For the PM peak hour, similar to the Bored Tunnel Alternative, the intersections of Western Avenue at Broad Street and Second Avenue at Marion Street are expected to operate with the high levels of congestion for the Program. The enhancements in transit service expected as part of the Program may help to reduce general-purpose vehicle demands on city streets and consequently result in an overall decrease in intersection delays.

The modeling results show that for the tolled Program, intersection operations in the central area are projected to be similar to the forecasted operations for the tolled Bored Tunnel Alternative, with a few exceptions. Detailed results of the tolled Bored Tunnel Alternative are summarized in Chapter 7. The intersection of Western Avenue at Broad Street is expected to operate with longer delays during the PM peak hour with the tolled Program compared to the tolled Bored Tunnel Alternative. Higher volumes are forecasted along Western Avenue because of the Elliott/Western connection with the Program.

8.2.4.1.3 North Area

As with the south and central areas, no specific technical results or tables are provided in this discussion of intersection operations in the central area. However, congestion levels at intersections for the Program are qualitatively compared to those described for the Bored Tunnel Alternative to highlight the similarities between the modeled conditions.

For the Program, the network changes in the north area described for the Bored Tunnel Alternative would be retained. East-west arterials such as John, Thomas, and Harrison Streets would all intersect with a new north-south arterial (surface Aurora Avenue) with east-west through movements allowed, and the northbound SR 99 off-ramp south of Mercer Street and the southbound on-ramp would both be located at Republican Street. Additional surface street changes would include closing Broad Street, extending Sixth Avenue N. to Mercer Street, and converting Sixth Avenue N. from one-way to two-way between Wall Street and Denny Way.

The major difference between the arterial networks in the Bored Tunnel Alternative and the Program is the Mercer West Project, which would convert Mercer Street and Roy Street to two-way operations west of Fifth Avenue N. for the Program. Mercer Street would continue as a two-way street to Elliott Avenue W. Roy Street would be converted from one-way to two-way between Fifth Avenue N. and Queen Anne Avenue N. Roy Street is currently two-way west of Queen Anne Avenue N. The Mercer West Project is not expected to substantially affect traffic distributions or congestion levels in the Uptown neighborhood.

During the AM peak hour, similar conditions are expected to occur with the Program as those expected for the Bored Tunnel Alternative. The key hot spots would be Denny Way at Dexter Avenue N., Denny Way at First Avenue, Mercer Street at Dexter Avenue N., Mercer Street at Ninth Avenue N., Mercer Street at Fifth Avenue N., and the gateway intersection of Mercer Street at Fairview Avenue N./I-5 ramps.

During the PM peak hour for the Program, similar hot spots as those described above for AM peak hour conditions would occur. Additional locations such as W. Mercer Place at Elliott Avenue W., Battery Street at Sixth Avenue, Denny Way at Aurora Avenue, Mercer Street at Westlake Avenue N., and Valley Street at Fairview Avenue N. would also be included on the list of highly congested intersections during the PM peak hour. These intersections would operate at similar LOS for the Bored Tunnel Alternative.

Two elements that may result in slightly lower congestion levels for the Program compared to the Bored Tunnel Alternative are the Elliott/Western Connector and the enhanced transit service levels. The Elliott/Western Connector may draw some traffic volumes away from SR 99 into and out of the South Lake Union and Uptown neighborhoods due to a more direct routing of trips along the central waterfront, while increased transit service may capture some mode shift in the north area. Congestion levels at intersections in the north area may be slightly lower for locations near and/or west of the SR 99 corridor as a result.

The modeling results show that for the tolled Program, intersection operations in the north area are projected to be similar to the forecasted operations for the tolled Bored Tunnel Alternative, with a few exceptions. Detailed results of the tolled Bored Tunnel Alternative are summarized in Chapter 7. During both the AM and PM peak hours, intersection delay is expected to increase at the intersection of Fifth Avenue N at Mercer Street and decrease at the intersection of Fifth Avenue N. at Roy Street as a result of geometric changes proposed under the Mercer West Project.

8.2.5 Peak Hour Travel Times

The key findings related to effects on peak hour travel times are the following:

- Projected travel times for the majority of the routes evaluated are expected to be similar or slightly lower for the Program compared to those presented for the Bored Tunnel Alternative.
- Differences in travel time between the Program and the Bored Tunnel Alternative would be modest and generally range from 1 to 2 minutes.

- Even with the Elliott/Western Connector in place for the Program, travel times for routes that rely on Alaskan Way would be similar to those for the Bored Tunnel Alternative due to higher volume demands on Alaskan Way for the Program (thus offsetting potential travel time reductions).
- Tolling effects for the Program would generally be similar to those described in Chapter 7 for the Bored Tunnel Alternative in terms of travel time differences between tolled and non-tolled conditions.

As described in the evaluation of travel times for the Bored Tunnel Alternative in Chapter 5, the forecasted travel times during the AM and PM peak hours for the Program reflect a diverse set of routes to gauge the effectiveness of the various roadway and transit improvements included in the Program as they compare to the Bored Tunnel Alternative. The travel time routes analyzed for the Program, which are shown in Exhibit 2-6, include the following:

- South to and from downtown, represented by West Seattle to CBD (Fourth Avenue and Seneca Street) via SR 99
- North to and from downtown via SR 99, represented by Woodland Park (SR 99 and N. 50th Street) to CBD (Fourth Avenue and Seneca Street)
- Through trips on SR 99, represented by Woodland Park to S. Spokane Street
- Through trips on the Elliott/Western corridor, represented by Ballard Bridge to S. Spokane Street:
  - Via Alaskan Way (or Alaskan Way Viaduct if applicable)
  - Via Mercer Street, bored tunnel
- Northgate to Boeing Access Road via I-5
- Mercer Street from I-5 to Elliott Avenue W.
- Second Avenue from Wall Street to S. Royal Brougham Way
- Fourth Avenue from S. Royal Brougham Way to Battery Street

Exhibit 8-21 summarizes the corridor travel times by route and direction.

Exhibit 8-21. Corridor Travel Times

	AM Peak Hour (minutes)				PM Peak Hour (minutes)			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
West Seattle to CBD (Fourth Avenue and Seneca Street)								
Southbound	-	-	-	-	27	25	31	28
Northbound	26	25	32	31	-	-	-	-
Woodland Park to CBD (Fourth Avenue and Seneca Street)								
Southbound	22	22	27	25	-	-	-	-
Northbound	-	-	-	-	18	18	23	22
Woodland Park to S. Spokane Street								
Southbound	16	16	16	17	15	15	14	14
Northbound	12	12	12	12	16	16	15	15
Ballard Bridge to S. Spokane Street (via Alaskan Way, Alaskan Way Viaduct)								
Southbound	17	17	20	19	19	19	23	20
Northbound	21	19	27	23	24	23	27	33
Ballard Bridge to S. Spokane Street (via Mercer Street, Bored Tunnel)								
Southbound	17	17	18	17	22	21	24	21
Northbound	25	22	24	21	27	24	27	23
Northgate to Boeing Access Road (via I-5)								
Southbound	31	31	32	32	38	38	40	39
Northbound	32	32	33	33	35	35	36	36
Mercer Street (I-5 to Elliott Avenue W.)								
Westbound	12	10	12	8	14	12	13	10
Eastbound	8	8	9	8	13	12	15	14
Second Avenue (Wall Street to S. Royal Brougham Way)								
Southbound	15	15	20	21	16	17	24	24
Fourth Avenue (S. Royal Brougham Way to Battery Street)								
Northbound	12	13	21	19	14	13	21	20

Note: CBD = Central Business District

8.2.5.1 West Seattle to CBD

For the inbound (northbound) direction during the AM peak hour, travel times for the Program would be nearly the same as those for the Bored Tunnel Alternative. This travel time similarity is expected because the volumes on SR 99 and exiting to the stadium area would largely be similar between the Program and Bored Tunnel Alternative. For the outbound direction (southbound) during the PM peak hour, travel times for the Program would be similar though slightly lower than those for the Bored Tunnel Alternative due in part to trips on the Elliott/Western Connector that would contribute to modestly lower volumes on SR 99 (southbound). For the tolled Program, increases in AM and PM peak hour travel times compared to travel times for the non-tolled Program are generally expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.2 Woodland Park to CBD

For the inbound (southbound) direction during the AM peak hour, travel times for the Program would be the same as those for the Bored Tunnel Alternative. PM travel times for the reverse outbound direction (northbound) would also be the same as those for the Bored Tunnel Alternative. These comparable travel times would be due to the similar volumes on SR 99 and the on- and off-ramps in the north area segment.

For the tolled Program, changes in travel times compared to those for the non-tolled Program are expected to be similar in magnitude to those described for the tolled Bored Tunnel Alternative in Chapter 7.

8.2.5.3 Woodland Park to S. Spokane Street

Similar to the Woodland Park to CBD corridor, travel times for the Program between Woodland Park and S. Spokane Street are not expected to change compared to the travel times for the Bored Tunnel Alternative. These travel time similarities would be due in large part to the comparable volumes on SR 99 and at the major on- and off-ramps.

For the tolled Program, changes in travel times compared to those for the non-tolled Program are expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.4 Ballard Bridge to S. Spokane Street – Via Alaskan Way

During the AM peak hour, estimated travel times for the Program would be similar or slightly lower than those for the Bored Tunnel Alternative. In the southbound direction, Program travel times are likely to be the same as those for the Bored Tunnel Alternative, while northbound travel times are expected to decrease slightly. A similar pattern is expected for the PM peak hour, with similar travel times in the southbound direction and slightly shorter travel times in the northbound direction (for the Program). The travel time changes noted for the northbound direction are primarily attributed to the introduction of the Elliott/Western Connector, which is expected to provide a more direct path to and from Alaskan Way for the Ballard routes. Benefits to the northbound direction would occur because left turns from Broad Street to Western Avenue would no longer be required and rail interactions on Broad Street would be removed.

For the tolled Program, changes in travel times compared to those for the non-tolled Program are expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.5 Ballard Bridge to S. Spokane Street – Via Mercer Street and Bored Tunnel

For the AM peak hour, estimated travel times in the southbound direction are similar between the Program and the Bored Tunnel Alternative, though slightly shorter for the Program in the northbound direction. The expected decrease in travel times for the northbound direction would likely be due to the two-way Mercer Street conversion from Fifth Avenue N. to First Avenue W. providing a more direct route to Elliott Avenue W. from Mercer Street (for the westbound segment of the overall northbound travel time route).

During the PM peak hour, estimated travel times are also expected to be similar for the southbound direction between the Program and the Bored Tunnel Alternative and slightly shorter in the northbound direction for the Program. The more direct two-way section of Mercer Street from Fifth Avenue N. to First Avenue W. with the Program is again expected to result in shorter travel times for the northbound direction.

For the tolled Program, changes in AM and PM peak hour travel times compared to those for the non-tolled Program are generally expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.6 Northgate to Boeing Access Road – Via I-5

The results of the operational analysis show no change in travel times in either direction between the Program and the Bored Tunnel Alternative. This similarity is expected because traffic volumes during the peaks hours and, therefore, general operational conditions on the I-5 corridor would not be noticeably affected by the Program compared to the Bored Tunnel Alternative.

For the tolled Program, changes in travel times compared to those for the non-tolled Program are expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.7 Mercer Street – I-5 to Elliott Avenue W.

For the AM and PM peak hours, estimated travel times in both the eastbound and westbound directions for the Program are similar to or slightly shorter than those for the Bored Tunnel Alternative. Decreases in travel time for the westbound direction would be mainly due to the introduction of the two-way Mercer Street between First Avenue W. and Fifth Avenue N., which would provide a more direct path to Elliott Avenue W. from Dexter Avenue N. and Mercer Street.

For the tolled Program, changes in AM and PM peak hour travel times compared to those for the non-tolled Program are generally expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.8 Second Avenue – Wall Street to S. Royal Brougham Way

During the AM peak hour, projected travel times along Second Avenue are expected to be similar for the Program compared to the Bored Tunnel Alternative. For the PM peak hour, travel times for the Program would also be similar or slightly longer than those for the Bored Tunnel Alternative due to a slight increase in volumes at some intersections along the travel time corridor.

For the tolled Program, changes in travel times compared to those for the non-tolled Program would be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.5.9 Fourth Avenue – S. Royal Brougham Way to Battery Street

Similar to the analysis results for the Second Avenue corridor, travel times along Fourth Avenue are expected to be similar or slightly higher for the Program compared to the Bored Tunnel Alternative. Specifically for the AM peak hour, travel times for the Program may be slightly higher than those for the Bored Tunnel Alternative due to minor increases in peak hour through-volumes at some intersections between S. Royal Brougham Way and Battery Street.

For the tolled Program, potential changes in AM and PM peak hour travel times compared to those for the non-tolled Program are generally expected to be similar in magnitude to those described for the Bored Tunnel Alternative in Chapter 7.

8.2.6 Roadway Connectivity and Access

The key findings related to roadway connectivity and access are the following:

- The Program would create additional roadway connections and access opportunities that would offer more travel routes in the future.
- The Elliott/Western Connector would improve access between the central waterfront and these corridors, and in conjunction with the Alaskan Way S. ramps and improvements to Alaskan Way, would provide an additional, high-quality route for trips from SR 99. It also would provide an improvement over the Alaskan Way route in the Bored Tunnel Alternative, in particular avoiding the conflicts with the at-grade rail crossing of Broad Street just east of Alaskan Way and providing additional capacity on Alaskan Way south of Columbia Street.
- Mercer Street would become two-way from Fifth Avenue N. to First Avenue W.

8.2.6.1 Alaskan Way Surface Street Improvements – S. King Street to Pike Street

The improved roadway, coupled with the Elliott/Western Connector described below, would provide a key route for trips from SR 99 to the Elliott and Western Avenue corridor.

8.2.6.2 Elliott/Western Connector – Pike Street to Battery Street

The Elliott/Western Connector would improve connectivity between Alaskan Way on the central waterfront and the Elliott/Western corridor in the Belltown area. Since the Bored Tunnel Alternative would not provide an access point directly to Elliott and Western Avenues, this new route would be an alternative for traffic and trucks traveling to and from the Ballard/Interbay/Magnolia areas that formerly used those ramps. The Elliott/Western Connector would likely attract additional traffic to Alaskan Way.

8.2.6.3 Mercer West Project – Fifth Avenue N. to Elliott Avenue W.

The reconfiguration of the Mercer Street corridor to two-way operations between I-5 and Elliott Avenue W. would be completed with this project. The Mercer Street corridor would provide an improved east-west connection for trips in the north area and would provide access to Ballard/Interbay for freight, as well as general traffic traveling to Ballard and Magnolia. This corridor would also help to reduce circuitous routing for freight vehicles that connect to I-5 at Mercer Street, as well as all westbound vehicles between South Lake Union and Uptown or points west.

8.2.7 Transit Services

The key findings related to transit services are the following:

- For the non-tolled Program, several transit enhancements would occur that involve expanded streetcars and buses. Also, transit priority treatments would occur. These service and operations improvements would support transit service for the Program and could affect characteristics such as ridership levels, travel times, and traffic operating conditions.
- Transit ridership in terms of daily and peak hour trips as well as mode shares would be higher for the non-tolled Program compared to the non-tolled Bored Tunnel Alternative. Depending on the screenline, ridership during the peak hours and daily ridership would be approximately 1 or 2 percent higher under non-tolled Program compared to the Bored Tunnel Alternative.
- For the five selected transit corridors, relatively small variations in travel times are projected under the non-tolled Program and the non-tolled Bored Tunnel Alternative. For the Elliott Avenue and Aurora Avenue corridors, transit travel times would be generally similar for AM peak hour trips. In the PM peak hour, the most extensive variations would be 2 more minutes for southbound and northbound trips under the non-tolled Program compared to the non-tolled Bored Tunnel Alternative.

- For general-purpose travel times along major transit corridors, the biggest variation would be for PM southbound (peak direction) trips in the West Seattle corridor. Under the non-tolled Program, travel times would be 2 minutes shorter than those under the non-tolled Bored Tunnel Alternative.
- LOS conditions under the non-tolled Program would generally be the same as those under the non-tolled Bored Tunnel Alternative. Transit service and operations enhancements under the Program would help address potential changes affecting traffic (e.g., the Elliott/Western Connector) in the north area.

8.2.7.1 Transit Network Changes and Transit Priority Treatments

As compared to non-tolled Bored Tunnel Alternative, the non-tolled Program would include enhanced transit facilities and services, as well as speed and reliability improvements. These elements would help attract higher transit ridership as compared that under the Bored Tunnel Alternative and could potentially affect traffic operations in the project area. The transit network changes and priority treatments under the non-tolled Program are described in the following subsections.

8.2.7.1.1 Streetcar Expansion

The First Avenue streetcar is currently planned to run along First Avenue between S. Jackson Street and Republican Street and would include an extension, via Stewart Street, to the South Lake Union streetcar line. The First Avenue streetcar would connect to the First Hill streetcar line. The maintenance base would likely be located either at the extension of the South Lake Union line or at a new maintenance base that would be built as part of the First Hill streetcar line.

8.2.7.1.2 Bus Service Enhancements

A variety of bus enhancements would be provided to support planned transportation improvements associated with the Program and accommodate future demand. These include (1) the Delridge RapidRide line, (2) RapidRide transit along the Aurora Avenue corridor, (3) additional service hours on the West Seattle and Ballard RapidRide lines, (4) peak-hour express routes added to South Lake Union and Uptown, (5) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes, and (6) simplification of the electric trolley system.

8.2.7.1.3 Transit Priority Treatments

Between Alaskan Way and Third Avenue, transit priority treatments on S. Main Street and/or S. Washington Street would be provided. For the RapidRide lines, signal prioritization and other methods to improve bus speed and reliability would occur.

8.2.7.2 Modeled Transit Ridership

Exhibit 8-22 presents estimated daily transit ridership for the Viaduct Closed (No Build Alternative), as well as the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled). Information is presented for three screenlines located in the study area: south, central, and north. With the non-tolled Program, estimated additional ridership compared to that with the non-tolled Bored Tunnel Alternative would range between 1 and 2 percent, depending on the screenline. The increases in daily ridership levels would reflect enhanced transit service and speed and reliability improvements that would occur under non-tolled Program. Under the tolled Program, daily transit ridership levels would be generally similar to the levels under the non-tolled Program. This would be the case for the Bored Tunnel Alternative and Program.

Exhibit 8-22. Model-Estimated Daily Transit Ridership (Person-Trips) at Selected Screenlines

Screenline	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South (south of S. King Street)	160,800	164,900	166,900	164,400	166,900
Central (north of Seneca Street)	162,400	178,000	181,200	177,300	181,000
North (north of Thomas Street)	165,400	168,400	171,600	168,000	171,400

Model-estimated transit ridership in the AM peak period is shown in Exhibit 8-23. The additional ridership during peak periods under the Program (tolled and non-tolled), as compared to the Bored Tunnel Alternative (tolled and non-tolled), generally reflects the rates of growth discussed above for daily transit ridership.

Exhibit 8-23. Model-Estimated AM Peak Period Transit Ridership (Person-Trips) at Selected Screenlines

Screenline	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
South (south of S. King Street)	54,090	56,200	56,840	56,130	56,980
Central (north of Seneca Street)	48,500	54,090	54,830	54,270	55,190
North (north of Thomas Street)	50,990	52,530	53,690	52,700	53,860

8.2.7.3 Modeled Transit Mode Shares

Exhibit 8-24 shows estimated daily transit mode shares for the Viaduct Closed (No Build Alternative), the Bored Tunnel Alternative (tolled and non-tolled), and the Program (tolled and non-tolled). The shares under the Bored Tunnel Alternative and the Program would be about the same, 41 percent for home-based work trips and 10 percent for non-work trips. The slightly higher shares under the Program (tolled and non-tolled) would reflect the enhanced transit services; however, the transit system, involving bus and rail service, would be generally similar between the Program (tolled and non-tolled) and the Bored Tunnel Alternative (tolled and non-tolled).

Exhibit 8-24. Model-Estimated Daily Transit Mode Shares: To, From, and Within Seattle's Center City

Mode	Viaduct Closed (No Build Alternative)	Non-Tolled		Tolled	
		Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Home-based work	39.6%	41.0%	41.4%	41.0%	41.4%
Non-work	9.8%	10.1%	10.2%	9.9%	10.0%

8.2.7.4 Peak Hour Travel Times for Transit Corridors

Exhibit 8-25 shows estimated travel times for major transit corridors under the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled). For the Elliott Avenue and Aurora Avenue corridors, transit travel times are available, whereas the information for the other corridors applies to general-purpose travel.

8.2.7.4.1 Elliott Avenue Corridor

Transit travel times along Elliott Avenue in the peak hours between the south side of the Ballard Bridge and Denny Way would generally be the same for the non-tolled Program and the non-tolled Bored Tunnel Alternative. The greatest variation in travel time would involve northbound trips in the PM peak hour. Under the Program (non-tolled), there would be 1 minute in additional travel time. With the Elliott/Western Connector included in the Program, potential additional traffic in the Uptown area may affect travel times along the Elliott Avenue corridor.

For the tolled Program, changes in travel times compared to those of the non-tolled Program are expected to be similar in magnitude to those shown for the Bored Tunnel Alternative (also described in Chapter 7).

Exhibit 8-25. Travel Times Along Major Transit Travel Corridors

	AM Peak Hour (minutes)				PM Peak Hour (minutes)			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Elliott Avenue (South of Ballard Bridge to Denny Way)								
Southbound	8	8	8	8	8	8	8	8
Northbound	7	8	7	8	8	9	8	10
Aurora Avenue (South of Aurora Bridge to Denny Way)								
Southbound	6	6	8	8	5	7	5	7
Northbound	7	7	8	7	7	9	8	8
Second Avenue (Wall Street to S. Royal Brougham Way)								
Southbound	14	13	13	14	15	16	17	17
Fourth Avenue (S. Royal Brougham Way to Battery Street)								
Northbound	14	14	17	16	14	13	15	16
West Seattle to CBD (Fourth Avenue and Seneca Street) [1]								
Inbound	26	25	32	27	18	20	23	18
Outbound	16	16	16	13	27	25	31	23

Note: CDB = Central Business District
[1] Travel times are for general-purpose traffic.

8.2.7.4.2 Aurora Avenue Corridor

Transit travel times along Aurora Avenue in the AM peak between the south side of the Aurora Bridge and Denny Way would generally be the same for the non-tolled Program and the non-tolled Bored Tunnel Alternative. During the PM peak, under the non-tolled Program, there would be 2 minutes in additional travel time. As is the case with Elliott Avenue, the Elliott/Western Connector included in the Program may result in additional traffic in the Uptown area. This added traffic may affect travel times along the Aurora Avenue corridor.

For the tolled Program, changes in travel times compared to those of the non-tolled Program are expected to be similar in magnitude to those shown for the Bored Tunnel Alternative (also described in Chapter 7).

8.2.7.4.3 Second Avenue Corridor

The Second Avenue corridor is served by high volumes of buses operating in downtown Seattle from south King County, east King County, and other locations. Since Second Avenue is one-way southbound in downtown Seattle, only inbound travel times are available.

In the AM peak hour, travel times would be almost the same between the non-tolled Bored Tunnel Alternative and the non-tolled Program. The greatest variation in travel time between them would occur in the AM peak hour, under tolled conditions and the PM peak hour under non-tolled conditions. In both cases, the travel times under the Program would be approximately 1 minute longer than under the Bored Tunnel Alternative.

8.2.7.4.4 Fourth Avenue Corridor

Similar to the Second Avenue corridor, the Fourth Avenue corridor is also served by a high volumes of buses operating in downtown Seattle from north Seattle, south King County, east King County, and other locations. Since Fourth Avenue is one-way northbound in downtown Seattle, only outbound travel times are available.

In the PM peak hour, travel times would be almost the same between the non-tolled Bored Tunnel Alternative and the non-tolled Program. A one minute variation in travel time is expected during the AM peak hour, under tolled conditions, and in the PM peak hour under both non-tolled and tolled conditions

8.2.7.4.5 West Seattle to CBD Corridor

Travel times along the West Seattle corridor would involve general-purpose traffic; however, this corridor is also served by high volumes of buses operating between West Seattle and downtown Seattle via SR 99. Travel times under the non-tolled Bored Tunnel Alternative and the non-tolled Program would be generally similar. The greatest variation in travel time would involve outbound (southbound) trips in the PM peak hour (peak direction travel) when the non-tolled Program would have a 2-minute reduction in travel time compared to that of the non-tolled Bored Tunnel Alternative. This travel time difference (2 minutes) could be the result of speed and reliability enhancements included in the non-tolled Program.

For the tolled Program, increases in AM and PM peak hour travel times compared to those of the non-tolled Program are generally expected to be similar in magnitude to those shown for the Bored Tunnel Alternative (also described in Chapter 7). The exception is for the outbound (southbound) direction in the PM peak hour, which shows a decrease compared to non-tolled conditions. This decrease would likely be due to fewer downstream interactions near the off-ramp to the West Seattle Bridge.

8.2.7.5 Intersection Level of Service Changes Affecting Transit

This section describes potential LOS-related effects involving transit services operating in the south, central, and north areas.

8.2.7.5.1 South Area

With little or no change in the street network between the Bored Tunnel Alternative and the Program coupled with the proposed transit enhancements, travel delays and LOS for the Program are expected to be similar to those for the Bored Tunnel Alternative, if not slightly improved. Specific AM peak hour hot spots identified for the Bored Tunnel Alternative also would operate at high congestion levels for the Program. These locations include several that are served by transit. Examples include Fourth Avenue S. at Airport Way S., Fourth Avenue S. at S. Royal Brougham Way, Fourth Avenue S. at S. Holgate Street, First Avenue at Yesler Way, First Avenue S. at S. Atlantic Street, and Second Avenue S. at S. Jackson Street.

8.2.7.5.2 Central Area

With the Program, the majority of intersections in the central area are expected to operate similarly to the intersection operations with the Bored Tunnel Alternative. During the AM peak hour, critical hot spots identified for the Bored Tunnel Alternative include locations with high bus volumes such as Second Avenue at Marion Street and Fourth Avenue at Columbia Street. Similar delays could be expected at these locations for the Program. During the PM peak hour, the intersections of Western Avenue at Broad Street and Second Avenue at Marion Street are expected to operate with the high levels of congestion for the Program and the Bored Tunnel Alternative. Enhancements in transit service expected to be implemented as part of the Program may help to reduce general-purpose vehicle demands on city streets and consequently result in an overall decrease in intersection delays.

8.2.7.5.3 North Area

During the AM peak hour for the non-tolled Program, intersections in the north area are expected to operate at similar conditions as those expected for the non-tolled Bored Tunnel Alternative. These include key hot spots that are served by transit such as Denny Way at Dexter Avenue N., Denny Way at First Avenue, Mercer Street at Dexter Avenue N., Mercer Street at Ninth Avenue N., and Mercer Street at Fifth Avenue N.

During the PM peak hour for the Program, similar hot spots as those described above for AM peak hour conditions would occur. Additional intersections, including those served by public transit, such as W. Mercer Place at Elliott Avenue W., Battery Street at Sixth Avenue N., Denny Way at Aurora Avenue, Mercer Street at Westlake Avenue N., and Valley Street at Fairview Avenue N., also would be highly congested during the PM peak hour. These intersections would operate at similar LOS under the Bored Tunnel Alternative.

Two elements that may result in slightly lower congestion levels for the Program compared to the Bored Tunnel Alternative are the Elliott/Western Connector and the enhanced transit service levels. The connector may draw some traffic volumes away from SR 99 into and out of the South Lake Union and Uptown neighborhoods. These added volumes would be due to more direct routing of trips along the central waterfront, while increased transit service may capture some mode shift in the north area.

8.2.8 Truck Traffic and Freight

The key findings related to truck traffic and freight are the following:

- The Elliott/Western Connector roadway would reintroduce a very important connection for freight trips traveling to and from the BINMIC and neighborhoods northwest of downtown Seattle.
- The Mercer West Project would extend two-way connections from South Lake Union to Elliott Avenue W. Changes to the operations in the corridor would help provide a more direct route to and from the Ballard/Interbay areas from Aurora Avenue and I-5.
- Transportation system management strategies including traffic signal improvements and real-time traveler information would result in improved performance for freight operators and provide better information.
- Travel times between the Bored Tunnel Alternative (tolled and non-tolled) and Program (tolled and non-tolled) would generally be similar regardless of the travel corridor, time period, or direction of travel.

8.2.8.1 Program Enhancements That Affect Truck Traffic and Freight

8.2.8.1.1 Alaskan Way Surface Street Improvements

The new reconfigured Alaskan Way surface street, while conceptual at this stage, would continue to provide access for freight vehicles. The street would be six lanes wide between S. King and Columbia Streets, transitioning to four lanes between Marion and Pike Streets. The reconfigured street would include new sidewalks, a bicycle facility, parking and loading zones, and signalized pedestrian crossings at cross streets.

8.2.8.1.2 Elliott/Western Connector

The Elliott/Western Connector, while conceptual at this stage, would reintroduce the connection to and from the BINMIC and neighborhoods north of downtown Seattle (including Ballard and Magnolia). The roadway would connect surface Alaskan Way to Elliott and Western Avenues in the vicinity of Pike Place Market. The facility would provide two lanes in each direction and would be built at grades that comply with City standards and accommodate trucks (less than 7 percent). The new roadway would include pedestrian and bicycle facilities.

8.2.8.1.3 Mercer West Project – Fifth Avenue N. to Elliott Avenue W.

The Mercer West Project would provide two-way operations between Fifth Avenue N. and Elliott Avenue W. This would allow the entire Mercer Street/Mercer Place corridor to operate with two-way operations from Fairview Avenue N. to Elliott Avenue W. The changes to the operations in the corridor would help provide a more direct route to and from the Ballard/Interbay areas from Aurora Avenue and I-5. The corridor would also feature improvements at key intersections to accommodate large trucks.

8.2.8.1.4 Other Improvements

Transportation system management strategies, including the application of high technology devices and systems would help freight move more effectively on truck routes in the study area. These strategies include variable speed limit signs on I-5, which would help minimize the number and severity of collisions on I-5, and dynamic message signs to alert freight operators of traffic incidents or provide real-time travel time information so that operators can make better decisions about routes. Planned improvements to the City's traffic signal system would help to reduce delays at congested intersections.

8.2.8.2 Travel Times for Freight Corridors

Exhibit 8-26 shows estimated travel times for popular freight travel corridors serving the study area. The times reflect travel under the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled). The three popular freight corridors presented are Ballard to S. Spokane Street (via Mercer Street, bored tunnel), Northgate to Boeing Access Road (via I-5), and Mercer Street (from I-5 to Elliott Avenue W.)

8.2.8.2.1 Ballard to S. Spokane Street

As shown in Exhibit 8-26, freight operators traveling in a southbound direction during the AM peak hour would have virtually the same travel times between the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled). In the northbound direction, travel times would also be similar between the Bored Tunnel Alternative and the Program under both tolled and non-tolled conditions, although the Bored Tunnel Alternative under tolled and non-tolled conditions would have slightly longer travel times in comparison to those of the Program under tolled and non-tolled conditions.

Travel times in the PM peak hour would be slightly longer than those in the AM peak hour due to the higher overall demand during the evening commute period. The Bored Tunnel Alternative (tolled and non-tolled) would have slightly longer travel times than the Program (tolled and non-tolled) for both directions.

Exhibit 8-26. Peak Hour Travel Times Along Major Corridors Used by Freight Trucks

	AM Peak Hour (minutes)				PM Peak Hour (minutes)			
	Non-Tolled		Tolled		Non-Tolled		Tolled	
	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program	Bored Tunnel Alternative	Program
Ballard to S. Spokane Street (via Mercer Street, Bored Tunnel)								
Southbound	17	17	18	17	22	21	24	21
Northbound	25	22	24	21	27	24	27	23
Northgate to Boeing Access Road (via I-5)								
Southbound	31	31	32	32	38	38	40	39
Northbound	32	32	33	33	35	35	36	36
Mercer Street (I-5 to Elliott Avenue W.)								
Westbound	12	10	12	8	14	12	13	10
Eastbound	8	8	9	8	13	12	15	14

8.2.8.2.2 Northgate to Boeing Access Road

The travel patterns in the Northgate to Boeing Access Road corridor would be similar to those for the Ballard to S. Spokane Street corridor. During the AM peak hour, there would be virtually no difference in travel time between the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled). During the PM peak hour, there would also be virtually no difference between the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled).

8.2.8.2.3 Mercer Street

During the AM peak hour in the westbound direction, the Bored Tunnel Alternative (tolled and non-tolled) would result in slightly longer travel times compared to those of the Program (tolled and non-tolled). In the eastbound direction, the Bored Tunnel Alternative (tolled and non-tolled) and the Program (tolled and non-tolled) would have virtually identical travel times.

During the PM peak hour, travel times would be slightly longer than those during the AM peak hour for both directions. In the westbound direction, the Bored Tunnel Alternative would have a slightly longer travel time than the time estimated for the Program. In the eastbound direction, the travel times are virtually the same between the Bored Tunnel Alternative and the Program.

8.2.9 Parking

The key findings related to the potential effects on parking are the following:

- Several Program elements would affect parking along the waterfront and in the Belltown and Uptown areas.
- The Alaskan Way surface street improvements could affect about 580 on-street parking spaces along Alaskan Way and under the Alaskan Way Viaduct, although some of the spaces would be replaced.
- A number of parking mitigation strategies could be implemented to address the cumulative effects of parking disruption, including informational and pricing strategies and an increased supply of short-term visitor and customer parking.

8.2.9.1 Program Elements That Could Affect Parking

This discussion of effects on parking is slightly different from the quantitative approach used in Chapter 5. This discussion of cumulative effects of the Program is supported by general magnitudes of parking spaces, where data are available. The Program elements that could affect parking are described in the following subsections. No parking removals are assumed for the First Avenue Streetcar Evaluation or the Transit Enhancements.

8.2.9.1.1 Alaskan Way Surface Street Improvements – S. King Street to Pike Street

Rebuilding the Alaskan Way surface street would affect parking spaces currently available on Alaskan Way and under the Alaskan Way Viaduct. There are approximately 580 on-street parking spaces on the Alaskan Way surface street and under the viaduct from S. King to Pike Streets. An additional 260 off-street parking spaces nearby could be affected by the street reconfiguration. This totals almost 1,000 parking spaces along the central waterfront that could be affected by the Alaskan Way surface street improvements. A number of these spaces would be replaced, with the number, location, and type of spaces to be determined by the City.

8.2.9.1.2 Elliott/Western Connector – Pike Street to Battery Street

This project would affect approximately 280 parking spaces, divided equally between on- and off-street parking spaces. Initial estimates indicate that approximately 120 of the 140 on-street parking spaces could be replaced, depending on the final design of the streets.

8.2.9.1.3 Mercer West Project – Fifth Avenue N. to Elliott Avenue W.

Improvements to Mercer Street from Fifth Avenue N. to Elliott Avenue W. and improvements to Roy Street from Fifth Avenue N. to Queen Anne Avenue N.

could affect on-street parking. There are currently about 250 on-street parking spaces on these sections of Mercer and Roy Streets.

8.2.9.2 Mitigation of Effects on Parking

Potential mitigation measures for effects on parking during construction are discussed in Section 6.9.5. Although the mitigation measures would be most needed during construction, many of them could be retained and provide benefits over the longer term. Specific parking mitigation strategies have not yet been determined, but the project has allocated $30 million for parking mitigation. The mitigation measures could include the following:

- Encourage privately held parking lots to institute measures that reward short-term parking.
- Provide short-term parking (off-street), especially serving retail and commercial areas.
- Partner with private and public parking facilities to implement e-Park, an electronic guidance system displaying real-time parking availability on right-of-way signs, facility signs, and the Seattle Parking Map website. Dynamic message signs would be located at key access points to downtown, Pioneer Square, and the central waterfront.
- Encourage businesses to use parking vouchers that they could give to customers to park in designated parking lots.

8.2.10 Pedestrians

The key findings related to the potential effects on pedestrians are the following:

- Pedestrian mobility and access would be improved in the south portal area as a result of the Port Side Pedestrian/Bike Trail and the City Side Trail.
- Program elements would improve the pedestrian environment along the waterfront.
- Pedestrian mobility and access would be greatly improved in the north portal area by three new crossings of SR 99 at John, Thomas, and Harrison Streets, as well as the improved pedestrian streetscape and pedestrian path on Mercer Street.

As stated in Chapter 5, pedestrian mobility and overall pedestrian experience would be improved considerably due to the addition of the Port Side Pedestrian/Bike Trail and the City Side Trail in the south portal area.

The Program elements in the central area would enhance the pedestrian environment with a more pedestrian-focused waterfront that would include a substantial increase in pedestrian space with the proposed promenade along a redesigned Alaskan Way. The new expanded promenade and public space would be located west of the new Alaskan Way surface street between S. King Street and Pike Street. Between Marion and Pike Streets, this space is expected to be approximately 70 to 80 feet wide.

The existing Lenora Street crossing of the SR 99 facility is grade-separated (Lenora Street dead-ends under the elevated SR 99 roadway) with a connection to a public stairway and elevator that provides pedestrians with access the east side of Alaskan Way. Under the Program, Lenora Street would connect with a new four-lane Elliott/Western Connector roadway. The Elliott/Western Connector would include a sidewalk on both sides of the roadway and would connect to Lenora via an at-grade intersection. The at-grade intersection of Lenora Street and the Elliott/Western Connector would include pedestrian crosswalks on the south and east intersection approaches.

Pedestrian mobility would be enhanced by the connection of John, Thomas, and Harrison Streets over SR 99 and the provision of the pedestrian path on the north side of Mercer Street, which is a key connection for the Lake to Bay Trail crossing of SR 99.

8.2.11 Bicycles

The key findings related to the potential effects on bicycle traffic are the following:

- The bicycle environment would be enhanced by the waterfront promenade, the in-street bicycle lanes on Alaskan Way, and the bicycle lanes and sharrows proposed for the new Elliott/Western Connector.
- Mobility and access for bicyclists would be improved in the north portal area due to improved bicycle connections facilitated by the Mercer West Project.

As noted in Chapter 5, bicycle access and mobility would be improved in the south portal area by the construction of the Port Side Pedestrian/Bike Trail and the City Side Trail.

The Program elements in the waterfront area would enhance the bicycle environment by the reconfiguration of a large portion of the Alaskan Way right-of-way to focus on nonmotorized transportation. Bicyclists would be able to use the promenade and the in-street bicycle lanes on Alaskan Way, and sharrows would be painted on the new Elliott/Western Connector.

Bicyclists would experience improved access and mobility in the north portal area as a result of the new connections across SR 99 at John, Thomas, and Harrison Streets and the modifications to Mercer Street completed by the Program and the Mercer West Project. The Mercer West Project improvements also include a bicycle lane on Roy Street. The bicycle facilities on the north side of Mercer Street are part of the Lake to Bay Trail that connects bicycle facilities in South Lake Union with the Elliott Bay Trail and attractions west of SR 99.

8.2.12 Ferries

The key findings related to the potential effects on ferry traffic are the following:

- Ferry passengers on foot would benefit from the enhanced pedestrian environment along the waterfront.
- Some of the vehicle traffic to and from the Seattle Ferry Terminal at Colman Dock would have slightly better access due to the new roadway configuration along Alaskan Way and Elliott and Western Avenues.

For walk-on passengers who access the Seattle Ferry Terminal on foot, the Program elements in the area would enhance the pedestrian environment by the construction of a more pedestrian-focused waterfront.

For ferry passengers in vehicles, the cumulative effect of the Program elements would be limited for most users. The new roadway configuration on Alaskan Way should slightly improve access to the Seattle Ferry Terminal, but the overall surface street network in downtown Seattle would remain substantially the same. An exception is that traffic exiting the terminal and destined for points north would benefit from the new connection between Alaskan Way and the Elliott/Western corridors.

While volumes on Alaskan Way are expected to increase under the tolled Program compared to the non-tolled Program, operations at the intersections to Colman Dock are expected to improve under the tolled Program compared to the tolled Bored Tunnel Alternative. This improvement would be due to the proposed improvements along Alaskan Way under the Program. With additional capacity, vehicle queues are expected to be smaller along Alaskan Way, possibly improving travel times for vehicles traveling to Colman Dock.

8.2.13 Safety

The key finding related to traffic safety is the following:

- Traffic safety under the Program is expected to be similar to safety under the Bored Tunnel Alternative.

Traffic safety for the Program is expected to be similar to that for the Bored Tunnel Alternative. Some elements of the Program are expected to affect traffic patterns, which may have some effect on the potential for conflicts between vehicles, pedestrians, or bicycles.

Most notably, the construction of the Elliott/Western Connector would draw additional traffic to Alaskan Way through the central waterfront. Under tolled conditions, more trips would be diverted to the arterial network than the number of diverted trips under non-tolled conditions.

This additional traffic could increase conflicts between vehicles, pedestrians, and bicycles using the corridor, though potential adverse safety effects are expected to be mitigated by roadway design features that moderate travel speeds and provide accommodations for all travelers in the corridor—drivers, cyclists, and pedestrians. Facility design associated with pedestrian and cyclist mobility includes a large pedestrian promenade along the proposed Alaskan Way surface street, appropriately located and well-marked crosswalks, as well as bicycle lanes or a cycle track on Alaskan Way and sharrows on the Elliott/Western Connector.

The Elliott/Western Connector would likely reduce traffic volumes along the north waterfront, shifting some of the traffic from Alaskan Way to Elliott Avenue and Western Avenue. Traffic volumes on Elliott and Western Avenues for the Program would be higher than volumes for the Bored Tunnel Alternative.

The Mercer West Project would convert Mercer and Roy Streets to two-way streets. Crossing the street may be somewhat more difficult for pedestrians at unsignalized intersections because the traffic would be traveling in both directions, rather than a single direction. Most intersections on Mercer Street are signalized, however, and pedestrian safety at these locations is not expected to change under the Program.

8.2.14 Event Traffic

The key findings related to the potential effects on event traffic are the following:

- Changes to the south area roadway network for the Program would not be substantial compared to the changes for the Bored Tunnel Alternative in terms of the relative number and magnitude of the improvements. As a result, minimal changes to event traffic access and mobility in the stadium area would occur.
- The two-way Mercer Street configuration would allow more direct access to the Seattle Center parking garages north of Mercer Street from the east. However, in terms of egress capacity after events at Seattle Center, the two-way system may result in slightly longer travel times and delays. More direct access to SR 99 from the Mercer Garage (eastbound) would be possible, however, due to the two-way configuration for Roy Street.
- The new Elliott/Western Connector would provide more access options for events at Seattle Center and would likely shift some traffic away from the bored tunnel, downtown surface streets, and local roadways in the South Lake Union area.

8.2.14.1 South Area

For Program conditions, no substantial changes in the south area beyond those identified for the Bored Tunnel Alternative would be expected in terms of roadway network components and connections to and from regional facilities. Therefore, no major differences for event traffic in terms of detour routing, congestion levels, or requirements for traffic management would result.

8.2.14.2 North Area

Differences in the roadway network in the north area between the Bored Tunnel Alternative and the Program would generally consist of the Mercer West Project and the new Elliott/Western Connector. The Mercer West Project would complete the two-way conversion of the Mercer Street corridor initiated by the Mercer East Project and the Alaskan Way Viaduct Replacement Project.

With regard to event traffic, the two-way Mercer Street configuration would allow more direct access to the Seattle Center parking garage north of Mercer Street from the east (e.g., I-5) by eliminating the need to use the one-way couplet system of Roy and Mercer Streets. However, in terms of egress capacity (toward I-5) after events at Seattle Center, the two-way system may result in slightly longer travel times and delays compared to the traditional one-way system due to the need to serve a larger number of movements at nearby intersections/signals between Queen Anne Avenue N. and Fifth Avenue N. More direct access to SR 99 from the Mercer Garage after events due to conversion of Roy Street to two-way operations may also result in improved travel times specifically for event patrons using SR 99 to travel south.

The Elliott/Western Connector would improve access options for events at Seattle Center, thereby shifting some event traffic way from the bored tunnel and the surface streets in the South Lake Union area. However, the added volumes on the arterial network for the Program may increase congestion levels slightly on Broad Street and cross streets such as First Avenue N. compared to the congestion levels for the Bored Tunnel Alternative.

8.3 Cumulative Effects of the Program

The focus of the cumulative effects analysis is the combined effects of the Bored Tunnel Alternative, other Program elements, and other past, present, and reasonably foreseeable future projects that are expected to add to transportation effects in the study area. The difference between this section and the discussion in Section 8.2 is that this section focuses on other past, present, and reasonably foreseeable future projects that are not included in the Program. This entire section is approached qualitatively.

The key findings of the analysis of potential cumulative effects of the Program are the following:

- The cumulative effects of the Program elements and other past, present, and future projects would generally be similar to the effects of the Program elements.
- Overall, increased transit service, whether it is provided by bus, light rail, or commuter rail, would help in reducing SOV demand to the Center City and reduce the growth rate of demand on SR 99, I-5, and local arterials for years to come.
- Other regional transportation improvements, such as the Link light rail expansion and the improvements to I-5 would help the system meet the growing demand.
- The intersection congestion levels under the Program, with the combined effects of regional projects, would likely be similar to or lower than those for the Program in terms of average vehicle delays and LOS.

8.3.1 Projects Considered for Cumulative Effects

The projects listed below, in addition to the Program elements described in Section 8.2.1, were considered for potential activities that could have cumulative effects. These projects have been captured in the 2030 modeled conditions. Any notable cumulative effects are described in the subsections that follow the lists.

8.3.1.1 Seattle Planned Urban Development

- Gull Industries on First Avenue S.
- North Parking Lot Development at Qwest Field
- Seattle Center Master Plan (EIS) (Century 21 Master Plan)
- Bill and Melinda Gates Foundation Campus Master Plan
- South Lake Union Redevelopment
- U.S. Coast Guard Integrated Support Command
- Seattle Aquarium and Waterfront Park

8.3.1.2 Local Roadway Improvements

- Bridging the Gap Projects
- SR 99/East Marginal Way S. Grade Separation

8.3.1.3 Regional Roadway Improvements

- I-5 Improvements
- SR 520 Bridge Replacement and HOV Program

- I-405 Corridor Program
- I-90 Two-Way Transit and HOV Operations, Stages 1, 2, and 3
- SR 518 Widening

8.3.1.4 Transit Improvements

- First Hill Streetcar
- Sound Transit University Link Light Rail Project
- RapidRide
- Sound Transit North Link Light Rail Project
- Sound Transit East Link Light Rail Project

8.3.1.5 Transportation Network Assumptions

- HOV Definition Changes to 3+ Throughout the Puget Sound Region
- Sound Transit Phases 1 and 2
- Other Transit Improvements

8.3.2 Regional Context and Travel Patterns

Most of the projects considered for cumulative effects would not have a substantial effect on the larger region or regional travel patterns, given the scale of the overall transportation network and the level of travel demand. However, the transit improvements are worth noting. A longer Link light rail system connecting the Eastside and extending north at least to Lynnwood and a more complete King County Metro RapidRide system, coupled with additional transit service hours, would increase the person-carrying capacity across the Center City screenlines. Overall, increased transit service, whether provided by bus, light rail, or commuter rail, would help expand person-trip capacity into the Center City.

8.3.3 Traffic Operations on SR 99

The improvements related to the Program would include greater connectivity and options for travel to and from downtown Seattle, including improvements to the Alaskan Way surface street, a new Elliott/Western Connector, and a two-way Mercer Street. These improvements would provide increased mobility to and along the waterfront as well as to the downtown Seattle area in general. In addition, transit enhancements that would be implemented as part of the Program would provide increased travel alternatives in the corridor. The Program is expected to result in operations that are similar to those for the Bored Tunnel Alternative.

As other major regional transportation improvements are completed, traffic operations on SR 99 are expected to improve. For example, the surface improvements to I-5 are expected to include restriping, which would provide higher capacity through downtown Seattle. In addition, the extension of Link light rail north to Lynnwood and south to Federal Way would provide additional person-carrying capacity.

8.3.4 Traffic Operations at Key Arterial Intersections

Intersection congestion levels under the Program, plus the combined effects of regional projects, would likely be similar or improved relative to congestion levels under the Program alone (see Section 8.2) in terms of average vehicle delays and LOS for both the non-tolled and tolled conditions. Traffic demand and peak hour volumes along the SR 99 corridor and at intersections within the three areas would either remain consistent with Program levels or decrease slightly once the regional projects are completed.

As discussed in Section 8.2, the transit enhancements proposed for the Program alone may induce some shift to non-automobile-based modes such as light rail or bus; although in general, these changes would likely not reduce traffic volumes or congestion on most arterials and highway facilities. With additional transit resources and services included as part of the comprehensive regional transportation system, however, including completion of the Sound Transit streetcar program in the downtown area, Link light rail extensions to the north and east, implementation of Metro's RapidRide system, and completion of the HOV system, the mode shift to transit services should be more pronounced than it would be under the Program. In principle, the ubiquity of transit services may increase overall ridership and potentially encourage a portion of regional trips to shift away from conventional automobile-based options (e.g., SOV and HOV). To the extent that transit patronage is realized with the long-range systems in place for the Program, traffic volumes in the downtown core and on regional facilities such as SR 99 could conceivably decrease from the expected Program levels. Consequently, intersection delays and area congestion could be reduced due to lower peak hour demands on local streets and arterials.

8.3.5 Peak Hour Travel Times

Travel times on the SR 99 corridor would benefit from the cumulative effects of regional transportation projects, especially when combined with the improvements that are part of the Program. Projects related to the S. Spokane Street Viaduct Widening, the SR 99/East Marginal Way S. Grade Separation, the Mercer Street West widening, and the SR 519 Intermodal Access Project, Phase 2, would improve access to and from the corridor and enhance local circulation in neighboring areas. In addition, regional transit projects such as Link light rail and Sounder commuter expansions may encourage the use of transit modes, thereby reducing peak and non-peak volumes and congestion levels on highway corridors such as SR 99.

8.3.6 Roadway Connectivity and Access

The combined effects of the Alaskan Way Viaduct Replacement Project and other roadway, transit, and non-roadway improvements would further enhance accessibility and connectivity in the region and in some cases directly benefit access to or from the SR 99 corridor. Projects such as the Bridging the Gap Projects, the S. Spokane Street Viaduct Widening, the SR 99/East Marginal Way S. Grade Separation, the Mercer West Project, and the SR 519 Intermodal Access Project, Phase 2, would improve access to the corridor and local circulation in neighboring areas as well.

8.3.7 Transit Services

Cumulative effects involving transit include future development of regional high-capacity transit facilities and service. With voter approval of the Sound Transit 2 Plan in November 2008, Link light rail serving downtown Seattle will be extended north to Lynnwood, east to Redmond (Overlake), and south to Federal Way. The streetcar system in Seattle would be expanded by the construction of a line connecting the International District, First Hill, and Capitol Hill (future Sound Transit Link station).

Additional trips and system capacity will also be provided on Sounder commuter rail service operating between Lakewood and downtown Seattle. With tolls, the increased costs of driving would provide an incentive for higher ridership on public transit to downtown Seattle.

8.3.8 Truck Traffic and Freight

The combined strategies of the Bored Tunnel Alternative and the Program elements should improve freight operations through the study area, as described previously. Other projects in the vicinity would further improve freight access and mobility, including the S. Spokane Street Viaduct Widening, the SR 99/East Marginal Way S. Grade Separation, the Mercer West Project, and the SR 519 Intermodal Access Project, Phase 2.

8.3.9 Parking

Cumulative effects related to parking would be experienced largely during construction if parking is disrupted. Effects on parking during construction are discussed in Section 6.9. Beyond the parking effects related to the Program elements, none of the projects considered for cumulative effects is expected to have a substantial effect on parking.

8.3.10 Pedestrians

The addition of the new roadway connections across existing pedestrian barriers such as SR 99 in the north area, improvements to pedestrian facilities and amenities, and greater consideration of the pedestrian experience in the project area may enhance overall nonmotorized and transit travel within and to the downtown Seattle area, contributing to the achievement of the region's goal of reduced automobile travel, decreased traffic congestion, and improvements in other overall quality of life measures, such as air quality.

8.3.11 Bicycles

The addition of new bicycle facilities in the south area and a substantial increase in the connectivity of the street grid to SR 99 and to other major bicycle facilities in the north portal area may increase nonmotorized travel and transit travel in the greater Seattle area, contributing to an overall decrease in dependence on automobiles and improvements in congestion, air quality, and other quality of life measures.

8.3.12 Ferries

For walk-on ferry passengers who access the Seattle Ferry Terminal on foot, the elimination of the Alaskan Way Viaduct, enhancements to the pedestrian environment nearby and along Alaskan Way, and other transit enhancements in the city such as the Link light rail system and the Third Avenue transit corridor, should all improve daily conditions and encourage continued increases in nonmotorized travel with and without tolls.

When the Bored Tunnel Alternative is operational, the cumulative effects for ferry users in vehicles would be negligible, except that Alaskan Way would be reconstructed.

8.3.13 Safety

The overall cumulative effects related to traffic safety would be similar to the effects described for the Program, and no further effects are expected. Several of the projects considered for cumulative effects would likely have safety benefits of their own. For example, the SR 99/East Marginal Way S. Grade Separation project would eliminate rail/highway conflicts at the existing at-grade crossing. The SR 519 Intermodal Access Project, Phase 2, improvements have separated automobile, freight, pedestrian, and rail traffic, helping to improve mobility, increase pedestrian safety, and reduce the risk of collisions.

8.3.14 Event Traffic

8.3.14.1 South Area

Cumulative effects on event traffic in the stadium area would be influenced mainly by changes in land use and the expansion of transit options. With Link light rail providing service to the stadium area in addition to the expansion of Sounder commuter rail trains on weekends and potential future bus service enhancements, event-goers will likely rely more on non-automobile transportation options as parking costs increase and congestion on surface arterials increases over time. This transition would not be immediate, however, because transit service changes may take some time to develop and implement; the timeline for these changes could be several years.

Land use changes such as the potential development of the Qwest Field north lot and a general increase in density of existing parcels in the south area could also influence traffic demands. Such changes would potentially rebalance trip activity origins and destinations and could possibly influence shifts to alternative modes, such as transit and walking.

8.3.14.2 North Area

Similar to the south area, event traffic impacts due to cumulative effects in the north area would be influenced primarily by long-term changes in land use and transit modes and services. Future streetcar service between downtown and Seattle Center as well as expanded RapidRide BRT service may be provided by the time the Program elements are completed. Such changes in the transportation system accompanied by increased densification of land uses near Seattle Center may influence a shift to non-automobile travel modes and help to offset future (and inevitable) increases in background traffic demands during major events. However, these shifts would likely occur over a long period of time.

8.4 Cumulative Effects of the Cut-and-Cover Tunnel Alternative

The focus of the cumulative effects analysis is the combined effects of the Cut-and-Cover Tunnel Alternative and other past, present, and reasonably foreseeable future projects that are expected to add to transportation effects in the study area. This entire section is approached qualitatively.

The key findings of the analysis of potential cumulative effects of the Cut-and-Cover Tunnel Alternative are the following:

- Overall, increased transit service, whether it is provided by bus, light rail, or commuter rail, would help in reducing SOV demand to the Center City and reduce the growth rate of demand on SR 99, I-5, and local arterials for years to come.
- Other regional transportation improvements, such as the Link light rail expansion and the improvements to I-5 would help the system meet the growing demand.
- Intersection congestion levels, with the combined effects of regional projects, would likely be similar to or lower than those for the Cut-and-Cover Tunnel Alternative in terms of average vehicle delays and LOS.

8.4.1 Projects Considered for Cumulative Effects

The projects listed below were considered for potential activities that could have cumulative effects. These projects have been captured in the 2030 modeled conditions. Any notable cumulative effects are described in the subsections that follow the lists.

8.4.1.1 Seattle Planned Urban Development

- Gull Industries on First Avenue S.
- North Parking Lot Development at Qwest Field
- Seattle Center Master Plan (EIS) (Century 21 Master Plan)
- Bill and Melinda Gates Foundation Campus Master Plan
- South Lake Union Redevelopment
- U.S. Coast Guard Integrated Support Command
- Seattle Aquarium and Waterfront Park

8.4.1.2 Local Roadway Improvements

- Bridging the Gap Projects
- SR 99/East Marginal Way S. Grade Separation

8.4.1.3 Regional Roadway Improvements

- I-5 Improvements
- SR 520 Bridge Replacement and HOV Program
- I-405 Corridor Program
- I-90 Two-Way Transit and HOV Operations, Stages 1 and 2
- SR 518 Widening

8.4.1.4 Transit Improvements

- First Hill Streetcar
- Sound Transit University Link Light Rail Project
- RapidRide
- Sound Transit North Link Light Rail Project
- Sound Transit East Link Light Rail Project
- Sound Transit South Link Light Rail Project

8.4.1.5 Transportation Network Assumptions

- HOV Definition Changes to 3+ Throughout the Puget Sound Region
- Sound Transit Phases 1 and 2
- Other Transit Improvements

8.4.2 Regional Context and Travel Patterns

Most of the projects considered for cumulative effects would not have a substantial effect on the larger region or regional travel patterns. However, the transit improvements are worth noting. A longer Link light rail system connecting the Eastside and extending north at least to Lynnwood and a more complete King County Metro RapidRide system, coupled with additional transit service hours, would increase the person-carrying capacity across the Center City screenlines. Overall, increased transit service, whether provided by bus, light rail, or commuter rail, would help expand person-trip capacity into the Center City while reducing SOV demand to the Center City.

8.4.3 Traffic Operations on SR 99

As other major regional transportation improvements are completed, traffic operations on SR 99 are expected to improve. For example, the reconstruction of I-5 is expected to include restriping, which would provide greater capacity through downtown Seattle. In addition, the extension of Link light rail north to Lynnwood and south to Federal Way would provide additional person-carrying capacity. The additional capacity on these other facilities would help to reduce demand on SR 99.

8.4.4 Traffic Operations at Key Arterial Intersections

Intersection congestion levels under the Cut-and-Cover Tunnel Alternative plus the combined effects of regional projects would likely be similar or improved relative to congestions levels under the Cut-and-Cover Tunnel Alternative alone in terms of average vehicle delays and LOS for both the non-tolled and tolled conditions (see Section 7.3.2). Traffic demand and peak hour volumes along the SR 99 corridor and at intersections within the three areas would either remain consistent with the demand and volumes presented in Section 7.3.2 or decrease slightly once the regional projects are completed.

With additional transit resources and services included as part of the comprehensive regional transportation system, however, including completion of the Sound Transit streetcar program in the downtown area, Link light rail extensions to the north and east, implementation of Metro's RapidRide system, and completion of the HOV system, the mode shift to transit services should be more pronounced than that under the Cut-and-Cover Tunnel Alternative alone. In principle, the ubiquity of transit services included as part of the comprehensive transportation system may increase overall ridership and potentially encourage a portion of regional trips to shift away from conventional automobile-based options (e.g., SOV and HOV).

To the extent that transit patronage is realized with the long-range systems in place, traffic volumes in the downtown core and on regional facilities such as SR 99 could conceivably decrease from the levels expected for the Cut-and-Cover Tunnel Alternative alone. Consequently, intersection delays and area congestion could be reduced due to lower peak hour demands on local streets and arterials.

8.4.5 Peak Hour Travel Times

The combined effects of the Cut-and-Cover Tunnel Alternative and regional transportation projects such as the S. Spokane Street Viaduct Widening Project, the SR 99/East Marginal Way S. Grade Separation, and the SR 519 Intermodal Access Project, Phase 2, would likely result in reduced travel times on the SR 99 corridor by providing not only good alternate routes to SR 99 but also improved access to and from the corridor. In addition, expansion of regional transit systems such as Link light rail and Sounder commuter Rail as well as the introduction of King County Metro RapidRide BRT service may encourage the use of transit modes, thereby reducing peak and non-peak volumes and congestion levels on highway corridors such as SR 99.

8.4.6 Roadway Connectivity and Access

None of the projects considered for cumulative effects would be expected to have a substantial effect on roadway connectivity and access beyond the effects that are described for the Cut-and-Cover Tunnel Alternative in Chapter 5.

8.4.7 Transit Services

In general, conditions for transit services under the Cut-and-Cover Tunnel Alternative would be similar to those under the Bored Tunnel Alternative. Although the alignment and access characteristics would vary slightly between the alternatives, key outcomes such as travel times and transit ridership would not vary substantially. With tolled conditions, these variations also would not differ substantially.

8.4.8 Truck Traffic and Freight

In general, cumulative effects for freight travel for the Cut-and-Cover Tunnel Alternative would be similar to those under the Bored Tunnel Alternative. Although the alignment and connections would vary slightly between the alternatives, travel times through the study area would not vary substantially.

8.4.9 Parking

None of the projects considered for cumulative effects is expected to have a substantial effect on parking. Some of the planned urban development may change the off-street parking supply, but the effects would be specific to the surrounding blocks and relatively minor compared to the parking effects associated with the Cut-and-Cover Tunnel Alternative.

8.4.10 Pedestrians

Similar to the cumulative effects of the other build alternatives, the addition of the new roadway connections across existing pedestrian barriers such as SR 99 in the north area, improvements to pedestrian facilities and amenities, and greater consideration of the pedestrian experience in the project area may enhance overall nonmotorized and transit travel within and to the downtown Seattle area.

8.4.11 Bicycles

Similar to the cumulative effects of the other build alternatives, the addition of new bicycle facilities in the south area and an increase in the connectivity of the street grid to SR 99 and to other major bicycle facilities in the north area may increase nonmotorized travel and transit travel in the greater Seattle area.

8.4.12 Ferries

For walk-on ferry passengers who access the Seattle Ferry Terminal on foot, the elimination of the Alaskan Way Viaduct, enhancements to the pedestrian environment nearby and along Alaskan Way, and other transit enhancements in the city such as the Link light rail system and the Third Avenue transit corridor, should all improve daily conditions and encourage continued increases in nonmotorized travel with or without tolls for the Cut-and-Cover Tunnel Alternative.

When the Cut-and-Cover Tunnel Alternative is operational, the cumulative effects for ferry users in vehicles would be negligible, except that Alaskan Way would be reconstructed.

8.4.13 Safety

No cumulative effects related to traffic safety, apart from the direct effects described in Chapter 5, are expected under the Cut-and-Cover Tunnel Alternative. As described in Section 8.2.13, several of the projects considered for cumulative effects should have safety benefits of their own.

8.4.14 Event Traffic

8.4.14.1 South Area

As with the Program, long-term cumulative effects on event traffic for the Cut-and-Cover Tunnel Alternative in the stadium area would be influenced by changes in the land use mix and the expansion of transit options over time. Link light rail service is expected to expand to the north and south, thereby attracting a much larger event population. In addition, Sounder commuter rail trains will likely run more frequently on weekends, and enhanced bus service specifically for stadium area events will be implemented. The end result of these long-term transit enhancements would be greater use of non-automobile transportation options by event-goers, especially in light of parking cost increases and greater congestion on surface arterials and intersections.

Land use changes such as the potential development of the Qwest Field north lot and a general increase in density of existing parcels in the south area could also influence traffic demands. Such changes would potentially rebalance trip activity origins and destinations and could possibly influence shifts to alternative modes, such as transit and walking.

8.4.14.2 North Area

Similar to the cumulative effects in the north area for the Program, cumulative effects on event traffic in the north area for the Cut-and-Cover Tunnel Alternative would be mainly influenced by long-term changes in land use and transit modes and services. Future streetcar service between downtown and Seattle Center as well as expanded RapidRide BRT service may be provided some time in the next 5 to 10 years. Such transit-related changes combined with increased densification of land uses near Seattle Center may influence a shift to non-automobile travel modes, especially as congestion on surface arterials increases over time and parking costs continue to climb.

8.5 Cumulative Effects of the Elevated Structure Alternative

The focus of the cumulative effects analysis is the combined effects of the Elevated Structure Alternative and other past, present, and reasonably foreseeable future projects that are expected to add to transportation effects in the study area. This entire section is approached qualitatively.

The key findings of the analysis of potential cumulative effects of the Elevated Structure Alternative are the following:

- Overall, increased transit service, whether it is provided by bus, light rail, or commuter rail, would help in reducing SOV demand to the Center City and reduce the growth rate of demand on SR 99, I-5, and local arterials for years to come.

- Other regional transportation improvements, such as the Link light rail expansion and the improvements to I-5 would help the system meet the growing demand.
- Intersection congestion levels, with the combined effects of regional projects, would likely be similar to or lower than those for the Elevated Structure Alternative in terms of average vehicle delays and LOS.

8.5.1 Projects Considered for Cumulative Effects

The projects considered for cumulative effects of the Elevated Structure Alternative are the same as those listed for the Cut-and-Cover Tunnel Alternative in Section 8.4.1.

8.5.2 Regional Context and Travel Patterns

Most of the projects considered for cumulative effects would not have a substantial effect on the larger region or regional travel patterns. However, the transit improvements are worth noting. A longer Link light rail system connecting the Eastside and extending north at least to Lynnwood and a more complete King County Metro RapidRide system, coupled with additional transit service hours, would increase the person-carrying capacity across the Center City screenlines. Overall, increased transit service, whether provided by bus, light rail, or commuter rail, would help expand person-trip capacity into the Center City while reducing SOV demand to the Center City.

8.5.3 Traffic Operations on SR 99

As other major regional transportation improvements are completed, traffic operations on SR 99 are expected to improve. For example, improvements to I-5 would include restriping to provide greater capacity through downtown Seattle. In addition, the extension of Link light rail north to Lynnwood and south to Federal Way would provide additional person-carrying capacity. The additional capacity on these other facilities would help relieve demand on SR 99.

8.5.4 Traffic Operations at Key Arterial Intersections

Intersection congestion levels under the Elevated Structure Alternative, plus the combined effects of regional projects, would likely be similar or improved relative to the congestions levels for the Elevated Structure Alternative alone in terms of average vehicle delays and LOS for both the non-tolled and tolled conditions (see Section 7.3.3). Traffic demand and peak hour volumes along the SR 99 corridor and at intersections within the three areas evaluated under the Elevated Structure Alternative would either remain consistent with is the demand and volumes presented in Section 7.3.3 or decrease slightly once the regional projects are completed.

With additional transit resources and services included as part of the comprehensive regional transportation system, however, including completion of the Sound Transit streetcar program in the downtown area, Link light rail extensions to the north and east, implementation of Metro's RapidRide system, and completion of the HOV system, the mode shift to transit services should be more pronounced than that under the Elevated Structure Alternative alone. In principle, the ubiquity of transit services included as part of the comprehensive transportation system may increase overall ridership and potentially encourage a portion of regional trips to shift away from conventional automobile-based options (e.g., SOV and HOV).

To the extent that transit patronage is realized with the long-range systems in place, traffic volumes in the downtown core and on regional facilities such as SR 99 could conceivably decrease from the levels expected for the Elevated Structure Alternative. Consequently, intersection delays and area congestion could be reduced due to lower peak hour demands on local streets and arterials.

8.5.5 Peak Hour Travel Times

The benefits of the Elevated Structure improvements combined with regional transportation projects such as the S. Spokane Street Viaduct Widening Project, the SR 99/East Marginal Way S. Grade Separation, and the SR 519 Intermodal Access Project, Phase 2, would extend to reduced travel times on the SR 99 corridor by providing not only good alternate routes to SR 99 but improved access to and from the corridor. Also, with expansion of regional transit systems such as Link light rail and Sounder commuter Rail as well as the introduction of King County Metro BRT service, a shift from automobile-oriented travel to transit modes may occur, thereby reducing peak and non-peak volumes and congestion levels on highway corridors such as SR 99.

8.5.6 Roadway Connectivity and Access

None of the projects considered for cumulative effects are expected to have a substantial effect on roadway connectivity and access beyond the effects that are described for the Elevated Structure Alternative in Chapter 5.

8.5.7 Transit Services

In general, conditions for transit services with the Elevated Structure Alternative would be similar as those for the Bored Tunnel Alternative. Although the access characteristics would vary slightly between the alternatives, key outcomes such as travel times and transit ridership would not vary substantially. With tolls, these variations also would not differ substantially.

8.5.8 Truck Traffic and Freight

In general, cumulative effects for freight travel for the Elevated Structure Alternative would be similar to those for the Bored Tunnel Alternative. Although the alignment and connections would vary slightly between the alternatives, travel times through the study area would not vary substantially.

8.5.9 Parking

None of the projects considered for cumulative effects is expected to have a substantial effect on parking. Some of the planned urban development may change the off-street parking supply, but the effects would be specific to the surrounding blocks and relatively minor compared to the parking effects associated with the Elevated Structure Alternative.

8.5.10 Pedestrians

Similar to the cumulative effects of the other build alternatives, the addition of the new roadway connections across existing pedestrian barriers such as SR 99 in the north area, improvements to pedestrian facilities and amenities, and greater consideration of the pedestrian experience in the project area may enhance overall nonmotorized and transit travel within and to the downtown Seattle area.

8.5.11 Bicycles

Similar to the cumulative effects of the other build alternatives, the addition of new bicycle facilities in the south area and an increase in the connectivity of the street grid to SR 99 and to other major bicycle facilities in the north area may increase nonmotorized travel and transit travel in the greater Seattle area.

8.5.12 Ferries

For walk-on ferry passengers who access the Seattle Ferry Terminal on foot, the elimination of the Alaskan Way Viaduct, enhancements to the pedestrian environment adjacent to and along Alaskan Way, in addition to other transit enhancements in the city such as the Link light rail system and the Third Avenue transit corridor, should all improve pedestrian and bicycle connections and encourage continued increases in nonmotorized travel under the Elevated Structure Alternative both with and without tolls.

When the Elevated Structure Alternative is operational, the cumulative effects for ferry users in vehicles would be negligible, except that Alaskan Way would be reconstructed.

8.5.13 Safety

No cumulative effects related to traffic safety, apart from the direct effects described in Chapter 5, are expected for the Elevated Structure Alternative. As described in Section 8.2.13, several of the projects considered for cumulative effects should have safety benefits of their own.

8.5.14 Event Traffic

8.5.14.1 South Area

Cumulative effects on event traffic in the stadium area for the Elevated Structure Alternative would be influenced by long-term changes in the land use mix and the expansion of transit options over time. As mentioned in the discussions of event traffic in Sections 8.3.14 and 8.4.14, Link light rail service is expected to expand to the north and south, thereby attracting a much larger event population. Also, Sounder commuter rail trains will likely run more frequently on weekends, and future bus service enhancements specifically for stadium area events will be implemented in time. These changes to the broader transit system would likely result in greater use of non-automobile transportation options by event-goers, especially in light of parking cost increases and increases in congestion on surface arterials over time.

Land use changes such as the potential development of the Qwest Field north lot and the increasing density of existing land uses in the south area could also influence traffic demands. Such changes would potentially rebalance trip activity origins and destinations and could possibly influence shifts to alternative modes, such as transit and walking.

Changes to the transit system and to land use may take several years to materialize, however. Therefore, their effects on travel behavior may occur over a long period of time.

8.5.14.2 North Area

Similar to the discussions of event traffic in the north area in Sections 8.3.14 and 8.4.14, cumulative effects on the Elevated Structure Alternative would be generally influenced by long-term changes in land use and transit modes and services. Future streetcar service between downtown and Seattle Center as well as expanded RapidRide BRT service would attract a greater number of transit patrons to and from events. These new services in tandem with increases in land use density near Seattle Center could influence shifts to non-automobile travel modes, especially as congestion on surface arterials and parking costs increases over time.

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