Alaskan Way Viaduct Replacement Project Discipline Report
Instructions to Reviewers

Attached is the draft **Transportation Discipline Report** prepared for the Alaskan Way Viaduct Replacement Project Supplemental Draft Environmental Impact Statement (SDEIS). You have been asked to review this report because of your specialized knowledge of this subject. Please read and follow these instructions carefully.

Please note: Chapter 7 includes evaluation of the BAT lanes north of Roy Street as part of the 2030 Program. Text discussing this is highlighted in yellow. In the next version of this report, the 2030 Program results (highlighted sections) will be discussed qualitatively in less detail. This discussion should include some selected quantitative results, and to that end please use this review cycle to decide what those will be. Also, there are placeholders for some missing data to be provided later, including intersection LOS/delay for north portal area intersections affected by Option 2, and some travel times.

This discipline report will be the substantive foundation for the project's SDEIS and will be published as an appendix to the SDEIS. Following your review and subsequent revisions, these reports will be made available to cooperating and interested agencies. The final discipline report should:

- Describe studies, coordination, and methodology used to complete the study.
- Include a complete, current description of the affected environment.
- Evaluate impacts and mitigation (operation and construction) for these plans:
    - July 2009 plan set
    - AWV Bored Tunnel Construction Flowchart, October 1, 2009

1. Use the comment form provided. Draft materials are distributed as PDF files, or hard copy where requested. While this facilitates document distribution, it does not allow modification. Forms are provided for you to note your comments. All drafts are formatted with page and line numbers. Note these on the comment form in the columns provided to help us locate the subject of your comment. Your use of these forms will make it easier to compare and consolidate comments from multiple reviewers.

   Assign a priority to each comment: Please assign each comment one of these priorities:
   1. **Critical issue requiring inter-agency discussion**
   2. Factual or substantive error or issue that should be corrected prior to publication
   3. Editorial suggestion to improve readability or other idea

2. Make substantive, not editorial, comments. This is the first in our lead agency review cycles, so you have the opportunity to ensure that the analysis is complete and accurate. We are looking for comments on content and significant issues not yet identified in the report. Please do not spend time editing or proofreading; a technical editor will perform those tasks later. Feel free, however, to point out areas that need to be rewritten because the information needs clarification or is inaccurate. As a reviewer you should consider:
    - Is the information factually correct?
    - Is the analysis complete and at the appropriate level of detail?
    - Is mitigation appropriate and sufficiently described?
    - Can it be clearly understood?

   Your comments should have an explanation or accomplish a clear purpose. Comments without a good explanation may not be addressed.

3. Comments must be returned to **Angela Freudenstein** and **Mike Sallis** by ***October 23, 2009***.

This Page Intentionally Left Blank

Transportation Discipline Report
Alaskan Way Viaduct Replacement Project
Supplemental Draft EIS

Preliminary Draft
For Internal Review Only

We respectfully request that the public not be given access to this document because FHWA has determined that this preliminary document is an intergovernmental exchange that may be withheld under the Freedom of Information Act. Premature release of this material to any segment of the public could give some sectors an unfair advantage and would have a chilling effect on intergovernmental coordination and the success of the cooperating agency concept.

October 2009

This Page Intentionally Left Blank

Alaskan Way Viaduct Replacement Project

Supplemental Draft EIS
Transportation Discipline Report

Agreement No. Y-9715

Task CC.04

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 2200
Seattle, WA 98104

In association with:
A & G Consultants, Inc.
Berger/ABAM Engineers Inc.
Bolima Drafting & Design
Coughlin Porter Lundeen, Inc
David Evans and Associates, Inc.
Entech Northwest, Inc.
EnviroIssues, Inc.
Geosentia, Inc.
HDR Engineering, Inc.
Hough, Beck and Baird, Inc.
Jacobs Engineering Group Inc.
KPFF, Inc.
Magnusson Klemencic Associates, Inc.
Mimi Sheridan, AICP
Northwest Archaeological Associates, Inc.
Parametrix, Inc.
Power Engineers, Inc.
Roma Design Group
RoseWater GHD
Sequana Environmental
Shannon & Wilson, Inc.
So-Deep, Inc.
Telvent Farradyne, Inc.
Tetra Tech, Inc.
William P. Ott Construction Consultants

This Page Intentionally Left Blank

TABLE OF CONTENTS

LIST OF EXHIBITS

ACRONYMS AND ABBREVIATIONS

AWV	Alaskan Way Viaduct
BAT	business access and transit
BINMIC	Ballard Interbay Northend Manufacturing and Industrial Center
BRT	bus rapid transit
CBD	central business district
EB	eastbound
EIS	environmental impact statement
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
HOV	high-occupancy vehicle
I-5	Interstate 5
LOS	level of service
LRT	light rail transit
mph	miles per hour
MTP	Metropolitan Transportation Plan
MVMT	million vehicle miles of travel
NB	northbound
NEPA	National Environmental Policy Act
PSRC	Puget Sound Regional Council
Program	Alaskan Way Viaduct and Seawall Replacement Program
project	Alaskan Way Viaduct Replacement Project
SB	southbound
SDOT	Seattle Department of Transportation
SIG	Seattle International Gateway
SLU	South Lake Union
SODO	South of Downtown
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
WB	westbound
WOSCA	Washington–Oregon Shippers Cooperative Association
WSDOT	Washington State Department of Transportation

This Page Intentionally Left Blank

Chapter 1 INTRODUCTION AND SUMMARY

1.1 Introduction

This discipline report evaluates the Bored Tunnel Alternative, the new alternative under consideration for replacing the Alaskan Way Viaduct. This report and the Alaskan Way Viaduct Replacement Project Supplemental Draft Environmental Impact Statement (EIS) that it supports are intended to provide new information and updated analyses to those presented in the March 2004 Alaskan Way Viaduct and Seawall Replacement Project Draft EIS and the July 2006 Alaskan Way Viaduct and Seawall Replacement Project Supplemental Draft EIS. The discipline reports present detailed technical analyses of existing conditions and predicted effects of the Bored Tunnel Alternative. The results of these analyses are presented in the main volume of the Supplemental Draft EIS.

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. As part of the NEPA process, FHWA is also responsible for selecting the preferred alternative. FHWA will base their decision on the information evaluated during the environmental review process, including the Supplemental Draft EIS, to be followed by the Final EIS. FHWA can then issue their NEPA decision, called the Record of Decision (ROD), independent from the other agency recommendations.

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 the City of Seattle. The March 2007 ballot included an elevated alternative and a surface-tunnel hybrid alternative. The citizens voted down both alternatives.

Following this election, the lead agencies committed to a collaborative process to find a solution to replace the viaduct along Seattle's central waterfront. This Partnership Process is described in Appendix T, the Project History Report. 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.

The environmental review process for the Alaskan Way Viaduct Replacement Project (the project) builds on the five Build Alternatives evaluated in the 2004 Draft EIS and the two Build Alternatives evaluated in the 2006 Supplemental Draft EIS. It also incorporates the work done during the Partnership Process. The bored tunnel was not studied as part of the previous environmental review process, and so it becomes the eighth alternative to be evaluated in detail.

The Bored Tunnel Alternative analyzed in this discipline report and in the Supplemental Draft EIS has been evaluated both quantitatively and qualitatively. The Bored Tunnel Alternative includes replacing State Route (SR) 99 with a bored tunnel and associated improvements, such as relocating utilities located on or under the viaduct, removing the viaduct, decommissioning the Battery Street Tunnel, and making improvements to the surface streets in the tunnel's south and north portal areas. For these project elements, the analyses of effects and benefits have been quantified with supporting studies, and the resulting data are found in the discipline reports (Appendices A through R). These analyses focus on assessing the Bored Tunnel Alternative's potential effects for both construction and operation, and considering appropriate mitigation measures that could be employed. The Viaduct Closed (No Build Alternative) is also analyzed.

The Alaskan Way Viaduct Replacement Project is one of several independent projects that 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 often referred to as the Alaskan Way Viaduct and Seawall Replacement Program (the Program). This Supplemental Draft EIS evaluates the cumulative effects of complementary projects referred to as the Program. Direct and indirect environmental effects of these independent projects are considered separately. This collection of projects is categorized into four groups: roadway elements, non-roadway elements, projects under construction, and completed projects.

Roadway Elements

- Alaskan Way Surface Street Improvements
- Elliott/Western Connector
- Mercer Street Improvements

Non-Roadway Elements

- First Avenue Streetcar
- Transit Enhancements
- Seawall Replacement
- Alaskan Way Promenade

Projects Under Construction

- S. Holgate Street to S. King Street Viaduct Replacement
- Transportation Improvements to Minimize Traffic Effects During Construction
- Electrical Line Relocation along the Viaduct's South End

Completed Projects

- Column Safety Repairs

1.2 Summary

This Transportation Discipline Report, Appendix C to the Alaskan Way Viaduct Replacement Project Supplemental Draft EIS, describes transportation conditions associated with the SR 99 corridor through the downtown Seattle area and predicts transportation performance and impacts of the project and 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 project alternative.

Chapter 4, Affected Environment, includes discussion of current transportation conditions.

Chapter 5, Operational Effects, Mitigation, and Benefits, describes changes in travel patterns and traffic volumes for the following conditions:

1. 2015 Baseline (with the Alaskan Way Viaduct [AWV])
2. 2015 Viaduct Closed (No Build Alternative)
3. 2015 Project
4. 2030 Project

A brief discussion of 2040 conditions will provide 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 Bored Tunnel Alternative, traffic management approaches (detours), and expected performance associated with major construction stages.

Chapter 7, Cumulative Effects, describes the secondary and cumulative effects of the combined effect of the project (proposed action), other Program elements, and other projects that are anticipated to affect transportation in the study area.

References consulted in the preparation of this report are provided in Chapter 8.

1.2.1 Alternatives Studied

The Bored Tunnel Alternative includes replacing SR 99 with the bored tunnel and associated improvements, such as the relocation of those utilities located on or under the viaduct; the removal of the viaduct, the decommissioning of the Battery Street Tunnel, and improvements to the surface streets in the tunnel's south and north portal areas. Also included are improvements to the Mercer Street corridor from Dexter Avenue N. to Fifth Avenue N., and to Sixth Avenue N. from Denny Way to Mercer Street. In addition, Broad Street would be closed from Taylor Avenue N. to Ninth Avenue N. The Viaduct Closed (No Build Alternative) also is analyzed.

Viaduct Closed (No Build Alternative)

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

- 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.

Scenario 1 is referred to as the Viaduct Closed (No Build Alternative) scenario in this report. Scenario 2 is discussed qualitatively but is not quantitatively analyzed in this report. The Transportation Discipline Report also analyzes traffic and transportation conditions for continued operation of the current viaduct and seawall. This scenario is referred to in this report as the Baseline. While this scenario 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.

Bored Tunnel Alternative

The Bored Tunnel Alternative (the project) would be located generally under First Avenue's current alignment, with access provided at a south portal near Qwest and Safeco Fields between S. Royal Brougham Way and S. King Street. Ramps providing northbound on, northbound off, southbound on, and southbound off movements to and from SR 99 would also be constructed in this area. New surface streets would be constructed between S. Royal Brougham Way and S. King Street. Three new streets, S. Plummer, S. Charles, and S. Dearborn Streets, would connect First Avenue S. and Alaskan Way.

There are three primary components of the Bored Tunnel Alternative: the south portal area, the bored tunnel, and the north portal area. Each of these areas is discussed in more detail below.

South Portal Area

Full northbound and southbound access to/from SR 99 would be provided in the south portal area near S. Royal Brougham Way. The northbound off-ramp from SR 99 connecting to Alaskan Way would have a general purpose lane and a peak hour transit-only lane to accommodate transit coming from south or West Seattle.

Surface streets would be reconfigured and improved in the south portal area. The southbound on-ramp and northbound off-ramp to SR 99 would feed directly into a reconfigured Alaskan Way surface street. Along this section, Alaskan Way would have three lanes in each direction. A left-hand turn pocket for southbound traffic would be provided at most intersections. The newly configured Alaskan Way would have three new intersections and cross-streets. The new cross-streets would be built west of Qwest Field and would be named S. Plummer, S. Charles, and S. Dearborn Streets. The cross-streets would have sidewalks on both sides. The reconfigured Alaskan Way would have a sidewalk on the west side and a minimum 25-foot-wide multi-use path, called the City Side Trail, on the east side. The City Side Trail would travel from S. Atlantic Street up to S. King Street.

The new East Frontage Road east of SR 99 would be widened slightly at S. Atlantic Street to accommodate truck turning movements, and a new right-turn pocket would be added between S. Atlantic Street and S. Royal Brougham Way.

Central: Bored Tunnel Alignment – S. King Street to Denny Way

The bored tunnel would begin at approximately Railroad Way S. and would continue to John Street. The tunnel would generally travel under First Avenue up to Pine Street, where it would curve slightly to the northeast to approximately John Street.

The tunnel would have two lanes in each direction. Southbound lanes would be located on the top portion of the tunnel, and the northbound lanes would be located on the bottom. Travel lanes would be approximately 12 feet wide, with a 2-foot-wide shoulder on one side and an 8-foot-wide shoulder on the other side. The wider shoulder would provide emergency vehicle access and space for disabled vehicles to safely stop.

The wider shoulder would also provide access to emergency tunnel exits, which would be provided at least every 650 feet. In an emergency, travelers would walk along the shoulders to reach a doorway into a secure waiting area, called a refuge area, located between the tunnel's levels. Staircases inside the refuge area would provide access between the roadway levels. Signs would point travelers to the nearest exit where they would wait for assistance or walk out of the tunnel. Refuge areas would contain emergency telephones.

The tunnel would be equipped with ventilation, a fire detection and suppression system, and drainage. Video cameras would provide real-time information to operators at the Washington State Department of Transportation (WSDOT) 24-hour tunnel control center and allow them to respond quickly to changing conditions and emergencies. The tunnel control center would be incorporated into the tunnel ventilation building at either the south or north tunnel portal.

North Portal Area – Options 1 and 2

Full northbound and southbound access to/from SR 99 would be provided near Harrison and Republican Streets. The existing on- and off-ramps provided at Denny Way would be closed and replaced with downtown access ramps to/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 a southbound on-ramp would be provided on the west side of SR 99. The northbound off-ramp would be routed to an intersection at Dexter Avenue N. Drivers would access the southbound on-ramp via a new connection at Sixth Avenue N.

Surface streets would be reconfigured and improved in the north portal area. The street grid between Denny Way and Harrison Street would be reconnected by building a new north-south street over the top of SR 99 (referred to as surface Aurora Avenue) and connecting John, Thomas, and Harrison Streets as cross-streets. The new north-south 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.

John Street would be built with one lane in each direction, a center turn lane, and bike lanes and sidewalks on each side of the roadway. Thomas Street would be built with one lane in each direction, a center turn lane, and sidewalks. Harrison Street would be built with two lanes in each direction and sidewalks.

Mercer Street would become a two-way street and would be widened from Dexter Avenue N. to Sixth Avenue N. The rebuilt Mercer Street would have three lanes in each direction with left-hand turn pockets. Broad Street would be filled and closed between Ninth Avenue N. and Taylor Avenue N.

Two configurations for Sixth Avenue N. and the southbound on-ramp are being considered:

- Option 1 proposes to build a new roadway that would extend Sixth Avenue N. from Harrison Street to Mercer Street in a typical grid formation. The new roadway would have two lanes in each direction with signalized intersections at Republican and Mercer Streets.
- Option 2 proposes to build a new roadway that would extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets. The new roadway would have two lanes in each direction and a signalized intersection at Republican Street.

Viaduct Removal and Battery Street Tunnel Decommissioning

Following completion of the new SR 99 bored tunnel, the existing viaduct would be removed. Utilities located on the viaduct and, where necessary, those under the viaduct would be relocated and the Battery Street Tunnel would be decommissioned. The demolition of the existing Alaskan Way Viaduct from S. King Street to Battery Street would take approximately 9 months.

1.2.2 Alaskan Way Viaduct and Seawall Replacement Program

This Supplemental Draft EIS evaluates the short and long-term environmental effects of the project and the cumulative effects of complementary projects referred to as the Program. Exhibit 1-1 lists the project and Program elements.

Exhibit 1-1. Project and Program Elements

	Cumulative Effects (Program)	
Bored Tunnel Alternative	Other Roadway Elements	Non-Roadway Elements
- Remove viaduct - Replace SR 99 with tunnel or other limited-access facility - Relocate utilities located on viaduct - Surface streets at south portal - Surface streets at north portal (Mercer Street from Dexter Avenue to Fifth Avenue, Sixth Avenue reconnection, remove Broad Street) - Decommission Battery Street Tunnel	- Alaskan Way surface street (on location of former viaduct) from S. King Street to Pike Street - Elliott/Mercer Connector from Pike Street to Battery Street - Mercer Street west corridor improvements (Fifth Avenue to Elliott Avenue)	- Replace seawall - Develop Alaskan Way promenade - First Avenue Streetcar - Enhanced transit service

Roadway Elements

Alaskan Way Surface Street Improvements

The Alaskan Way surface street would be rebuilt and improved between S. King Street and Pine Street. The new surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), 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, bike lanes, parking/loading zones, and signalized pedestrian crossings at cross streets. The existing waterfront streetcar would be replaced by a new streetcar line running on First Avenue. The new surface street would provide a regional truck route for freight traveling to/from the Duwamish/Harbor Island/SR 519 area and the Ballard Interbay Northend Manufacturing and Industrial Center (BINMIC).

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/from BINMIC and neighborhoods north of Seattle (including Ballard and Magnolia). The connector would be four lanes wide and would provide a grade-separated crossing of the BNSF mainline railroad tracks. Additionally, it would provide local street access to Pike Street and Lenora Street and integrate back into the street grid at Bell Street, which would improve local street connections in Belltown. The new roadway would include bicycle and pedestrian facilities.

Mercer Street West Corridor Improvements

The Mercer Street west corridor improvements include reconfiguring Mercer Street between Fifth Avenue N. and Elliott Avenue to accommodate two-way traffic. The route would be redesignated by the City as a regional truck route to provide vital freight connections to Ballard/Interbay. These improvements would provide access to Ballard/Interbay freight and drivers coming from Ballard and Magnolia. Additionally, Roy Street from Aurora Avenue to Queen Anne Avenue would be reconfigured to accommodate two-way traffic.

Non-Roadway Elements

First Avenue Streetcar

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 Central Business District (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, Seattle Art Museum, Seattle Aquarium, and the Olympic Sculpture Park.

Transit Enhancements

A variety of transit enhancements would be provided to support planned transportation improvements associated with the Program. This includes (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, and (4) local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes. Additionally, northbound and southbound right-side transit lanes on SR 99 are assumed from just south of the Aurora Bridge to north of Aloha Street.

Seawall Replacement

The Alaskan Way Seawall Replacement Project is a rehabilitation effort to protect the shoreline along Elliott Bay, including Alaskan Way, from seawall failure due to seismic and storm events. The project limits extend from S. Washington Street in the south to Broad Street in the north.

Alaskan Way Promenade

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 cruise ship and 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.

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 current roadway and safety standards. An Environmental Assessment for this project was completed in June 2008, and the Finding of No Significant Impact was published in February 2009. Construction and early utility relocations began in mid-2009 and is the project expected to be completed at the end of 2014.

Transportation Improvements to Minimize Traffic Effects During Construction

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 Interstate 5 (I-5) to help maximize safety and traffic flow.
- Providing funding for the 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 bus travel time monitoring system.
- 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.

Completed Projects

Column Safety Repairs

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

Electrical Line Relocation Along the Viaduct's South End

Construction to relocate electrical lines began in September 2008 and was completed in fall 2009. WSDOT and Seattle City Light are relocating electrical lines from the viaduct to underground locations east of the viaduct between S. Massachusetts Street and Railroad Way S.

1.2.3 Summary of Findings

Operational benefits of the Bored Tunnel Alternative can be seen both in comparison to the Baseline scenario as well as the Viaduct Closed (No Build Alternative). The Baseline itself would have improved access in the south end area in comparison to existing conditions with the addition of the stadium area ramps to/from the south. The Viaduct Closed (No Build Alternative), however, would substantially reduce mobility throughout the corridor and result in highly congested conditions along Alaskan Way surface street as well as downtown arterials. Travel times between Woodland Park and Spokane Street for the PM peak hour would be expected to triple compared to the Baseline. I-5 also would be expected to have increased congestion with the Viaduct Closed (No Build Alternative).

The Bored Tunnel Alternative is projected to experience some decrease in performance in overall conditions compared to the Baseline, but conditions would be substantially better than the Viaduct Closed (No Build Alternative). SR 99 through traffic is expected to operate better than Baseline due to the removal of the merging and weaving conflicts associated with the Elliott/Western ramps and the midtown ramps.

Peak hour travel times for SR 99 through trips are projected to be 9 to 25 percent faster than under Baseline depending on the peak hour and direction, and three times as fast as for the Viaduct Closed (No Build Alternative). Regarding other key peak hour travel time routes analyzed, the Bored Tunnel Alternative is projected to be about 1 minute slower than the Baseline between West Seattle and downtown Seattle due to the removal of the midtown ramps. Between Ballard and Spokane Street, the Bored Tunnel Alternative using the Alaskan Way surface street route is expected to be 2 to 8 minutes slower than Baseline, which includes the existing Elliott/Western ramps. The Bored Tunnel Alternative's travel times along this route would be compromised due to the lack of a connection from Elliott/Western Avenues to the waterfront, causing traffic to use Broad Street, which includes an at-grade rail crossing. However, using Mercer Street and the bored tunnel, the Bored Tunnel Alternative is expected to be only 1 to 2 minutes slower in the AM peak hour, and in the PM peak hour less than a minute slower southbound, and a minute faster northbound.

The main points expected for each scenario are summarized below.

2015 Baseline

- Access would be improved in the south end due to the S. Holgate Street to S. King Street Viaduct Replacement Project interchange, compared to existing conditions.
- There would be heavy traffic on Alaskan Way surface street between S. King Street and Marion Street.
- First Avenue S. and S. Atlantic Street would operate at level of service (LOS) E/F (AM/PM).

- Travel times would likely be a little higher than existing conditions.
- Mercer Street/Fairview Avenue N. would be problematic in the PM peak period for all scenarios.

2015 Viaduct Closed (No Build Alternative)

- There would be a high level of congestion throughout the corridor.
- Alaskan Way surface street would be severely congested.
- North/south CBD arterials would be substantially affected.
- I-5 is likely to experience the greatest increase in traffic of all alternative scenarios.
- Travel times in general are likely to be much higher than in 2015 Baseline.
- The interface of Alaskan Way traffic with Seattle Ferry Terminal traffic at Colman Dock would be problematic.

2015 Bored Tunnel Alternative

- There would be some decreased performance in overall conditions compared to Baseline, but conditions would be substantially better than under the Viaduct Closed (No Build Alternative).
- SR 99 through traffic is expected to operate better than Baseline and would be greatly improved over Viaduct Closed (No Build Alternative).
- LOS at First Avenue S./S. Atlantic Street would be expected to improve in the AM peak period as compared to the Baseline.
- Connection of east/west streets across Aurora Avenue in the South Lake Union area would improve local circulation and mobility for motorized vehicles and nonmotorized modes.
- Extension of Sixth Avenue N. to Mercer Street would improve access to southbound SR 99 from Mercer Street. This improvement is increased with Option 1 as compared to Option 2.
- I-5 traffic would be similar to Baseline.
- Outside of the SR 99 through traffic, where travel times are faster than Baseline, travel times would be similar or somewhat slower than Baseline, but substantially improved over Viaduct Closed (No Build Alternative).
- Alaskan Way surface street would likely experience heavier traffic than Baseline but still would be improved over Viaduct Closed (No Build Alternative).

- Travel along Alaskan Way at the Seattle Ferry Terminal at Colman Dock could be problematic during peak ferry loading.
- The waterfront route would be compromised due to lack of an Elliott/Western Connector and the rail crossing at Broad Street.
- Heavier volumes would be seen on First Avenue through Pioneer Square in comparison to Baseline.

North Portal Area: Option 1

- Option 1 would provide all movements at Sixth Avenue N./Mercer Street.
- Option 1 would provide an additional route from downtown to Uptown, and a more direct route than Option 2 from I-5 to southbound SR 99.
- Option 1 would provide a pedestrian and bike crossing at Sixth Avenue N., connecting to the proposed trail along the north side of Mercer Street.

North Portal Area: Option 2

- Option 2 would move the intersection closer to Dexter Avenue N. and immediately adjacent to the Aurora Avenue overcrossing.
- The signal would be problematic due to proximity to Dexter Avenue N. and sight distance issues westbound due to the Aurora Avenue overcrossing. Hence, Option 2 would likely allow right turns only in and out of Sixth Avenue N and would not be signalized.
- Option 2 would not provide an additional downtown-to-Uptown route.
- To travel from I-5 to SR 99 southbound, drivers would need to take either Dexter Avenue N. to Harrison Street to the Republican Street on-ramp or Taylor Avenue N. to Roy Street to SR 99.
- This option would not provide a pedestrian and bike crossing at Sixth Avenue N.

2015 Partial Program

- The Partial Program is projected to experience similar or better overall performance as compared to the project.
- The waterfront route would be improved due to the Elliott/Western Connector and widened Alaskan Way surface street.
- The westbound Mercer Street route would be improved with two-way Mercer Street west of Fifth Avenue N.

2015 Program

- Increased RapidRide service from West Seattle and Ballard would increase ridership along those routes.
- The transit lane on SR 99 between Aurora Bridge and Aloha Street may attract additional ridership, but is likely to substantially impair overall traffic operations, including creating backups into the northbound tunnel as well as southbound across the Aurora Bridge, and affecting the ability of transit to access the left side off-ramp to Denny Way.

Construction

- Two lanes in each direction would be maintained on SR 99.
- Access to/from SR 99 would be maintained in all areas where current access exists.
- Traffic levels are projected to be reduced between 20 and 30 percent on SR 99 (Spokane Street to Mercer Street) in comparison to the 2015 Baseline Alternative.
- Peak period traffic speeds and travel times on SR 99 are expected to be only slightly slower than Baseline.
- Some peak period traffic is expected to divert to north/south arterials and I-5 and/or other time periods.
- Heavier volumes would use First Avenue through Pioneer Square.

2030 Project and Program

By 2030, there would be similar patterns as in the 2015 Project and Program, except with slightly lower performance due to overall traffic growth.

Chapter 2 METHODOLOGY

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

2.1 Study Area

The study area for transportation 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 previous EIS studies, such as the 2006 Supplemental Draft EIS (see Exhibit 2-1). 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.

The potential for cumulative effects is considered for the broader region.

2.2 Data Collection and Sources

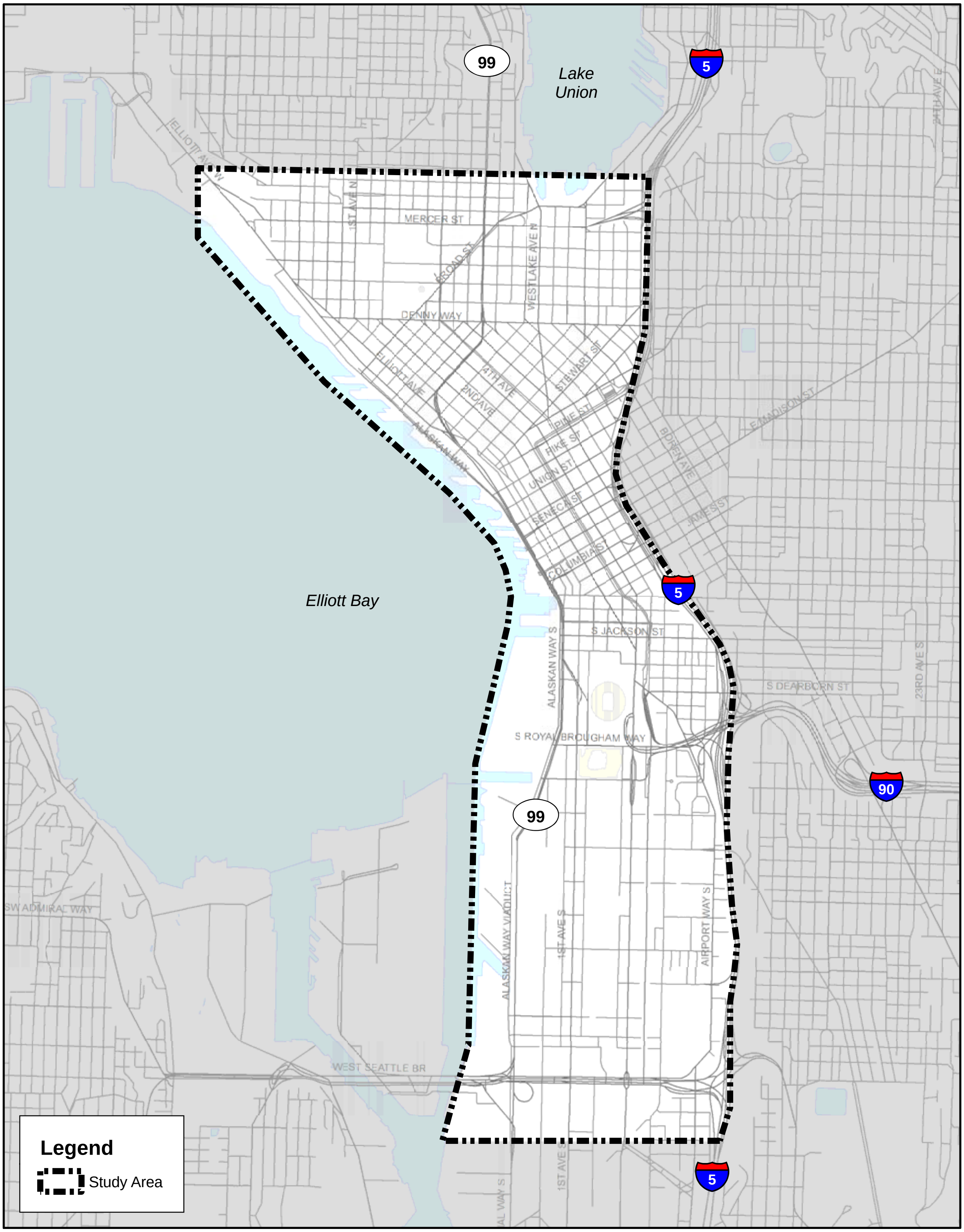
2.2.1 Transportation Analyses

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.

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

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, 5th Edition* (AASHTO 2004a).
- *A Guide for Achieving Flexibility in Highway Design, 1st Edition* (AASHTO 2004b).
- *Guide for the Development of Bicycle Facilities, 3rd Edition* (AASHTO 1999).
- *Manual on Uniform Traffic Control Devices, 3rd Edition* (FHWA 2003).
- *Design Manual* (WSDOT 2009).
- Any relevant City of Seattle design guidelines/standards.



N

0 2,000 4,000 8,000 Feet

Data Source: City of Seattle, 2009.

Exhibit 2-1
Study Area

U:\GIS\e-3\Maps\SDEIS2-Bored_Tunnel\Study Area.mxd

2.3 Travel Demand Estimates and Forecasts

A regional travel demand model was used for this study to support assessment of future conditions. 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, the Metropolitan Transportation Plan for the Central Puget Sound Region* (PSRC 2001). These data were most recently updated in 2006.

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

- *PSRC Travel Model Documentation (for Version 1.0), Updated for Congestion Relief Analysis, Final Report* (PSRC 2007a).
- *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 forecast population and employment changes, as well as planned transportation system improvements. Horizon year forecasts were developed for 2030 conditions, while forecasts for the year of opening and the construction period were derived from model runs for 2015.

2.3.1 Model Assumptions

The future year model scenarios include a unique set of baseline assumptions for each horizon year (e.g., 2015, 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 for 2030 is as follows:

- New ramps to/from Alaskan Way south of S. King Street and reconfiguration of Alaskan Way S. and S. Atlantic Street as proposed in the SR 99 S. Holgate Street to S. King Street Viaduct Replacement Project.
- Sound Transit Phase 1 and 2: Sounder Commuter Rail; ST Express Bus; First Hill Streetcar; and South Link, University Link, North Link, and East Link light rail.
- Existing transit services and new services proposed in 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 Sound Transit Tunnel Conversion).
- King County Transit Now service changes and bus rapid transit (BRT) corridors (called RapidRide) approved through Transit Now (2006).
- SR 519 Intermodal Access Project, Phase 2.
- The Two-way Mercer Corridor 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.
- Spokane Street Viaduct Project, including widening between Sixth Avenue S. and SR 99, relocation of westbound off-ramp from Fourth Avenue S. to First Avenue S., and new eastbound off-ramp at Fourth Avenue S.

The 2015 model has similar components as the 2030 model, but does not include Sound Transit Phase 2 (ST2) elements (North Link or East Link).

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 SR 99: 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 prior to any operational analyses). The PSRC 2040 freight element is not incorporated into the travel demand model at this point.

2.3.2 Model Scenarios

A baseline model for 2015 was prepared that included the baseline elements described previously. The Baseline scenario assumes that the existing viaduct would remain in place in its current configuration except for new ramps to/from

Alaskan Way south of S. King Street and reconfiguration of Alaskan Way S. and S. Atlantic Street as proposed in the SR 99 S. Holgate Street to S. King Street Viaduct Replacement Project. The 2015 Baseline scenario serves as a reference point to compare both the Viaduct Closed (No Build Alternative) and the Bored Tunnel Alternative. The Viaduct Closed (No Build Alternative) assumes that the existing viaduct would not be in service 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 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.

A 2015 build scenario was developed to gauge year-of-opening conditions that include network changes associated with the Bored Tunnel Alternative. Additionally, one 2015 construction scenario was developed to reflect conditions during the most disruptive construction phase. The Bored Tunnel Alternative was also modeled for design year (2030) conditions. 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. Two 2015 networks and one 2030 network were modeled to analyze cumulative effects as well. In total, nine model runs were conducted reflecting the following conditions:

1. Existing Conditions (used for model calibration)
2. 2015 Baseline (with AWV)
3. 2015 Viaduct Closed (No Build Alternative)
4. 2015 Bored Tunnel Alternative
5. 2015 Partial Program (Bored Tunnel Alternative plus all Program elements except the First Avenue Streetcar and King County Metro transit improvements – Cumulative Effects)
6. 2015 Program (Bored Tunnel Alternative plus all Program elements – Cumulative Effects)
7. 2030 Bored Tunnel Alternative
8. 2030 Program (Cumulative Effects)
9. 2015 Construction

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

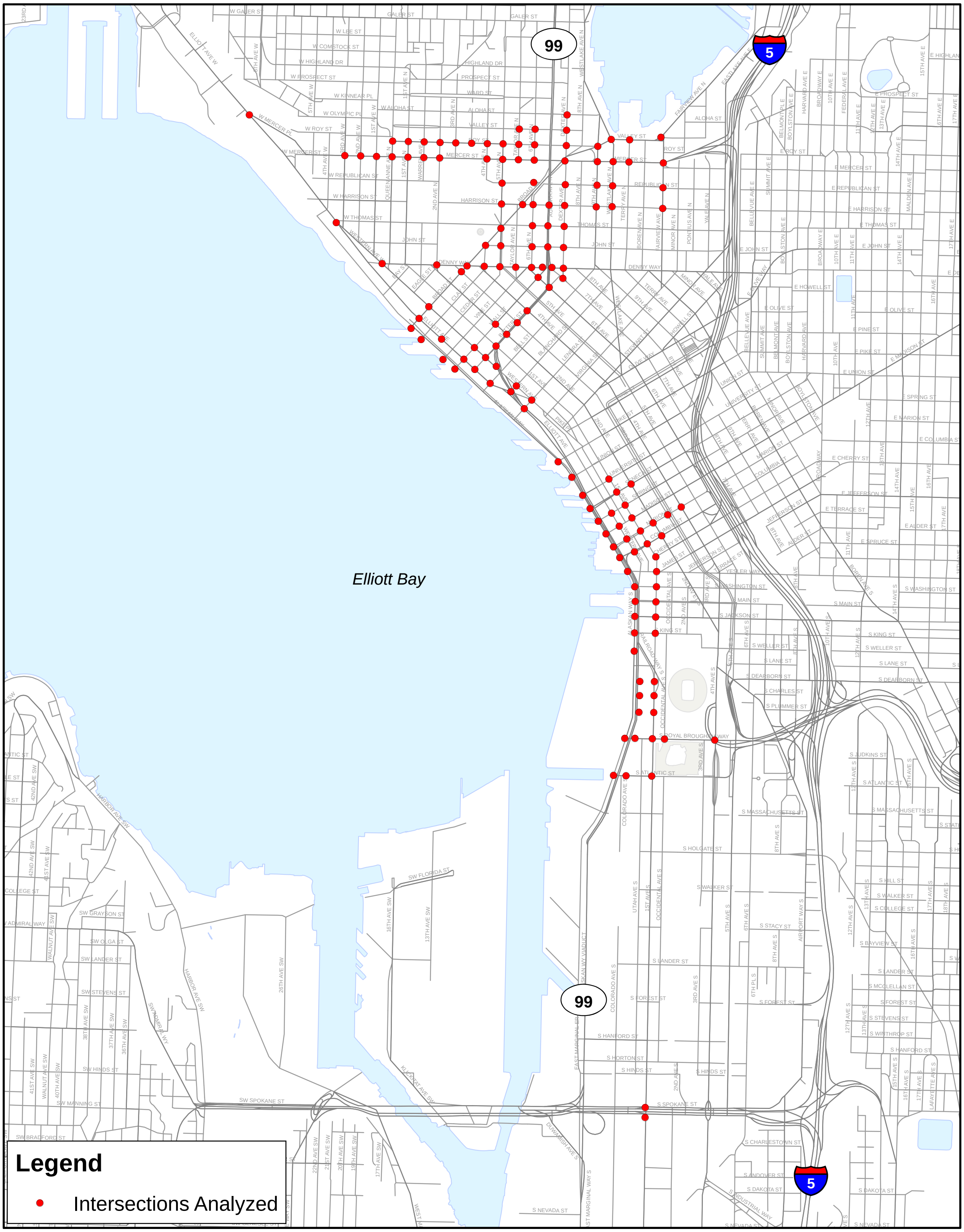
Intersection traffic operations were evaluated for key locations on the arterial network using models developed in Trafficware Corporation's Synchro software (version 7.0 or later). Synchro is a traffic modeling program designed for analysis of intersection traffic operations and the optimization of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

Intersections were selected for analysis based primarily on relation to the AWV corridor and changes in traffic patterns predicted by the travel forecasting model. These included ramp termini, new or revised intersections (including those along Alaskan Way), and other intersections in the study area that would experience substantial increases in traffic (approximately 100 vehicles per hour per lane or more and an increase of 20 percent or more) as a result of implementing the proposed action. Additionally, intersections within the study area along routes chosen as travel time routes were also analyzed. Exhibit 2-2 displays 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 roadway geometry, channelization, and traffic control (including signal timing) data for the Program. These data were reviewed for consistency with existing field conditions and updated as necessary.

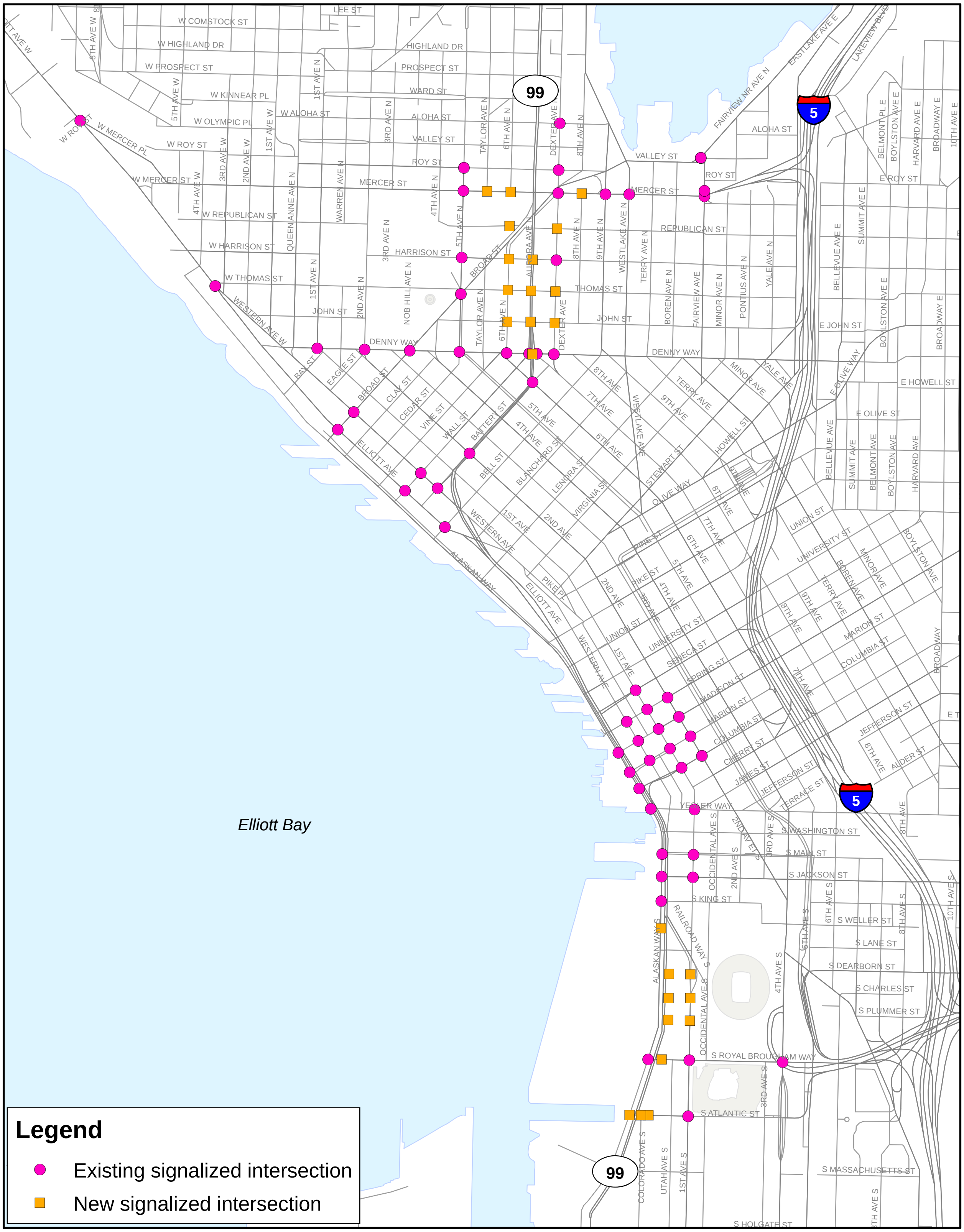


N

0 2,000 4,000 8,000 Feet

Basemap Data Source: King County, 2005.

Exhibit 2-2
Intersections Analyzed



N

0 1,000 2,000 4,000 Feet

Basemap Data Source: King County, 2005.

Exhibit 2-3
Intersections Reported

2.5.2 Traffic Volume Information

Mainline SR 99 Traffic Counts

Transportation analysts have previously prepared AM peak hour, PM peak hour, and daily traffic volume estimates for SR 99 mainline segments and ramps for 2005 conditions. These volume estimates were derived from traffic counts conducted by WSDOT and City of Seattle from 2004 through 2006. Traffic volumes on SR 99 within the study area have generally remained stable in recent years, so these volume estimates may still be considered current. Some additional on-corridor traffic count data were collected in 2007 and 2008 by the City of Seattle. These data were evaluated and existing traffic volume estimates updated as necessary to reflect changes evident in these latest counts.

Intersection Traffic Counts and Related Data

Previous work associated with the Program led to development of a database of turning movement counts for intersections throughout the study area. Data include AM and PM peak hour vehicle turning movements, heavy vehicle percentages, 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 not available have been estimated based on counts at adjacent intersections.

Turning movement counts were originally conducted between 2003 and 2005, though the database has been updated as newer data become available. The intersections selected for detailed traffic analysis were evaluated to determine whether newer traffic counts were needed. This process involved considering whether new development in the area is likely to have altered traffic patterns since the date the current traffic count was conducted, and comparing turning movement count volumes to newer automated traffic counter data available from the City of Seattle (2007-08). New peak hour turning movement counts were conducted for locations where current estimates are determined to be out of date. Newer counts were compared to prior counts to identify any anomalies.

High-Occupancy Vehicles)

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

Nonmotorized Users

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

Trucks

Heavy-vehicle volumes were collected during the arterial turning movement counts described previously. These data were supplemented by video reconnaissance of freight traffic on SR 99 conducted in June 2006. Additional information on heavy trucks' use of the SR 99 corridor is summarized in the project memorandum *Updated SR 99 Truck Volumes* (Parsons Brinckerhoff 2006a). 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. 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. Parking spaces surrounding the north portal area were counted in the summer of 2009. City of Seattle parking space data from 2009 also were used. Off-street parking data collected in 2005 and published in 2006 by PSRC have been obtained.

2.5.4 Transit Service Routes and Frequencies

Transit information was collected that related to service coverage, frequency, and travel times for buses that currently use SR 99 and other nearby street segments from published schedules and maps provided by King County Metro, Community Transit, Pierce Transit, and Sound Transit. Available transit ridership data from King County Metro were collected, 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 previously 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 in the vicinity of Colman Dock have also been collected, as previously described.

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 crash data for the Battery Street Tunnel area were assessed for 2004. Additionally, crash data recently gathered for the corridor for years 2005 through 2007 was assessed.

2.6 Analysis of Existing Conditions (Affected Environment)

Existing conditions analysis was conducted for a base year of 2005, unless otherwise noted. The elements of the analysis are described below.

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 north, south, and in downtown Seattle. Transit ridership and total person-throughput estimates for all travel modes were prepared at the screenline level. Additionally, projected regionwide AM peak period, PM peak period, and daily vehicle miles of travel (VMT), vehicle hours of travel (VHT), and vehicle hours of delay (VHD) are reported from the travel demand forecasting model, as well as daily transit mode shares to/from the Center City area.

2.6.2 Traffic Operations on SR 99

AM and PM peak hour travel speed and LOS for all mainline segments and ramps on SR 99 are reported. 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, ranging from "A" to "F," is defined in the HCM. LOS A represents ideal, uncongested operating conditions, while LOS F designates congested, breakdown conditions. LOS B through LOS D designate intermediate operating conditions, while LOS E denotes conditions at the point of maximum service rate.

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, though its posted speed is lower than a typical freeway. Both multilane arterial and freeway classifications use the same density range to estimate LOS. These traffic density ranges are used to classify LOS for all SR 99 mainline and ramp segments. However, because SR 99's posted speeds are less than a typical freeway's, the LOS as based on the HCM density ranges for freeways will likely be lower than is truly experienced on the facility. Note that intersection LOS at ramp termini are also categorized using intersection-based LOS measurements as described in the following section.

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

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

pcpmpl = passenger car equivalents per mile per lane.

Source: Transportation Research Board *Highway Capacity Manual* (2000).

2.6.3 Traffic Operations at Key Arterial Intersections

Average vehicle delay and LOS for AM and PM peak hour conditions for selected study area intersections on adjacent and nearby arterials are reported. Additionally, locations with queuing issues are described.

Average vehicle delay is reported from either Synchro's HCM Signals report or from the VISSIM model. 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 (Signalized Intersection)	Average Vehicle Delay (seconds)
A	0–10
B	> 10–20
C	> 20–35
D	> 35–55
E	> 55–80
F	> 80

Source: Transportation Research Board *Highway Capacity Manual* (2000).

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 connections (high-speed/capacity ramp connections, low-speed/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).

2.6.5 Transit Services

Public transportation services in the study area are described. Those bus routes that could be directly affected by proposed changes to SR 99 under the Bored Tunnel Alternative are identified and described in terms of routing, frequency of service, and scheduled travel times.

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).

2.6.7 Parking

The location and type of parking for areas that may be affected by the project 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 is quantified for areas where activity is known to be high, with particular emphasis on the waterfront. Pedestrian interactions with vehicle traffic are discussed as related to Alaskan Way, Aurora Avenue, and ramps from the Alaskan Way Viaduct.

2.6.9 Bicycles

Bicycle routes and facilities are 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/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 signal preemption 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 described. A more detailed discussion of collision history also is presented, updating the prior Program analysis conducted for 2001–03 to reflect the most recent available collision data (2005-07). The following elements are considered:

- *Collision Rates:* To allow comparison of crash 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 crash types (e.g., fixed-object collisions, rear-end collisions) relative to total collisions, and collision rates by type (per MVMT) were reported. Comparing the proportion of accident types by segment can help identify possible contributing factors to collisions.
- *Collision Severity:* The share of injury collisions (per MVMT) relative to total collisions was reported.

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 derive estimated changes in travel patterns and traffic volumes for the future years of 2015 and 2030. Project construction is expected to occur between 2011 and 2016. Both the construction analysis and year-of-opening analysis rely on model runs for 2015. Detailed analysis was conducted for the baseline (2015), project design year (2015), and project horizon year (2030) conditions.

2.7.1 Conditions in 2015 and 2030

Changes in Travel Patterns and Systemwide Performance Measures

The travel demand forecasting model was used to estimate how travel patterns might change under the 2015 Baseline, Viaduct Closed (No Build Alternative), and Project conditions, as well as 2030 Project conditions. Traffic volumes on regional transportation corridors, including I-5, SR 99, and major arterials in central Seattle were compared at study area screenline locations north, south, and in downtown Seattle.

Transit ridership and total person-throughput estimates (for total vehicles and transit modes) were prepared at the screenline level. Additionally, forecasted regionwide AM peak period, PM peak period, and daily VMT, VHT, and VHD are reported, as well as daily transit mode shares to/from the Center City area.

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 scenarios. These data were estimated from VISSIM traffic simulation modeling of the Baseline, Viaduct Closed (No Build Alternative), Project, and Partial Program scenarios. Notable areas of congestion and any substantial difference in operating conditions are identified and described.

Travel characteristics on Alaskan Way for the Bored Tunnel Alternative were compared to existing SR 99 trips that use the Elliott/Western Avenue ramps.

Traffic Operations at Key Arterial Intersections

Average vehicle delay, LOS, and queues for AM and PM peak hour conditions for 2015 Baseline and Project and 2030 Project were estimated for selected study area intersections, consistent with locations evaluated for existing conditions. Any new or revised intersections under the Bored Tunnel Alternative were included in the evaluation.

Intersection analyses were undertaken to calculate estimated vehicle delay by intersection approach for the Viaduct Closed (No Build Alternative) and the Partial Program as needed to provide input to the travel time analyses. Peak hour volumes used for these intersection analyses were developed by applying the implied traffic volume growth/changes indicated by the project's travel demand forecasting model to observed peak hour traffic counts.

All intersection analyses were conducted using the Synchro/SimTraffic model version 7.0 for all locations analyzed. Additionally, the VISSIM model version 5.1 was used to analyze intersections on the following arterials:

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

These VISSIM analyses were conducted for the following four scenarios:

1. 2015 Baseline (with the existing Alaskan Way Viaduct in place)
2. 2015 Viaduct Closed (No Build Alternative) (without the existing Alaskan Way Viaduct in place)
3. 2015 Project Build
4. 2030 Project Build

Travel Times

AM and PM peak hour travel time estimates for 2015 conditions and the 2030 Bored Tunnel Alternative were developed for routes that represent major traffic movements accommodated by the SR 99 corridor. The routes selected extend beyond the traffic study area boundary 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 or destined to 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 delay estimated from VISSIM simulation model results where available, 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 of 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). Additionally, travel time contours were estimated from the travel demand model and presented graphically for each alternative.

Travel times are reported for each direction of travel on routes that represent the following range of trips covering all of the affected corridor segments:

- South to/from downtown, represented by West Seattle to CBD via SR 99.
- North to/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 to Spokane Street.
- Through trips on the Elliott/Western corridors, represented by Ballard Bridge to Spokane Street.
  a. via Alaskan Way (or AWV if applicable)
  b. via Mercer Street and the bored tunnel

- Mercer Street: from I-5 to Elliott Avenue
- Northgate to Boeing Access Road via I-5

Travel times for all routes were not estimated for every alternative and future year. Exhibit 2-6 identifies which travel time estimates were developed for each scenario analyzed, including for existing conditions.

Exhibit 2-6. Scenarios and Routes for Estimated Travel Times

Routes	Existing[1]	Year 2015			2030
		Baseline	Viaduct Closed	Project	Project
West Seattle Jct. to CBD (Seneca Street & Fourth Avenue) via SR 99, Alaskan Way		Peak direction only		Peak direction only	Peak direction only
Woodland Park (SR 99 & N. 50th Street) to CBD		Peak direction only		Peak direction only	Peak direction only
Woodland Park (SR 99 & N. 50th Street) to Spokane Street	PM peak only	AM & PM	AM & PM	AM & PM	AM & PM
Ballard Bridge/Elliott to Spokane Street					
A) via Alaskan Way (or AWV if applicable)	PM peak only	AM & PM		AM & PM	AM & PM
B) via Mercer Street, bored tunnel				AM & PM	AM & PM
Northgate to Boeing Access Road via I-5		AM & PM		AM & PM	AM & PM
Mercer Street: I-5 to Elliott		AM & PM		AM & PM	AM & PM

Roadway Connectivity and Access

The Bored Tunnel Alternative's 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 connections (high-speed/capacity ramp connections, low-speed/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).

Transit

The expected effects on transit services were assessed using both qualitative and quantitative information. Expected changes in transit routing under the project are identified and compared to routing under baseline conditions. The comparison focuses on changes in coverage area and potential effects on speed and reliability (based on traffic operations results). Traffic analysis results are used to gauge potential travel time effects on routes operating on SR 99 (Aurora Avenue and SODO). Modeled changes in mode share are reported as well.

Truck Traffic and Freight

The project's effects on freight and goods movement, including comparison of routing alternatives for trips that currently use the Elliott/Western Avenue corridor, are described, along with potential changes in vehicle restrictions (regarding weight and/or flammable or hazardous materials).

Parking

Potential parking effects are quantified for the area that would be directly affected by the project. The location and proximity to dependent uses and alternative parking availability also are qualitatively examined.

Pedestrians

Pedestrian components of the project 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 to pedestrian connectivity, and means for providing safe and convenient crossings of streets and highways.

Bicycles

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

Ferry Traffic

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

Event Traffic

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

Safety

Potential changes in conditions that could affect motorist, pedestrian, and vehicle safety are assessed based on review of the major design elements associated with the project, including facility type, lane widths, geometric configuration, and potential vehicle and pedestrian conflict locations. The safety discussion also assesses how design features might affect existing locations that experience a relatively higher share of accidents, or 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, a qualitative discussion of the potential effect of year 2040 conditions on the project's operational performance is included.

2.7.3 Construction Travel Conditions

Traffic management approaches (detours) associated with major construction stages are described. Travel forecasts were prepared for one construction stage, corresponding to the stage that is expected to be most disruptive. SR 99 mainline speeds and travel times are 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 disruption forecast. Impacts to stadium and Seattle Center event access and egress is assessed and discussed qualitatively.

2.8 Cumulative Effects

Cumulative effects are those that, when combined with the effects of past, present, and reasonably foreseeable neighboring projects, may have an additive effect on the environment. The focus of the cumulative effects analysis is on the combined effect of the project (proposed action), Program elements, and other projects that are anticipated to add to transportation effects in the study area. Two levels of cumulative effects were assessed. The first level includes the project plus Program elements. This level is assessed quantitatively. The second level of cumulative effects includes all Program elements plus other regional transportation projects. This analysis is qualitative in nature and relies on other studies previously conducted.

2.8.1 Program Elements

Other roadway Program elements were assessed for operational and construction effects using the available design year (2015) and horizon year (2030) traffic data and potential roadway alignments. The projects included in this analysis include the following:

- Alaskan Way Surface Street Improvements
- Elliott/Western Connector
- Mercer Street West Corridor Improvements
- First Avenue Streetcar
- Transit Enhancements
- Northbound and southbound right-side transit lanes on SR 99 from just south of the Aurora Bridge to north of Aloha Street

Non-roadway/transit elements of the Program are qualitatively evaluated:

- Seawall Replacement
- Alaskan Way Promenade

2.8.2 Other Projects

Other projects include the following major projects (some of which are already included in the project baseline):

- Cumulative effects specifically associated with major construction projects in or near downtown Seattle
    - Bridging the Gap Projects
    - Sound Transit University Link light rail - Extension to University of Washington
    - Mercer Street two-way conversion from I-5 ramps to Dexter Avenue
    - North Parking Lot Development at Qwest Field
    - Bill and Melinda Gates Foundation Campus
    - E. Marginal Way Grade Separation
    - S. Spokane Street Widening
- Other planned transportation projects with potential cumulative effects
    - I-5 Improvements
    - SR 520 Project
    - I-405 Improvements
    - I-90 Improvements
    - SR 509 Improvements
    - South Lake Union and/or South Downtown redevelopment

Potential changes in travel effects associated with the combined or cumulative implementation of the identified projects are qualitatively described for both construction and operational timeframes. Other subject areas also describe related cumulative effects in their discipline reports (e.g., any potential for induced growth would be described in the Land Use Discipline Report).

2.8.3 Changes in Travel Patterns and Systemwide Performance Measures

The travel demand forecasting model was used to estimate how travel patterns might change under 2015 Partial Program and full Program, and 2030 Program conditions. The same performance measures as outlined in Section 2.7.1 above are assessed for cumulative effects.

2.8.4 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 2015 Partial Program. These data were estimated from VISSIM traffic simulation modeling. Notable areas of congestion and any substantial difference in operating conditions are identified and described. Travel characteristics on Alaskan Way under the Program scenario are specifically compared to existing SR 99 trips that use the Elliott/Western Avenue ramps.

2.8.5 Traffic Operations at Key Arterial Intersections

AM and PM peak hour vehicle delay by approach for key study area arterial intersections for the 2015 Partial Program and 2030 Program were developed, as needed, to provide input to the travel time analyses.

Intersection analyses were conducted using the Synchro/SimTraffic model software Version 7.0. Additionally, the VISSIM model version 5.1 was used to analyze intersections on the following arterials:

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

2.8.6 Travel Times

AM and PM peak hour travel time estimates were developed for the cumulative effects scenarios as indicated in Exhibit 2-7 consistent with the methodology identified previously. Exhibit 2-8 shows the routes graphically.

Exhibit 2-7. Scenarios and Routes for Estimated Travel Times for Cumulative Effects

Routes	2015 Partial Program	2030 Full Program
West Seattle Jct. to CBD (Seneca Street & Fourth Avenue) via SR 99, Alaskan Way	Peak direction only	
Woodland Park (SR 99 & N. 50th Street) to CBD	Peak direction only	
Woodland Park (SR 99 & N. 50th Street) to Spokane Street	AM & PM	
Ballard Bridge/Elliott to Spokane Street		
A) via Alaskan Way (or AWV if applicable)	AM & PM	AM & PM
B) via Mercer Street, bored tunnel	AM & PM	AM & PM
Northgate to Boeing Access Road via I-5	AM & PM	
Mercer Street: I-5 to Elliott	AM & PM	AM & PM

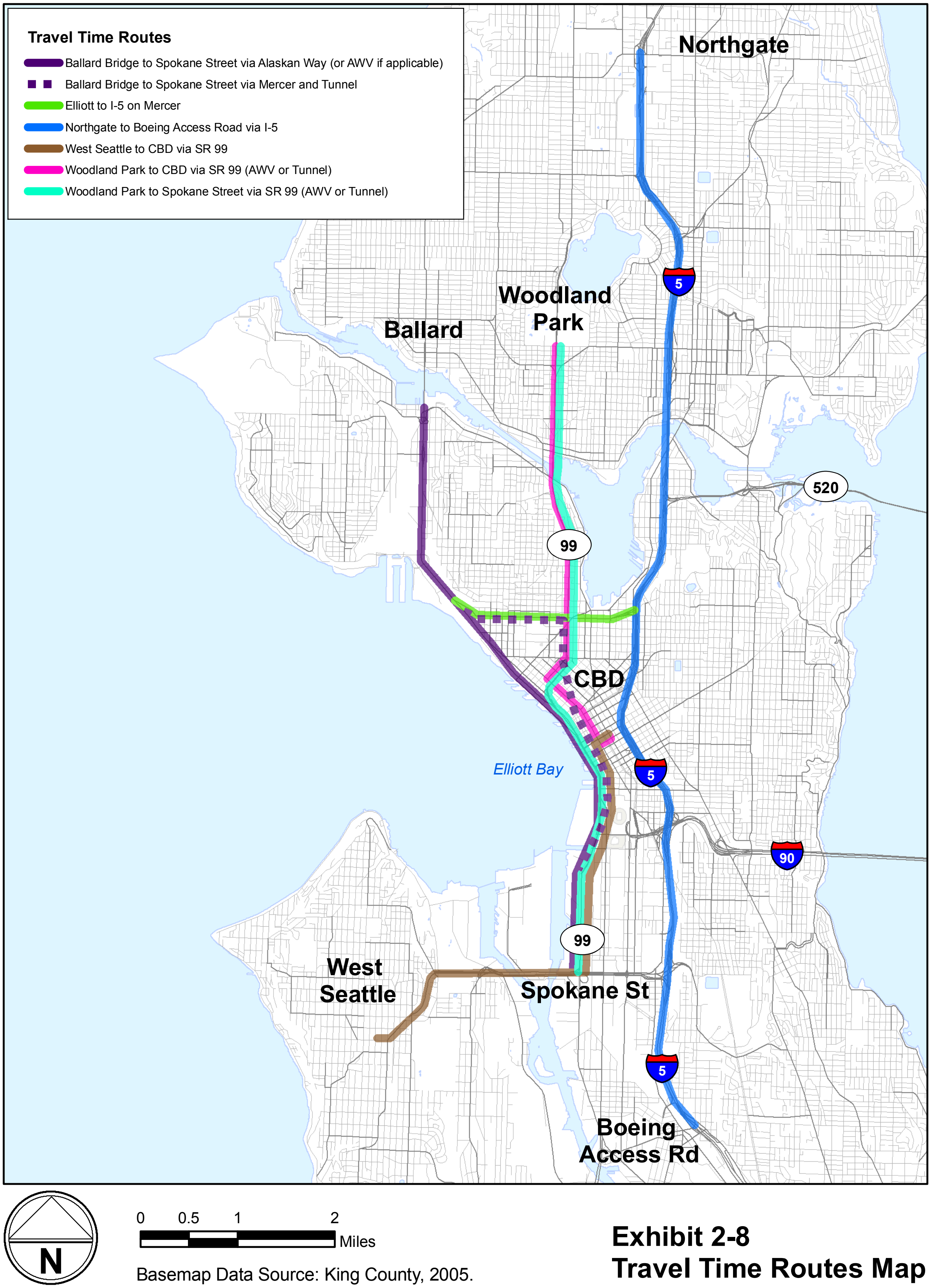
2.9 Determining Transportation Mitigation Measures

2.9.1 Operational Mitigation

Long-term (post-construction) transportation mitigation measures are not anticipated for the project.

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 proposed detour routes and the forecast degree of travel disruption, including changes in existing pedestrian or vehicle circulation patterns, parking, and changes in access. The measures build on efforts completed previously for the Program's Draft Construction Transportation Management Plan (Parsons Brinckerhoff 2006b). The intent of the mobility measures is to maximize the throughput of available routes; preserve access to businesses, public facilities, and residences; maintain truck and Port drayage routes; and protect the reliability of transit services during the construction period.



Basemap Data Source: King County, 2005.

Exhibit 2-8
Travel Time Routes Map

This Page Intentionally Left Blank

Chapter 3 STUDIES AND COORDINATION

This section provides a summary of the studies and adopted plans undertaken in the region that have relevance to this 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*, 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* 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 take to promote economic growth in Seattle and the region, support livable neighborhoods, improve the environment, and address the traveling public's complex demands. 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* is a planning document used to guide future improvements to Seattle's bicycle network. This master plan focuses on evaluating arterial streets to implement bike lanes and encourage more bicycling throughout the city of Seattle.

3.1.4 City of Seattle Center City Circulation Report (2003)

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

3.1.5 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.

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

The *Freight Mobility Strategic Action Plan* 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 the Seattle Comprehensive Plan and the Seattle *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 Committee.

3.1.7 Seattle Intermediate Capacity Transit Study (2001)

The *Seattle Transit Study for Intermediate Capacity Transit* 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:

1. Bus Rapid Transit (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.
2. Streetcars and Trams – electric vehicles running on rails in the streets.
3. 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.

The intermediate-capacity transit study examined transit system performance for various types of transit service that may operate in the AWV corridor.

3.1.8 City of Seattle Transit Plan (2005)

The City of Seattle adopted a Transit Plan to define its transit strategies for its *Transportation Strategic Plan*. The Transit Plan's purpose 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.

3.1.9 Seattle Streetcar Network Development Report (2008)

The 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.

3.1.10 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. This would be accomplished with new marketing, way-finding, and technology measures in place by 2012. The program 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.

3.1.11 Waterfront Parking Strategy Study (2002)

The Waterfront Parking Strategy Study 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 & Development Authority, and the Port of Seattle. 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 preservation of neighborhood character and businesses.

3.1.12 South Lake Union Transportation Study (Final Report, July 2004)

The main objective of the South Lake Union Transportation Study 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.

3.1.13 Destination 2030 Metropolitan Transportation Plan

The *Destination 2030* Metropolitan Transportation Plan (MTP) is the adopted regional long-range transportation plan for the central Puget Sound region. The MTP comprises all transportation projects and programs planned for implementation by 2030 (funded and unfunded). The MTP 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 regional transportation system's performance, 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. Conversely, the analysis conducted for the project's Supplemental Draft EIS presumes only those projects that have secured funding and are presently programmed for implementation by 2030.

3.1.14 Sound Transit 2 Plan (2008)

In 2008, voters approved funding for the ST2 Plan, 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 to downtown Seattle, and significant expansion of Sounder commuter rail and ST Express bus service.

Currently operating between downtown Seattle and Tukwila (with expansion to the Seattle-Tacoma International [Sea-Tac] Airport scheduled for December 2009), Link LRT under ST2 will be extended to Lynnwood in the north, Overlake in the east, and Federal Way in the south. A new streetcar line will connect Union Station in the south end of downtown Seattle with Capitol Hill. Sounder commuter rail serving downtown Seattle will be enhanced through expanded operations, extended platforms at stations, and improved access at South King and Pierce County stations. ST Express bus service will undergo expansion, including BRT service along the SR 520 corridor.

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 complete, LRT service will be provided between 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 the baseline definition as well as future conditions.

3.1.15 King County Transit Now (2006)

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). 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 and will consist of five corridors with streamlined bus service. Each corridor will have frequent transit operations that include peak period service with headways of 10 minutes or better. Three RapidRide corridors will directly serve downtown Seattle, including portions of the project. These corridors and their estimated years of service inauguration are as follows:

C – West Seattle (2011)

D – Ballard/Uptown (2012)

E – Shoreline via Aurora Avenue (2013)

3.1.16 King County Metro 6-Year Transit Development Plan (2004)

The King County Metro *Six-Year Transit Development Plan for 2002 to 2007* provides the framework for transit service and capital investments. 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* replaced and updated the *Six-Year Transit Development Plan*.

3.1.17 King County Ferry District – Technical Studies (2009)

The King County Ferry District is assessing the feasibility of adding new routes to its system. The *King County Ferry District Demonstration Project Technical Studies Implementation/Refined Corridor Analysis* (King County 2009) documented the assessment of several potential new ferry routes, including those connecting to downtown Seattle. The analysis identified a short list of four routes for potential implementation in 2010. The routes include Ballard (Shilshole) to downtown Seattle (Pier 50) and Des Moines to downtown Seattle. Further assessment of potential new ferry corridors will take place in 2009 with selection of two finalists by fall of 2009.

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

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

3.1.19 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 closure of the Downtown Transit Tunnel Conversion Project. These reports have provided updates on a number of performance measures during the closure of the Downtown Seattle Transit Tunnel. The information in these studies has been helpful in the documentation of potential traffic impacts during construction.

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

The Task 1 Report provides insights on 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. Information from the report provided comparison information for the development of travel forecasts and traffic analysis activities.

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

The Washington State Transportation Plan 2007–2026 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 City of Seattle are lead agencies for this study. Cooperating agencies include the U.S. Army Corps of Engineers, 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. This includes:

- City of Seattle 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 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 BNSF Railway and Union Pacific Railroad (UPRR).

Chapter 4 Affected Environment

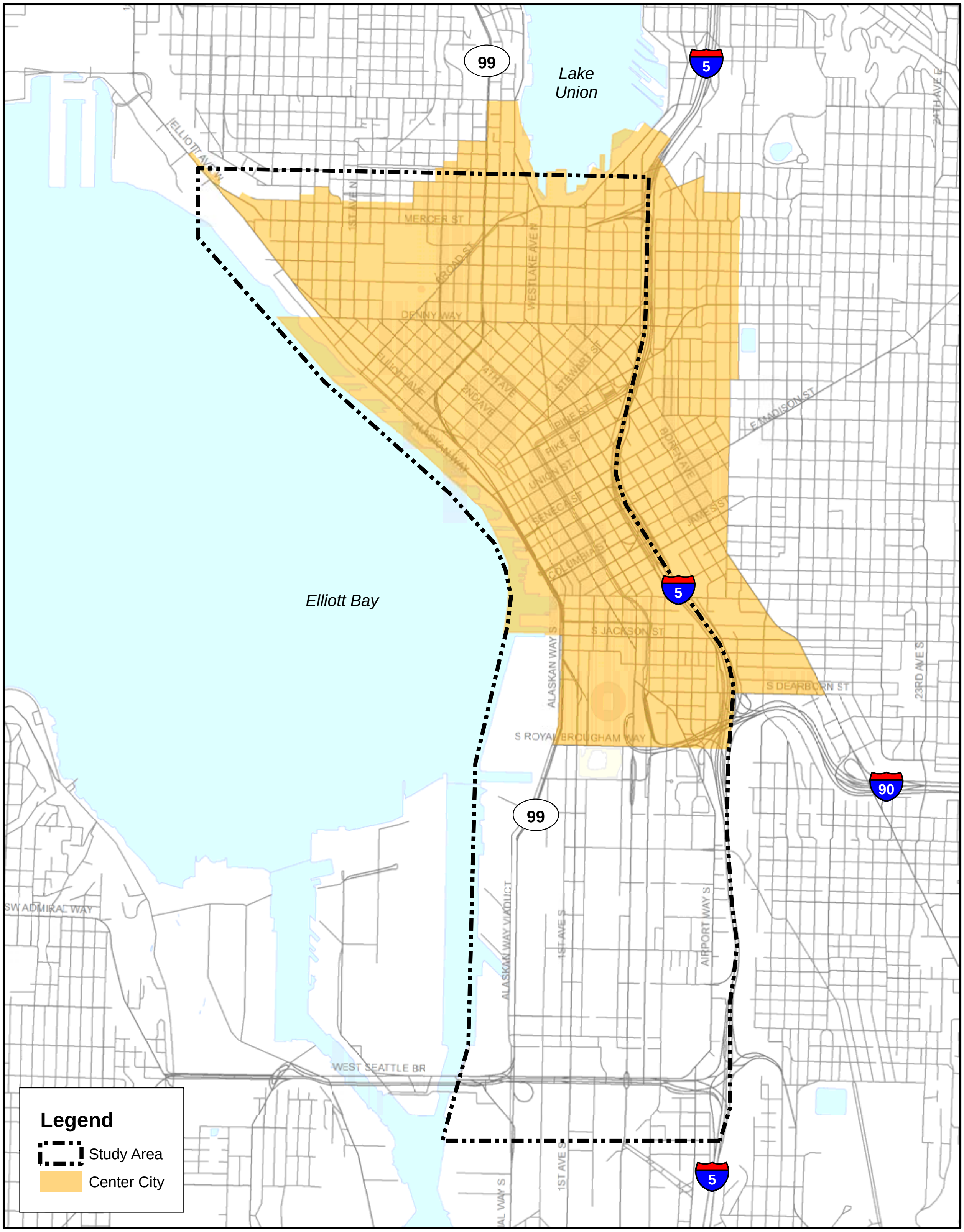
This chapter describes existing conditions (2005 analysis year) for transportation systems within the study area. Information regarding current transportation facilities, their use, and their performance is presented. This information establishes an understanding of current conditions and serves as a basis against which projected future conditions for the Bored Tunnel Alternative can be compared. Note that while 2005 is listed as the analysis year, existing conditions as reported in this document have been updated where appropriate to reflect more current conditions. This includes changes in transportation facilities and services since 2005 (e.g., roadways, transit, parking supply), and changes in traffic volumes where appropriate. In many cases, 2005 traffic volumes were found to be higher than 2008 volumes due to the recent economic downturn. To reflect more conservative existing conditions, 2005 volumes were retained in those instances.

4.1 Regional Context and Travel Patterns

The project is proposing a Bored Tunnel Alternative for the SR 99 corridor through downtown Seattle. The project limits extend from S. Atlantic Street in the south to Roy Street in the north.

A 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, was shown in Exhibit 2-1. The study area is roughly bordered by I-5 to the east, Puget Sound to the west, Valley Street in the north, and S. Spokane Street in the south. It 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.

The transportation study area is located within downtown Seattle, a dense urban area that contains a major interstate freeway (I-5), two state routes (SR 99 and SR 519), 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. The Seattle Center City is also a useful area for reference. Center City represents the core of Seattle, in terms of geography, jobs, and density. Center City is shown in relation to the study area in Exhibit 4-1.



U:\GIS\e-3\Maps\SDEIS2-Bored_Tunnel\Center City.mxd

N

0 2,000 4,000 8,000 Feet

Data Source: City of Seattle, 2009.

Exhibit 4-1
Center City

The transportation study area establishes the area for which the transportation performance and impacts of the Bored Tunnel Alternative are assessed. The most intensive evaluation of transportation performance and impacts is performed on SR 99 itself. Elsewhere in the study area, assessment focuses on capturing the important impacts and primary operational differences associated with the different analysis scenarios. On occasion, information beyond the study area boundaries is provided to provide context for the data being presented.

4.1.1 SR 99

SR 99 serves important local and regional transportation functions. Within the project area, it provides access to downtown for many parts of the western neighborhoods of the city of Seattle and provides freight access between the Interbay/Ballard areas and the SODO and Duwamish industrial areas. It is an important alternative 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, SR 99 is classified as an "Other Urban Expressway" and has been designated as part of the Washington State National Highway System. 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 S. Holgate 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. One full interchange and four partial interchanges are located within the study area, and there are a number of streets where drivers can access SR 99 via right-on and right-off maneuvers in the South Lake Union area.

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 in downtown.

In addition to the mainline, a reversible set of express lanes provides HOV access to and from downtown and additional capacity for general-purpose through traffic. 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 the two interstates. 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 study area and South Lake Union.

4.1.3 Arterial and Local Streets

Nearly all of the downtown area streets 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 travelways, with a mixture of minor and collector arterials providing travel opportunities in the east and west directions.

While SR 99 is designated as an "Other Urban Expressway" and the majority of trips travel through the downtown area, approximately 62 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.

Recent Improvements to Local Streets

Since the 2006 Supplemental Draft EIS was published, recent improvements have been made to Westlake Avenue. Westlake Avenue and Westlake Avenue N. between Blanchard Street and Valley Street was restriped from one-way traffic to two-way traffic in the fall of 2007 to prepare for the South Lake Union Streetcar. Westlake Avenue N. was restriped for two northbound and two southbound travel lanes. New left-turn pockets were added at Valley Street, Mercer Street, Republican Street, and Denny Way, with on-street parking on both sides of Westlake Avenue between Republican Street and Denny Way.

4.1.4 Travel Demand and Traffic Patterns

Vehicle Miles of Travel

VMT provide a measure of vehicle demand on the four-county regional roadway network. In short, VMT is the product of the number of vehicles traveling over the sum total of roadways in the transportation network times the length of roadways in that network. The existing conditions (2005) total for daily VMT is estimated to be approximately 73,623,000. During the AM peak period, regional VMT is estimated at about 13,800,000 and PM peak period VMT is estimated to be 16,116,000. VMT is shown in Exhibit 4-2.

Vehicle Hours of Travel

VHT provide an estimate of how long travelers spend on the roadway system. Daily VHT for existing conditions is estimated to be 2,022,000. During the AM peak period, the VHT is estimated to be 452,000, while the PM peak period, the estimate is 518,000. VHT is shown in Exhibit 4-2.

Vehicle Hours of Delay

VHD measure 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. Daily VHD for existing conditions is estimated to be 385,000. VHD for the AM peak period is 138,000, while the PM peak period is estimated to be 150,000. VHD is shown in Exhibit 4-2.

Exhibit 4-2. VMT, VHT, and VHD for Center City and Region

Performance Measure	AM Peak	PM Peak	Daily
Seattle Center City			
VMT	385,400	472,400	2,118,200
VHT	13,200	17,600	67,500
VHD	3,500	5,400	14,500
Four-County Region			
VMT	13,830,000	16,116,800	73,622,500
VHT	452,100	517,800	2,021,800
VHD	137,600	149,900	384,800

Notes:
[1] VMT = Vehicle Miles of Travel
[2] VHT = Vehicle Hours of Travel
[3] VHD = Vehicle Hours of Delay
[4] The VMT, VHT, and VHD estimates do not include centroid connectors in the calculations.

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 sections present data that describes users of SR 99 within the study area for existing conditions (2005 analysis year).

Existing SR 99 Daily Traffic Patterns

Exhibit 4-3 shows the existing daily traffic patterns on SR 99 within the study area. Blue 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 ramp movement. Because access in the South Lake Union area is provided by many closely spaced cross-streets, these movements are shown grouped.

At the north end of the study area (on Aurora Avenue), almost half of trips using SR 99 enter and exit the corridor north of the Battery Street Tunnel. Of the 84,800 daily vehicle trips on Aurora Avenue, 36,400 trips enter and exit in the South Lake Union area.

Some 63,500 vehicles use the Battery Street Tunnel on a typical weekday. They include the remainder of the Aurora Avenue trips, as well as 15,100 additional trips entering and exiting the corridor in the South Lake Union area. A relatively small number of trips enter or exit at the Battery Street ramps in the Belltown area. About 6,600 vehicles exit southbound and enter northbound at this location at the south portal of the Battery Street Tunnel.

The Elliott and Western ramps are major access points to the corridor. About 34,500 vehicles enter SR 99 southbound on the Elliott Avenue on-ramp and exit on the Western Avenue off-ramp. These connections provide access to Belltown, Uptown, and points farther north, including the Ballard/Interbay areas via 15th Avenue W.

In downtown, 19,800 vehicles join southbound SR 99 from the Columbia Street on-ramp and exit northbound via the Seneca Street off-ramp. South of these ramps, the viaduct carries its highest level of traffic: 111,200 vehicles on a typical weekday.

South of midtown, a total of 24,200 vehicles exit southbound in the stadium area on the First Avenue S. off-ramp and enter northbound on the corresponding on-ramp. This is the last connection in the greater downtown area, as no other connections are provided until S. Spokane Street. At S. Spokane Street, 33,100 vehicles exit the corridor southbound to either the West Seattle high bridge or the low bridge to Harbor Island and enter SR 99 northbound from the West Seattle high bridge. Approximately 53,900 trips continue southbound and enter northbound to and from E. Marginal Way.

Southbound, 12,000 vehicles exit in the stadium area on the First Avenue S. off-ramp and 11,300 vehicles enter northbound on the corresponding on-ramp. This is the last connection in the greater downtown area, as no other connections are

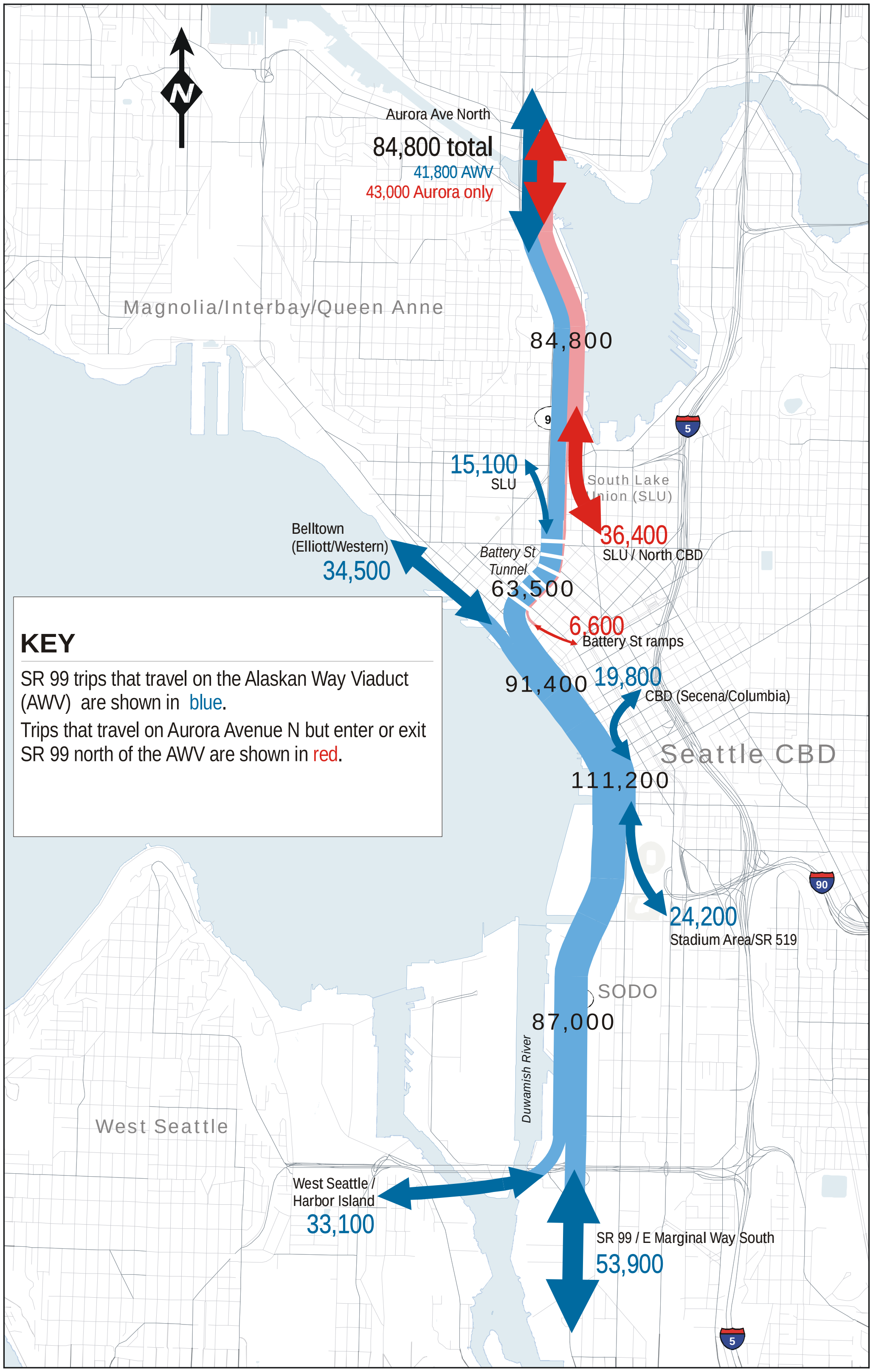


Exhibit 4-3
Existing (2005) Daily SR 99 Traffic Patterns

provided until S. Spokane Street. At S. Spokane Street, 16,200 vehicles exit the corridor to either the West Seattle high bridge or the low bridge to Harbor Island. Northbound, 16,900 vehicles enter SR 99 from the West Seattle high bridge. Approximately 25,900 trips continue south to E. Marginal Way. The corresponding northbound volume entering from E. Marginal Way is 27,900 vehicles.

Origins and Destinations of AWV 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 AWV trip origins are in the downtown, Queen Anne, Fremont, Ballard, and West Seattle neighborhoods. Trips beginning as far north as Snohomish County and as far south as Pierce County also use SR 99. These trips primarily originate from westside communities (e.g., Burien, Shoreline, White Center). Destinations are more concentrated, with most trips accessing work and commercial sites downtown, in 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 are other primary destinations during the AM peak.

Existing daily trips along the viaduct were also estimated using travel demand model assignments. The majority of trips using the viaduct are going to or coming from the CBD of downtown Seattle. Approximately 20 percent of all users travel along the viaduct through the core downtown, but are destined to nearby locations just north or south of downtown, such as South Lake Union, Queen Anne, Capitol Hill, or SODO. The remaining trips that use the viaduct are longer-distance trips, such as trips from Ballard to Burien. Exhibit 4-4 lists the percentage of daily trips to downtown and other areas.

Exhibit 4-4. Model Estimated Origins/Destinations of Existing Daily Person Trips Using the Alaskan Way Viaduct

	Downtown Seattle	Areas Near Downtown[1]	Longer-Distance Trips
Auto	58%	24%	18%
Auto + Transit	62%	21%	17%

1. South Lake Union, Queen Anne, Capitol Hill, South Downtown.

Modeled Traffic Volumes

Exhibit 4-5 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. I-5 carries the majority of traffic through the study area, approximately 53 percent in the downtown area. SR 99 carries about 23 percent of traffic in the central downtown area, while the local streets in downtown combined carry approximately 24 percent of daily north-south traffic.

Exhibit 4-5. Existing (2005) Model-Estimated Daily Traffic Distributions

	Existing Daily Traffic (vehicles)
Alaskan Way	
North (North of Thomas Street)	N/A
Central (North of Columbia Street)	12,000
South (South of S. King Street)	12,000
North–South Arterials West of I-5 (Except SR 99)	
North (North of Thomas Street)	154,000
Central (North of Seneca Street)	97,000
South (South of S. King Street)	70,000
SR 99 (AWV)	
North (North of Thomas Street)	88,000
Central (North of Seneca Street)	91,000
South (South of S. King Street)	87,000
I-5 (Main and Reversible/HOV)	
North (North of Thomas Street)	292,000
Central (North of Seneca Street)	243,000
South (South of S. King Street)	256,000
TOTAL VEHICLE TRAFFIC	
North (North of Thomas Street)	534,000
Central (North of Seneca Street)	443,000
South (South of S. King Street)	425,000

North of downtown, SR 99's share of traffic decreases relative to local streets or I-5. South of downtown, SR 99 carries about 24 percent of traffic. SR 99 carries more traffic than any single facility in the study area other than I-5.

Modeled Transit Ridership

SR 99 is an important transit corridor that provides access into the downtown area from neighborhoods and communities to the north and south. SR 99 carries a model-estimated 11,900 transit riders per day north of downtown, and 14,300 riders per day south of downtown (Exhibit 4-6). About 25 percent of transit riders entering or leaving downtown from the south currently use bus routes that travel on SR 99. Most of the riders are from the West Seattle area.

Exhibit 4-6. Existing (2005) Model-Estimated Daily Transit Ridership

	Existing Transit Ridership (persons)
Buses on SR 99	
North (North of Thomas Street)	11,900
Central (North of Seneca Street)	N/A
South (South of S. King Street)	14,300
Other north-south transit (bus or rail) routes in Seattle	
North (North of Thomas Street)	78,100
Central (North of Seneca Street)	90,200
South (South of S. King Street)	42,200
TOTAL Daily Transit Passengers	
North (North of Thomas Street)	90,000
Central (North of Seneca Street)	90,200
South (South of S. King Street)	56,500

Modeled Person-Trips

Analysts use person-trips to measure the number of people, rather than vehicles, which 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 4-7 summarizes model-estimated daily person-trips at screenline locations. The figures reported include all trip purposes (e.g., work trips, commercial trips, non-work trips).

Exhibit 4-7. Existing (2005) Model-Estimated Daily Person Throughput at Selected Screenlines

Screenline Location	Total Person Throughput	Transit Riders
North (North of Thomas Street)	672,900	90,000
Central (North of Seneca Street)	585,100	90,200
South (South of S. King Street)	644,700	56,500

4.1.5 Roadway Connectivity and Access

SR 99 is a regional facility, but it primarily serves shorter regional trips and intracity trips. Between S. Spokane Street and the Battery Street Tunnel, all access is provided via ramps. North of the Battery Street Tunnel, arterial connections to the SR 99 mainline provide access (right turn on/right turn off only). This section describes the SR 99 corridor through the study area.

Travel Lanes

The SR 99 facility comprises two or more general-purpose lanes in each direction through the study area. Exhibit 4-8 depicts the number of lanes on SR 99 throughout the corridor. Northbound, the SR 99 corridor carries three lanes from S. Spokane Street to the First Avenue S. ramps, four lanes to the Seneca Street off-ramp, and three lanes to the Western Avenue off-ramp. Two lanes continue northbound into the Battery Street Tunnel. Southbound, two lanes exiting the Battery Street Tunnel are joined by a third lane entering from Elliott Avenue. The three-lane southbound segment is carried through the corridor, merging to a two-lane segment south of S. Spokane Street. The Battery Street Tunnel operates with two lanes in each direction. Exiting the tunnel northbound, the highway is joined by two additional lanes from Denny Way. The four-lane segment continues intermittently to Aloha Street, where the outside lane is dropped to an off-ramp. The three-lane segment continues beyond the study area. In the southbound direction, three lanes are provided north of the Denny Way off-ramp at the Battery Street Tunnel. In this area north of the Battery Street Tunnel, the outside lane serves to collect and distribute right-turning vehicles to side streets. Through movements are primarily accommodated in the inside lanes.

Access to SR 99

Exhibit 4 9 summarizes connections currently provided between SR 99 and other facilities. To summarize the quality of access the connections provide, a qualitative rating system grades the degree (full access, partial access, or no access) and quality of connections (ranging from direct ramp connections to indirect connections). Transit connections are addressed separately as part of the Transit section (Section 4.4).

To/From West Seattle

Access and egress to SR 99 is provided at several locations. 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.

To/From Stadium Area

Near the stadium area, ramps at First Avenue S. provide access to northbound SR 99 and egress from southbound SR 99. New connections to the south will be provided as part of the S. Holgate Street to S. King Street Viaduct Replacement Project.

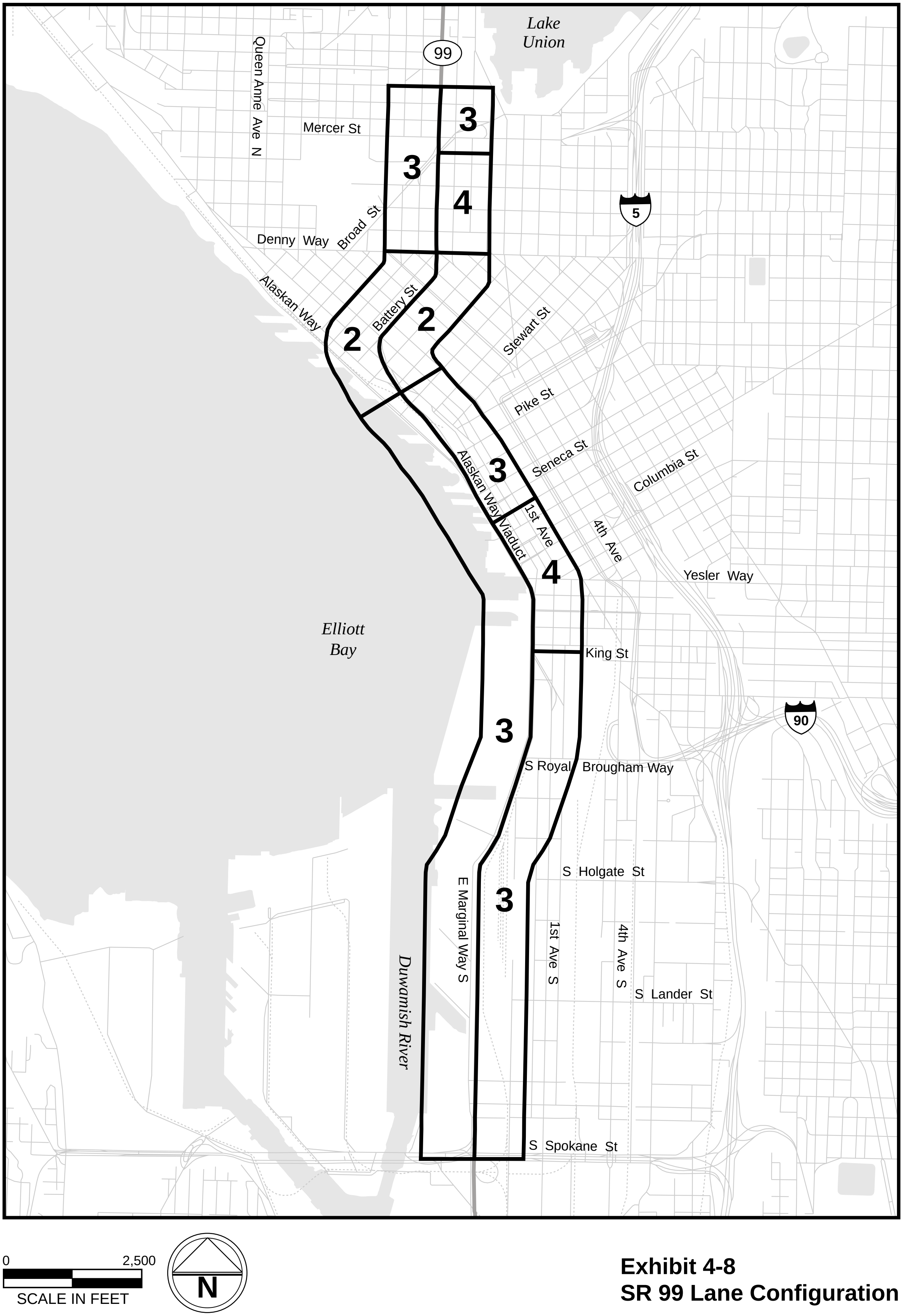


Exhibit 4-8
SR 99 Lane Configuration

Exhibit 4-9. Existing Connections

	Good Access	Partial or Substandard Access	No Access
Stadium Area			
SB SR 99 to Stadium Area	First Avenue off-ramp		
Stadium Area to SB SR 99			None (but would be added as part of S. Holgate Street to S. King Street Viaduct Replacement Project)
NB SR 99 to Stadium Area			None (but would be added as part of S. Holgate Street to S. King Street Viaduct Replacement Project)
Stadium Area to NB SR 99	First Avenue on-ramp		
Downtown Seattle			
SB SR 99 to Downtown			None
Downtown to SB SR 99		Columbia Street on-ramp (left-side merge)	
NB SR 99 to Downtown		Seneca Street off-ramp (poor exit transition)	
Downtown to NB SR 99			None
Elliott/Western Corridor			
SB SR 99 to Elliott/Western		Battery Street off-ramp (substandard)	
Elliott/Western to SB SR 99	Elliott Avenue on-ramp		
NB SR 99 to Elliott/Western	Western Avenue off-ramp		
Elliott/Western to NB SR 99		Battery Street on-ramp (substandard)	

Exhibit 4-9. Existing Connections (continued)

	Good Access	Partial or Substandard Access	No Access
South Lake Union Area			
SB SR 99 to west South Lake Union	Denny Way off-ramp Broad Street off-ramp	Arterial connections	
SB SR 99 to east South Lake Union	Denny Way off-ramp Broad Street off-ramp		
West South Lake Union to SB SR 99		Arterial connections	
East South Lake Union to SB SR 99			Indirect[1]
NB SR 99 to west South Lake Union			Indirect[2]
NB SR 99 to east South Lake Union	Mercer/Dexter off-ramp	Arterial connections	
West South Lake Union to NB SR 99		Arterial connections (via Mercer Street)	
East South Lake Union to NB SR 99	Denny Way on-ramp	Arterial connections	

SB = southbound, NB = northbound, EB = eastbound, WB = westbound

[1] For example, access to SB SR 99 from EB Roy, Harrison, or Thomas Streets after crossing to the west side of SR 99 by Broad Street or Denny Way.

[2] For example, access from NB SR 99 from EB Roy, Republican, Harrison, or Thomas Streets, to Dexter Avenue, to WB Broad Street or Denny Way.

To/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 and from the north is provided in the downtown area.

To/From Elliott and Western Avenues

In the Belltown area, an interchange at Western Avenue and Elliott Avenue provides access to north downtown, Pike Place Market, and the waterfront, as well as access to arterials connecting to Interbay, Uptown, Magnolia, and Ballard. The roadway and ramp geometrics for the southbound off-ramp and northbound on-ramp, which are near the Battery Street Tunnel portal, limit overall use of these ramps.

To/From South Lake Union 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, Seattle Center, Queen Anne, the north waterfront and Port of Seattle facilities), and are also the transit access point for all routes traveling on the corridor between downtown and points north.

In the South Lake Union area, an off-ramp to Mercer Street provides direct access to the South Lake Union neighborhood for northbound traffic, while the Broad Street exit provides access to Seattle Center and Queen Anne for southbound traffic. Other access in the South Lake Union 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 that drivers accelerate from a stopped position when entering or decelerate considerably before exiting SR 99.

Design Constraints

The design of SR 99 in the study area is substandard in several locations. Throughout the study area, the mainline provides narrow travel lanes and limited shoulders. Battery Street Tunnel users experience low speeds due to an existing curve designed for between 35 and 40 miles per hour (mph) and narrow shoulders. In the southbound direction, the off-ramp at Western Avenue provides no deceleration length and limited sight lines for vehicles using the ramp due to the sudden vertical drop upon exiting the mainline. The left-side on-ramp at Columbia Street requires low speeds followed by a short acceleration length. Finally, the left-side off-ramp at First Avenue S. provides a short deceleration lane.

In the northbound direction, the off-ramp at Seneca Street requires low speeds due to a very tight curve upon leaving the mainline. Congestion forming at the Seneca ramp exit slows traffic on the viaduct. Also northbound, the on-ramp to SR 99 at Battery Street merges immediately with the mainline without an acceleration length and has limited sight distance.

Transport of combustible materials through the Battery Street Tunnel is prohibited at all times and is also prohibited from the viaduct during peak commuting hours.

Speed Limits

Posted speed limits on the SR 99 mainline are shown in Exhibit 4 10.

Exhibit 4-10. Posted Speed Limits on SR 99 (miles per hour)

Mainline Segment	Posted Speed Limit (NB and SB)
North of Denny Way	40
Battery Street Tunnel	40 (35 advisory)
Elliott/Western Ramps to Seneca/Columbia Ramps	50
Seneca/Columbia Ramps to First Avenue S. Ramps	50
First Avenue S. Ramps to S. Spokane Street	50 (40 trucks)
South of S. Spokane Street	50

NB = northbound; SB = southbound

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 existing (2005) SR 99 mainline and ramps.

AM Peak Hour

Traffic volumes on the SR 99 corridor are highest during commuting hours. In the morning, peak hour traffic volumes on SR 99 are fairly directional, with heavier volumes entering the central downtown. At the north end of the study area, AM peak hour mainline volumes are higher in the southbound direction, as more vehicles are entering the downtown area (4,160 vehicles) than are leaving it (2,630 vehicles). Southbound off-ramp volumes at Denny Way (1,230 vehicles) exceed those on the northbound on-ramp (430 vehicles). In the Battery Street Tunnel, the volumes are fairly balanced, with the volume of northbound vehicles (2,850 vehicles) slightly exceeding the volume of southbound vehicles (2,640 vehicles). The Battery Street Tunnel ramps providing access to and from the north show directionality, with 410 vehicles exiting southbound and only 150 vehicles entering northbound. The ramps to and from the south at Elliott and Western Avenues show directionality as well, with 1,130 vehicles entering southbound and 1,330 vehicles exiting northbound.

The downtown ramps providing access to and from the south show the opposite directionality as those to the north, with more vehicles exiting northbound at Seneca Street (1,050 vehicles) than entering southbound at Columbia Street (350 vehicles). The First Avenue S. ramps show similar directionality favoring travel to central downtown, with 1,410 vehicles exiting southbound but only 760 vehicles entering northbound. South of downtown and in the stadium area, mainline volumes are considerably higher in the northbound direction (4,320 vehicles) than the southbound direction (2,300 vehicles). At S. Spokane

Street, volumes entering northbound from West Seattle (1,630 vehicles) are over double those exiting southbound to West Seattle (660 vehicles). AM peak hour mainline and ramp volumes are shown in Exhibit 4 11.

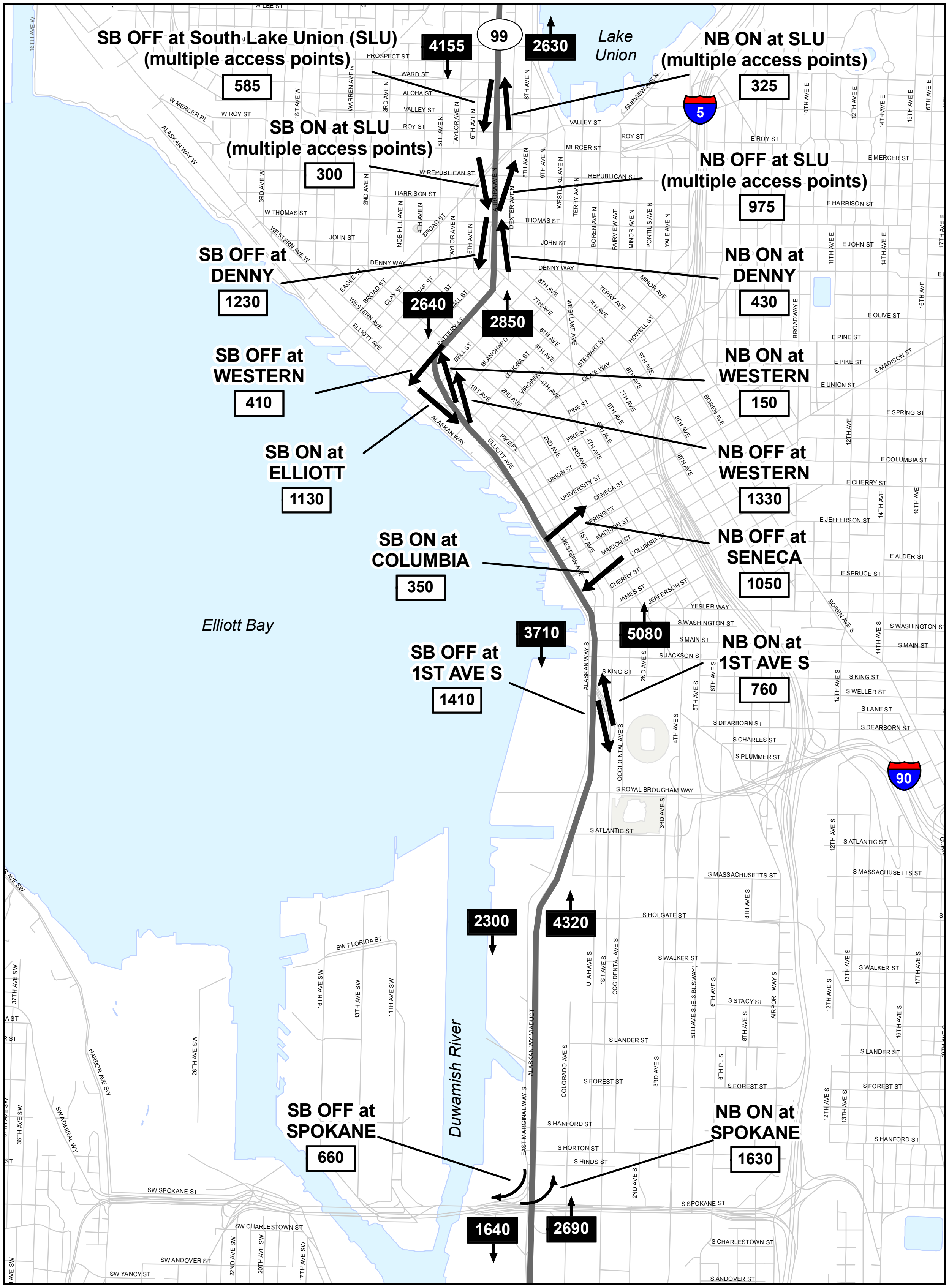
PM Peak Hour

Similar to the AM peak, the PM peak hour traffic volumes along SR 99 are directional, with heavier volumes leaving the central downtown. At the north end of the study area, PM peak hour mainline volumes are higher in the northbound direction, as more vehicles are leaving the downtown area (4,300 vehicles) than are entering it (3,345 vehicles). Northbound on-ramp volumes at Denny Way (1,340 vehicles) exceed those on the southbound off-ramp (680 vehicles). In the Battery Street Tunnel, the volume of northbound vehicles (3,260 vehicles) again exceeds the volume of southbound vehicles (2,790 vehicles). The Battery Street Tunnel ramps providing access to and from the north also show directionality, with 490 vehicles entering northbound but only 200 vehicles exiting southbound. The ramps at Elliott/Western to and from the south show directionality as well, with 1,320 vehicles entering southbound and 1,200 vehicles exiting northbound.

The downtown ramps providing access to and from the south show the opposite directionality as those to the north, with more vehicles entering southbound at Columbia Street (1,230 vehicles) than those exiting northbound at Seneca Street (680 vehicles). The First Avenue S. ramps show similar directionality, with 1,200 vehicles entering northbound but only 810 vehicles exiting southbound. South of downtown and in the stadium area, mainline volumes are considerably higher in the southbound direction (4,330 vehicles) than the northbound direction (3,450 vehicles). At S. Spokane Street, volumes exiting southbound to West Seattle (1,890 vehicles) are almost double those entering northbound from West Seattle (1,110 vehicles). PM peak hour mainline and ramp volumes are shown in Exhibit 4-12.

Daily

As expected, daily traffic volumes along SR 99 are generally balanced by direction, with similar volumes leaving the central downtown as entering. At the north end of the study area, the majority of exiting southbound vehicles exit at Denny Way (11,240), with a little more than half that many exiting at the multiple access points in South Lake Union (6,200). Similarly, about 11,050 northbound vehicles enter SR 99 at Denny Way, with 7,900 entering at other South Lake Union access points. In the Battery Street Tunnel, the volume of northbound vehicles (32,450 vehicles) is similar to the volume of southbound vehicles (31,010 vehicles). 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 3,850 vehicles entering northbound but only 2,740 vehicles exiting



N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 4-11
AM Peak Hour Mainline and Ramp Volumes - Existing Conditions (2005)

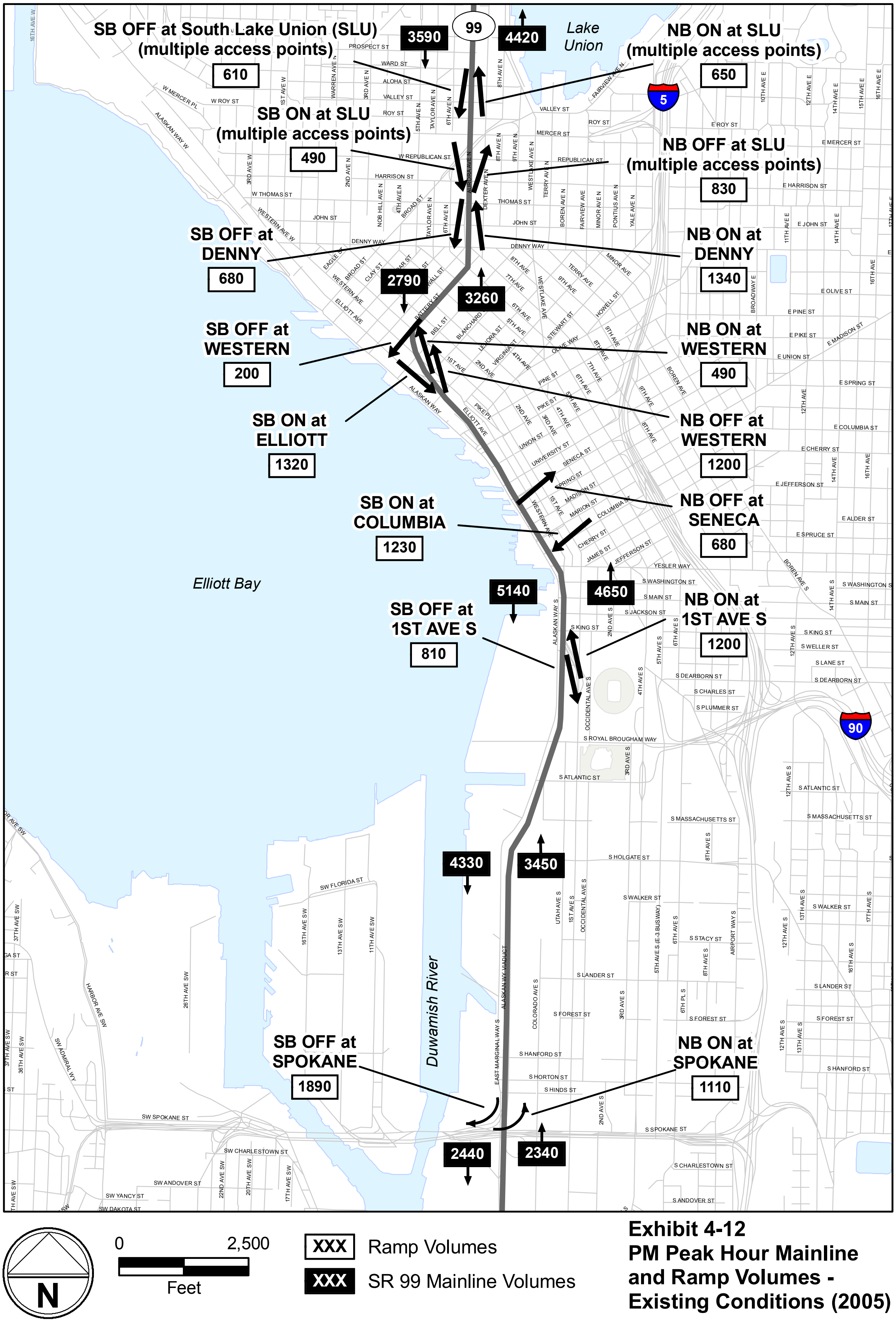


Exhibit 4-12
PM Peak Hour Mainline and Ramp Volumes - Existing Conditions (2005)

southbound. However, the Elliott/Western ramps to and from the south are relatively balanced, with 17,100 vehicles entering southbound and 17,380 vehicles exiting northbound. These ramps have the highest volume of all ramps in the project area.

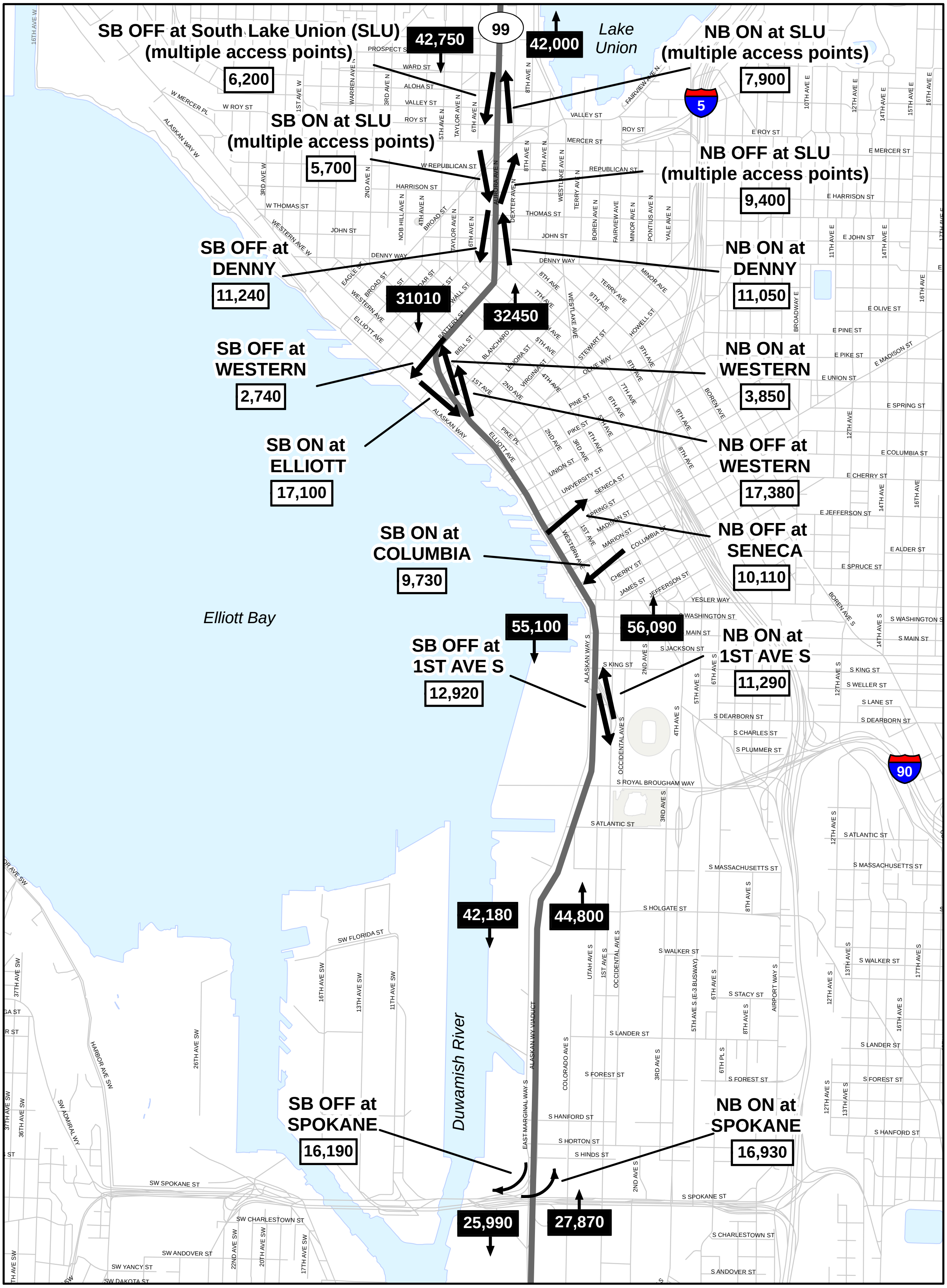
The downtown ramps providing access to and from the south are relatively balanced, with 9,730 vehicles entering southbound at Columbia Street and 10,110 vehicles exiting northbound at Seneca Street. The First Avenue S. ramps are similarly balanced, with 11,290 vehicles entering northbound and 12,920 vehicles exiting southbound. South of downtown and the stadium area, mainline volumes are somewhat higher in the northbound direction (44,800 vehicles) than the southbound direction (42,180 vehicles). At S. Spokane Street, volumes exiting southbound to West Seattle (16,190 vehicles) are similar to those entering northbound from West Seattle (16,930 vehicles). Daily mainline and ramp volumes are shown in Exhibit 4 13.

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.

Mainline traffic performance was modeled using VISSIM simulation software. Current 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 14 to 4-17.

In the south end of the corridor, mainline traffic operates at LOS B to LOS D in both directions in the AM and PM peak hours. Mainline traffic through midtown generally operates at LOS D to LOS F in both directions in the AM and PM peak hours, with the exception of southbound traffic from the Elliott Avenue on-ramp to the Columbia Street on-ramp during the AM peak hour, which operates at LOS C. Particular areas of congestion include southbound between the Columbia Street left-side on-ramp merge and the left-side off-ramp to First Avenue S. Conditions here are exacerbated by the lack of an acceleration lane for the merge, as well as traffic weaving into the lane to exit at First Avenue S. Northbound traffic also experiences significant congestion due to backups from both the Seneca Street and Western Avenue off-ramps. These backups are due to a combination of substandard geometry on the Seneca Street off-ramp, as well as queues emanating from the ramp termini intersections. Through the Battery Street Tunnel, operations are at or over capacity (i.e., LOS E or F) in both directions in both peak hours. North of the Battery Street Tunnel, operations are at LOS D to LOS E, except for northbound traffic during the AM peak hour, which operates at LOS C.



N

0 2,500

Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 4-13
Daily Mainline and Ramp Volumes - Existing Conditions (2005)

Exhibit 4-14. Existing (2005) AM Peak Hour Southbound SR 99 Segment LOS

Southbound - AM Segment	Existing LOS
South Corridor	
First Avenue S. Off to S. Spokane Street	B
Midtown	
Columbia On to First Avenue S. Off (SB)	E
Elliott On to Columbia On (SB)	C
Battery Street Tunnel	F
North Corridor	
North of Battery Street Tunnel	E

Exhibit 4-15. Existing (2005) AM Peak Hour Northbound SR 99 Segment LOS

Northbound - AM Segment	Existing LOS
South Corridor	
S. Spokane Street to First Avenue S.	D
Midtown	
First Avenue S. On to Seneca Off (NB)	E
Seneca Off to Western Off (NB)	F
Battery Street Tunnel	E
North Corridor	
North of Battery Street Tunnel	C

Exhibit 4-16. Existing (2005) PM Peak Hour Southbound SR 99 Segment LOS

Southbound - PM Segment	Existing LOS
South Corridor	
First Avenue S. Off to S. Spokane Street	D
Midtown	
Columbia On to First Avenue S. Off (SB)	F
Elliott On to Columbia On (SB)	D
Battery Street Tunnel	E
North Corridor	
North of Battery Street Tunnel	D

Exhibit 4-17. Existing (2005) PM Peak Hour Northbound SR 99 Segment LOS

Northbound - PM Segment	Existing LOS
South Corridor	
S. Spokane Street to First Avenue S.	C
Midtown	
First Avenue S. On to Seneca Off (NB)	F
Seneca Off to Western Off (NB)	F
Battery Street Tunnel	F
North Corridor	
North of Battery Street Tunnel	E

4.2.3 SR 99 Mainline Speeds

The existing 2005 AM and PM peak hour segment speed results are shown in Exhibits 4 18 to 4-21 below. 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 E. Marginal Way and the Western Avenue off-ramp. North of the Western Avenue off-ramp, the posted speed drops to 40 mph. The posted speed remains at 40 mph to the north end of the project limits. The southbound posted speed limit is 40 mph from the north end of the project area to the Western Avenue off-ramp, where it increases to 50 mph.

Existing estimated speeds on SR 99 in the AM peak hour range from 30 to 49 mph in the southbound direction and 23 to 47 mph in the northbound direction. In the PM peak hour, speeds range from 20 to 47 mph in both directions. The segments with the slowest speeds correspond to the locations with lower LOS, i.e., the Battery Street Tunnel and midtown sections.

Exhibit 4-18. Existing (2005) AM Peak Hour Southbound SR 99 Segment Speeds

Southbound – AM Segment	Existing Speed (mph)
South Corridor	
First Avenue S. Off to S. Spokane Street	49
Midtown	
Columbia On to First Avenue S. Off (SB)	35
Elliott On to Columbia On (SB)	47
Battery Street Tunnel	30
North Corridor	
North of Battery Street Tunnel	34

Exhibit 4-19. Existing (2005) AM Peak Hour Northbound SR 99 Segment Speeds

Northbound – AM Segment	Existing Speed (mph)
South Corridor	
S. Spokane Street to First Avenue S.	47
Midtown	
First Avenue S. On to Seneca Off (NB)	33
Seneca Off to Western Off (NB)	23
Battery Street Tunnel	33
North Corridor	
North of Battery Street Tunnel	36

Exhibit 4-20. Existing (2005) PM Peak Hour Southbound SR 99 Segment Speeds

Southbound – PM Segment	Existing Speed (mph)
South Corridor	
First Avenue S. Off to S. Spokane Street	47
Midtown	
Columbia On to First Avenue S. Off (SB)	20
Elliott On to Columbia On (SB)	45
Battery Street Tunnel	33
North Corridor	
North of Battery Street Tunnel	35

Exhibit 4-21. Existing (2005) PM Peak Hour Northbound SR 99 Segment Speeds

Northbound - PM Segment	Existing Speed (mph)
South Corridor	
S. Spokane Street to First Avenue S.	47
Midtown	
First Avenue S. On to Seneca Off (NB)	31
Seneca Off to Western Off (NB)	20
Battery Street Tunnel	33
North Corridor	
North of Battery Street Tunnel	35

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
- Central
- North

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 or 2006 Supplemental Draft EIS.
- Intersection has an LOS of E or worse in either peak period.
- Intersection is new in 2015 Baseline or 2015 Project.

4.3.1 South

Exhibit 4-22 presents traffic operations for intersections in the south area. There are no notably congested intersections in the south end, though S. Royal Brougham Way is estimated to operate at LOS E in the PM peak hour at both First and Fourth Avenues S. First Avenue S. and S. Atlantic Street also has been observed to experience relatively long queues, particularly in the PM peak hour.

Exhibit 4-22. Existing (2005) AM and PM Peak Hour Detailed Traffic Operations, South

		AM PEAK HOUR		PM PEAK HOUR	
Street	Cross Street	LOS	Avg Veh Delay	LOS	Avg Veh Delay
Alaskan Way S.	S. Royal Brougham Way	C	22	C	20
Alaskan Way S.	S. Plummer Street/SR 99 Ramps				
Alaskan Way S.	S. Charles Street				
Alaskan Way S.	S. Dearborn Street				
Alaskan Way S.	S. King Street				
Alaskan Way S.	S. Jackson Street	A	2	A	3
Alaskan Way S.	S. Main Street	A	3	A	4
E. Frontage Rd/Alaskan Way S.	S. Atlantic Street				
E. Frontage Rd/Alaskan Way S.	S. Royal Brougham Way				
Alaskan Way S./Ferry Holding	SR 99 Ramp	A	4	A	6
Alaskan Way	Yesler Way	B	19	C	22
E. Marginal Way/T-46	S. Atlantic Street				
Colorado Avenue S.	S. Atlantic Street				

Exhibit 4-22. Existing (2005) AM and PM Peak Hour Detailed Traffic Operations, South (continued)

Street	Cross Street	AM PEAK HOUR		PM PEAK HOUR	
		LOS	Avg Veh Delay	LOS	Avg Veh Delay
First Avenue S.	S. Atlantic Street	D	46	D	43
First Avenue S.	S. Royal Brougham Way	D	47	E	73
First Avenue S.	S. Plummer Street				
First Avenue S.	S. Charles Street				
First Avenue S.	S. Dearborn Street				
First Avenue S.	S. Jackson Street	B	15	C	24
First Avenue S.	S. Main Street	B	18	B	10
First Avenue	Yesler Way	B	19	C	27
Fourth Avenue S.	S. Royal Brougham	D	43	E	68

Note: Delay is reported in seconds.

4.3.2 Central

Exhibit 4 23 shows AM and PM peak hour signalized intersection LOS and delay for selected signalized intersections in the waterfront, downtown, and Belltown areas. First Avenue at Columbia Street operates under congested conditions in the PM peak hour, with LOS F and an average vehicle delay of 144 seconds. This intersection serves as the access point to southbound SR 99 from downtown, and therefore experiences a relatively high volume of traffic.

Exhibit 4-23. Existing (2005) AM and PM Peak Hour Detailed Traffic Operations, Central

Street	Cross Street	AM PEAK HOUR		PM PEAK HOUR	
		LOS	Avg Veh Delay	LOS	Avg Veh Delay
Alaskan Way	Columbia Street	A	7	A	5
Alaskan Way	Marion Street	B	12	B	15
Alaskan Way	Madison Street	B	10	B	11
Elliott Avenue	Bell Street	A	5	E	67
Elliott Avenue	Wall Street	B	17	C	25
Elliott Avenue	Broad Street	D	40	D	35
Western Avenue	Marion Street	B	17	B	16
Western Avenue	Madison Street	B	17	B	20
Western Avenue	Spring Street	B	11	B	12
Western Avenue	Battery Street/SR 99 off-ramp	B	15	B	10
Western Avenue	Wall Street	B	18	C	27
Western Avenue	Broad Street	B	16	B	13
First Avenue	Columbia Street	C	22	F	144
First Avenue	Marion Street	B	11	B	14
First Avenue	Madison Street	A	9	A	10
First Avenue	Spring Street	A	7	B	12
First Avenue	Seneca Street	B	19	B	16

Exhibit 4-23. Existing (2005) AM and PM Peak Hour Detailed Traffic Operations, Central (continued)

Street	Cross Street	AM PEAK HOUR		PM PEAK HOUR	
		LOS	Avg Veh Delay	LOS	Avg Veh Delay
Second Avenue	Columbia Street	B	16	C	24
Second Avenue	Marion Street	B	15	C	20
Second Avenue	Madison Street	A	8	A	10
Second Avenue	Spring Street	B	13	B	15
Second Avenue	Battery Street	B	19	A	9

Note: Delay is reported in seconds.

4.3.3 North

In the Uptown and South Lake Union area, one notably congested intersection is at Fairview Avenue N. at Mercer Street, operating at LOS F conditions with an average vehicle delay of over 200 seconds in the PM peak hour, as shown in Exhibit 4-24. This is mainly due to the heavy volume of traffic from the adjacent I-5 ramps. Intersections operating at LOS E include Fairview Avenue N. at Mercer Street and Fairview Avenue N. at the I-5 off-ramp in the AM peak hour. In the PM peak hour, several intersections operate at LOS E, including Western Avenue W. at Elliott Avenue W., Dexter Avenue N. at Mercer Street, and Westlake Avenue N. at Mercer Street.

Exhibit 4-24. Existing (2005) AM and PM Peak Hour Detailed Traffic Operations, North

Street	Cross Street	AM PEAK HOUR		PM PEAK HOUR	
		LOS	Avg Veh Delay	LOS	Avg Veh Delay
Western Avenue W.	Elliott Avenue W.	A	9	E	56
Mercer Place	Roy Street	B	11	B	14
First Avenue	Denny Way	C	33	C	33
Second Avenue	Denny Way	A	9	A	8
Broad Street	Denny Way	C	27	C	26
Broad Street Turn	Mercer Street				
Fifth Avenue	Denny Way	B	17	B	15
Fifth Avenue N.	Broad Street	D	37	C	33
Fifth Avenue N.	Harrison Street	C	26	C	31
Fifth Avenue N.	Mercer Street	C	21	D	36
Fifth Avenue N.	Roy Street	C	35	B	18
Taylor Avenue N.	Mercer Street				
Sixth Avenue	Battery Street	A	10	B	17
Sixth Avenue	Denny Way	B	12	B	17
Sixth Avenue N.	John Street				
Sixth Avenue N.	Thomas Street				
Sixth Avenue N.	Harrison Street				
Sixth Avenue N.	Republican/ SR 99 On-ramp				

Exhibit 4-24. Existing (2005) AM and PM Peak Hour Detailed Traffic Operations, North (continued)

Street	Cross Street	AM PEAK HOUR		PM PEAK HOUR	
		LOS	Avg Veh Delay	LOS	Avg Veh Delay
Sixth Avenue N.	Mercer Street				
Aurora Avenue SB	Denny Way	B	13	B	20
Aurora Avenue NB	Denny Way	C	24	D	50
Aurora Avenue	Denny Way				
Aurora Avenue	John Street				
Aurora Avenue	Thomas Street				
Aurora Avenue	Harrison Street				
Dexter Avenue N.	Denny Way	B	19	C	23
Dexter Avenue N.	John Street				
Dexter Avenue N.	Thomas Street				
Dexter Avenue N.	Harrison Street	C	23	B	11
Dexter Avenue N.	Republican/ SR 99 Off-ramp				
Dexter Avenue N.	Mercer Street	C	35	E	62
Dexter Avenue N.	Roy Street	A	7	B	10
Dexter Avenue N.	Aloha Street	B	17	B	12
Ninth Avenue N.	Mercer Street	C	22	C	27
Westlake Avenue N.	Mercer Street	A	8	E	67
Fairview Avenue N.	Valley Street				
Fairview Avenue N.	I-5 Off Ramp	E	67	C	23
Fairview Avenue N./ I-5 Ramp	Mercer Street	E	68	F	211

Note: Delay is reported in seconds.

4.4 Transit Services

Downtown Seattle is served by a well-developed system of bus transit, supplemented by a large, regionally implemented vanpool program, Link light rail between Westlake Center and Tukwila, a waterfront streetcar (currently suspended), a new South Lake Union streetcar operating between downtown Seattle and Lake Union, and Sound Transit commuter rail connecting Everett, Edmonds, Seattle, Tukwila, Kent, Auburn, Sumner, Puyallup, and Tacoma.

4.4.1 HOV and Transit Facilities

A number of HOV facilities operate in the study area, though none of these relate directly to the SR 99 corridor. Exhibit 4 25 provides a summary of study area HOV facilities.

Exhibit 4-25. Existing HOV Facilities and Treatments

Arterial	From	To	Treatment Description
I-5 Express Lanes	CBD	Northgate	Freeway HOV lane
I-90	I-90	Airport Way	Bus lane/HOV segment
Downtown Seattle Transit Tunnel	S. King Street	Stewart Street/ Ninth Avenue	Transit tunnel
E-3 Busway	Airport Way	Spokane Street	Transit facility
Second Avenue	Stewart Street	Yesler Way	Bus lane/HOV segment
Second Avenue Ext.	Yesler Way	Jackson Street	Bus lane/HOV segment
Prefontaine Place S.	S. Washington Street	S. Yesler Way	Transit-only (peak hours)
Third Avenue	Stewart	Jefferson	Transit-only corridor (peak hours)
Fourth Avenue, Fourth Avenue S.	Yesler Way	Pike Street	Bus lane/HOV segment
Pine Street	Third Avenue	Fourth Avenue	Bus lane/HOV segment
S.W. Spokane Street	West of Chelan Ramp	Chelan/WSF ramp	Bus lane/HOV segment
Alaskan Way	North of Yesler Way	Yesler Way	Left-hand turn lane for transit
Howell Street	West of Ninth Avenue	Ninth Avenue	Queue-jump transit lane
Fairview Avenue N.	North of Valley Street	Valley Street	Left-hand turn lane for transit
15th/Elliott	W Armour	W Harrison	BAT lanes

Note: BAT = business access and transit
Source: Seattle Department of Transportation.

Freeway (I-5) HOV Facilities

Within the study area, HOV lanes are provided on I-5 only on the reversible express lanes. These lanes carry both general-purpose and HOV traffic separately from the I-5 mainline and operate southbound in the morning and northbound in the afternoon. In addition to these facilities, HOV lanes are provided on I-5 outside of the study area north of Northgate and south of I-90.

Arterial HOV and Transit-Only Facilities

Several HOV facilities are provided on arterial streets in the study area. Many of these primarily facilitate transit movement through the downtown area (see

Exhibit 4 26). None of the arterial HOV facilities link directly to the SR 99 corridor, though the southbound transit lane on Second Avenue and the transit-only left-turn pocket on Alaskan Way are located near the viaduct. Transit routing and use of these facilities is discussed later in this section under Transit Services.

In addition to on-street arterial HOV facilities, the transit-only E-3 Busway on Fifth Avenue S., between S. Spokane Street and S. King Street, provides transit access south of downtown between I-5 and the Downtown Seattle Transit Tunnel.

New Arterial HOV and Transit-Only Facilities

Several new arterial HOV and transit-only facilities have been added to the local street system since the 2006 Supplemental Draft EIS was published.

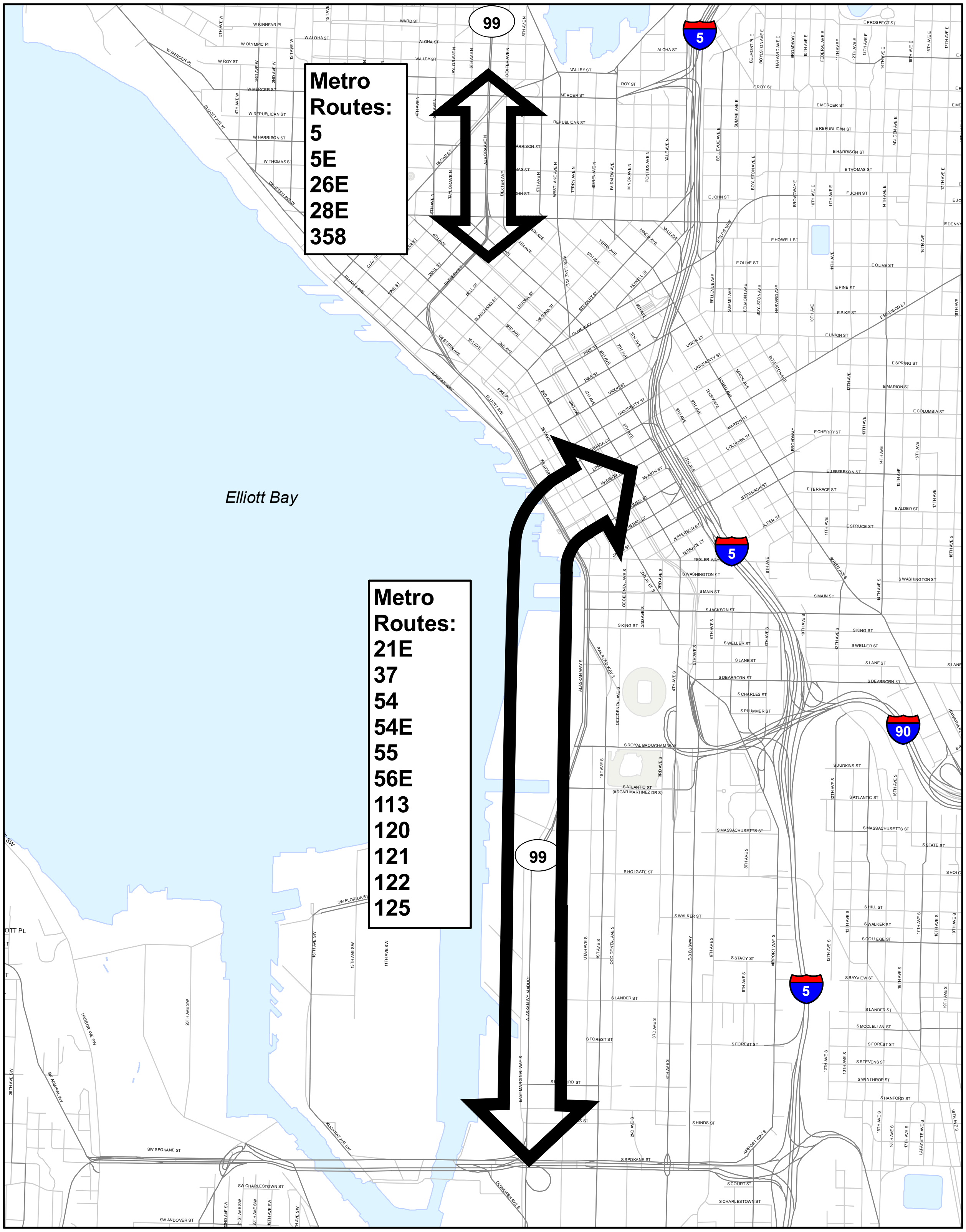
Third Avenue

Third Avenue, between Stewart Street and Jefferson Street, operates as a transit-only corridor during peak commute hours (6:00 to 9:00 a.m. and 3:00 to 6:30 p.m.). During those periods, other vehicles would 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., evenings, nights, and on weekends.

Business Access and Transit Lanes – 15th Avenue W./Elliott Avenue W.

Metro Transit, in coordination with the City of Seattle, is planning a new, streamlined bus service that would make frequent trips all day between Crown Hill and downtown Seattle via Ballard, Interbay, Uptown/Queen Anne, and Belltown. Metro and the City of Seattle are working together on roadway and traffic signal improvements to speed the movement of buses, including business access and transit (BAT) lanes, transit signal priority, and queue jumps.

In 2008, curb lanes along 15th Avenue W. and Elliott Avenue W. in both directions between W. Harrison and W. Armour Streets were converted to BAT lanes. In general, BAT lanes are reserved for vehicles intending to turn right at the next signaled intersection (or beforehand, into a business driveway) and for those vehicles merging left after turning into a BAT lane. King County Metro transit vehicles are permitted to pass through signaled intersections without turning right (as are bicycles), but other vehicles may be ticketed for doing so. Parking is allowed in the curb lane for most of the day, but the right-hand turn requirement is in effect at all hours. The BAT lanes are expected to directly benefit the nearly 10,000 bus riders that ride through the area each day with minimal disruption to non-bus traffic.



N

0 1,000 2,000 4,000
Feet

Source: King County, 2007.

Exhibit 4-26
SR 99 Bus Transit Connections

U:\GIS\e-3\Maps\SDEIS2-Bored_Tunnel\TDR_Graphics\Ex 4-20 Bus Transit Connections.mxd

4.4.2 Transit Services

Bus Service

As listed in Exhibit 4 27 and Exhibit 4-28, several King County Metro routes use SR 99/Alaskan Way Viaduct during the peak hours. The ramps that are used are the northbound off-ramp at Seneca Street, the southbound on-ramp at Columbia Street, and the ramps at Denny Way.

Exhibit 4-27. Transit Routes Using SR 99/Alaskan Way Viaduct South of Downtown

Route No.[1]	Description	Ramp Usage	Buses Per Hour	
			AM Peak	PM Peak
21E	To Seattle	Seneca Street	3	
	To Arbor Heights	Columbia Street		3
37	To Alaska Junction	Columbia Street		3
54	To Seattle	Seneca Street	3	3
	To White Center	Columbia Street	2	3
54E	To Seattle	Seneca Street	3	
	To White Center	Columbia Street		3
55	To Seattle	Seneca Street	4	2
	To Admiral District	Columbia Street	2	4
56E	To Seattle	Seneca Street	2	
	To Alki	Columbia Street		2
113	To Seattle	Seneca Street	2	1
	To Shorewood	Columbia Street		2
120	To Seattle	Seneca Street	5	4
	To Burien	Columbia Street	4	6
121	To Seattle	Seneca Street	2	2
	To Burien	Columbia Street	3	3
122	To Seattle	Seneca Street	3	
	To Burien	Columbia Street		1
125	To Seattle	Seneca Street	4	4
	To White Center	Columbia Street	4	4

[1] "E" indicates Express route.

Exhibit 4-28. Transit Routes Using SR 99/Aurora Avenue North of Downtown

Route No.	Description	Ramp Usage	Buses Per Hour	
			AM Peak	PM Peak
5	To Seattle	Denny Way	4	4
	To Shoreline	Denny Way	4	4
5E[1]	To Seattle	Denny Way	4	
	To Shoreline	Denny Way		4
26E	To Seattle	Denny Way	4	
	To Greenlake	Denny Way		3
28E	To Seattle	Denny Way	5	
	To Broadview	Denny Way		3
358	To Seattle	Denny Way	8	4
	To Aurora Village	Denny Way	4	8

[1] "E" indicates Express route.

In addition, an extensive network of bus routes converges on downtown Seattle from I-5 and via surface streets. In general, bus routes are oriented north–south, using First, Second, Third, Fourth, and to a lesser extent, Fifth Avenues. In addition, a number of express routes from Seattle neighborhoods and nearby communities use the Downtown Seattle Transit Tunnel, located beneath Third Avenue and Pine Street. As of July 2009, bus operations in the tunnel are mixed with Link light rail trains. Bus routes in the tunnel may be accessed from the International District Station (S. Jackson Street at Fifth Avenue), Pioneer Square Station (Third Avenue at Cherry Street), University Street Station (Third Avenue at University Street), Westlake Center (Pine Street at Fifth Avenue), or Convention Place Station (Pine Street at Ninth Avenue).

Most transit service operating on east–west streets in the downtown area (including James Street, S. Jackson Street, Yesler Way, Marion Street, Madison Street, Spring Street, Seneca Street, Pike Street, and Pine Street) is oriented to provide service between downtown and the Capitol Hill/First Hill neighborhoods or uses those streets for short segments only as part of a larger north–south oriented route.

Other agencies providing bus service within the study area are Sound Transit and Community Transit. These transit agencies provide more commuter-oriented services in that they operate several peak-only express services to downtown Seattle from outlying cities and neighboring counties. Sound Transit provides service to cities throughout the region in Snohomish, King, and Pierce Counties, while Community Transit provides commuter service to downtown Seattle from

Snohomish County. These transit providers operate routes that access downtown on I-5 or I-90. Other than King County Metro, none of the region's transit agencies uses SR 99 within the study area.

Vanpools

The transit agencies in the region all operate vanpool programs, with King County Metro's being the nation's largest public vanpool program. Under Metro's program, the transit agency provides and maintains a vehicle, provides ride-matching service and support, and in turn collects a fee from vanpool users to cover expenses. As of September 2009, approximately 40 of Metro's active vanpools serve destinations in downtown Seattle, including the CBD, First Hill, South Lake Union, and SODO. Vanpools are dependent on the regional highway system, including HOV facilities where available, as well as local streets for mobility.

Link Light Rail Service

The Central Link light rail line opened with the 13.9-mile segment from Westlake Station to Tukwila International Boulevard Station beginning service in July 2009. This line serves downtown Seattle, the SODO industrial area, the Beacon Hill and Rainier Valley neighborhoods, and Tukwila. Between the International District Station and the terminus at Westlake Station, light rail trains operate along with bus routes in the Downtown Seattle Transit Tunnel. A fare-free shuttle bus service connects the Tukwila Link Station with Sea-Tac Airport. The 1.7-mile extension to Sea-Tac Airport is scheduled to open in late 2009.

The light rail trains offer two-way service for 20 hours each day, running every 7.5 minutes during peak periods and every 10 to 15 minutes during midday and evening hours. Each train has two cars, each of which can carry about 200 riders.

Sounder Commuter Rail Service

Sound Transit's commuter rail line, Sounder, serves commuters north and south of Seattle. The south line travels between Tacoma and King Street Station in downtown Seattle and serves the communities of Puyallup, Sumner, Auburn, Kent, and Tukwila. The north line travels between Everett and King Street Station with a stop in Edmonds. Park-and-ride facilities in these communities further extend the effective reach of the service.

Currently, 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 during the morning (out of Seattle) and evening (into Seattle). Four Sounder trains 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 or Seahawks games also operate.

King Street Station interfaces with several other forms of transportation, including the waterfront streetcar and Downtown Seattle Transit Tunnel. The Weller Street Pedestrian Bridge provides a direct connection between Sounder service and the Downtown Seattle Transit Tunnel.

Waterfront Streetcar

Improvements to downtown Seattle's north waterfront area, including construction of the Olympic Sculpture Park and work on the northern end of the seawall, have necessitated the temporary suspension of the George Benson Line Waterfront Streetcar vintage trolley service. King County Metro has provided replacement service with free bus service on Route 99 Waterfront Streetcar Line buses. Bus routing and stop locations do not exactly duplicate the Waterfront Streetcar; however, Route 99 serves the same neighborhoods—the waterfront, Pioneer Square, and Chinatown/International District.

King County Metro is currently working on plans to restore the Waterfront Streetcar to active service. The project is dependent on many factors, including construction of a new maintenance facility and the final alternative selected for the Alaskan Way Viaduct Replacement Project.

The streetcar is popular with tourists and visitors, but also provides access to downtown activities and businesses located in the central waterfront area, International District, Pioneer Square, and Pike Place Market. It also interfaces with several other transportation modes, including the Downtown Seattle Transit Tunnel at the International District Station and the Seattle Ferry Terminal at Colman Dock. A number of King County Metro bus stops are located near the streetcar stations, as are pedestrian facilities such as the Bell Street and Marion Street Pedestrian Bridges. The current service function is to serve pedestrians to some of the cultural, recreational, and shopping attractions within the Seattle waterfront area.

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 new streetcar line runs from Fairview Avenue N./Yale Avenue N. to Westlake Avenue/Olive Way and includes 11 stops. The streetcars run approximately every 15 minutes and 7 days a week. The streetcar connects with several other public transportation modes, including Metro and Sound Transit buses, light rail transit (Westlake Station), and the Monorail.

4.4.3 Transit Connectivity and Coverage

Transit Connections

In-bound express bus routes serving West Seattle and Burien use SR 99, entering or exiting downtown at the Seneca Street off-ramp or Columbia Street on-ramp. Because the first downtown stop for these routes is at First Avenue and Union Street, many riders who need to reach the southern portion of downtown must transfer to other services to backtrack southbound.

All bus transit serving northwest Seattle by way of SR 99 enters or exits the downtown at the Denny Way ramps. From there, a number of surface streets provide access into the downtown area.

Currently, all transit service on SR 99 in the study area exits the corridor to access downtown Seattle. Transit using SR 99 from West Seattle or points south accesses the downtown area at the Seneca and Columbia Street ramps. These ramps provide fast service to the retail core, but passengers must transfer to other buses or walk to reach offices or other destinations in the southern portion of downtown.

There is no direct access to the viaduct to and from the north in downtown Seattle, so transit routes serving the north end access SR 99 from Denny Way, Battery Street, or north of Denny Way from Dexter Avenue N. or Fifth Avenue N.

Transit Travel Times and Coverage Area

All transit routes that use the SR 99 corridor access downtown at the Denny Way ramps to the north, or the Columbia and Seneca Street ramps downtown. Since HOV or transit-only facilities are not provided on the corridor, transit routes are subject to the overall operating conditions and performance of SR 99. As mentioned in the previous section, transit services serving downtown have direct access into the area at Seneca and Columbia Streets, but are not able to effectively provide access to the southern portions of downtown or the Pioneer Square and stadium areas.

4.5 Freight

The state of Washington classifies freight routes according to the number of tons of cargo carried on them. Only state routes are classified this way. Truck freight tonnage on Interstate and State Routes is shown in Exhibit 4 29.

Exhibit 4-29. Freight Tonnage Designations for State Routes

Interstate/State Route	Segment	Classification
I-5	Oregon border to just south of Canadian border	T-1
I-5	Express Lanes	T-1
I-90	SR 519 to I-5	T-1
I-90	I-5 to Idaho border	T-1
SR 99	First Avenue S. Bridge to Elliott Avenue	T-1
SR 99	North of Elliott Avenue	T-2
SR 99	Alaskan Way Viaduct	T-1
SR 519	I-90 to First Avenue S.	T-2
SR 519	First Avenue S. to Seattle Ferry Terminal	T-2
SR 509	Sea-Tac to Seattle	T-2
SR 599	I-5 (Tukwila) to SR 99	T-1

Source: WSDOT Freight and Goods Transportation System Update, 2007.
Classification:
T-1 more than 10 million tons per year.
T-2 4 million to 10 million tons per year

The City of Seattle designates all principal arterials as truck streets and has also classified certain streets 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 in Exhibit 4 30. SR 99 is designated as a Major Truck Street, as are all or portions of 15th Avenue W., Elliott Avenue, Western Avenue, Broad Street, E. Marginal Way, 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.

4.5.1 Weight 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. 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.

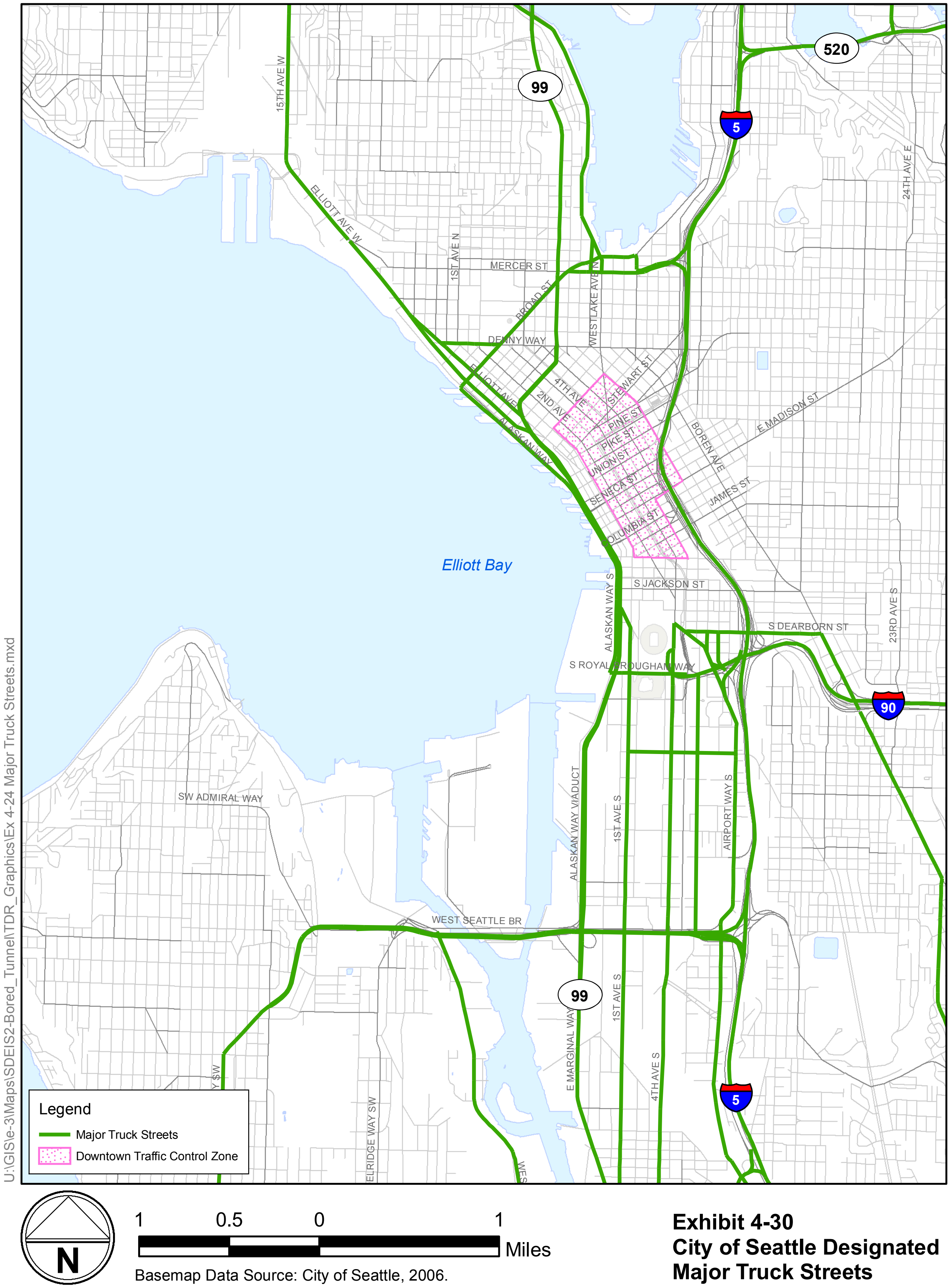


Exhibit 4-30
City of Seattle Designated Major Truck Streets

4.5.2 Alternative Truck Routes in the AWV Corridor

In case of congestion, incidents, or lack of access to the Alaskan Way Viaduct, different trucks have different alternative route options. Oversized or overweight trucks are limited to the designated over-legal route along Alaskan Way and Broad Street, or I 5. Trucks larger than 27 feet are precluded from using city streets in the downtown area north of S. King Street from 6:00 a.m. to 6:00 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 in Exhibit 4-30. Trucks 27 feet or smaller have the option to divert to city streets to get through the downtown area.

The Alaskan Way surface street has some drawbacks as a truck route. Truck traffic may be perceived to detract from increased waterfront and residential uses, including condominiums and sightseeing, and these uses reduce speeds and reliability for trucks along this route. Alaskan Way also contains a high number of signalized intersections along the central waterfront, which reduces travel speeds for trucks and increases potential conflicts with high volumes of pedestrians and bicyclists.

I-5 also presents challenges to 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.

4.5.3 Freight and Commercial Traffic

Truck volume and classification counts were collected by video along the SR 99 corridor in downtown Seattle in June 2006. An estimated 3,720 trucks use the Alaskan Way Viaduct through central Seattle on a typical weekday (see Exhibit 4-31). This includes single-unit trucks, combination trucks, and tanker (liquid transport) trucks. Garbage trucks and concrete trucks were classified as single-unit trucks. Based on comparisons to previously collected data, the confidence level in this revised estimate is high.

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

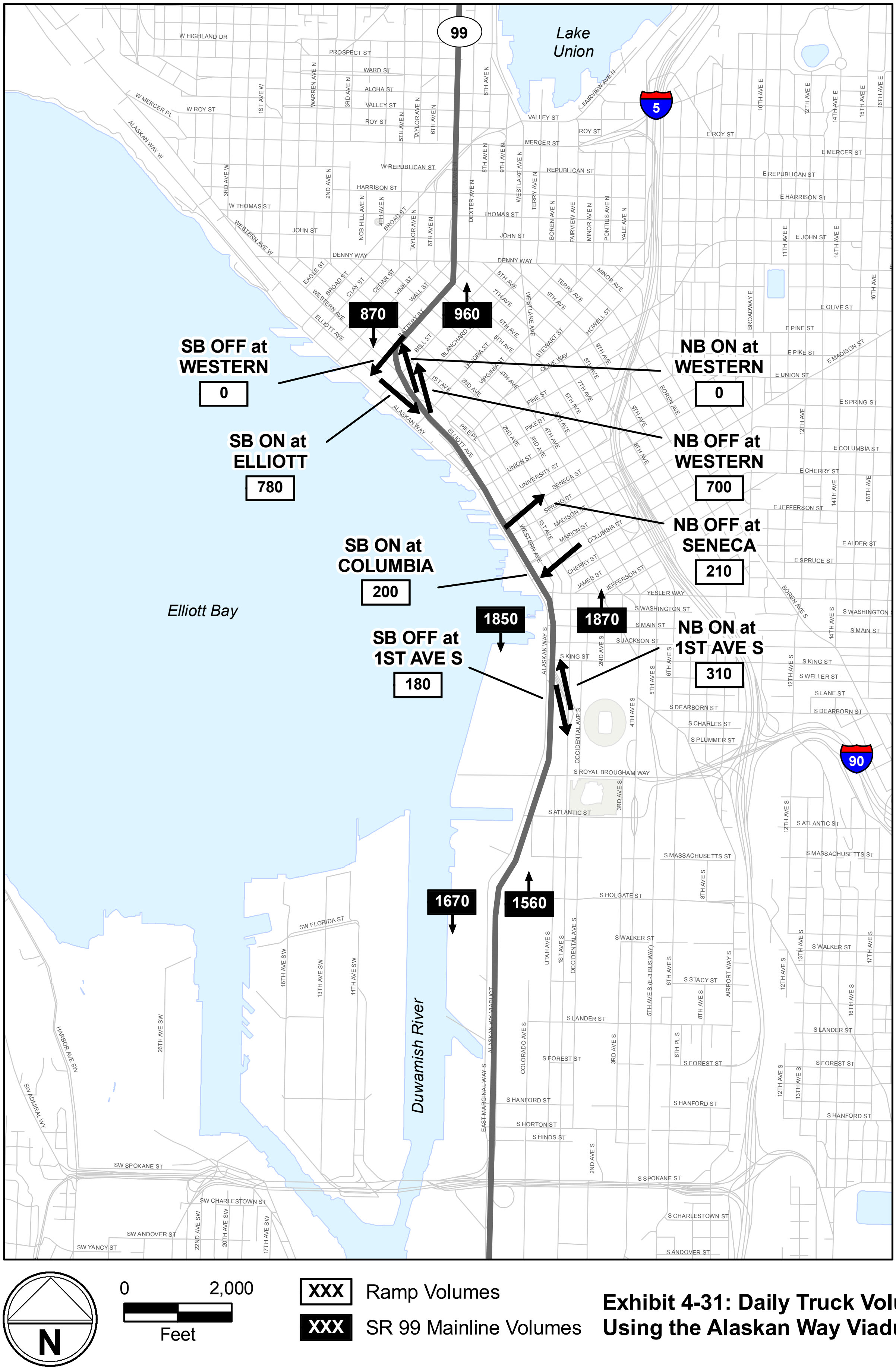


Exhibit 4-31: Daily Truck Volumes Using the Alaskan Way Viaduct

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 E. Marginal Way or West Seattle/Harbor Island.

North of downtown, the Elliott/Western ramps provide access to the Ballard/ Interbay industrial areas (by way of 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 Seneca Street and Columbia 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) by way of the Elliott Street on-ramp, and 11 percent (200 trucks) use the Columbia Street on-ramp.

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 corridors, hence the composition in the Battery Street Tunnel is 93 percent single units, 6 percent combination trucks, and 1 percent tankers.

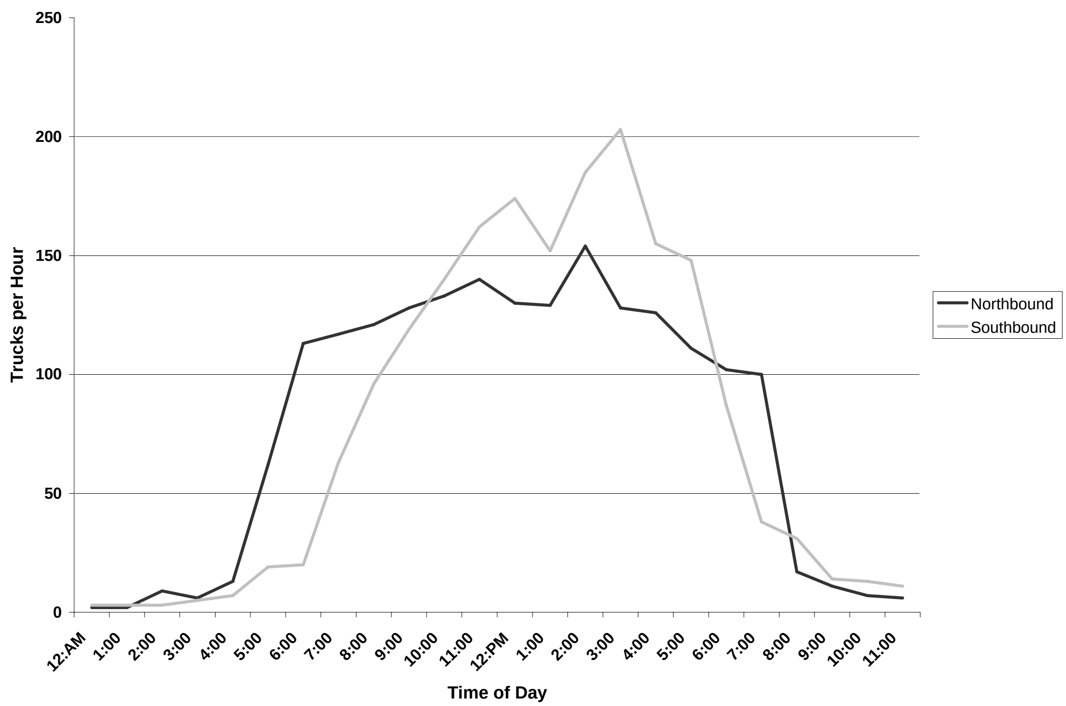
Tanker/Liquid Transport Trucks

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 combustible or flammable materials is unknown. However, approximately 15 percent of tankers on the viaduct were observed using the Battery Street Tunnel, where flammable and combustible materials are prohibited. An additional 15 percent of tanker trucks use the viaduct during times when flammable and combustible 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 flammable or hazardous loads on the viaduct.

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 32 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 (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 4-32. Hourly Truck Volumes on the Alaskan Way Viaduct (Midtown)



Freight Access

The project corridor serves areas that generate substantial freight and truck traffic. Exhibit 4 33 shows the boundaries of the Duwamish/SODO manufacturing and industrial area and the Ballard Interbay Northend Manufacturing and Industrial Center (BINMIC), as determined by the City of Seattle.

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.

In addition to the industrial areas, trucks using the project corridor are destined to consumer markets throughout the city and the region.

Ballard Interbay Northend Manufacturing and Industrial Center

The BINMIC area comprises 866 acres, with over 650 businesses employing approximately 14,500 employees in 2008 (City of Seattle 2009b). 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. Rail access is provided at the BNSF Balmer Yard. The Port of Seattle also has facilities in the area at Terminals 86 and 91 and Fishermen's Terminal.

The BINMIC area 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 by way of the Elliott Avenue and Western Avenue ramps. Alternative 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 of Seattle.

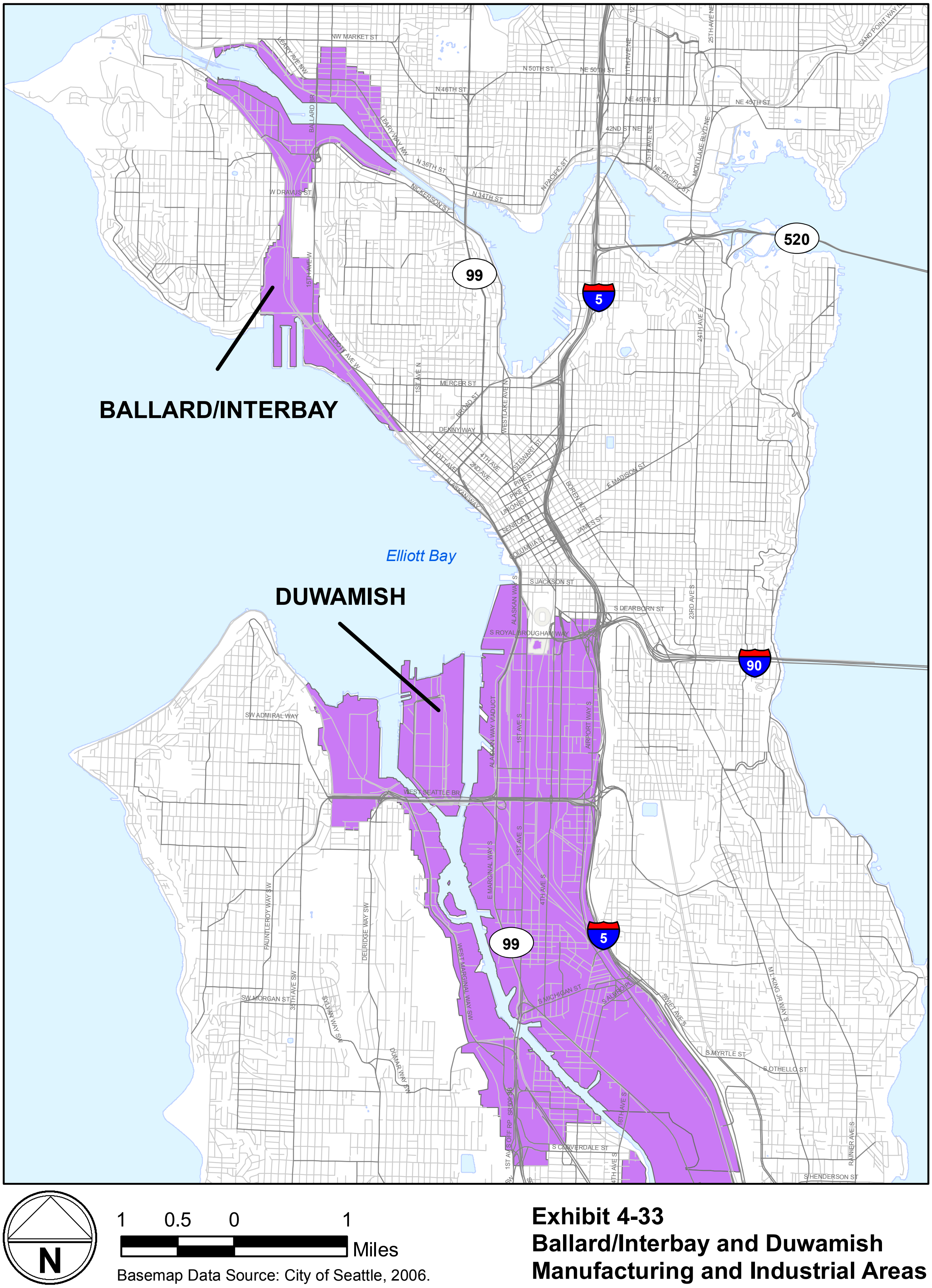


Exhibit 4-33
Ballard/Interbay and Duwamish Manufacturing and Industrial Areas

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

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 SIG and UPRR Argo Railyards. As described in Section 4.2.8 *Railroads*, the North SIG Railyard became operational in 2008.

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 Industrial Way. Alternative 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 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 would add a corresponding westbound connection by 2010.

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 34 shows Port of Seattle facilities, including marine cargo terminals at Harbor Island and the SW Harbor (Terminals 5 and 18), along Alaskan Way in the SE Harbor (Terminals 25, 30, 37, and 46), and in the Interbay area north of the study area (Terminals 86 and 91). The BNSF and UPRR intermodal railyards are also shown.

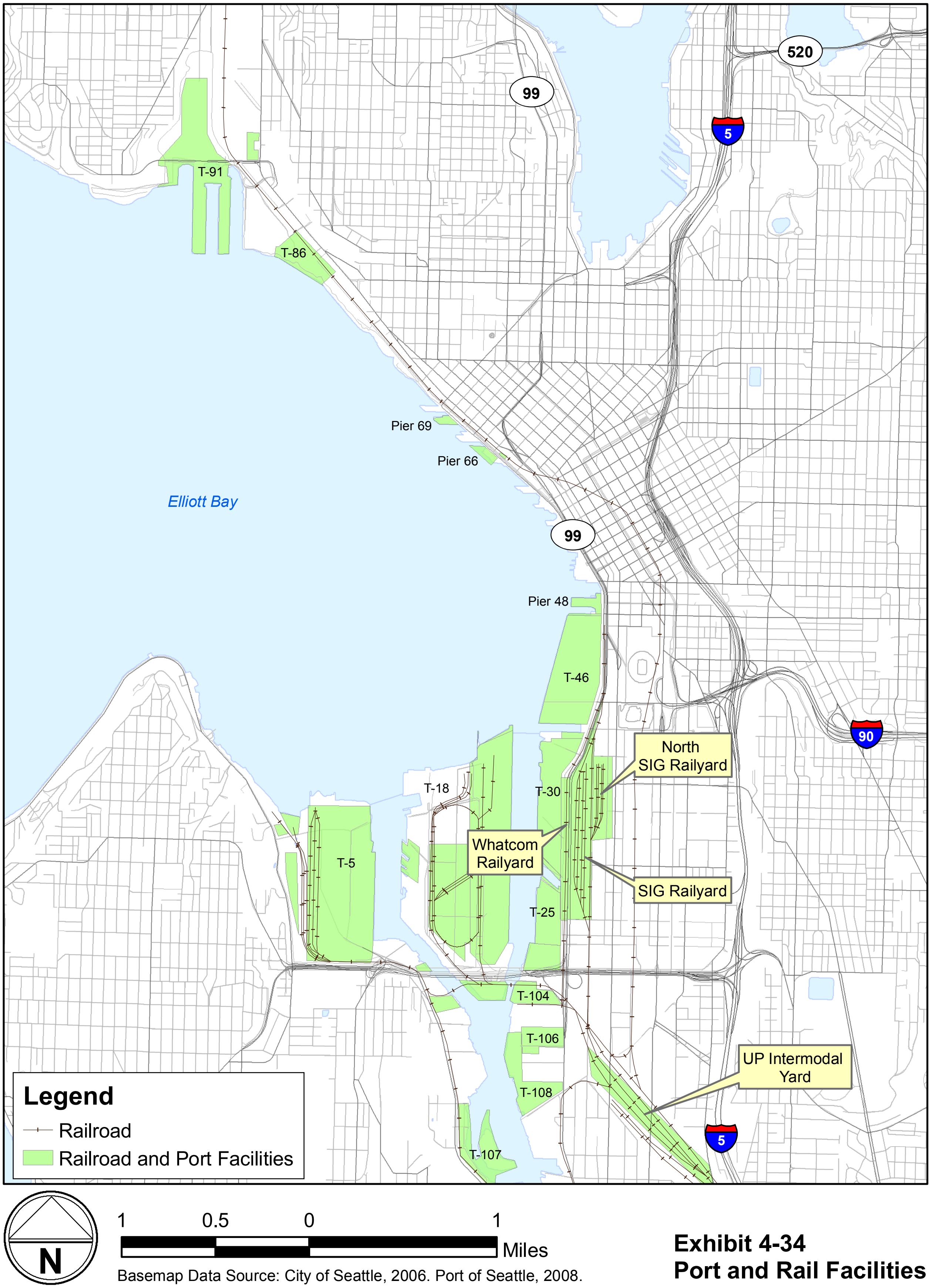


Exhibit 4-34
Port and Rail Facilities

Most of the freight shipped through the port is in intermodal containers that are transferred to or from railcars or trucks on the dock. 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 intermodal railyards 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 SE 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 E. Marginal Way 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 W. Marginal Way, Alaskan Way, and S. Michigan and S. Hanford Streets.

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 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 designated over-legal route to and from the Interbay area.

Truck arrivals at port gates are constant between 8:00 a.m. and about 3:30 p.m., with few arrivals during the noon hour when gate employees take lunch break. Port gate operation determines when trucks can arrive and leave, including the hours when the gates open and close and when employee breaks are observed.

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.

4.5.4 Railroads

BNSF 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 the 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. The BNSF mainline serves the I-5 corridor south to Long Beach and north to British Columbia, connecting to east–west tracks crossing the Cascades at Everett, Auburn, and along the Columbia River. BNSF 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 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. 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 E. Marginal Way at-grade, creating delays for heavy truck traffic in that area.

SIG and Whatcom Railyard Operations

The BNSF SIG Railyard is located on the east side of SR 99, south of S. Atlantic Street. This intermodal yard is 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, termed the tail track, extends north from the SIG Railyard, crossing S. Atlantic Street and S. Royal Brougham Way. Switching operations at the SIG Railyard frequently block these streets near their intersections with Alaskan Way.

As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, a grade separation from the BNSF tail track will be provided by a U-shaped depressed roadway that extends from the S. Atlantic Street/Colorado Avenue S. intersection to the S. Atlantic Street/E. Marginal Way S. intersection. The aerial mainline structure and depressed local street would combine to provide both at-grade and grade-separated access across the BNSF tail track.

Two additional BNSF tracks pass through the Whatcom Railyard on the west side of SR 99. One track 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.

4.6 Parking

4.6.1 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 of on-street short-term, on-street long-term, and off-street parking. Viaduct demolition poses a special case where restricted parking spaces are discussed.

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.

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 south end of the project area under the viaduct and in the south portal area.

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 private business customer or employee parking. The exception is some parking under the viaduct that is restricted during daytime hours on weekdays but used as public parking at other times.

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 6.1.8, Parking.

4.6.2 Parking Study Boundaries

The parking study was generally limited to the areas that are within the urban design boundary for surface street improvements. The parking assessment areas are organized according to south portal, central, and north portal areas. Only the south and north portal areas are associated with the final configuration of the project. The central area is discussed in the context of construction and the larger Program and viaduct demolition activities.

Potential parking effects were estimated for the Bored Tunnel Alternative. The plans for surface street improvements, submitted with the Alaskan Way Viaduct Replacement Project configuration drawings (July 2009), were used as a guide for on-street parking lanes and affected off-street parking areas.

4.6.3 Existing Parking Spaces

Exhibit 4 35 summarizes the existing parking in the study area. By definition, the parking study areas were delineated to quantify parking in the vicinity of SR 99 and Alaskan Way that would be affected by the project.

Near the south portal, about 180 on-street spaces and 250 off-street spaces are within the surface street improvement boundary. In the north portal area, about 330 on-street spaces are within the surface street improvement boundary, about half of which are 10-hour metered spaces. Approximately 40 off-street spaces in public pay lots are also within the surface street improvement boundary.

Parking spaces in the central area, under the viaduct and along Alaskan Way from S. King Street to Pine Street, would only be affected during viaduct demolition activities.

Exhibit 4-35. Summary of Existing Parking Spaces

	On-Street Spaces			Off-Street Spaces	Total Spaces
	Short-Term	Long-Term	Subtotal		
South portal area	170	40	210	250	460
Central: under the viaduct and along Alaskan Way	580	10	590	435	1,025
North portal area	70	230	300	40	340

4.7 Pedestrians

The study area includes several noteworthy pedestrian generators:

- 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 a multi-use path on the east side of Alaskan Way and pedestrian bridges across Alaskan Way at Marion Street, Lenora Street, and Bell

Street that link the downtown and Belltown areas with the waterfront. The following discussion will provide information on pedestrian facilities for the following project areas:

- South portal area
- Waterfront area
- North portal area

4.7.1 South Portal Area

The southern project 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 southern project area due to the mix of land uses in the area and the stadiums. With sidewalks on both sides, First Avenue S. and Occidental Avenue S. provide the main north-south pedestrian facilities in the area; both streets have low traffic volumes and large sidewalk areas adjacent to Qwest Field. Alaskan Way S. provides intermittent sidewalks in this area, typically on the western edge of the roadway adjacent to the Port of Seattle properties.

During non-event times, pedestrian traffic is relatively light along First Avenue S., Occidental Avenue S., and Alaskan Way S. However, these roadway facilities, particularly those on 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 or a Seahawks football game, thousands of pedestrians crowd the sidewalks and alleys in the stadium and Pioneer Square areas. Intersections throughout the area become saturated with pedestrian activity, and both the pedestrian and traffic LOS are considerably degraded. During such events, police officers typically provide traffic control to manage the very high vehicle and pedestrian volumes.

4.7.2 Waterfront Area

The waterfront area includes Alaskan Way from S. King Street to Broad Street. Primary pedestrian traffic generators along the waterfront include tourist activities, businesses, recreational uses, and ferry service. The north waterfront (north of Pike Street) includes two major pedestrian facilities providing connections to the waterfront:

- Bell Street Pedestrian Bridge, which extends over Alaskan Way and the BNSF railroad tracks and connects to the Bell Street Pier.
- Lenora Street Pedestrian Bridge, which provides access from Elliott Avenue to the east side of Alaskan Way.

South of the existing Battery Street Tunnel portal, SR 99 is elevated as it passes over local streets and pedestrian facilities. Sidewalks on these local streets provide the majority of pedestrian routes between areas downtown and the waterfront. Between University Street and Elliott Avenue, steep grades limit east–west connections under the viaduct. The only pedestrian connection between downtown and the waterfront in this area is the Lenora Street Pedestrian Bridge. The viaduct structure itself is also a barrier to pedestrian travel to some degree, as it is an imposing presence and creates a visual barrier between the western edge of downtown and the waterfront. Its shadows, dark spaces, and vehicle noise create an unfriendly pedestrian environment.

Pedestrian Facilities Along Alaskan Way

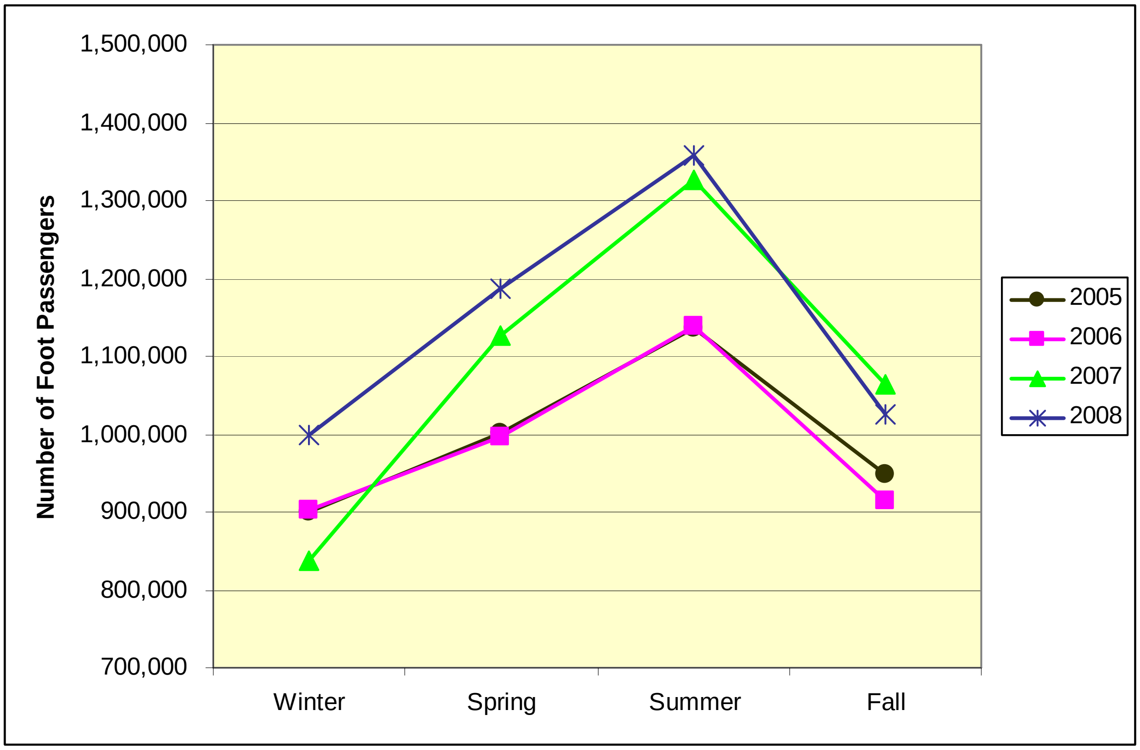
A widened sidewalk on the west side of Alaskan Way fronts waterfront businesses and attractions, acting as a pedestrian promenade. The promenade varies from 16 to 20 feet wide in the central waterfront area. The east side of Alaskan Way is only periodically fronted by sidewalks between S. King Street 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. An asphalt walkway is provided for the length of Alaskan Way on the opposite (east) side of the streetcar tracks. This path is used by a mix of users, including walkers and bicyclists.

Pedestrians cross Alaskan Way both at-grade and at two pedestrian bridges. 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 at-grade. To the north, the Bell Street Pedestrian Bridge connects to Elliott and Western Avenues. The Lenora Street Pedestrian Bridge links the Belltown and north Pike Place Market area to Alaskan Way (providing grade separation from SR 99 and the BNSF mainline), but does not cross Alaskan Way.

Surface crossings of Alaskan Way are provided regularly at intersections; the intersections are signalized at Yesler Way and Columbia, Marion, Madison, University, Pike, Wall, and Clay Streets. Some pedestrian crossings at signalized intersections may require pedestrians to travel out of direction if they are unaware that there are only two crossings between Madison and Wall Streets, a stretch of nearly one 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 (Exhibit 4-36) show that overall foot passenger volumes are typically higher during the summer months than during the fall and winter months. 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.

Exhibit 4-36. Washington State Ferries Seasonal Foot Passenger Traffic at Colman Dock



Source: Washington State Ferries, 2009.

4.7.3 North Portal Area

The north portal area consists of the western portion of the South Lake Union neighborhood and the Uptown neighborhood. 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 sidewalks on both streets are quite narrow, and these streets pass under SR 99, which does 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. Similar to the south portal area, pedestrian activity increases near Seattle Center during events to levels considerably higher than during non-event times.

4.7.4 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 has been identified by WSDOT as a high pedestrian accident location.

The Battery Street and Elliott Avenue/Western Avenue 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 on-ramp, accelerating traffic entering the highway crosses pedestrian traffic traveling along Western or 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.

At the southbound off-ramp to First Avenue S., pedestrians on First Avenue S. are routed around the ramp structure to a narrow, hidden walkway. The Columbia and Seneca Street ramps are signal controlled, and traffic is slowed to arterial speeds due to sharp curves on the ramps. Still, traffic entering or exiting the ramps encounters conflicting pedestrian traffic when turning on to or off of First Avenue S. to access the ramps.

4.8 Bicycle Facilities

Bicycles are used in the study area both for recreational and commuting purposes. 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 following discussion will provide information on bicycle facilities for the following project areas:

- South portal area
- Waterfront area
- North portal area

4.8.1 Bicycle Facilities and Designated Bike Routes

Seattle features an extensive network of bicycle facilities and routes. A substantial number of commuters travel to jobs in the downtown area via these routes. Sharrows are bicycle symbols that are 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. City of Seattle designated bicycle facilities and routes in the downtown area are shown in Exhibit 4-37.

4.8.2 South Portal Area

E. Marginal Way S. is a major bicycle route near the south portal area and is a regional connection that serves as the main route into and out of downtown for West Seattle residents. The SR 99/E. Marginal Way corridor is recognized as being the safest and primary connection for bicyclists from the West Seattle, White Center, Arbor Heights, and Burien areas to the downtown CBD. This corridor also serves as a key conduit to allow bicyclists access to other neighborhoods and communities in the region. Recent improvements to the bicycle network include sharrows on First Avenue S. between S. Lander Street and S. Jackson Street.

4.8.3 Waterfront Area

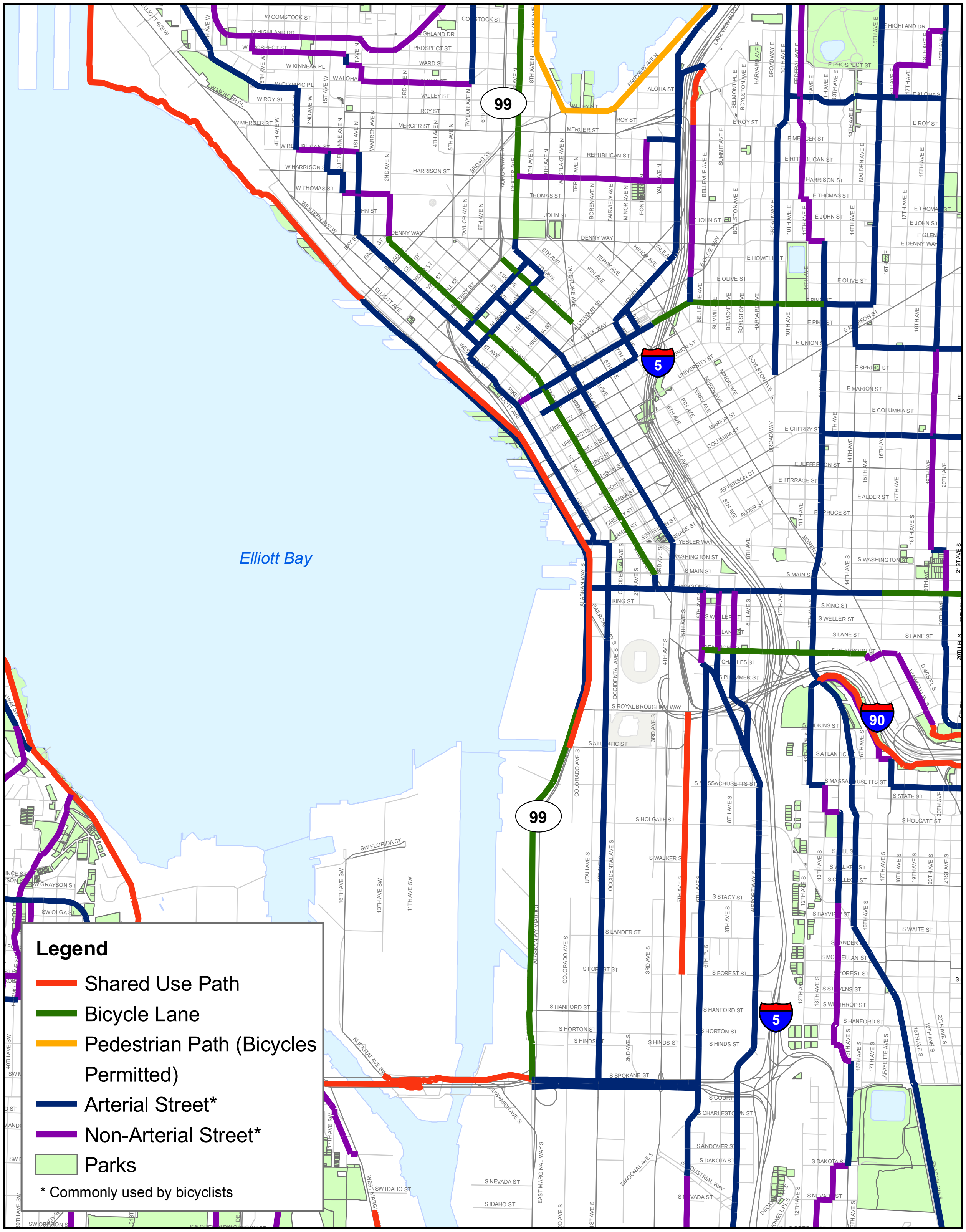
Major facilities along the waterfront include the multi-use path located to the east of Alaskan Way surface street, which runs from the stadium area to Myrtle Edwards Park, and the multi-use trail that starts in Myrtle Edwards Park and runs northward through the Interbay area to Magnolia. Bicycle facilities are not presently provided on the Alaskan Way surface street, though cyclists ride either in the street or on the parallel asphalt path shared with pedestrians.

4.8.4 North Portal Area

Dexter Avenue N. serves as the main northbound and southbound route for bicyclists traveling between downtown and points north. Second Avenue serves as the main route for bicyclists heading southbound through downtown, while First, Third, and Fourth Avenues are used for northbound travel. A new bicycle lane has been provided on Ninth Avenue N. between Denny Way and Republican Street.

4.8.5 Regional Connections

Near the north portal 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 along Lake Washington. As mentioned previously, the trail in Myrtle Edwards Park leads to a trail through the Interbay area to Magnolia and a trail along the south side of the Fremont cut.



N

0 0.25 0.5 1
Miles

Basemap Data Source: City of Seattle, 2009.

Exhibit 4-37
City of Seattle Designated Bicycle Routes

To the south, E. Marginal Way 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 beyond.

4.8.6 Planned Improvements

The City of Seattle adopted a Bicycle Master Plan that was approved May 22, 2007, by the Seattle Bicycle Advisory Board. The plan has informed development of approximately 450 miles of marked or separated bicycle routes, which will be completed over the next 10 years, including multi-use trails, bicycle lanes, and sharrows.

The Bicycle Master Plan calls for a number of improvements in the stadium area, many of which will be provided as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, as well as this project. These two projects will construct a combined bicycle and pedestrian facility adjacent to the Port of Seattle property between S. King Street and S. Atlantic Street. Bicycle lanes would be incorporated into the new street grid between S. King Street and the new S. Plummer Street, and cyclists can also use the combined pedestrian and bicycle sidewalk/promenade between S. Atlantic Street and S. Plummer Street on the new Alaskan Way S.

The City of Seattle's Bicycle Master Plan also calls for new bike facilities on S. Royal Brougham Way from the new Alaskan Way S. to Fourth Avenue S. (on a new overpass over the BNSF tracks), and on S. Holgate Street east from First Avenue S. A new multi-use path is planned 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.

In the central waterfront area, the Bicycle Master Plan includes a bicycle lane on Alaskan Way with an additional bicycle lane on Western Avenue from Blanchard Street to Yesler Way. In the north waterfront, a new bicycle lane is planned for Alaskan Way from Broad Street to the south, and Elliott, Western, and First Avenues would include sharrows.

In the South Lake Union area, Western and Fairview Avenues are called out as key study corridors. Several planned bicycle improvements in the north portal area include the Lake Union to Elliott Bay Trail (previously known as the Potlatch Trail). The Lake Union to Elliott Bay Trail project is being coordinated with the City of Seattle's larger Mercer Corridor project and the Mercer Street changes completed by this project. Other planned improvements include a new bicycle/pedestrian overpass connecting Uptown to the waterfront at Thomas Street that is currently under design by the City of Seattle.

4.9 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 (effective September 28, 2009). 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 Pier 50 and 52 on Seattle's downtown waterfront, is the Seattle terminus for the Washington State Ferries. The service from Vashon Island also uses Colman Dock while the service from West Seattle uses Pier 55 in the central waterfront. 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.

4.9.1 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. daily, with departures and arrivals approximately every 50 minutes. Service to Bremerton is provided by one Super Class ferry, which has a capacity of 144 vehicles and 2,500 passengers and one Jumbo Class ferry, which has a capacity of 188 vehicles and 2,000 passengers. Bremerton service operates on an approximate 80-minute headway daily between 4:50 a.m. and 12:50 a.m.

4.9.2 Passenger-Only Ferries

The King County Ferry District service from West Seattle currently uses one boat leased from Argosy Cruises. The passenger-only boat can accommodate 250 passengers. On weekdays, service is provided approximately each hour starting at 7:00 a.m. and ending at approximately 11:00 p.m. On weekends, service levels are the same as weekdays except that operations start at 8:30 a.m. The West Seattle ferry operates April through October. Starting in 2010, the service will operate year-round.

Passenger-only ferries also connect downtown Seattle and Vashon Island. While currently operated by Washington State Ferries, the King County Ferry District will assume operations for this route effective September 28, 2009. Service is provided by a vessel with a capacity of 250 people. Service departs from Pier 50 three times per day.

4.9.3 Characteristics of Ferry-Related Traffic

Arterial intersection analysis estimates that 525 vehicles exit Colman Dock during the AM peak hour, while 200 vehicles arrive to travel westbound during the same time period. During the PM peak hour, the pattern reverses to a degree, with 360 vehicles exiting Colman Dock during the PM peak hour and 540 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/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 the volumes represent a typical traffic day, there are days throughout the year during which even higher volumes occur.

Currently, offloading (eastbound) traffic cues a signal preempt that allocates up to 180 seconds for traffic exiting Colman Dock at either Marion Street or Yesler Way. Once the preempt phase is completed, the north-south movements are allocated their normal split timings. The combined splits result in very long—and uncoordinated—signal cycle lengths. The preempt will continue to trigger subsequent allocations of up to 180 seconds for exiting ferry traffic until the vessel is empty (typically three preempt 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 movements are emphasized.

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 auto crossings. Note that the pattern of regular unloading with such a long preempt often leads to essentially uncoordinated traffic operations on Alaskan Way during a large share of the peak period today. The traffic models used to assess intersection conditions for this EIS do not specifically model the back-and-forth preemption cycles, and instead reflect an estimated "average" condition during the peak hour. Therefore, LOS and delay at these locations may be somewhat understated.

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 while ferries are unloading, as traffic exits at Marion Street (to northbound and southbound Alaskan Way, as well as eastbound on Marion Street) and Yesler Way (to southbound Marion Street 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.

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 B during both the AM and PM peak hours (Exhibits 4-38 and 4-39). 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 4-38. Existing (2005) AM Peak Hour Average Vehicle Delay (seconds) and LOS by Movement at Colman Dock

Traffic Movement	Average AM Peak Hour Conditions	
	Delay (seconds)	LOS
Marion Street	**16**	**B**
Eastbound (exiting Colman Dock)	28	C
Northbound Alaskan Way	10	B
Southbound Alaskan Way	7	A
Yesler Way	**20**	**C**
Eastbound (exiting Colman Dock)	18	B
Northbound left (entering Colman Dock)	16	B
Northbound through Alaskan Way	19	B
Southbound Alaskan Way	24	C

Exhibit 4-39. Existing (2005) PM Peak Hour Average Vehicle Delay (seconds) and LOS by Movement at Colman Dock

Traffic Movement	Average PM Peak Hour Conditions	
	Delay (seconds)	LOS
Marion Street	**13**	**B**
Eastbound (exiting Colman Dock)	27	C
Northbound Alaskan Way	10	A
Southbound Alaskan Way	8	A
Yesler Way	**24**	**C**
Eastbound (exiting Colman Dock)	15	B
Northbound left (entering Colman Dock)	21	C
Northbound through Alaskan Way	18	B
Southbound Alaskan Way	29	C

4.10 Safety

This section summarizes collision data for SR 99 within the transportation study area. The analysis was conducted to describe the collision history on SR 99 in terms of rate of occurrence, crash 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 crashes. 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. The following key findings were identified for the SR 99 corridor:

- 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 crashes appear to be associated with the Battery Street on-ramp.
- The northbound and southbound North of Battery Street Tunnel segments in the South Lake Union area experience different crash 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.

4.10.1 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 for collisions both on the mainline as well as on connecting ramps within 250 feet of the mainline. Several analyses were used to measure and assess collision characteristics:

- *Collision rates by segment*. To allow comparison of crash 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 crash 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.

4.10.2 Collision Rates by Segment

Collision frequency, expressed as the number of collisions per MVMT, is a standardized measure useful in comparing collision rates between different segments or even different highways. This section presents collision rates for the major segments on SR 99, 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.

Segments Analyzed

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

Northbound

- S. Spokane Street to Stadiums: Prior to the S. Spokane Street on-ramp to prior to the First Avenue S. on-ramp.
- Stadiums to Downtown: Prior to 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 prior to the Denny Way on-ramp. Note that this segment includes the Battery Street Tunnel as well as connecting mainline sections external to the tunnel.
- North of Battery Street Tunnel: Prior to the Denny Way on-ramp to after Valley Street.

Southbound

- North of Battery Street Tunnel: Prior to Valley Street to after the Denny Way off-ramp.
- Battery Street Tunnel: After the Denny Way off-ramp to prior to the Elliott Avenue on-ramp (includes the Battery Street Tunnel). As with northbound, this segment includes connecting mainline sections external to the tunnel.
- Battery Street Tunnel to Downtown: Prior to the Elliott Avenue on-ramp to prior to the Columbia Street on-ramp.
- Downtown to Stadiums: Prior to 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 ramps was not considered an independent segment, but rather 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).

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 4-40 and 4-41 summarize collision rates for the corridor.

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 on the corridor. Frequent collisions here are 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 on-ramp, which has limited sight distance and a very short merge area. 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.

Exhibit 4-40. Collision Rates for Northbound SR 99 Segments (2000–2003)[1]

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

[1] Includes collisions on ramps that occur within 250 feet of the mainline.

Exhibit 4-41. Collision Rates for Southbound SR 99 Segments (2000–2003)[1]

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

[1] Includes collisions on ramps that occur within 250 feet of the mainline.

Comparing Collision Rates on SR 99 to Other Facilities

Exhibit 4-42 summarizes average systemwide 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. Further, SR 99 is a somewhat unique facility type and is not fully consist with the Interstate Freeway designation.

Exhibit 4-42. Average Systemwide 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

[1] WSDOT Unpublished Collision Data for 2003, and 1996 WSDOT Highway Accident Report.

Collision rates on SR 99 are 14 to 54 percent higher than the average systemwide 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.

Collision rates for principal arterials are provided for added context as well. SR 99 collision rates are 16 to 38 percent lower than systemwide averages for urban principal arterials in Washington.

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 4-43 and 4-44). Collision types include:

- 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 4-43 summarizes the share of collisions by crash 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.

Exhibit 4-43. 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%

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

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 on-ramp contribute to high shares of rear-end collisions on the Battery Street Tunnel segment.

Sideswipe collisions tend to occur more frequently on segments where frequent lane changing occurs to access connections to/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 4-44 summarizes the share of collisions by crash 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.

Exhibit 4-44. 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%

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

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 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.

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.

Collision Severity by Segment

Exhibits 4-45 and 4-46 summarize collision severity for SR 99 corridor segments. Collisions are classified as either property-damage-only collisions or injury collisions. The latter category includes crashes that were identified in collision reports as possible injury, evident injury, debilitating injury, or fatal collisions.

Exhibit 4-45. 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%

Exhibit 4-46. 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%

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. While a lower 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.

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.

Conclusions

The frequency of collisions on the SR 99 corridor is higher than average rates for urban, limited-access highways in the state. Collisions on the SR 99 corridor occur at a corridorwide 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.

Some segments of SR 99 exhibit elevated collision rates relative to the corridor average. The northbound and southbound Battery Street Tunnel segments (Western/Elliott Avenue ramps to Denny Way ramps) show much higher collision rates than most other segments on the corridor. Northbound, a substantial share of these crashes appears to be associated with the Battery Street on-ramp. Review of collision locations also indicates that collision frequencies are higher in the curved section of the tunnel, where excessive speed, sight distance limitations, 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 First Avenue S. off-ramp) also experiences an elevated crash rate and moderately high rate of injury collisions relative to the rest of the corridor. A combination of factors likely contributes to these elevated crash rates, including narrow lanes, little roadside clearance, a left-side merge from Columbia Street, a left-side diverge to First Avenue S., heavy weaving movements associated with left-side on- and off-ramp traffic, and high congestion levels.

The northbound and southbound segments north of the Battery Street Tunnel (Denny Way ramps to north of Valley Street) in the South Lake Union area also exhibit moderate collision rates, but unique crash types. The numerous right-angle street connections to SR 99 are a factor in a large share of collisions on this segment, with high rates of enter-at-angle, sideswipe, and rear-end collisions. Pedestrian collisions are a particular concern in this area, as SR 99 is at-grade and pedestrians crossing the roadway (illegally) have been involved in a number of collisions. These collisions tend to most often involve fatalities or serious injury.

4.10.3 Corridor Design Aspects

SR 99 is a multi-lane, divided highway that travels through downtown Seattle within the study area. SR 99 is not a fully limited-access facility and does not meet access and other criteria normally associated with a freeway facility. As such, it most closely matches FHWA's "Principal Arterial – Other Freeways and Expressways" category. The City of Seattle 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 right-angle street connections north of the Battery Street Tunnel. 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. 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.

4.11 Event Traffic

South Portal Area

During events at Safeco Field or Qwest Field, traffic levels in the general vicinity intensify within a relatively short amount of time, travel patterns change as patrons search for parking, and pedestrian activity increases. As a result, local traffic conditions are typically much more congested prior to and following events compared to typical, non-event conditions (discussed previously). As an example, for a typical Seahawks game, estimates indicate that between 15,000 and 20,000 additional vehicles, beyond background traffic levels, enter and exit the stadium area.

Regional access to northbound SR 99 and from southbound SR 99 is currently provided for events via the on- and off-ramps at First Avenue S. SR 99 connections to/from the south are not provided in the stadium area. Nearby access points to/from downtown along SR 99 include a northbound off-ramp to Seneca Street and a southbound on-ramp from Columbia Street. No direct SR 99 access to or from the north is provided in the downtown area. The West Seattle travel market for events in the south end is served by SR 99 with an eastbound-to-northbound loop ramp and a reverse southbound-to-westbound ramp.

Additional regional access to/from the stadium area is provided by the following:

- To/from I-5 via SR 519 from Fourth Avenue S. (elevated intersection)
- To/from I-5 via Fourth Avenue S. and Industrial Way
- To/from I-5 via SR 99 and SR 599 to the south

- To/from S. Spokane Street at Sixth Avenue S.
- To/from I-90 via Fourth Avenue S. at SR 519 or from S. Spokane Street

Explicit detour routing and comprehensive traffic control measures are typically in place on First Avenue S. and critical east-west arterials (e.g., S. Royal Brougham Way and S. Atlantic Street) for large events at Safeco Field and Qwest Field such as Seahawks and Mariners Games and Sounders Matches. These measures commonly include police-based traffic management commissioned by the City of Seattle. Mode shift to alternative means of travel, particularly public transit (bus, light rail, commuter rail, walking, etc.), often occurs for events at both venues. As services increase and/or are enhanced for transit modes, event-related ridership to/from the stadium area will likely increase over time.

North Portal Area

Seattle Center is the major event facility in the north portal area of the project. This facility 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 and children's programs also occur throughout the year.

A primary route to Seattle Center is from I-5 via the Mercer Street exit to Valley Street and Broad Street. From Seattle Center to I-5, Mercer Street provides a connection to northbound and southbound I-5. Additional routes to and from Seattle Center include the following:

- Ballard: via Denny Way and Western 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 occasionally used to manage access to parking and general circulation. However, due to the smaller scale of events and the capacity of the Seattle Center facility, such measures are not in place as consistently nor are they required as frequently compared to the larger sporting venues in the south (Safeco Field and Qwest Field). Transit service for events at Seattle Center are not well-served compared to the south end stadium area. However, local bus and monorail service is provided to/from the downtown core (and to/from some neighborhoods on the periphery).

This Page Intentionally Left Blank

Chapter 5 OPERATIONAL EFFECTS, MITIGATION, AND BENEFITS

This chapter describes the changes in travel patterns and traffic volumes for the 2015 Baseline, Viaduct Closed (No Build Alternative), and Project scenarios and the 2030 Project scenario.

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 period and daily estimates of various travel parameters (e.g., VMT) for routes that represent major movements accommodated by the SR 99 corridor.

5.1.1 Vehicle Miles of Travel

VMT for this study is defined as the total number of miles traveled in either the four-county Puget Sound region or the Seattle Center City study area for a given time period. The discussions below describe estimated VMT for AM and PM peak periods and daily totals for the 2015 Baseline, Viaduct Closed (No Build Alternative), and Project (Bored Tunnel Alternative) scenarios and the 2030 Project (Bored Tunnel Alternative) scenario. These estimates were derived by the project's traffic demand model. Exhibit 5-1 provides a summary table of VMT.

Key Findings

- AM, PM, and daily VMT are about equal for all 2015 scenarios for the four-county Puget Sound region; this is because the impacts of the various SR 99 scenarios would have little effect on overall multi-county trip making. However, if we look at just the Seattle Center City area, changes to VMT are more notable because changes to SR 99 would cause greater impacts at this subarea level.

- The 2015 Viaduct Closed (No Build Alternative) shows substantially lower VMT for the Center City area than the other 2015 scenarios (Baseline, Project, and Program), regardless of time period. This is likely due to a disincentive of trip making either to or through the Center City area caused by increased traffic and congestion on city streets. Under the 2015 Viaduct Closed (No Build Alternative), roughly 100,000 daily trips on SR 99 would need to be accommodated either by local street capacity, I-5, transit, or bike and walk modes.

- The 2015 Project scenario shows a very slight decrease in daily VMT compared with the 2015 Baseline scenario. The slight decrease is likely due to the removal of access between SR 99 and the Magnolia/Interbay/ Ballard areas presumed in the Bored Tunnel alternative.

Exhibit 5-1. Vehicle Miles of Travel

Performance Measure	Existing (2005)	Year 2015 Baseline	Year 2015 Viaduct Closed (No Build Alternative)	Year 2015 Project	2030 Project
Seattle Center City					
AM	385,400	422,100	381,800	416,000	432,300
PM	472,400	523,400	476,000	516,000	541,300
Daily	2,118,200	2,371,600	2,175,000	2,342,900	2,463,600
Four-County Region					
AM	13,830,000	15,803,200	15,739,200	15,799,100	17,665,800
PM	16,116,800	18,562,800	18,508,900	18,558,000	20,831,900
Daily	73,622,500	84,769,700	84,501,000	84,754,100	94,955,300

For the 2015 Viaduct Closed (No Build Alternative), daily and AM and PM peak period VMT for the four-county region are about the same as those for the 2015 Baseline and 2015 Project scenarios. However, in the Center City area, AM Peak period VMT for the Viaduct Closed (No Build Alternative) is over 10 percent lower than for the 2015 Baseline scenario and over 9 percent lower than for the 2015 Project scenario. In the AM peak period, the Viaduct Closed (No Build Alternative) VMT is almost 11 percent lower than for the Baseline and 9 percent lower than for the Project. Lower VMT in the Center City area under the 2015 Viaduct Closed (No Build Alternative) is probably the result of increased congestion and delay due to the closure of the viaduct and redistribution of trips from this facility to congested surface streets, which would tend to discourage travel in this area.

For the 2015 Baseline scenario, daily VMT for the four-county Puget Sound region increase by about 15 percent over existing conditions (2005) levels, resulting from the forecasted growth in regional population and employment within the four-county region. Comparable increases in VMT are shown for the AM and PM peak periods. The 2015 Project scenario shows a very slight decrease in daily miles traveled in comparison with the 2015 Baseline scenario, both regionwide and for the Center City area. The slight decrease is likely due to the removal of access to the Magnolia/Interbay/Ballard areas in the Bored Tunnel Alternative. The 2015 Baseline scenario assumes that the ramps at Elliott and Western Avenues provide access to trips to and from northwest Seattle.

Daily VMT for the four-county region increases by 12 percent over the 2015 Baseline and Project scenarios. The 2030 VMT increase in the Center City area is expected to be less, however, at approximately 5 percent over 2015 Project conditions. For the 2030 Project, in the AM peak period, the 2030 Project VMT is expected to grow by about 4 percent over 2015 Project levels and by more than 2 percent over 2015 Baseline levels for the Center City area. For the PM peak period, the 2030 Project VMT is expected to grow by more than 3 percent over 2015 Baseline levels and by 5 percent over 2015 Project levels.

5.1.2 Vehicle Hours of Travel

VHT is defined as the calculated total number of hours traveled in either the four-county Puget Sound region or the Seattle Center City study area for a given time period. The VHT estimates discussed below were derived by the project's travel demand model. The evaluation describes AM and PM peak period and daily VHT totals for the 2015 Baseline, Viaduct Closed (No Build Alternative), and Project scenarios and the 2030 Project scenario. Exhibit 5-2 provides a summary table of VHT.

Key Findings

- Under the 2015 Baseline scenario, daily VHT for the four-county Puget Sound region is projected to grow by more than 25 percent over existing conditions (2005) levels. Comparable levels of growth in daily VHT are found in the Center City area, as well as in the AM and PM peak periods for both the four-county and Center City areas.
- Increased congestion levels brought about by the closure of the viaduct in the Viaduct Closed (No Build Alternative) are likely causing the measurable increase in VHT over the 2015 Baseline and Project levels.
- By 2030, the greatest percentage growth in VHT is expected to occur outside of the City of Seattle due to higher growth rates in population and employment outside of the city.

Under the 2015 Baseline, daily VHT for the four-county region increases by about 27 percent over comparable existing conditions levels. The 2015 Baseline AM peak period VHT is also forecasted to grow by more than 36 percent over existing conditions levels, and VHT for the PM peak period 2015 Baseline scenario is forecasted to increase similarly, by almost 35 percent over the comparable existing conditions levels. The daily and AM and PM peak period 2015 Baseline scenario shows VHT for the four-county region about equal to those forecasted for the 2015 Project scenario.

Exhibit 5-2. Vehicle Hours of Travel

Performance Measure	Existing (2005)	Year 2015			2030 Project
		Baseline	Viaduct Closed (No Build Alternative)	Project	
Seattle Center City					
AM	13,200	16,200	17,500	16,500	18,000
PM	17,600	22,900	25,500	23,600	29,600
Daily	67,500	83,000	87,500	84,300	96,600
Four-County Region					
AM	452,100	615,800	614,000	616,400	945,600
PM	517,800	697,700	700,100	698,700	1,037,500
Daily	2,021,800	2,568,800	2,569,900	2,571,000	3,532,500

Note: The VHT estimates do not include centroid connectors in the calculations.

For the 2015 Viaduct Closed (No Build Alternative), daily and AM and PM peak period VHT for the four-county region are forecasted to be about the same as those for the 2015 Baseline and 2015 Project scenarios.

In the Center City area, during the AM peak period, the 2015 Viaduct Closed (No Build Alternative) is 8 percent higher than for the 2015 Baseline scenario and 6 percent higher than for the 2015 Project scenario. During the PM peak period, the Viaduct Closed (No Build Alternative) shows over 11 percent higher VHT than the 2015 Baseline scenario and 8 percent higher than the 2015 Project scenario. Daily VHT is slightly higher for 2015 Viaduct Closed (No Build Alternative) than for the 2015 Baseline (4 percent) and 2015 Project (5 percent) scenarios. Increased congestion levels brought about by the closure of the Alaskan Way Viaduct and no replacement in capacity (assumed under the Viaduct Closed [No Build Alternative]) are likely causing the measurable increase in VHT over 2015 Baseline and Project scenarios.

For the 2030 Project scenario, daily VHT for the four-county region is expected to grow from the 2015 Project level by approximately 37 percent. AM peak period VHT is forecasted to increase by 53 percent, and PM peak period VHT by 48 percent. In the Center City area, however, VMT is expected to grow by only 9 percent in the AM peak period, 25 percent in the PM peak period, and 15 percent on a daily basis between the 2015 and 2030 Project scenarios. The reason for the higher percentage growth in VHT for the four-county region over the Center City area is likely the higher overall growth in population and employment forecasted to occur outside of the city of Seattle.

5.1.3 Vehicle Hours of Delay

VHD is defined as the calculated total number of hours during which normal traffic flows exceed roadway capacity in either the four-county Puget Sound region or the Seattle Center City study area for a given time period. This measure is often used as an indicator of overall traffic congestion. The VHD estimates were derived by the project's travel demand model. The evaluation describes AM and PM peak periods and daily totals for the 2015 Baseline, Viaduct Closed (No Build Alternative), and Project scenarios and the 2030 Project scenario. Exhibit 5-3 provides a summary table of VHD.

Key Findings

- Looking at activity in the Center City area, increased congestion levels brought about by the closure of the viaduct are likely causing the measurable increase in VHD over 2015 Baseline and Project levels.
- By 2030, a higher percentage growth in VHD is projected to occur outside the city of Seattle, reflecting the fact that a higher number of new trips to/from downtown are expected to be accommodated by transit in the future.

Exhibit 5–3. Vehicle Hours of Delay

Performance Measure	Existing (2005)	Year 2015			2030 Project
		Baseline	Viaduct Closed (No Build Alternative)	Project	
Seattle Center City					
AM	3,500	5,300	7,100	5,700	6,800
PM	5,400	9,200	12,400	10,000	15,100
Daily	14,500	22,900	30,000	24,500	33,200
Four-County Region					
AM	137,600	253,500	252,700	254,200	531,500
PM	149,900	271,800	274,800	272,800	548,100
Daily	384,800	678,100	682,600	680,200	1,370,400

In 2015, during the AM peak period, the Baseline scenario VHD for the four-county region increases by about 84 percent over the comparable existing conditions (2005) VHD. The Baseline PM peak period VHD increases by 81 percent over the existing conditions VHD, and daily VHD for the Baseline scenario increases by about 76 percent over the comparable existing conditions VHD. The 2015 Baseline scenario shows daily and AM and PM peak period VHD about equal to those forecasted for the 2015 Project, both regionwide and for the Center City area.

The 2015 Viaduct Closed (No Build Alternative) shows about the same levels of VHD as those for the 2015 Baseline and Project scenarios for the daily and AM and PM peak periods in the four-county region. Looking at the Center City area, however, the daily VHD for the Viaduct Closed (No Build Alternative) is substantially higher than for the Baseline (31 percent) and Project (22 percent) scenarios. In the AM peak period, the Viaduct Closed (No Build Alternative) also shows similar VHD increases over those for the Baseline (34 percent) and Project (25 percent) scenarios, while in the PM peak period, the Viaduct Closed (No Build Alternative) continues to show higher VHD than the Baseline (35 percent) and Project (24 percent) scenarios.

For the 2030 Project scenario, daily VHD levels for the four-county region are expected to grow from 2015 Project levels by approximately 102 percent. AM peak period VHD is forecasted to increase by 110 percent, and PM peak period VHD by 102 percent. However, VHD growth within the Center City area between the 2015 and 2030 Project scenarios is expected to be lower, at 19 percent, 51 percent and 36 percent for the AM, PM and daily periods, respectively. The lower rate of increase expected within the Center City area is likely due to the fact that with the proposed enhancements to transit serving downtown, much of the growth in trips is expected to be accommodated by transit as opposed to additional vehicle trips.

5.1.4 Alaskan Way Viaduct (SR 99) Users

The following sections present data that describe users of SR 99 within the study area for the 2015 Baseline and Project scenarios.

Key Findings

- Traffic patterns of SR 99 users for the 2015 Baseline scenario are expected to be similar to those described for existing conditions, except that less traffic is expected to use the midtown ramps due to a shift to the stadium ramps. The stadium ramps are also expected to attract some traffic to SR 99 that would have otherwise used First Avenue S. to reach destinations in the SODO area.

- The Bored Tunnel Alternative would serve a higher percentage of through traffic to/from SR 99/Aurora Avenue north of the project area than the current facility does. Of the 81,100 trips projected to use the bored tunnel in the 2015 Baseline scenario, 70 percent are expected to come from Aurora Avenue north of Aloha Street, and 30 percent from the South Lake Union area. This compares to current through trips on SR 99 of roughly 46 percent from Aurora Avenue north of Aloha Street and 17 percent from South Lake Union. (Note that the Elliott/Western ramps provide the other 38 percent of the existing through traffic.)
- Some traffic that would have otherwise used the Elliott/Western ramps to access SR 99 is expected to use Mercer Street to access SR 99 at the South Lake Union area ramps instead. This contributes to the relatively high percentage of bored tunnel traffic (30 percent) accessing SR 99 from the South Lake Union area.
- The new stadium area ramps to/from the south are expected to serve both traffic destined for downtown (i.e., the traffic that currently uses the midtown ramps) as well as a large share of the traffic destined for the Interbay area, Magnolia, and northwest Seattle (i.e., traffic that currently uses the Elliott/Western ramps).

SR 99 Daily Traffic Patterns – 2015 Baseline

Traffic patterns of SR 99 users for the 2015 Baseline scenario are expected to be similar to those described for Existing Conditions, except that less traffic is expected to use the midtown ramps due to a shift to the stadium ramps. The stadium ramps are also expected to attract some traffic to SR 99 that would have otherwise used First Avenue S. to reach destinations in the SODO area.

SR 99 Daily Traffic Patterns – 2015 Project

Exhibit 5-4 shows the projected daily traffic patterns on SR 99 within the study area in the 2015 Project scenario. Blue 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 ramp movement. Because access in the South Lake Union area is provided by many closely spaced cross-streets, these movements are shown grouped.

At the north end of the study area (on Aurora Avenue), about 40 percent of trips using SR 99 are expected to enter and exit the corridor north of the Battery Street Tunnel. Of the 94,900 daily vehicle trips on Aurora Avenue, 38,100 trips would enter and exit in the South Lake Union area.

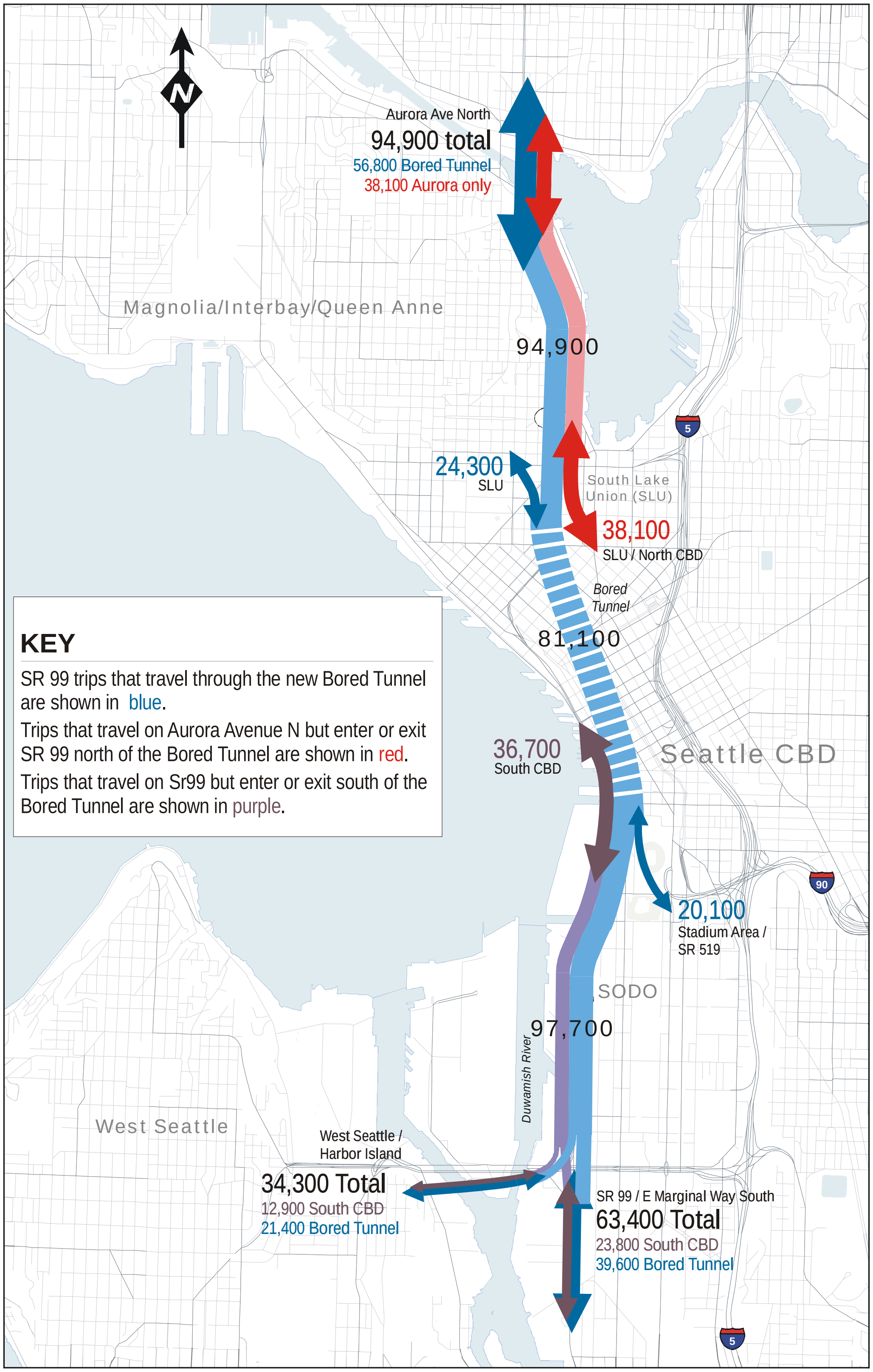


Exhibit 5-4
Daily SR 99 Traffic Patterns - 2015 Project

Some 81,100 vehicles are projected to use the bored tunnel on a typical weekday. Seventy percent of the bored tunnel traffic consists of the remainder (56,800 trips) of the Aurora Avenue trips; the 24,300 additional trips (or 30 percent of the bored tunnel traffic) enter and exit the corridor in the South Lake Union area.

At the south end of the downtown area, 36,700 vehicles are anticipated to travel between SR 99 south of the project area and the ramps at S. King Street. An additional 20,100 vehicles would exit SR 99 southbound or enter it northbound using the stadium area ramps.

At S. Spokane Street, 34,300 vehicles are projected to exit/enter the corridor to/from the west via either the West Seattle high bridge or the low bridge to Harbor Island. About two-thirds of those vehicles (21,400) are estimated to be vehicles emerging from or destined for the bored tunnel, while the remainder would be vehicles that would enter or exit south of the CBD. Approximately 63,400 trips would exit/enter the corridor to/from SR 99 south of S. Spokane Street. Again, almost two-thirds of these vehicles would be coming from or going to the bored tunnel, while the remainder would be vehicles entering or exiting south of the CBD.

5.1.5 Screenline Vehicle Volumes

AM and PM peak period and daily traffic volumes were assessed to gauge the general impacts to parallel streets and highways. Traffic volume forecasts from the project were measured at four screenline locations:

- A south screenline north of S. Spokane Street (referred to as the Spokane screenline), representing traffic entering and exiting the study area from and to the south.
- A south screenline south of S. King Street, representing traffic entering and exiting the study area at the south end of downtown.
- A central screenline north of Seneca Street, capturing north/south traffic flows in the center of the study area.
- A north screenline located north of Thomas Street, representing traffic entering and exiting the study area to the north.

Screenline volume results are presented in Exhibit 5-5. Additionally, daily volumes along key facilities (Alaskan Way, SR 99, and I-5) and arterial screenline volumes at locations generally similar to the above screenlines were compared across the scenarios and are shown graphically in Exhibits 5-6 and 5-7. Daily traffic volumes at two additional screenlines, east and west of Aurora Avenue, in north Seattle were also measured, representing the traffic traveling to and from the SR 99 corridor between the Ship Canal and Northgate Way. These results are shown graphically in Exhibit 5-8.

Key Findings

- The Alaskan Way surface street is projected to experience 24 to 37 percent heavier traffic than under Baseline conditions, but still 24 to 39 percent less than under the Viaduct Closed (No Build Alternative).
- For all screenlines assessed, both the 2015 Project and Baseline scenarios carry about the same amount of traffic (they show a 1 percent or less difference), which shows that the bored tunnel would accommodate a similar number of trips as under the Baseline condition even though access points in the corridor would have changed.
- The 2015 Project scenario shifts additional trips to the Alaskan Way surface street, which is projected to experience 24 to 37 percent heavier traffic than under Baseline conditions (but still 24 to 39 percent less than under the Viaduct Closed [No Build Alternative]). This shift is due to the changes to the Ballard/Interbay access to SR 99.
- For the Spokane and south screenlines, the Viaduct Closed (No Build Alternative) would have lower vehicle volumes than the 2015 Baseline and 2015 Project scenarios during congested peak periods. This is likely the result of an overall redistribution of trips and a reduction in demand to and through downtown Seattle due to reduced capacity through the central waterfront.
- As reflected in the central screenline, in the Viaduct Closed (No Build Alternative), dramatic increases are expected in Alaskan Way traffic and, to a lesser extent, other downtown north-south arterials due to removal of the viaduct and a shift of many of those viaduct trips to parallel arterials.
- New east-west connections across Aurora Avenue contained in the Project scenario provide greater mobility in the South Lake Union area and promote better utilization of the street grid.
- East-west traffic volumes on arterials both east and west of Aurora Avenue north of the Ship Canal are expected to be similar among the 2015 Baseline and Project scenarios, indicating that diversion from the 15th Avenue N.W./Elliott Avenue N. corridor to SR 99 or I-5 is not expected to occur.

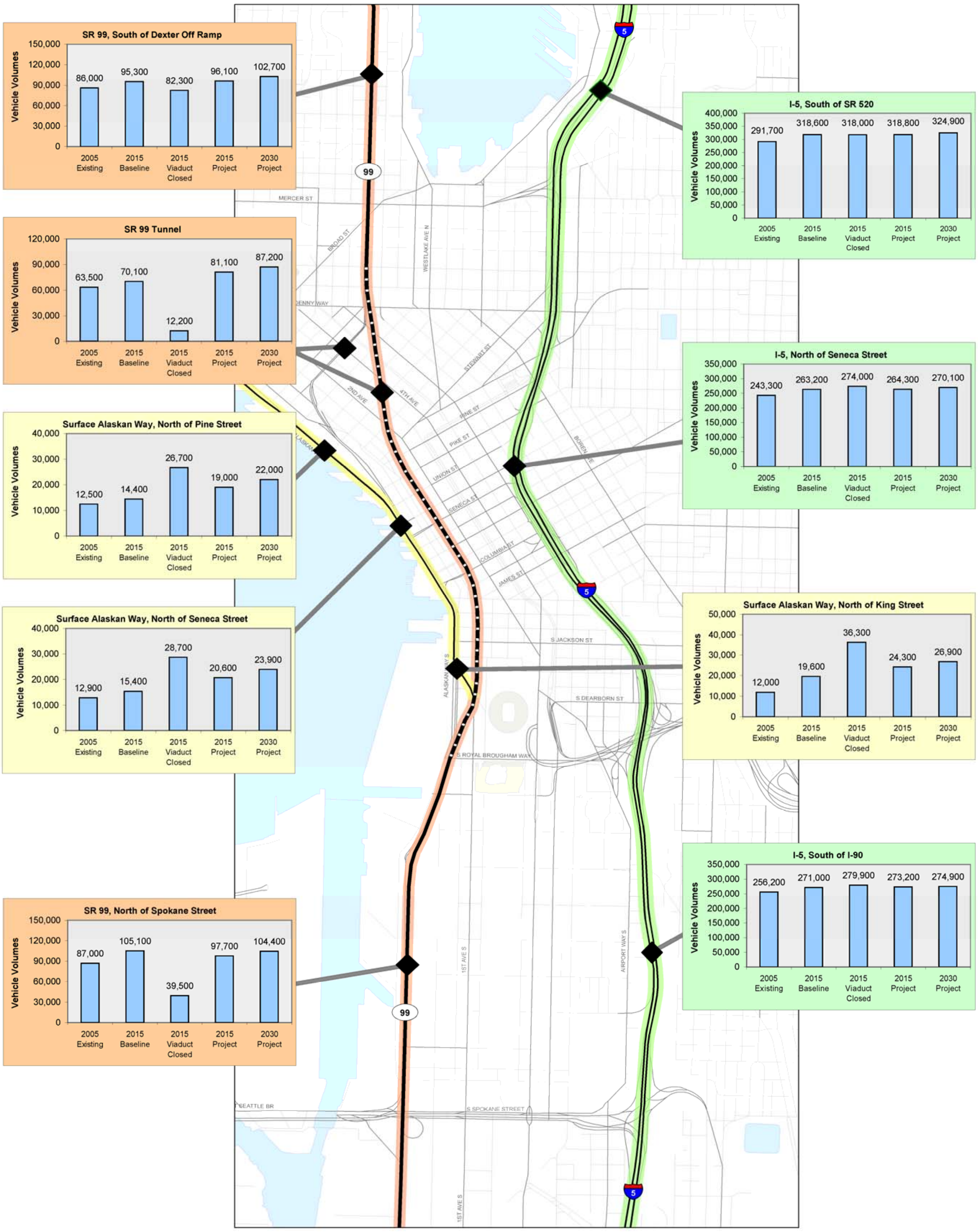
Exhibit 5-5. Model-Estimated Vehicle Volumes at Screenlines

	2005 Existing	2015 Baseline	Viaduct Closed (No Build Alternative)	2015 Project	2030 Project
Spokane Screenline (North of S. Spokane Street)					
AM	31,060	33,310	30,320	33,000	34,660
PM	33,610	37,280	33,680	37,770	38,580
Daily	422,800	473,500	435,200	468,900	497,600
South Screenline (South of S. King Street)					
AM	33,410	36,330	32,440	36,080	37,510
PM	37,580	42,340	37,640	42,130	43,630
Daily	470,500	534,900	531,900	536,800	561,600
Central Screenline (North of Seneca Street)					
AM	30,980	33,230	28,420	32,880	34,060
PM	34,590	37,190	31,790	36,790	37,850
Daily	409,700	444,800	387,600	440,400	453,900
North Screenline (North of Thomas Street)					
AM	36,720	39,550	35,910	39,360	40,650
PM	40,280	43,290	39,920	43,690	46,370
Daily	478,700	517,800	473,500	523,600	558,600

Spokane Screenline

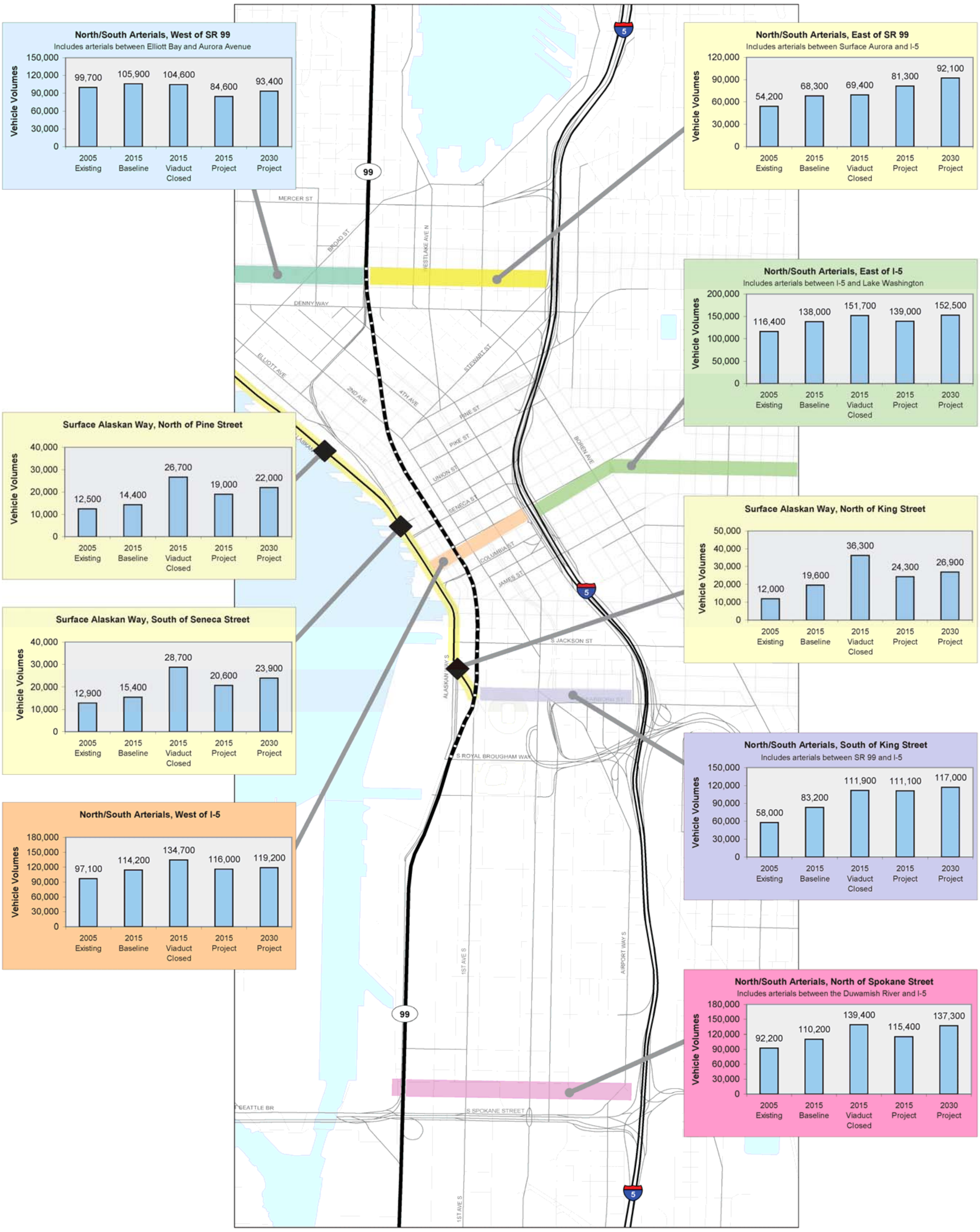
For the Spokane screenline, the 2015 Baseline and the 2015 Project volumes are projected to be similar, indicating that both scenarios would accommodate the same number of trips. Volumes for both scenarios were also higher than for existing conditions (2005), with an increase of 6 to 7 percent in the AM peak period and 11 to 12 percent in both the PM peak and daily periods.

Under the Viaduct Closed (No Build Alternative), peak demand at this screenline was about 11 percent less and the daily volume was 8 percent less than for the 2015 Baseline and 2015 Project scenarios. This was likely the result of an overall redistribution of trips and a reduction in demand to and through downtown Seattle due to reduced capacity through the central waterfront. While the total volumes decrease in the Viaduct Closed (No Build Alternative), the arterials in the 2015 Baseline and 2015 Project scenarios handle much of the demand, with volume increases of 26 percent and 21 percent, respectively.



N

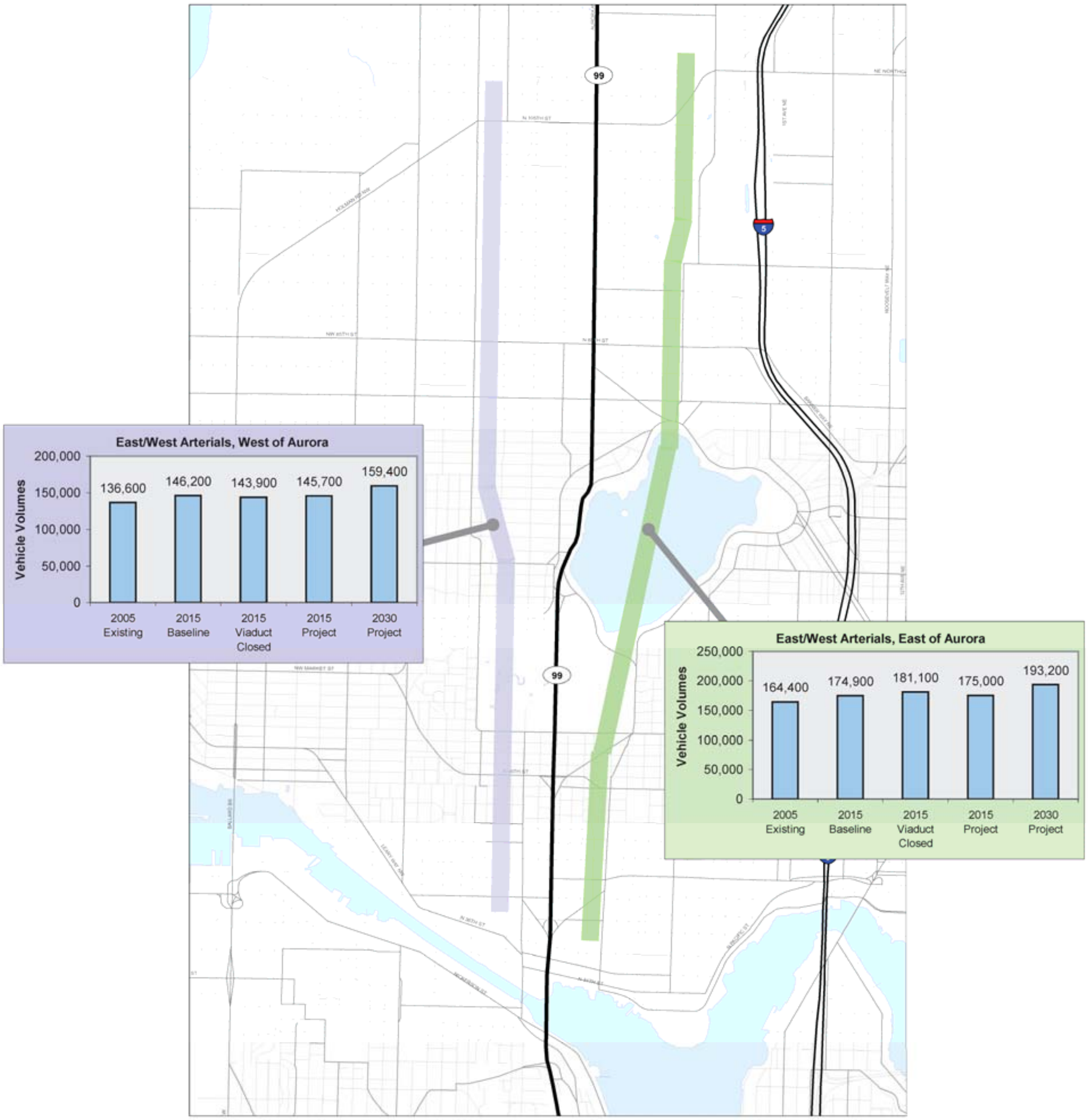
Exhibit 5-6
Daily Vehicle Volumes on I-5, SR 99, and Surface Alaskan Way



Arterial screenlines do not include I-5 or SR 99 volumes

N

Exhibit 5-7
Daily Vehicle Volumes on Arterials



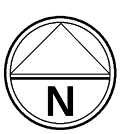


Exhibit 5-8
Daily Vehicle Volumes on Arterials
In North Seattle

South Screenline

For the south screenline, the 2015 Baseline scenario is projected to be slightly higher in the AM peak period (almost 9 percent) and in the PM peak period (almost 13 percent) than for existing conditions (2005). Daily screenline totals are expected to increase by almost 14 percent.

The 2015 Project scenario is estimated to have similar overall volumes as the 2015 Baseline scenario (see Exhibit 5-5), indicating that it accommodates the same number of trips. However, as can be seen in Exhibit 5-7, for the arterial screenline in the same location and for Alaskan Way volumes north of S. King Street, the volumes are expected to be redistributed such that the surface arterials under the 2015 Project carry a higher proportion of the overall screenline traffic, and SR 99 a lower proportion, in comparison to the 2015 Baseline. This is due to the relocation of the downtown access from the midtown ramps to the stadium ramps, and the Ballard/Interbay access from the Elliott/Western ramps also to the stadium ramps; the 2015 Project scenario directs more traffic to the surface arterials at this location than the 2015 Baseline scenario.

Under the Viaduct Closed (No Build Alternative), peak period demand at this screenline was about 12 percent less than with the comparable 2015 Baseline and 2015 Project scenarios. This was likely the result of an overall redistribution of trips and a reduction in demand to and through downtown Seattle due to reduced capacity through the central waterfront. Overall, daily screenline volumes were about equal between the 2015 Baseline, 2015 Project, and the 2015 Viaduct Closed (No Build Alternative) scenarios. In addition, vehicle demand displaced off of the Alaskan Way Viaduct under the Viaduct Closed (No Build Alternative) is showing up on parallel arterials, such as Alaskan Way S. Under the Viaduct Closed (No Build Alternative), daily vehicle volumes on Alaskan Way S. increase by about 225 percent over the 2015 Baseline levels. Peak period vehicle volumes here are over 240 higher under the Viaduct Closed (No Build Alternative) than under the 2015 Baseline scenario.

Central Screenline

2015 Project vehicle volumes at this screenline are very close to the 2015 Baseline volumes for the peak and daily travel periods (within 1 percent), which indicates that the Bored Tunnel Alternative provides capacity comparable to the Alaskan Way Viaduct (2015 Baseline). However, similar to the south screenline, the volumes are expected to be redistributed such that the surface arterials under the 2015 Project scenario carry a higher proportion of the overall screenline traffic, and SR 99 a lower proportion, in comparison to the 2015 Baseline. This is due primarily to the relocation of the Ballard/Interbay access from the Elliott/Western ramps to the stadium ramps in the 2015 Project scenario, which directs more traffic to Alaskan Way than the 2015 Baseline scenario.

Volumes were about the same on north-south arterials east of I-5 for both the 2015 Project and the 2015 Baseline scenarios. Both of these scenarios showed almost the same amount of traffic on I-5 for both the peak and daily travel periods as well, indicating little shift in traffic to I-5.

As shown in Exhibit 5-5, the scenario with the highest peak period and daily volumes remained the 2030 Program scenario. Volumes for this scenario are about 3 percent higher than for the 2015 Project scenario for all time periods. They are also about 2 percent higher than in the 2015 Baseline scenario, reflecting that the 2030 Project scenario would experience very marginal growth in vehicle volumes at this location.

The scenario with the lowest total daily and peak period screenline vehicle volumes is the Viaduct Closed (No Build Alternative). Volumes are lowest here due to the removal of the Alaskan Way Viaduct and the resulting redistribution of traffic on already congested roadways, which results in some trips not traveling through the downtown area.

While the estimated vehicle volumes at screenlines in the aggregate reflect one picture of vehicle demand on downtown streets, individual streets behaved much differently. As shown in Exhibit 5-6, Alaskan Way surface street consistently carried the most traffic during the AM and PM peak and daily periods under the Viaduct Closed (No Build Alternative). This was the case at all the locations evaluated along the waterfront. As shown in Exhibit 5-7, this phenomenon also carried to the north-south screenline west of I-5 (south of Madison Street), as these streets also carried higher vehicle volumes than were found in any other alternative. The higher volumes on Alaskan Way and the other north-south arterials under the Viaduct Closed (No Build Alternative) are due to the fact that these streets would need to absorb all traffic diverted from the (now closed) Alaskan Way Viaduct (SR 99).

Vehicle volume differences were less pronounced for those north-south arterials located east of I-5 than for those located on the west side of the freeway. As shown in Exhibit 5-7, daily vehicle volumes were 18 percent higher for the Viaduct Closed (No Build Alternative) than for the Baseline scenario for those arterials west of I-5, while Viaduct Closed (No Build Alternative) volumes were slightly less than 10 percent higher than Baseline volumes for the arterials east of I-5.

North Screenline

2015 Project daily vehicle volumes for north-south arterials on the west side of SR 99 (see Exhibit 5-7) show a 20 percent decrease over the 2015 Baseline levels. This change is more indicative of where the screenline is placed in relation to the street network than a true decrease of trips through this area. In the 2015 Baseline scenario, many trips traveling between the South Lake Union area and Elliott Avenue N. use Broad Street and Denny Way and then travel north on Elliott Avenue N., effectively crossing the north screenline twice. Because the 2015 Project scenario removes Broad Street between Ninth Avenue N. and Taylor Avenue N., and Mercer Street is made two-way between Ninth Avenue N. and Fifth Avenue N., these same trips between the South Lake Union area and Elliott Avenue N. are projected instead to stay on Mercer and Roy Streets in the 2015 Project and would not be counted at all in the north screenline volumes. On the other hand, daily volumes vary greatly on north-south arterials east of SR 99. The 2015 Project daily volumes are about 19 percent higher than those for the 2015 Baseline and Viaduct Closed (No Build Alternative) scenarios. This is likely due to improved east-west connections across Aurora Avenue (i.e., John, Thomas, and Harrison Streets as well as two-way Mercer Street), which allows for greater use of the grid network in the South Lake Union area.

North Seattle Screenlines

Vehicle volumes on east-west arterials north of the Ship Canal are very similar across all 2015 scenarios (see Exhibit 5-8). Volume changes across these screenlines are projected to be less than 0.5 percent between the 2015 Baseline and 2015 Project scenarios, indicating that diversion from the 15th Avenue N.W./Elliott Avenue N. corridor to SR 99 or I-5 is not expected to occur. The largest impact on vehicle volumes is with the Viaduct Closed (No Build Alternative), which shows a 3 percent increase over 2015 Baseline levels on arterials between Aurora Avenue and I-5, likely due to diversion of vehicles to I-5 from SR 99 to access destinations downtown and southward.

5.1.6 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, which 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.

This evaluation compares the total number of persons carried by the three major east-west screenlines in the study area. The evaluation describes AM and PM peak periods and daily totals for the 2015 Baseline and Project and the 2030

Project scenarios. Exhibit 5-9 provides a summary table of the person throughput by screenline for the study area.

Key Findings

- As reflected in all Center City screenlines, there would be a slight reduction in 2015 Viaduct Closed (No Build Alternative) person throughput in comparison to the respective 2015 Baseline and Project scenarios. This was likely the result of the removal of the capacity provided by the Alaskan Way Viaduct and redistribution of some trips to avoid traveling on already congested parallel facilities through downtown (i.e., downtown arterials and I-5).

Exhibit 5-9. Model-Estimated Daily Person Throughput (Person-Trips)

	2005 Existing	2015 Baseline	Viaduct Closed (No Build Alternative)	2015 Project	2030 Project
South Screenline (South of S. King Street)					
AM	45,690	54,730	49,950	54,000	65,350
PM	55,140	67,480	61,110	66,630	79,060
Daily	644,680	782,900	771,600	776,940	883,590
Central Screenline (North of Seneca Street)					
AM	46,090	52,870	46,970	52,330	60,360
PM	54,530	62,310	54,900	61,530	69,840
Daily	585,120	659,170	579,900	650,270	746,610
North Screenline (North of Thomas Street)					
AM	53,190	59,370	55,440	59,120	67,730
PM	61,990	69,460	65,200	70,030	80,770
Daily	672,920	752,450	698,420	760,840	866,730

South Screenline

During the 2015 Baseline scenario AM peak period, this screenline would carry almost 55,000 person trips, while during the PM peak period this screenline is forecasted to carry over 67,000 person trips. There are almost 783,000 daily person trips forecasted to be carried on the south screenline under 2015 Baseline conditions. Both the 2015 Baseline and 2015 Project scenarios carry virtually the same number of persons at this screenline location. The 2015 Viaduct Closed (No Build Alternative) carries slightly fewer person trips than the Baseline and Project scenarios, which is likely the result of the removal of the Alaskan Way Viaduct and redistribution of its traffic onto already congested north-south arterials and

I-5. By 2030, under the Project scenario, the south screenline would carry almost 834,000 daily persons, which is about 11 percent over 2015 Baseline levels. The AM and PM peak periods would carry slightly higher percentages of total person trips for the 2030 Project scenario than for the 2015 Baseline scenario.

Central Screenline

The central screenline carries about 659,000 daily persons under the 2015 Baseline conditions. During the AM peak period, this screenline would carry over 53,000 persons, while during the PM peak period it is forecasted to carry almost 62,000 person trips. Both the 2015 Baseline and 2015 Project scenarios forecast virtually the same number of persons at this screenline location. By 2030, the Project scenario would carry almost 747,000 daily persons, which is about 13 percent over the 2015 Baseline levels. During the AM peak period, the 2030 Project scenario would carry over 14 percent more people than the comparable period under the 2015 Baseline scenario. In the PM peak period, the 2030 Project would carry over 12 percent more people than the comparable period under the 2015 Baseline.

North Screenline

The north screenline would carry about 752,000 daily persons under the 2015 Baseline conditions. During the AM peak period, this screenline would carry over 59,000 persons, while during the PM peak period it would carry almost 70,000 person trips. Both the 2015 Baseline and 2015 Project scenarios would carry virtually the same number of persons at this screenline location. By 2030, under the Project scenario, the screenline would carry almost 867,000 daily persons, which is about 15 percent over the 2015 Baseline levels. During the AM peak period under the 2030 Project scenario, this screenline would carry over 14 percent more people than during the comparable period under the 2015 Baseline scenario. In the PM peak period under the 2030 Project scenario, this screenline would carry over 16 percent more people than during the comparable period under the 2015 Baseline scenario.

5.2 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-/off-ramps. This discussion focuses on the three applicable scenarios for operational impacts represented by 2015 Baseline, 2015 Project and 2030 Project conditions.

Key Findings

- Baseline volumes show peak period directionality, with higher volumes inbound to downtown during the AM peak hour, and the reverse during the PM peak hour.
- The function of the midtown ramps in the Baseline scenario is supplemented by the stadium area ramps to/from the south, resulting in less traffic using the mid-town ramps as compared to existing conditions.
- Because of the reduced capacity for corridor through trips, the Viaduct Closed (No Build Alternative) scenario is expected to have considerably lower volumes on SR 99 just north and south of downtown as compared to the Baseline and the Bored Tunnel Alternative.
- The Bored Tunnel Alternative changes access to/from SR 99 and downtown. Ramps in the stadium area would provide the connection to downtown from the south, while the ramps to/from Aurora Avenue at Harrison Street would provide the access route in the north end. The stadium area ramps are projected to carry higher volumes than the corresponding existing ramps at Seneca and Columbia Streets in the Baseline scenario. This is due to the absence of the Elliott/Western ramps, resulting in a projected increase in vehicles travelling on Alaskan Way surface street and then accessing SR 99 via the stadium area ramps.
- Volumes on SR 99 through the midtown area are projected to be lower than in the Baseline scenario. However, as described previously, screenline analysis shows that these trips are accommodated elsewhere in the system, with the result that the total volume of trips carried by the system is approximately the same.
- Most segments of the SR 99 mainline in the 2015 Baseline scenario are expected to operate at LOS E or F. Conditions in the Viaduct Closed (No Build Alternative) scenario are expected to be worse, with extremely high travel times for those travelling through the CBD.
- With the 2015 Project scenario, traffic operations on the mainline are expected to be similar to or slightly improved in comparison with the 2015 Baseline, with segments generally operating at LOS D or E. Similarly, travel speeds are expected to be higher with the 2015 Project scenario than with 2015 Baseline scenario, and substantially higher than in the Viaduct Closed (No Build Alternative) scenario.
- With the 2030 Project scenario, traffic operations on the mainline are expected to worsen slightly compared to the 2015 Project scenario, with segments operating at LOS D to F due to increased demand. Travel speeds are also expected to decrease slightly compared to the 2015 Project.

5.2.1 Alaskan Way Viaduct Mainline and Ramp Volumes

This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the 2015 Viaduct Closed (No Build Alternative), 2015 Baseline, and 2015 and 2030 Project scenarios; specifically, these estimates for each connection to/from SR 99 (ramps or side streets) and for each mainline segment (section of SR 99 between connections) are discussed in detail below.

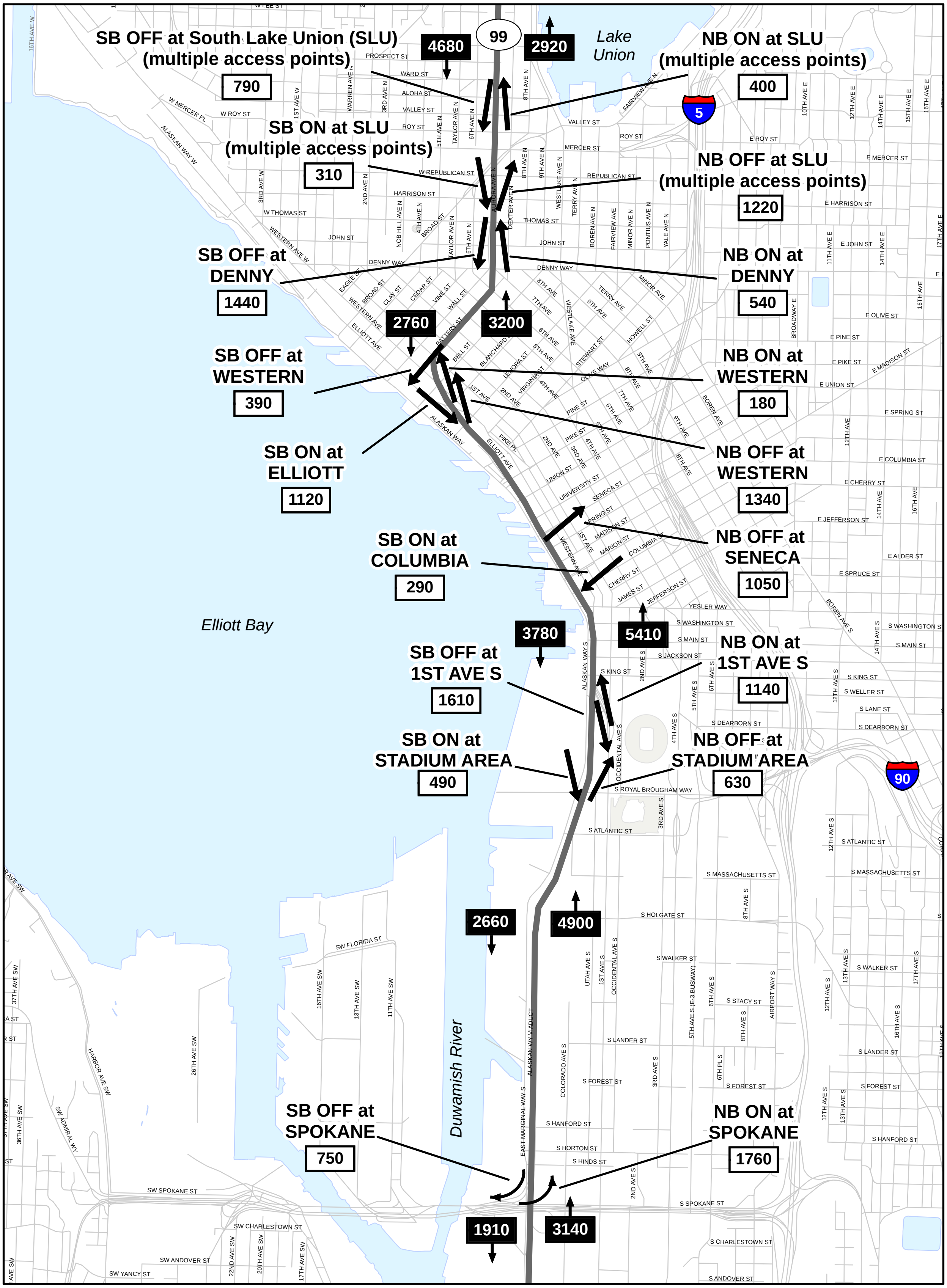
AM Peak Hour

As with most 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 5-10, 5-11, and 5-12 show the volumes in the AM peak hour for the Baseline, 2015 Project, and 2030 Project scenarios, respectively.

<u>2015 Baseline</u>

The downtown ramps providing access to and from the south show more vehicles exiting northbound SR 99 at Seneca Street (1,050 vehicles) than entering southbound SR 99 at Columbia Street (290 vehicles). AM peak hour mainline ramp volumes forecasted for the Baseline are shown in Exhibit 5-10. The First Avenue S. ramps show similar directionality, with 1,610 vehicles exiting southbound SR 99 in the morning but only 490 vehicles entering northbound to SR 99. South of downtown and the stadium area, mainline SR 99 volumes are considerably higher in the northbound direction (4,900 vehicles) than in the southbound direction (2,660 vehicles). At S. Spokane Street, volumes entering northbound SR 99 from West Seattle (1,760 vehicles) are more than double those exiting southbound SR 99 to West Seattle (630 vehicles). The volumes on the ramps at Seneca and Columbia Streets are projected to be generally lower than under existing conditions because of the new ramps at S. King Street, which would serve a similar function.

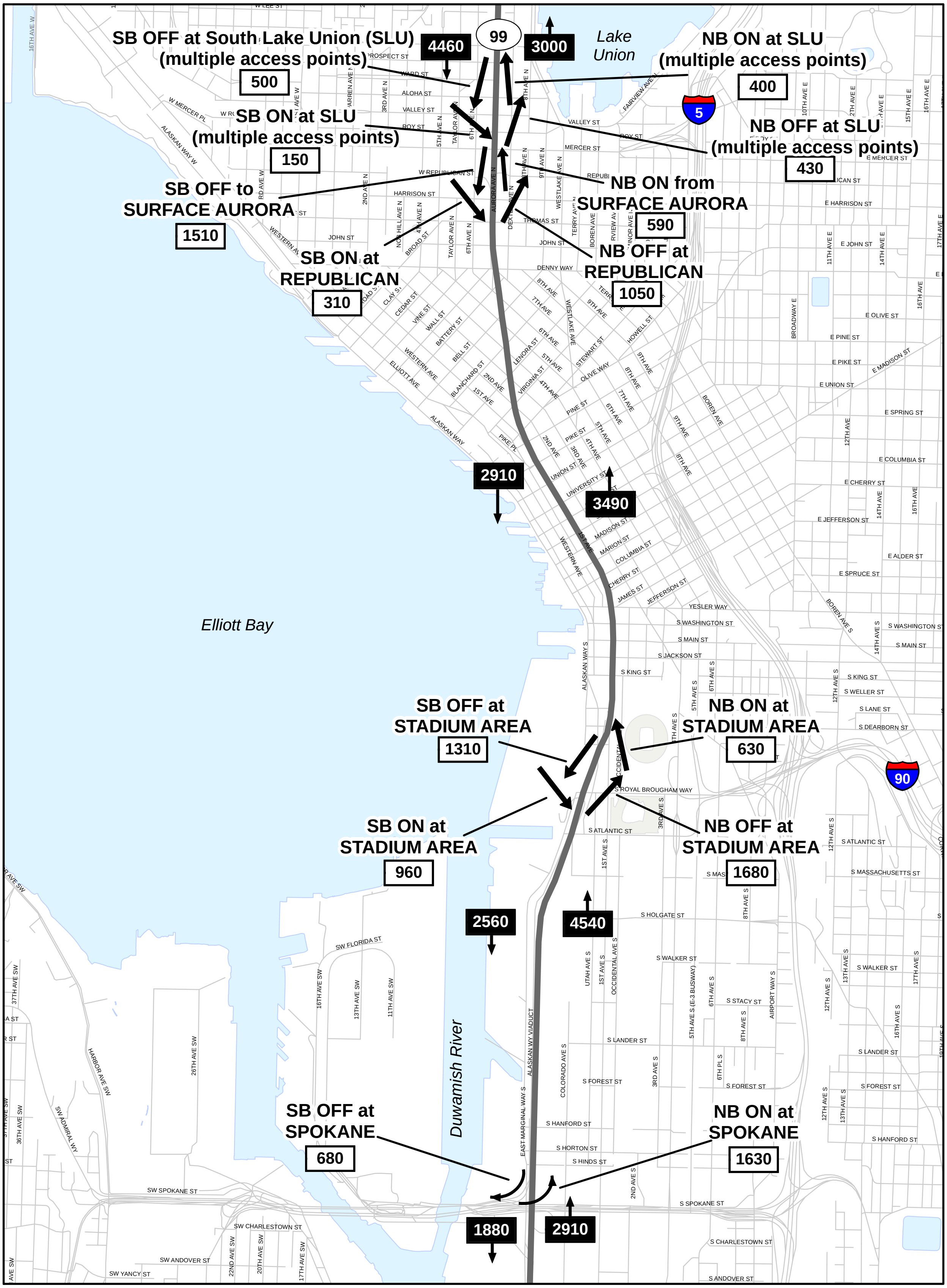
At the north end of the study area, AM peak hour mainline volumes are projected to be higher in the southbound direction (4,680 vehicles) than in the northbound direction (2,920 vehicles), as more vehicles are entering the South Lake Union and downtown areas. Southbound SR 99 off-ramp volumes at Denny Way (1,440 vehicles) exceed those on the northbound on-ramp (540 vehicles). In the Battery Street Tunnel, the northbound flow (3,200 vehicles) slightly exceeds the volume of southbound vehicles (2,760 vehicles), though volumes are generally similar overall. The ramps at the south end of the Battery Street Tunnel that provide access to and from the north show directionality as well, with 390 vehicles exiting southbound SR 99 and only 180 vehicles entering northbound SR 99. The Elliott/Western ramps to and from the south, however, do not show the same level of directionality, with 1,120 vehicles entering southbound SR 99 and 1,340 vehicles exiting northbound SR 99.



XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-10
AM Peak Hour Mainline and Ramp Volumes - 2015 Baseline



0 2,500
Feet

N

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-11
AM Peak Hour Mainline and Ramp Volumes - 2015 Project

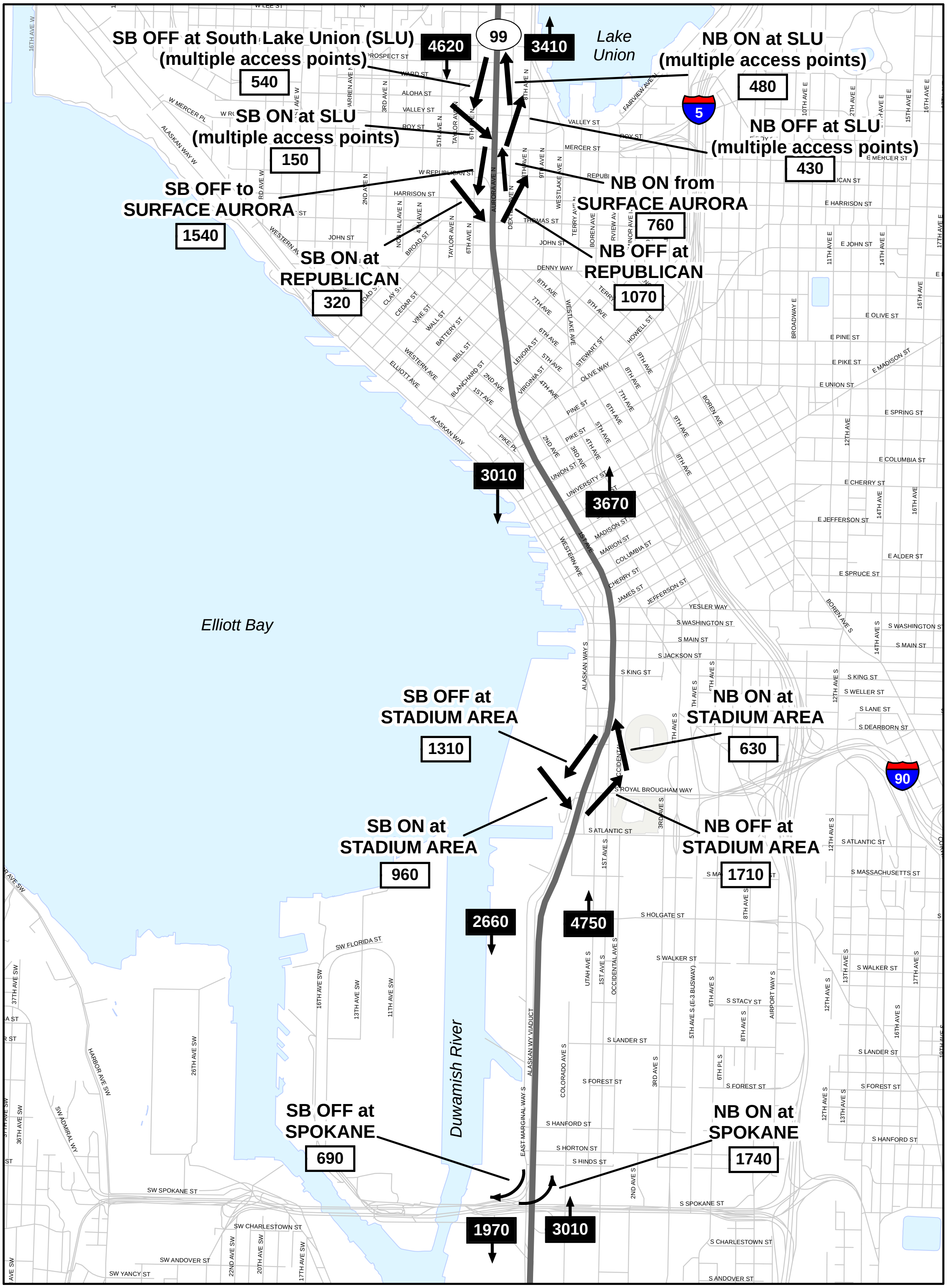


Exhibit 5-12
AM Peak Hour Mainline and Ramp Volumes - 2030 Project

2015 Viaduct Closed (No Build Alternative)

As the viaduct is assumed to be closed in this scenario, no southbound traffic is assumed to be on the facility between the Battery Street Tunnel off-ramp and the S. King Street on-ramp. Similarly, no northbound traffic is assumed to be on the facility between the S. King Street off-ramp and the Battery Street Tunnel on-ramp.

2015 Project

Compared with the 2015 Baseline, the 2015 Project (Bored Tunnel Alternative) scenario changes access to/from SR 99 and downtown. Ramps in the stadium area would provide the connection to downtown from the south, while the ramps to/from SR 99 at Harrison Street (ultimately to/from Denny Way) would provide the access route in the north end. The southbound stadium area on-ramp would serve vehicles that would otherwise have used the on-ramp at Columbia Street. It is expected to have higher volumes (960 vehicles) than the ramp at Columbia Street (290 vehicles) under Baseline conditions, partly due to the fact that, with the absence of the southbound on-ramp from Elliott Avenue, some traffic traveling through the corridor from points northwest of the CBD would use this entrance to travel further south. AM peak hour mainline ramp volumes forecasted for the 2015 Bored Tunnel Alternative are shown in Exhibit 5-11.

Similar to southbound, the northbound stadium area off-ramp would serve vehicles that would have otherwise used the Baseline ramp at Seneca Street. It is also expected to have higher volumes (1,680 vehicles) than the Baseline ramp at Seneca Street (1,050 vehicles). Also, similar to the southbound direction, this is partly due to the absence of the northbound off-ramp to Western Avenue. The mainline volumes in both directions south of the stadium area are similar under both Baseline and 2015 Project conditions.

The new downtown ramps providing access to and from the south show more vehicles exiting northbound SR 99 at S. King Street (1,680 vehicles) than entering southbound SR 99 (960 vehicles). The stadium ramps to and from the north show similar directionality, with 1,310 vehicles exiting southbound SR 99 but only 630 vehicles entering northbound SR 99. As with Baseline conditions, in the areas south of downtown and near the stadiums, mainline volumes are considerably higher in the northbound direction (4,540 vehicles) than the southbound direction (2,560 vehicles). At S. Spokane Street, volumes entering northbound from West Seattle (1,630 vehicles) are more than double those exiting southbound to West Seattle (600 vehicles).

The bored tunnel is projected to carry 2,910 vehicles southbound and 3,490 vehicles northbound during the AM peak hour. These volumes are lower than under Baseline conditions, with 3,490 southbound and 4,360 vehicles northbound through midtown between the Elliott/Western and Seneca/Columbia ramps. Again, this is because of the absence of the ramps at Elliott and Western Avenues. Many of the trips that would have used those Baseline ramps are anticipated to instead travel along the surface on Alaskan Way and other parallel streets. However, the bored tunnel volumes are higher than the volumes in the Battery Street Tunnel under Baseline conditions (2,760 vehicles southbound and 3,200 vehicles northbound), as some through traffic that would otherwise use parallel routes is attracted to the tunnel, including some vehicles that would have used the Elliott/Western ramps and are anticipated to access SR 99 north of downtown via Mercer Street.

At the north end of the study area, mainline volumes are anticipated to be fairly similar between Baseline and 2015 Project conditions, with 4,460 vehicles entering downtown (southbound) under Project conditions, compared to 4,680 vehicles under Baseline conditions. The Bored Tunnel Alternative does not include on-/off-ramps at Elliott and Western Avenues, generally resulting in slightly higher ramp volumes in the South Lake Union area in both directions compared to the Baseline. The higher volumes to and from the south in this area result because some of the traffic from northwest Seattle that previously used the Elliott/Western ramps to travel through the corridor are expected to take Mercer Street to access the bored tunnel at the Republican Street ramps.

2030 Project

The 2030 Project volume estimates are generally similar to 2015 Project forecasts, with modest increases in volumes for some mainline and ramp segments. Vehicle volumes in the bored tunnel are expected to increase to approximately 3,010 vehicles southbound and 3,670 northbound. AM peak hour mainline ramp volumes forecasted for the 2030 Project scenario are shown in Exhibit 5-12.

PM Peak Hour

Exhibits 5-13, 5-14, and 5-15 show the volumes in the PM peak hour for the Baseline, 2015 Project, and 2030 Project scenarios, respectively.

2015 Baseline

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 Baseline scenario are shown in Exhibit 5-13.

The downtown ramps to and from the south show more vehicles entering southbound SR 99 at Columbia Street (1,000 vehicles) than exiting northbound SR 99 at Seneca Street (660 vehicles). The First Avenue S. ramps show similar

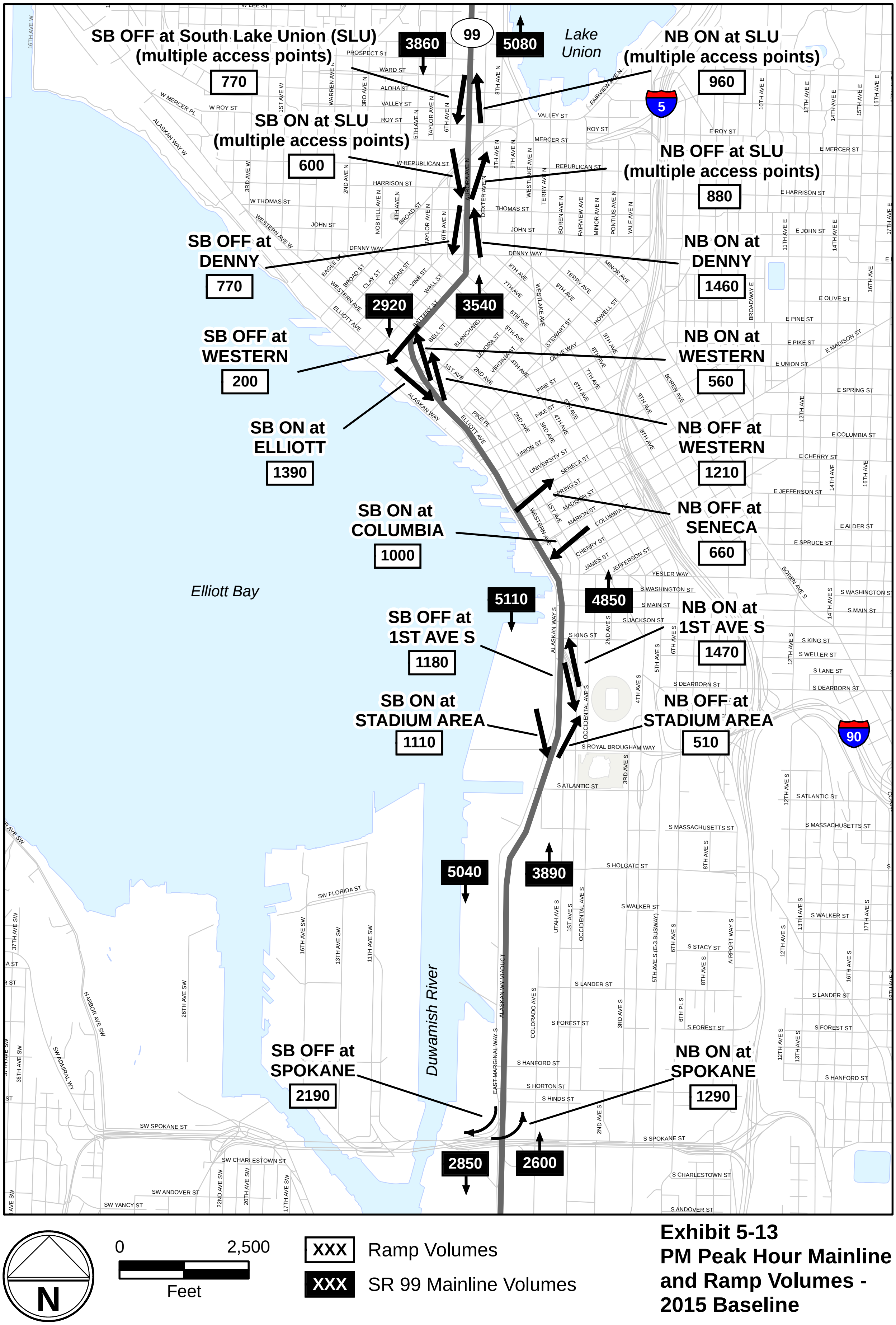


Exhibit 5-13
PM Peak Hour Mainline and Ramp Volumes - 2015 Baseline

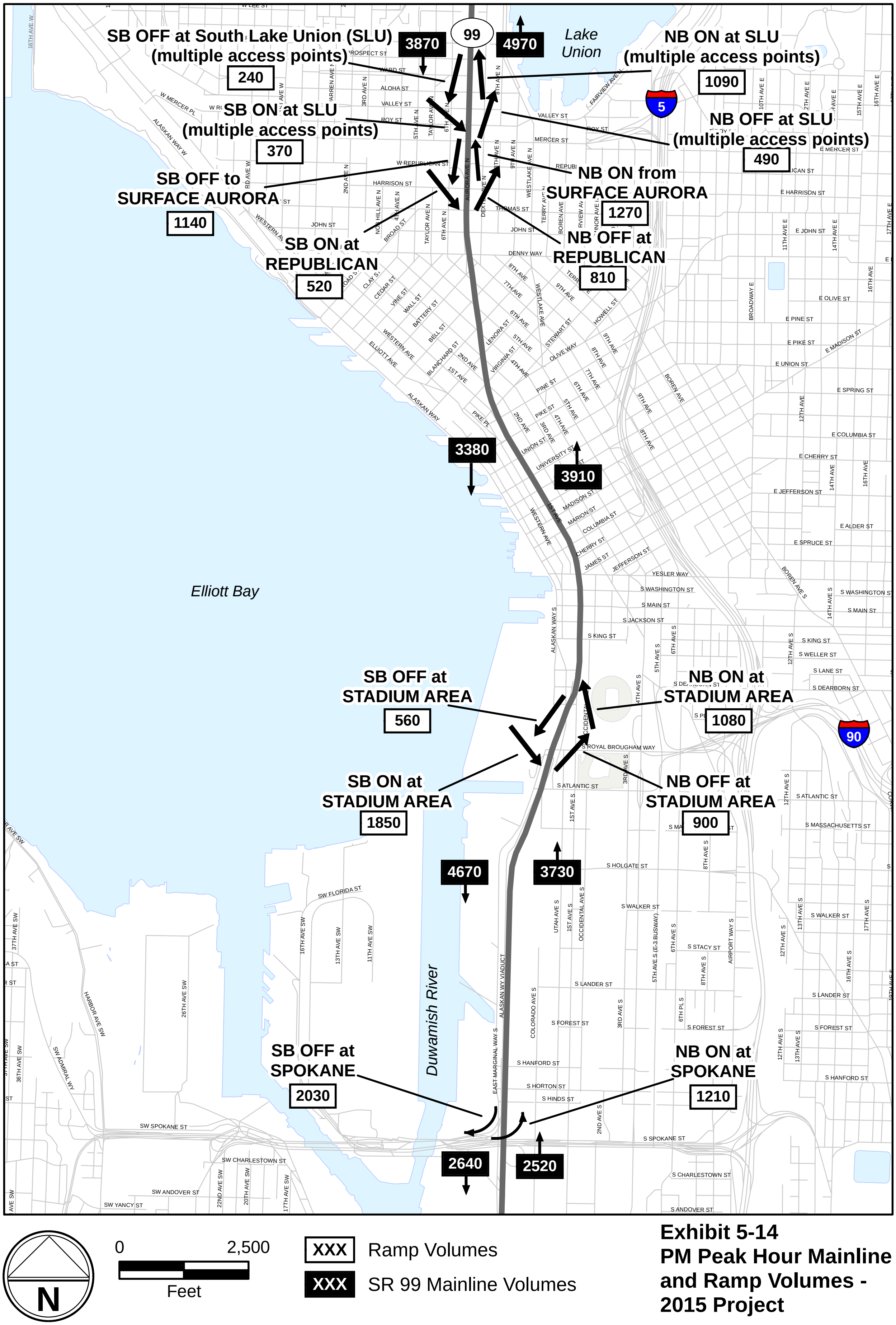
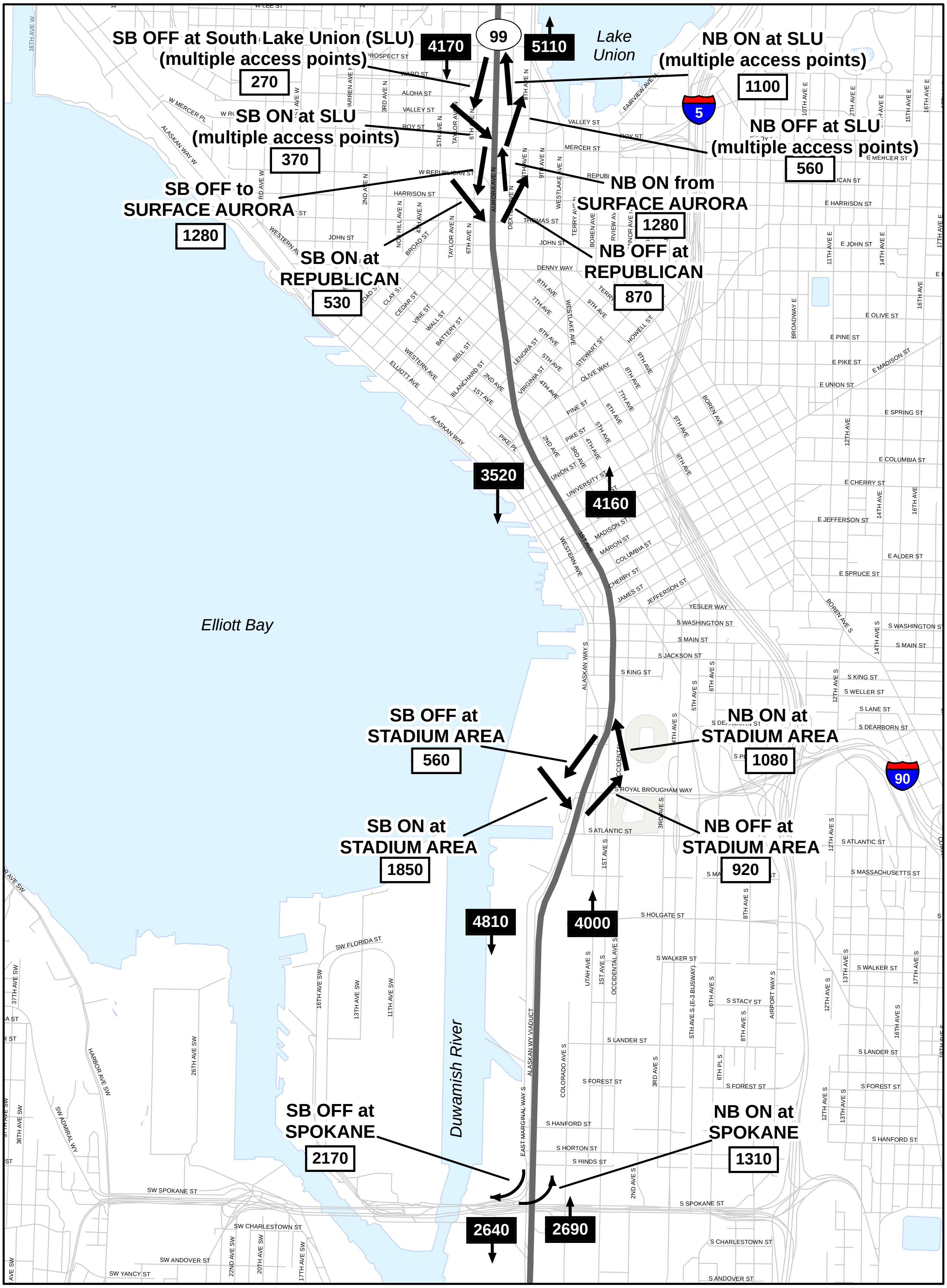


Exhibit 5-14
PM Peak Hour Mainline and Ramp Volumes - 2015 Project



N

0 2,500

Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 5-15
PM Peak Hour Mainline and Ramp Volumes - 2030 Project

directionality, with 1,470 vehicles entering northbound SR 99 but only 1,180 vehicles exiting southbound SR 99. South of downtown and the stadium area, mainline volumes are noticeably higher in the southbound direction (5,040 vehicles) than in the northbound direction (3,890 vehicles). At S. Spokane Street, volumes exiting southbound to West Seattle (2,190 vehicles) are also higher than those entering northbound from West Seattle (1,290 vehicles). As in the AM peak hour, the volumes on the ramps at Seneca and Columbia Streets are lower than under existing conditions because of the new ramps at S. King Street, which serve a similar function.

At the north end of the study area, PM peak hour mainline volumes are higher in the northbound direction (5,080 vehicles) than in the southbound direction (3860 vehicles), as more vehicles are leaving the downtown area than are entering. Northbound on-ramp volumes at Denny Way (1,460 vehicles) exceed those of the southbound off-ramp (770 vehicles). In the Battery Street Tunnel, the volume of northbound vehicles (3,540 vehicles) again exceeds the volume of southbound vehicles (2,920 vehicles). The ramps at the south end of the Battery Street Tunnel that provide access to and from the north show directionality as well, with 560 vehicles entering northbound but only 200 vehicles exiting southbound. The Elliott/Western ramps to and from the south show little directionality, with 1,390 vehicles entering southbound and 1210 vehicles exiting northbound.

2015 Viaduct Closed (No Build Alternative)

As the viaduct is assumed to be closed in this scenario, no southbound traffic is assumed to be on the facility between the Battery Street Tunnel off-ramp and the S. King Street on-ramp. Similarly, no northbound traffic assumed to be on the facility between the S. King Street off-ramp and the Battery Street Tunnel on-ramp.

2015 Project

As noted previously, in this scenario the stadium area ramps would provide the connection to downtown from the south. The southbound stadium area on-ramp is expected to have substantially higher volumes (1,850 vehicles) than the Baseline conditions ramp at Columbia Street (1,000 vehicles) in the PM peak hour. This is due to the fact that with the absence of the Elliott/Western ramps to the north, some traffic traveling through the corridor to/from points northwest of the City would use this ramp to connect from the alternative Alaskan Way surface route through the waterfront area.

Likewise, volumes for the northbound stadium area off-ramp (900 vehicles) are also expected to be higher than the Baseline ramp volume at Seneca Street (660 vehicles) because it captures some of the traffic that previously would have used the Elliott Avenue on-ramp. However, the mainline volume in both directions south of the stadium area is anticipated to have lower volumes under 2015 Project conditions than with the Baseline. PM peak hour mainline ramp volumes forecasted for the 2015 Project scenario are shown in Exhibit 5-14.

The bored tunnel would carry approximately 3,380 vehicles southbound and 3,910 vehicles northbound during the PM peak hour. This is lower than for Baseline conditions, with 4,110 southbound and 4,190 vehicles northbound through midtown between the Elliott/Western and Seneca/Columbia ramps. However, as described for the AM peak hour, the bored tunnel would likely carry more traffic than the Battery Street Tunnel under Baseline conditions, with 2,920 southbound and 3,540 northbound vehicles during the PM peak hour. At the north end of the study area, mainline volumes are anticipated to be similar to Baseline conditions. Entering and exiting volumes from the South Lake Union area, including the ramps at Denny Way, are expected to be slightly higher than under Baseline conditions.

2030 Project

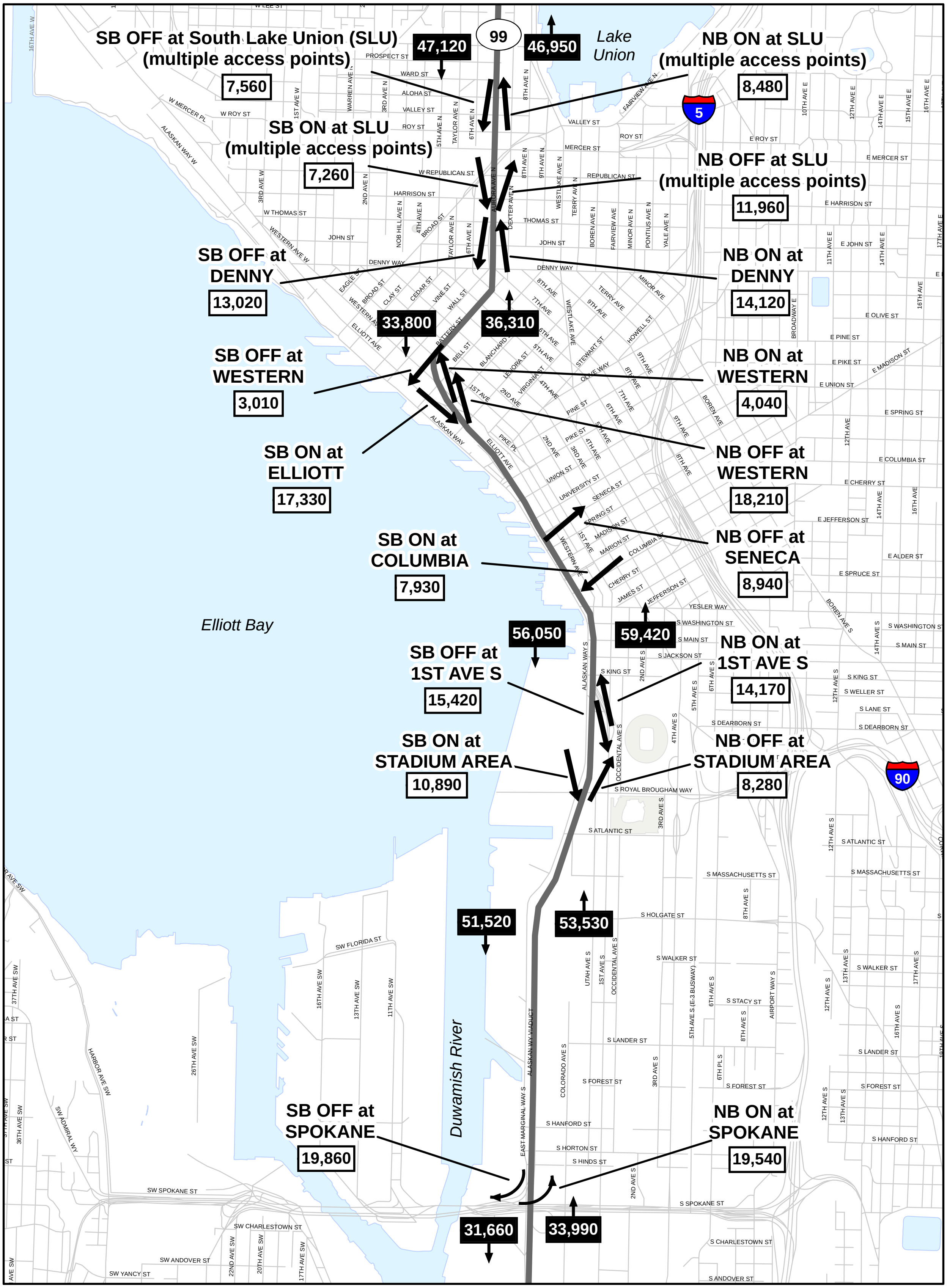
As was the case for the AM conditions, the 2030 Project volumes would be generally similar to 2015 Project volumes, with only minor increases noted. PM peak hour mainline ramp volumes forecasted for the 2030 Bored Tunnel Alternative are shown in Exhibit 5-15.

Daily

Daily volumes for each of the scenarios are shown in Exhibits 5-16, 5-17, and 5-18.

2015 Baseline

Similar to existing conditions, projected 2015 Baseline daily traffic volumes along SR 99 are generally balanced by direction, with similar volumes leaving and entering the central downtown area. At the north end of the study area, the majority of southbound vehicles exiting from SR 99 exit at Denny Way (13,020), with a little more than half that many (7,560) exiting at the multiple access points in South Lake Union. Similarly, about 14,120 northbound vehicles enter SR 99 at Denny Way, with 8,480 entering at other South Lake Union access points. In the Battery Street Tunnel, the volume of northbound vehicles (36,310 vehicles) is somewhat higher than the volume of southbound vehicles (33,800 vehicles). 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 4,040 vehicles entering northbound but only 3,010 vehicles exiting southbound. However, the Elliott/Western ramps to and from the south are relatively balanced, with 17,330 vehicles entering southbound and 18,210 vehicles exiting northbound.



N

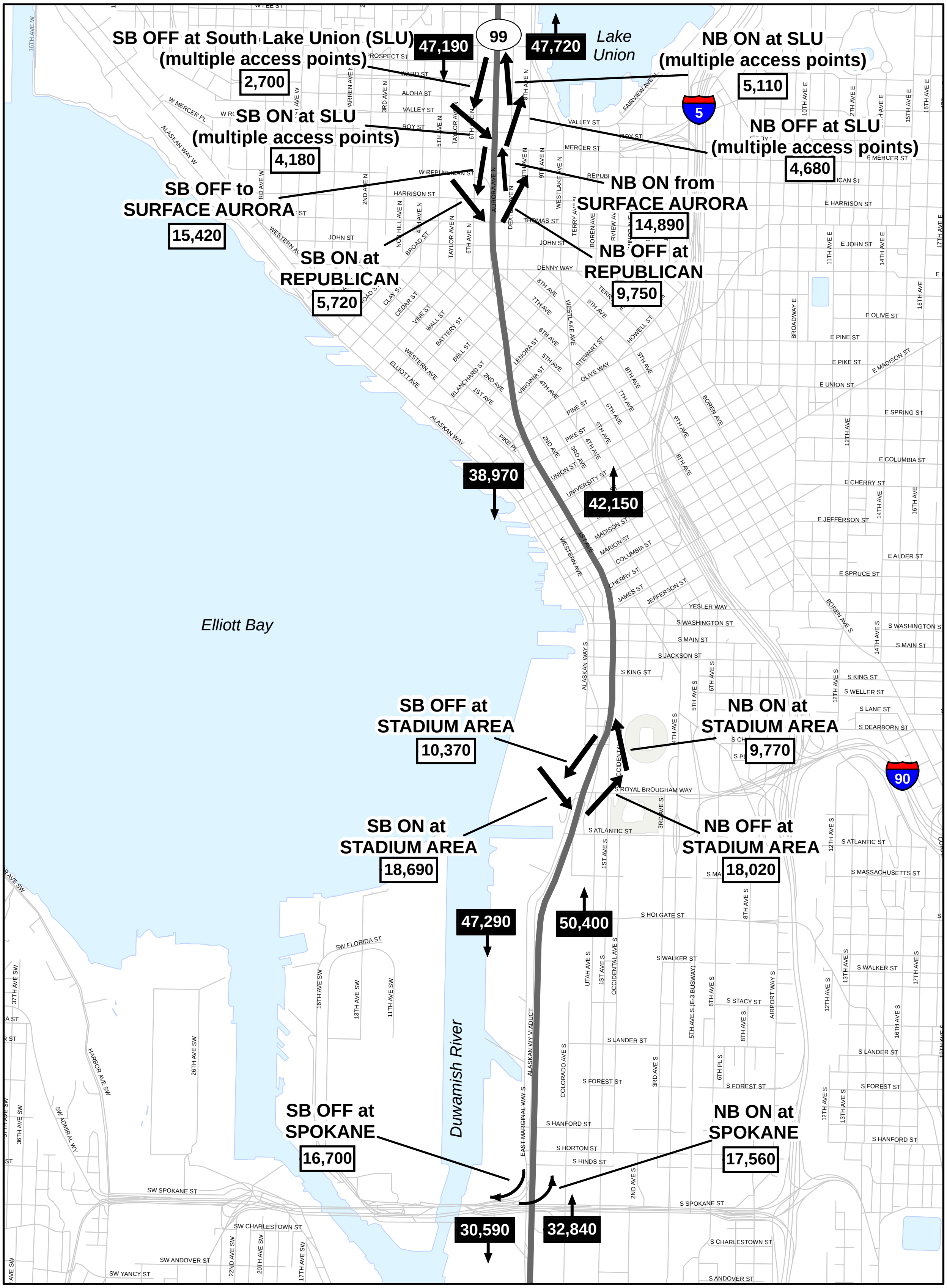
0 2,500

Feet

XXX	Ramp Volumes
XXX	SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 5-16
Daily Mainline and Ramp Volumes - 2015 Baseline



N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 5-17
Daily Mainline and Ramp Volumes - 2015 Project

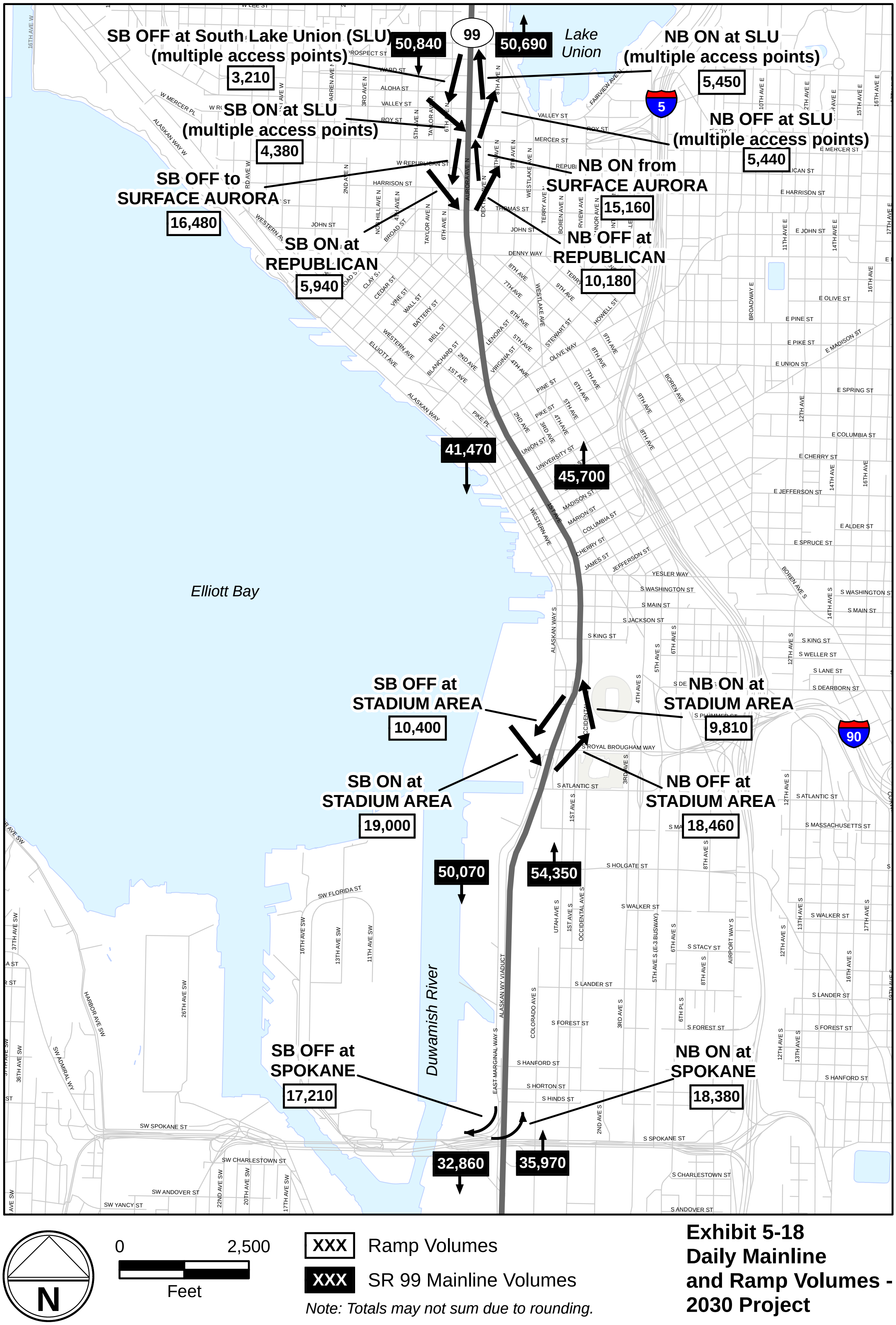


Exhibit 5-18
Daily Mainline and Ramp Volumes - 2030 Project

The downtown ramps providing access to and from the south are relatively balanced, with 7,930 vehicles entering southbound at Columbia Street and 8,940 vehicles exiting northbound at Seneca Street. The volumes on the First Avenue S. ramps are similarly balanced, with 14,170 vehicles entering northbound and 15,420 vehicles exiting southbound. The new ramps at S. King Street are somewhat unbalanced, with more vehicles entering southbound (10,890) than exiting northbound (8,280). South of downtown and the stadium area, mainline volumes are generally balanced by direction. At S. Spokane Street, volumes exiting southbound to West Seattle (19,860) are similar to those entering northbound from West Seattle (19,540). As in the AM and PM peak hours, the volumes on the ramps at Seneca and Columbia Streets are lower than in the Existing Conditions scenario because of the new ramps at S. King Street, which serve a similar function. Daily mainline and ramp volumes are shown in Exhibit 5-16.

2015 Viaduct Closed (No Build Alternative)

As the viaduct is assumed to be closed in this scenario, no southbound traffic is assumed to be on the facility between the Battery Street Tunnel off-ramp and the S. King Street on-ramp. Similarly, no northbound traffic assumed to be on the facility between the S. King Street off-ramp and the Battery Street Tunnel on-ramp.

2015 Project

As with the AM and PM peak hours, the southbound stadium area on-ramp is expected to have substantially higher daily volumes (18,690 vehicles) than the Baseline conditions ramp at Columbia Street (7,930 vehicles).

Likewise, volumes for the northbound stadium area off-ramp (18,020 vehicles) are also expected to be higher than the Baseline ramp volumes at Seneca Street (8,940), again because it captures some of the traffic that previously would have used the Elliott on-ramp. Also, similar to AM and PM peak hour conditions, traffic volumes in both directions south of the stadium area are anticipated to be lower under 2015 Project conditions than the Baseline. Daily mainline ramp volumes forecasted for the 2015 Bored Tunnel Alternative are shown in Exhibit 5-17.

The bored tunnel would carry approximately 38,970 vehicles southbound and 42,150 vehicles northbound on a daily basis. This is lower than under Baseline conditions, with 56,050 southbound and 59,420 northbound vehicles through midtown between the Elliott/Western and Seneca/Columbia ramps. However, as described for the AM and PM peak hours, the bored tunnel would likely carry more daily traffic than the Battery Street Tunnel under Baseline conditions, with 33,800 southbound and 36,310 northbound vehicles. In general, although SR 99 volumes through midtown are projected to be lower than in the Baseline scenario, screenline analysis shows that approximately the same number of trips would be accommodated by the overall system, including I-5 and parallel arterials. At the north end of the study area, mainline volumes are anticipated to be similar to those under Baseline conditions. Entering and exiting volumes from the South Lake Union area, including the ramps at Denny Way, are expected to be slightly higher than under Baseline conditions.

2030 Project

As was the case for the AM and PM peak hour conditions, the 2030 Project daily volumes would be generally similar to 2015 Project volumes, with only minor increases noted. Daily mainline ramp volumes forecasted for the 2030 Bored Tunnel Alternative are shown in Exhibit 5-18.

5.2.2 SR 99 Mainline Level of Service

This section describes the AM and PM peak hour level of service (LOS) for corridor segments under the 2015 Baseline and Project (Bored Tunnel Alternative) scenarios. While LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing scenarios for mainline conditions since ramp locations and segment arrangements may vary considerably among the scenarios. Additionally, as indicated in Chapter 2, because SR 99's posted speeds are less than a typical freeway's, the LOS (as based on the Transportation Research Board's Highway Capacity Manual [HCM] density ranges for freeways) would likely be lower than is truly experienced on the facility. Hence, the mainline LOS results are better suited for a relative comparison between scenarios as opposed to a true indication of operating levels. Projected speeds and travel times along the facility are better indicators of expected performance. SR 99 mainline LOS is summarized by segment for the Baseline, 2015 Project, and 2030 Project scenarios in Exhibits 5-19 to 5-22, reflecting both directions in the AM and PM peak hours.

Exhibit 5-19. AM Peak Hour Southbound SR 99 Segment LOS

Southbound - AM	2015 Baseline	2015 Project	2030 Project
South Corridor			
First Avenue S. Off to S. Spokane Street	B	N/A	N/A
Stadium On to S. Spokane Street	N/A	C	C
Midtown			
Columbia On to First Avenue S. Off (SB)	F	N/A	N/A
Elliott On to Columbia On (SB)	D	N/A	N/A
Bored Tunnel	N/A	D	D
Battery Street Tunnel	E	N/A	N/A
North Corridor			
North of Battery Street Tunnel	F	N/A	N/A
North of Bored Tunnel	N/A	E	F

Exhibit 5-20. AM Peak Hour Northbound SR 99 Segment LOS

Northbound - AM	2015 Baseline	2015 Project	2030 Project
South Corridor			
S. Spokane Street to First Avenue S.	E	N/A	N/A
S. Spokane Street to Stadium Off	N/A	D	E
Midtown			
First Avenue S. On to Seneca Off (NB)	F	N/A	N/A
Seneca Off to Western Off (NB)	F	N/A	N/A
Bored Tunnel	N/A	E	E
Battery Street Tunnel	E	N/A	N/A
North Corridor			
North of Battery Street Tunnel	C	N/A	N/A
North of Bored Tunnel	N/A	D	D

Exhibit 5-21. PM Peak Hour Southbound SR 99 Segment LOS

Southbound - PM	2015 Baseline	2015 Project	2030 Project
South Corridor			
First Avenue S. Off to S. Spokane Street	E	N/A	N/A
Stadium On to S. Spokane Street	N/A	D	D
Midtown			
Columbia On to First Avenue S. Off (SB)	F	N/A	N/A
Elliott On to Columbia On (SB)	F	N/A	N/A
Bored Tunnel	N/A	D	E
Battery Street Tunnel	E	N/A	N/A
North Corridor			
North of Battery Street Tunnel	E	N/A	N/A
North of Bored Tunnel	N/A	E	E

Exhibit 5-22. PM Peak Hour Northbound SR 99 Segment LOS

Northbound - PM	2015 Baseline	2015 Project	2030 Project
South Corridor			
S. Spokane Street to First Avenue S.	D	N/A	N/A
S. Spokane Street to Stadium Off	N/A	D	F
Midtown			
First Avenue S. On to Seneca Off (NB)	E	N/A	N/A
Seneca Off to Western Off (NB)	F	N/A	N/A
Bored Tunnel	N/A	E	F
Battery Street Tunnel	F	N/A	N/A
North Corridor			
North of Battery Street Tunnel	E/F	N/A	N/A
North of Bored Tunnel	N/A	E/F	E/F

2015 Baseline LOS

As shown in the exhibits above, the majority of the evaluated corridor is expected to operate at LOS E or LOS F conditions under 2015 Baseline conditions for the AM and PM peak hours.

The high levels of congestion identified under Baseline conditions 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 off-ramp in mid-town, 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, the off-ramp to Denny Way causes some spill back to the SR 99 mainline, while downstream friction from the Elliott Avenue on-ramp, Columbia Street on-ramp, and off-ramp to First Avenue S. also create pockets of congestion that affect peak period mainline flow. These merging and weaving areas are expected to collectively affect SR 99 corridor operations and are reflected in the level of service estimates shown in the exhibits above.

2015 Viaduct Closed (No Build Alternative) LOS

Traffic conditions in the corridor under the Viaduct Closed (No Build Alternative) scenario are anticipated to be highly congested compared with the 2015 Baseline.

These congested conditions are expected to result in extremely high travel times for vehicles travelling through the CBD. For example, the travel time between Woodland Park and S. Spokane Street in this scenario is estimated to be approximately three times greater than the travel time under Baseline conditions. LOS on SR 99 both north and south of the closed viaduct would likely be degraded at the point where traffic starts to back up from the transition from expressway to surface arterial system.

2015 Project LOS

The Bored Tunnel Alternative includes a number of changes to the SR 99 mainline that are expected to affect traffic operations noticeably. Key highlights of these changes include: (1) access consolidation in the South Lake Union area; (2) closure of the Elliott/Western ramps, which would result in trips re-routing primarily to Alaskan Way, with some to SR 99 via Mercer Street; and (3) relocation of downtown access to the stadium area with ramps providing northbound on, northbound off, southbound on, and southbound off movements to and from SR 99.

The bored tunnel segment of the mainline project elements is projected to operate at LOS D in the southbound direction and LOS E in the northbound direction for both the AM and PM peak hours. This is improved over 2015 Baseline conditions for SR 99 through midtown, which projects most segments to operate at LOS F in both peak hours.

In the south end from approximately S. Spokane Street to the stadium off-ramp area, northbound SR 99 speeds and densities would improve to LOS D levels while mainline performance in the southbound direction would decline slightly to LOS C in the AM peak hour. In the PM peak hour, LOS results are similar to those shown for the 2015 Baseline scenario.

In the north end during the AM peak hour, southbound conditions are expected to improve slightly over Baseline conditions to LOS E from LOS F in the Baseline scenario. Northbound conditions would become slightly more congested at LOS D. In the PM peak hour, the southbound speeds and densities would be in the LOS E range, while northbound performance would be at LOS E to LOS F, similar to Baseline conditions.

2030 Project LOS

Traffic demand for SR 99 is expected to increase by approximately 7 percent between 2015 and 2030. This would have some impact on LOS. As with the 2015 Project scenario, the bored tunnel segment of the mainline Project elements is projected to operate at LOS D in the southbound direction and LOS E in the northbound direction in the AM peak hours. However, in the PM peak hour, due to the increase in traffic demand, level of service is projected to decline from LOS D in 2015 to LOS E in 2030 in the southbound direction and from LOS E to LOS F in the northbound direction.

In the south end from approximately S. Spokane Street to the stadium off-ramp area, southbound SR 99 speeds and densities would remain at LOS C levels, while mainline performance in the northbound direction would decline from LOS D to LOS E in the AM peak hour. Similarly, in the PM peak hour, southbound SR 99 operations would remain at LOS D, while mainline performance in the northbound direction would decline from LOS D to LOS F.

In the north end during the AM peak hour, southbound conditions are expected to decline from LOS E to LOS F, while northbound conditions would remain at LOS D. During the PM peak hour, level of service is expected to remain the same as those under 2015 Project conditions for both directions.

5.2.3 SR 99 Mainline Speeds

This section discusses the AM and PM peak hour travel speeds for corridor segments under the Baseline, 2015 Project, and 2030 Project scenarios. As with LOS, comparing travel speeds between scenarios can present certain challenges since the ramp and segment arrangements vary among the scenarios. The speeds are presented in tabular format in Exhibits 5-23 to 5-26. To assist in comparison, the results are presented side-by-side graphically in Exhibits 5-27 and 5-28.

Exhibit 5-23. AM Peak Hour Southbound SR 99 Segment Speeds (miles per hour)

Southbound - AM	2015 Baseline	2015 Project	2030 Project
South Corridor			
First Avenue S. Off to S. Spokane Street	49	N/A	N/A
Stadium On to S. Spokane Street	N/A	48	45
Midtown			
Columbia On to First Avenue S. Off (SB)	24	N/A	N/A
Elliott On to Columbia On (SB)	45	N/A	N/A
Bored Tunnel	N/A	46	45
Battery Street Tunnel	32	N/A	N/A
North Corridor			
North of Battery Street Tunnel	28	N/A	N/A
North of Bored Tunnel	N/A	33	32

Exhibit 5-24. AM Peak Hour Northbound SR 99 Segment Speeds (miles per hour)

Northbound - AM	2015 Baseline	2015 Project	2030 Project
South Corridor			
S. Spokane Street to First Avenue S.	41	N/A	N/A
S. Spokane Street to Stadium Off	N/A	45	40
Midtown			
First Avenue S. On to Seneca Off (NB)	23	N/A	N/A
Seneca Off to Western Off (NB)	16	N/A	N/A
Bored Tunnel	N/A	44	43
Battery Street Tunnel	33	N/A	N/A
North Corridor			
North of Battery Street Tunnel	35	N/A	N/A
North of Bored Tunnel	N/A	35	35

Exhibit 5-25. PM Peak Hour Southbound SR 99 Segment Speeds (miles per hour)

Southbound - PM	2015 Baseline	2015 Project	2030 Project
South Corridor			
First Avenue S. Off to S. Spokane Street	43	N/A	N/A
Stadium On to S. Spokane Street	N/A	47	46
Midtown			
Columbia On to First Avenue S. Off (SB)	14	N/A	N/A
Elliott On to Columbia On (SB)	36	N/A	N/A
Bored Tunnel	N/A	46	46
Battery Street Tunnel	34	N/A	N/A
North Corridor			
North of Battery Street Tunnel	34	N/A	N/A
North of Bored Tunnel	N/A	34	34

Exhibit 5-26. PM Peak Hour Northbound SR 99 Segment Speeds (miles per hour)

Northbound - PM	2015 Baseline	2015 Project	2030 Project
South Corridor			
S. Spokane Street to First Avenue S.	48	N/A	N/A
S. Spokane Street to Stadium Off	N/A	47	32
Midtown			
First Avenue S. On to Seneca Off (NB)	39	N/A	N/A
Seneca Off to Western Off (NB)	30	N/A	N/A
Bored Tunnel	N/A	44	40
Battery Street Tunnel	33	N/A	N/A
North Corridor			
North of Battery Street Tunnel	34	N/A	N/A
North of Bored Tunnel	N/A	35	35

Segment travel speed results confirm LOS findings, with congested conditions causing slower speeds on the Baseline SR 99 through midtown. As indicated previously, the Viaduct Closed (No Build Alternative) scenario is expected to result in highly congested conditions, with corresponding speeds much lower than those estimated under Baseline conditions. Speeds in the bored tunnel would be approximately 44 to 46 miles per hour in both directions in both the AM and PM peak hours in 2015, and between 40 and 46 miles per hour in 2030. This compares with speeds ranging from 14 to 49 miles per hour for SR 99 in the Baseline scenario, depending on segment and time period.

In the south end of the corridor from S. Spokane Street to the stadium off-ramp area, in the 2015 Project scenario, speeds for northbound SR 99 would be slightly higher compared to Baseline conditions, with speeds in the southbound direction slightly lower in the AM peak hour. In the PM peak hour, speeds would be similar between the Baseline and Project conditions in 2015. In 2030, speeds would be similar to 2015 conditions in the southbound direction, but are anticipated to degrade in the northbound direction, with speeds as low as 32 miles per hour during the PM peak hour due to slowdowns associated with the friction caused by the northbound stadium on-ramp merge.

In the north end during the AM peak hour, southbound conditions in the 2015 Project scenario are expected to be slightly better, at 33 miles per hour, compared to 28 miles per hour in the Baseline scenario. Northbound speeds would be similar in both Baseline or Project scenarios. In the PM peak hour, speeds would again be similar in these scenarios. Speeds for the north end in 2030 are anticipated to be similar to those seen in 2015 for both AM and PM peak hours.

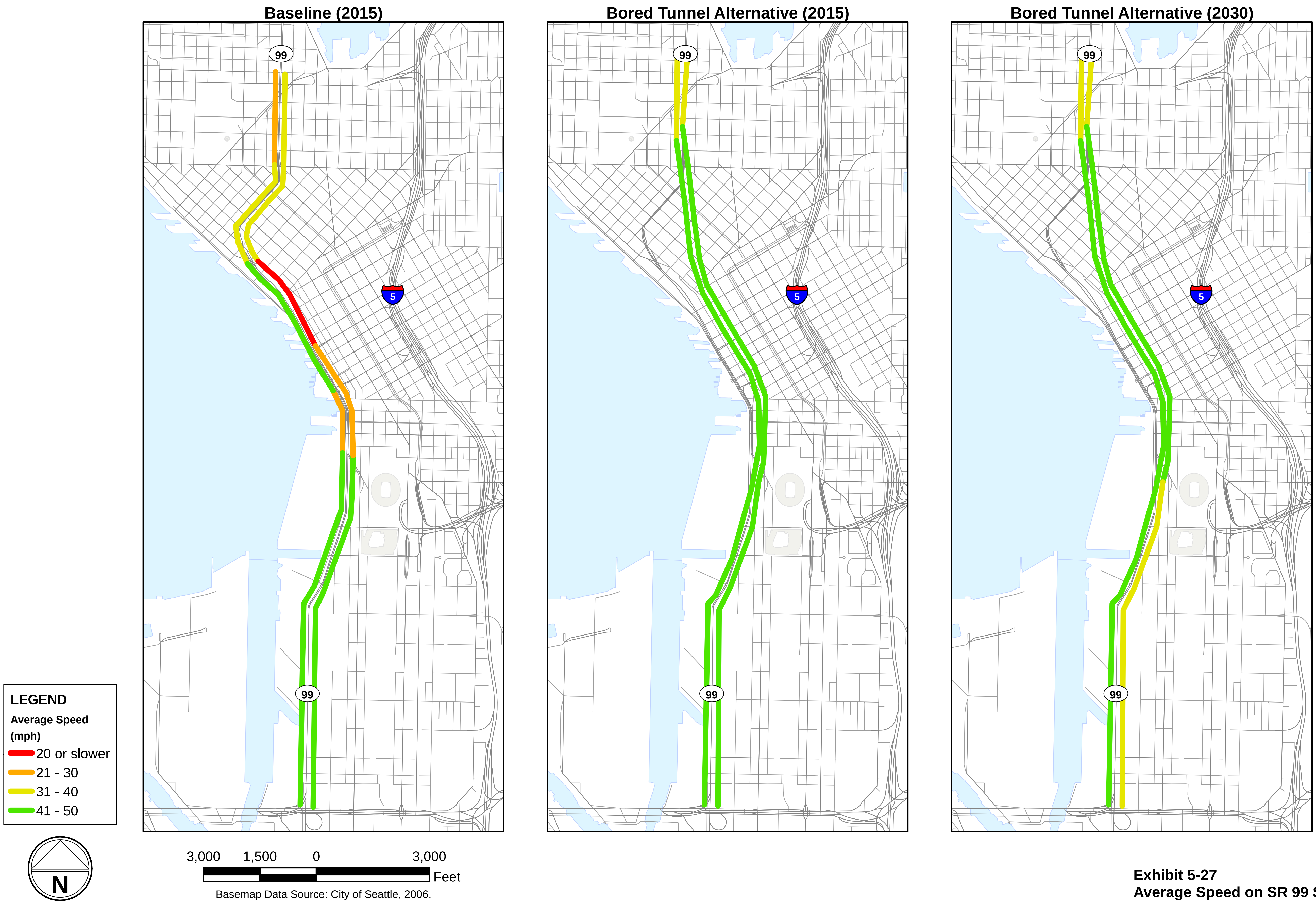


Exhibit 5-27
Average Speed on SR 99 Segments - AM Peak

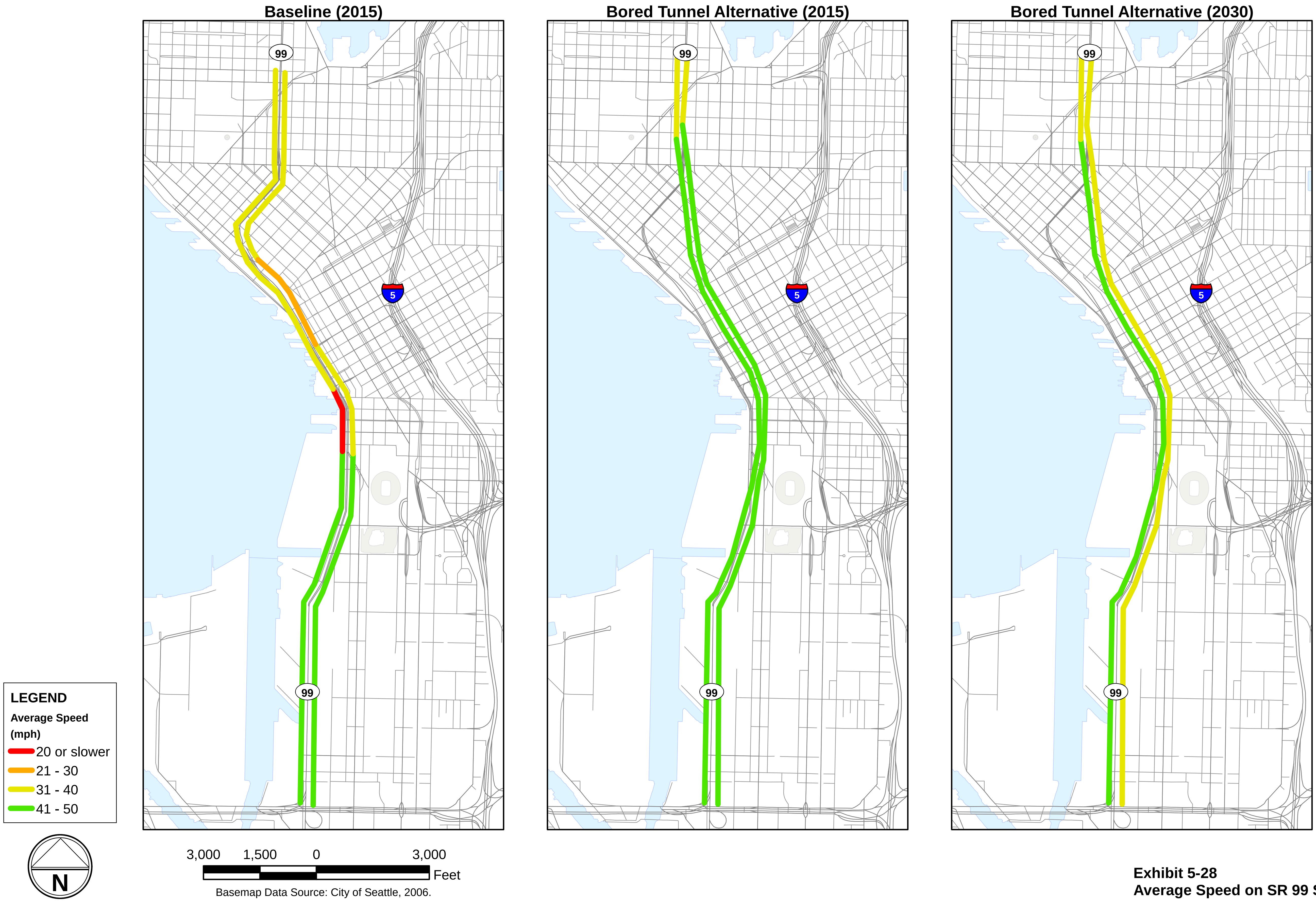


Exhibit 5-28
Average Speed on SR 99 Segments - PM Peak

5.3 Traffic Operations at Key Arterial Intersections

To assess the impacts of each project scenario on other streets within the transportation system, a description of intersection operations at selected locations is presented in this section. Intersection performance is discussed and summarized for four applicable scenarios: 2015 Baseline, 2015 Viaduct Closed (No Build Alternative), 2015 Project and 2030 Project. The primary performance measure used for this analysis is Level of Service (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" (low delays and free flow traffic conditions) to "F" (very congested or break-down conditions).

The intersection analysis results are summarized by the following sub-areas:

- South
- Central
- North

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 scenarios evaluated, and current congestion levels. Only signalized intersections (existing or proposed) were analyzed. All signalized intersections directly affected by, or created as a result of, implementation of the Project are included in the analysis.

Intersections that are projected to operate at Levels of Service (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-D would experience little to moderate congestion levels during peak times 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. Also of concern is whether congestion may lead to air quality concerns, which is assessed in the Air Discipline Report (Appendix M of the SDEIS).

Key Findings

- While most intersections in the south end are expected to operate at LOS D or better conditions under the 2015 Baseline, five locations are expected to operate at LOS E or F conditions during one or both of the peak hours. The project in general would maintain or modestly improve intersection traffic operations in the area for the 2015 timeframe. All intersections are expected to operate at LOS D or better during the AM peak hour, while three intersections are forecasted to operate at LOS E or F during the PM peak. By 2030, growth in traffic is expected to result in one LOS E intersection during the AM peak and three LOS F intersections during the PM peak.

- All intersections evaluated in the central sub-area are expected to operate at LOS D or better during the AM peak; only First Avenue at Columbia Street would experience LOS F conditions during the PM peak. Results are similar for the 2015 Project scenario, which would reduce congestion on many downtown streets (including the aforementioned First Avenue intersection at Columbia Street), but would increase congestion at the Western Avenue at Broad Street intersection (LOS E during the PM peak) due to increased traffic turning from Broad Street onto Western Avenue. Note that the improvements proposed as part of the Program, described under Cumulative Effects, would improve the LOS at this location. By 2030, traffic growth is expected to result in one LOS E intersection during the AM peak, and to worsen conditions at the Broad Street and Western Avenue intersection to LOS F.
- In the north end sub-area, LOS E and F conditions are expected at four intersections during the AM peak and at six locations during the PM peak, including both directions of Aurora Avenue (Denny ramps) at Denny Way. The 2015 Project would create a number of new intersections, all of which are expected to operate well. Elsewhere, four LOS E intersections are expected during the AM peak, while nine locations are expected to operate at LOS E or F conditions during the PM peak. Many of these locations are along Mercer Street, which carries a substantial share of the east-west traffic in the area and experiences very congested conditions during the peak periods today and under 2015 Baseline conditions as well. By 2030, traffic growth is expected to result in 7 intersections operating at LOS E or F conditions during the AM peak, and 12 during the PM peak.
- Though not specifically analyzed for intersection operations, the Viaduct Closed (No Build Alternative) scenario would considerably increase the number of intersections operating at LOS E and F, and would likely increase delay at many of these locations well beyond the LOS F threshold, leading to substantial congestion. This is especially likely for intersections in the north and south sub-areas and along north-south arterials through the central waterfront and downtown as traffic shifts from the SR 99 corridor to alternate surface street routes.

Detailed intersection analysis results are shown in Exhibits 5-29, 5-30, and 5-31 for the south, central, and north, respectively. Exhibit 5-32 reports results for intersections that would be affected differently by Option 2.

5.3.1 South Sub-Area

Detailed intersection analysis results for the south sub-area, which consists of arterials and intersections south of S. King Street and west of Fourth Avenue, are shown in Exhibit 5-30. Intersection performance for the study locations was evaluated using Synchro and VISSIM traffic analysis software.

2015 Baseline

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 Baseline conditions. 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 at S. King Street/Alaskan Way S. 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 additional access into the central waterfront and stadium areas. These new ramps are expected to draw additional traffic onto some area roadways, notably Alaskan Way S. Intersections on Alaskan Way are generally expected to operate to LOS D or better conditions in the south end sub-area, however. One exception is a new intersection on Alaskan Way S. where traffic exits the holding area for ferry traffic; this intersection is expected to operate at LOS F during both the AM and PM peaks, though this is largely a result of the operational approach to hold ferry traffic for a period of time and release it in platoons. Traffic on Alaskan Way would not experience particularly long delays at this location.

The intersection of E. Marginal Way/T-46 at S. Atlantic Street is projected to operate at a LOS E during both the AM and PM peak hours, which reflects the need for a relatively long cycle length in order to accommodate all movements when the U-shaped undercrossing is in operation. In addition, the signal system for this location must also provide for movements at the adjacent Colorado Avenue S./S. Atlantic intersection, further adding to potential delays in the general area. The signal system also serves rail crossings on the BNSF tail track while diverting traffic to the new undercrossing. As a result, even under moderately congested conditions, travelers would face delays at this location as the traffic signal cycles through all necessary signal phases.

Exhibit 5-29. Signalized Intersection Level of Service and Average Vehicle Delay (seconds), South

Street	Cross Street	AM PEAK HOUR: 2005 Existing		2015 Baseline		2015 Project		2030 Project		PM PEAK HOUR: 2005 Existing		2015 Baseline		2015 Project		2030 Project	
Alaskan Way S.	S. Royal Brougham Way	C	22							C	20						
Alaskan Way S.	S. Plummer St/SR 99 Ramps					B	13	B	14					B	10	B	12
Alaskan Way S.	S. Charles Street					A	8	A	8					A	7	A	8
Alaskan Way S.	S. Dearborn Street					B	11	B	11					A	9	A	9
Alaskan Way S.	S. King Street			B	11	A	8	A	8			B	11	A	8	A	10
Alaskan Way S.	S. Jackson Street	A	2	A	4	A	3	A	3	A	3	A	8	A	5	A	5
Alaskan Way S.	S. Main Street	A	3	A	9	A	3	A	4	A	4	A	10	B	15	B	12
E. Frontage Rd/Alaskan Way S.	S. Atlantic Street			B	16	C	25	C	27			B	19	B	16	C	20
E. Frontage Rd/Alaskan Way S.	S. Royal Brougham Way			B	17	B	15	B	16			D	37	B	13	C	22
Alaskan Way S./Ferry Holding	SR 99 Ramp	A	4	F	86					A	6	E	70				
Alaskan Way	Yesler Way	B	19	C	22	B	16	B	16	C	22	C	29	B	16	B	17
E. Marginal Way/T-46	S. Atlantic Street			E	61	D	51	E	58			E	58	D	44	D	48
Colorado Avenue	S. Atlantic Street			C	25	D	46	D	48			B	17	D	49	D	44
First Avenue S.	S. Atlantic Street	D	46	E	64	C	32	D	36	D	43	E	67	E	67	F	101
First Avenue S.	S. Royal Brougham Way	D	47	C	24	C	26	C	27	E	73	C	27	C	21	C	23
First Avenue S.	S. Plummer Street					A	9	A	9					B	11	B	16
First Avenue S.	S. Charles Street					A	9	A	8					A	9	B	11
First Avenue S.	S. Dearborn Street					A	9	B	11					B	11	B	15
First Avenue S.	S. Jackson Street	B	15	B	11	B	17	B	17	C	24	B	15	B	14	B	16
First Avenue S.	S. Main Street	B	18	A	7	B	12	B	12	B	10	B	10	B	14	B	13
First Avenue	Yesler Way	B	19	B	16	D	42	D	51	C	27	E	59	F	94	F	131
Fourth Avenue S.	S. Royal Brougham	D	43	C	25	C	30	D	38	E	68	E	56	E	61	F	149

Exhibit 5-30. Signalized Intersection Level of Service and Average Vehicle Delay (seconds), Central

Street	Cross Street	AM PEAK HOUR 2005 Existing		2015 Baseline		2015 Project		2030 Project		PM PEAK HOUR 2005 Existing		2015 Baseline		2015 Project		2030 Project	
Alaskan Way	Columbia Street	A	7	A	5	A	10	A	9	A	5	B	12	B	17	B	11
Alaskan Way	Marion Street	B	12	B	18	B	13	B	14	B	15	C	29	C	28	B	16
Alaskan Way	Madison Street	B	10	A	9	A	5	A	7	B	11	B	16	C	21	B	18
Elliott Avenue	Bell Street	A	5	A	5	A	2	A	2	E	67	A	8	A	3	A	4
Elliott Avenue	Wall Street	B	17	B	14	B	13	B	14	C	25	E	66	B	12	B	12
Elliott Avenue	Broad Street	D	40	C	24	C	27	C	28	D	35	D	43	C	33	D	37
Western Avenue	Marion Street	B	17	C	22	C	20	C	20	B	16	B	14	B	11	B	11
Western Avenue	Madison Street	B	17	B	19	B	17	B	18	B	20	C	28	C	22	C	23
Western Avenue	Spring Street	B	11	A	9	B	14	B	16	B	12	B	11	B	11	B	11
Western Avenue	Battery Street/ SR 99 off-ramp	B	15	B	15	A	1	A	2	B	10	B	10	A	3	A	3
Western Avenue	Wall Street	B	18	B	16	C	27	D	51	C	27	D	50	C	27	C	27
Western Avenue	Broad Street	B	16	B	14	C	21	C	26	B	13	C	21	E	71	F	147
First Avenue	Columbia Street	C	22	B	13	B	11	B	11	F	144	F	94	B	16	B	16
First Avenue	Marion Street	B	11	B	14	B	17	B	18	B	14	B	15	B	16	B	16
First Avenue	Madison Street	A	9	A	9	A	8	A	8	A	10	B	12	A	10	A	10
First Avenue	Spring Street	A	7	A	7	D	42	D	51	B	12	B	11	B	17	C	33
First Avenue	Seneca Street	B	19	C	21	B	17	B	19	B	16	C	24	B	14	B	15
Second Avenue	Columbia Street	B	16	D	38	A	6	A	6	C	24	B	18	A	8	A	8
Second Avenue	Marion Street	B	15	D	42	D	54	E	68	C	20	D	36	D	40	D	51
Second Avenue	Madison Street	A	8	D	49	C	27	C	27	A	10	B	11	B	17	C	24
Second Avenue	Spring Street	B	13	D	38	D	43	D	52	B	15	D	54	B	14	B	18
Second Avenue	Battery Street	B	19	A	5	A	5	A	6	A	9	A	7	A	8	A	7

Exhibit 5-31. Signalized Intersection Level of Service and Average Vehicle Delay (seconds), North

Street	Cross Street	AM PEAK HOUR: 2005 Existing		2015 Baseline		2015 Project		2030 Project		PM PEAK HOUR: 2005 Existing		2015 Baseline		2015 Project		2030 Project	
Western Avenue W	Elliott Ave W.	A	9	B	14	C	22	C	26	E	56	E	78	E	75	F	114
Mercer Place	Elliott Avenue W.	B	11	E	73	E	69	F	85	B	14	F	178	F	171	F	182
First Avenue	Denny Way	C	33	C	26	D	50	F	82	C	33	D	53	F	151	F	106
Second Avenue	Denny Way	A	9	A	8	A	7	A	8	A	8	B	15	B	12	C	32
Broad Street	Denny Way	C	27	B	19	B	17	B	17	C	26	C	29	C	26	C	34
Broad Street Turn	Mercer Street			F	163							B	14				
Fifth Avenue	Denny Way	B	17	B	15	B	15	B	16	B	15	C	21	C	25	D	40
Fifth Avenue N.	Broad Street	D	37	C	25	D	54	D	44	C	33	C	28	C	31	D	37
Fifth Avenue N.	Harrison Street	C	26	B	12	B	13	B	15	C	31	B	19	A	6	A	7
Fifth Avenue N.	Mercer Street	C	21	B	31	D	36	D	43	D	36	B	17	F	87	F	53
Fifth Avenue N.	Roy Street	C	35	D	41	D	36	D	38	B	18	D	39	C	31	C	31
Taylor Avenue N.	Mercer Street					C	22	C	25					B	14	C	23
Sixth Avenue	Battery Street	A	10	B	12	B	12	B	13	B	17	B	20	E	79	F	103
Sixth Avenue	Denny Way	B	12	A	10	B	16	B	18	B	17	C	21	C	26	B	18
Sixth Avenue N.	John Street					A	7	A	10					A	8	A	8
Sixth Avenue N.	Thomas Street					A	6	B	14					B	13	B	13
Sixth Avenue N.	Harrison Street					B	14	A	9					B	12	B	12
Sixth Avenue N.	Republican/SR 99 On-ramp					A	3	A	4					A	0	A	0
Sixth Avenue N.	Mercer Street					B	14	B	15					B	15	C	30
Aurora Avenue SB	Denny Way	B	13	B	17					B	20	E	64				
Aurora Avenue NB	Denny Way	C	24	C	30					D	50	F	110				
Aurora Avenue	Denny Way					D	38	D	36					D	45	E	77
Aurora Avenue	John Street					A	9	A	10					A	8	A	7
Aurora Avenue	Thomas Street					B	11	B	10					C	26	C	23
Aurora Avenue	Harrison Street					C	23	C	26					C	23	B	19

Exhibit 5-31. Signalized Intersection Level of Service and Average Vehicle Delay (seconds), North (Continued)

Street	Cross Street	2005 Existing		2015 Baseline		2015 Project		2030 Project		2005 Existing		2015 Baseline		2015 Project		2030 Project	
		AM PEAK HOUR								PM PEAK HOUR							
Dexter Avenue	Denny Way	B	19	C	27	D	49	F	84	C	23	C	32	C	25	E	77
Dexter Avenue N.	John Street					A	8	A	7					A	9	B	10
Dexter Avenue N.	Thomas Street					B	10	A	8					C	21	C	33
Dexter Avenue N.	Harrison Street	C	23	B	19	B	16	D	39	B	11	B	13	A	9	A	10
Dexter Avenue N.	Republican/SR 99 Off-ramp					B	16	B	19					B	12	B	16
Dexter Avenue N.	Mercer Street	C	35	E	42	E	40	F	42	E	62	D	48	E	69	F	94
Dexter Avenue N.	Roy Street	A	7	C	32	C	28	C	25	B	10	C	24	C	21	D	48
Dexter Avenue N.	Aloha Street	B	17	D	42	D	53	E	59	B	12	B	15	B	16	C	20
Ninth Avenue N.	Mercer Street	C	22	D	38	C	28	D	41	C	27	D	43	D	43	E	66
Westlake Avenue N.	Mercer Street	A	8	D	43	D	43	D	43	E	67	F	115	F	135	F	163
Fairview Avenue N.	Valley Street			E	63	E	63	F	91			D	53	E	58	E	80
Fairview Avenue N.	I-5 Off-ramp	E	67							C	23						
Fairview Avenue N./ I-5 Ramp	Mercer Street	E	68	D	47	E	63	E	66	F	211	F	140	F	135	F	168

Exhibit 5-32. Signalized Intersection Level of Service and Average Vehicle Delay (seconds), Intersections Affected by Option 2

(Data to be added when available)

Street	Cross Street	2005 Existing		2015 Baseline		2015 Project		2030 Project		2005 Existing		2015 Baseline		2015 Project		2030 Project	
		AM PEAK HOUR								PM PEAK HOUR							
Fifth Avenue N.	Mercer Street	n/a	n/a	n/a	n/a					n/a	n/a	n/a	n/a				
Sixth Avenue N.	Mercer Street	n/a	n/a	n/a	n/a					n/a	n/a	n/a	n/a				
Dexter Avenue N.	Mercer Street	n/a	n/a	n/a	n/a					n/a	n/a	n/a	n/a				

The high volume intersection of First Avenue S. at S. Atlantic Street is expected to operate at LOS E conditions for both the AM and PM peak hours. During the AM peak hour, heavy westbound left-turn movements queuing back into the westbound through travel lanes are problematic. During the PM peak hour, congestion levels are impacted by heavy northbound through movements and southbound left-turns, which require considerable portions of the available signal cycle lengths to accommodate.

First Avenue S. at S. Royal Brougham Way is expected to improve from LOS E (AM) today to LOS C under 2015 Baseline conditions due to improvements to SR 519 and those associated with the S. Holgate Street to S. King Street Viaduct Replacement Project.

The heavily traveled intersection of S. Royal Brougham Way at Fourth Avenue S. is expected to operate at LOS E during the PM peak hour. It should be noted that this intersection also currently operates with heavy congestion (LOS E conditions).

The intersection of First Avenue S. at Yesler Way also is expected to operate at LOS E during PM peak hour. Delays at this location are primarily due to increased traffic volumes on First Avenue S. compared to pre-Baseline (no S. Holgate Street to S. King Street Viaduct Replacement Project) conditions.

2015 Viaduct Closed (No Build Alternative)

As discussed previously in the Viaduct Closed (No Build Alternative) scenario, SR 99 mainline traffic in the south end would transition from the S. Holgate Street to S. King Street structure to/from the Alaskan Way surface arterial via a set of single lane ramps connecting to Alaskan Way at S. King Street. Consequently, traffic capacity into and out of the downtown area on SR 99 is expected to be severely constrained, with noticeable backups occurring at intersections within and near this transition point.

Though not specifically assessed for intersection operations, inferences based on modeled changes in travel patterns may be drawn. Locations in the south end most likely to experience considerable congestion are the transition ramps from SR 99 to Alaskan Way/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.

2015 Project

Under the 2015 Project scenario, traffic patterns in the south end would change substantially from the Baseline scenario due to the relocation of the SR 99 stadium ramps and the introduction of newly created intersections within the study network. The First Avenue S./Railroad Way ramps would be removed and replaced with ramps that connect to a new E. Frontage Road at S. Royal Brougham Way (and continuing on to S. Atlantic Street as well). This ramp relocation would redistribute traffic to Royal Brougham Way and S. Atlantic Street west of First Avenue S., rather than to First Avenue S. between Atlantic Street and Railroad Way. Additionally, Alaskan Way S. would no longer connect directly through to E. Marginal Way and S. Atlantic Street, which would shift some trips from the central waterfront First Avenue S. via three new east/west roadways and associated intersections.

Under the 2015 Project scenario, the intersection of First Avenue S. at S. Atlantic Street is anticipated to improve to LOS C during the AM peak but remain at LOS E during the PM peak, due in part to the heavy traffic on the west leg of S. Atlantic Street traveling from the relocated SR 99 ramps.

The new intersections along Alaskan Way and First Avenue S. created by the project are all projected to operate at LOS A or B.

First Avenue S. at Yesler Way is expected to operate at LOS F during the PM peak hour due to increased traffic volumes on First Avenue S. over 2015 Baseline conditions. Note that this assumes that First Avenue S. would remain as one lane each direction with a parking lane in both directions. If parking were prohibited during the PM peak period, then operations would improve at this location.

The intersection of S. Royal Brougham Way at Fourth Avenue S. would continue to show high levels of congestion, with delays in the LOS E range during PM peak hour.

2030 Project

As shown in Exhibit 5-29, intersection operations under 2030 Project conditions closely mirror those under the 2015 Project scenario. Of the 22 signalized intersections investigated for the south end, traffic growth between 2015 and 2030 is forecast to degrade LOS at five locations by one grade, though three of these are LOS C or better, indicating very little congestion.

Specific locations where LOS would degrade during the AM peak hour include E. Marginal Way (T-46 Driveway)/S. Atlantic Street, First Avenue S./S. Atlantic Street, First Avenue S./Dearborn Street, and Fourth Avenue S./S. Royal Brougham Way. The primary factors influencing future changes in LOS at these locations between 2015 and 2030 are mainly related to general background growth in traffic volumes due to changes in local and/or regional land use intensity.

During the PM peak hour, an estimated 5 of the 22 total intersections evaluated are expected to show an increase in congestion levels based on the LOS results. These intersections include two crossings of E. Frontage Road at S. Atlantic Street and S. Royal Brougham Way, as well as First Avenue S. at Charles Street, First Avenue S. at S. Atlantic Street, and Fourth Avenue S. at Royal Brougham Way. Of these locations, only the latter two locations would experience higher levels of congestion at LOS E or LOS F.

5.3.2 Central Sub-Area

Detailed intersection analysis results for the central sub-area are shown in Exhibit 5-30. As with the south end intersections, traffic operations for the targeted locations were analyzed using both Synchro and VISSIM traffic analysis software.

2015 Baseline

Under the 2015 Baseline scenario, two intersections during the PM peak hour are forecasted to operate at LOS E or F. No intersections are forecasted to operate under such conditions during the AM peak hour. However, for the AM peak hour the intersection of First Avenue at Seneca Street is anticipated to experience substantial queuing.

Since traffic in the downtown during the AM and PM peak hours is expected to grow only modestly, intersection signal phasing patterns were generally carried over from existing conditions. However, intersection signal timing splits (green time durations) and offsets were optimized.

Under the 2015 Baseline scenario, the intersections of First Avenue at Columbia Street and Elliot Avenue at Wall Street were identified as congested locations, with delays at LOS E or worse 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.

The intersection of Elliott Avenue at Wall Street is forecasted to operate at capacity during the PM peak hour, with delays in the LOS E range. Background traffic growth due to increased land use intensity in the Belltown area between existing conditions and 2015 Baseline conditions is the primary factor leading to increased delay at this intersection.

Under the 2015 Baseline scenario, 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. 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 off-ramp and northbound Western Avenue off-ramp, resulting in some queues and delay on SR 99.

2015 Viaduct Closed (No Build Alternative)

Traffic delays and congestion levels for intersections within the central sub-area under the 2015 Viaduct Closed (No Build Alternative) scenario are expected to be higher for the majority of locations than under 2015 Baseline conditions. Key groupings of intersections that would likely experience the most pronounced increases in congestion would include the signalized intersections along Alaskan Way (surface arterial), intersections on First Avenue, and those 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. As such, high levels of congestion would be expected for key north-south arterials, as well as for east-west connectors to/from I-5 between Union Street and James Street.

2015 Project

Under the 2015 Project scenario, the removal and/or relocation of some SR 99 on- and off-ramps is expected to result in changes in travel patterns to and from SR 99. Ramps currently provided at Columbia Street, Seneca Street, Western Avenue, and Elliott Avenue would be replaced by ramps to Alaskan Way in the stadium area, as well as by improved connections in the South Lake Union area. Traffic that uses the Columbia and Seneca Street ramps today would instead enter/exit on Alaskan Way at Plummer Street and continue into the Central Business District. Elliott/Western trips could similarly use Alaskan Way to travel to Broad Street, or instead continue through the new bored tunnel and enter/exit in the South Lake Union area.

Under the 2015 Project scenario, the intersection of Western Avenue at Broad Street is anticipated to operate with heavy congestion during the PM peak hour. The increase in delay and congestion at this intersection is due to an expected increase in conflicts between southbound left-turning vehicles and northbound through traffic. However, the rest of the intersection approaches are anticipated to operate with low levels of congestion. Note that the improvements proposed as part of the Program, described in Chapter 7, Cumulative Effects, would improve the LOS at this location.

Traffic operations would improve on most streets within the central business district, particularly at Columbia Street and First Avenue, which is congested today by SR 99 ramp traffic.

2030 Project

Under 2030 Project conditions, the majority of intersections are anticipated to operate much as they do under 2015 Project conditions in the central sub-area. During the AM peak hour the intersection of Second Avenue at Marion Street is anticipated to operate under constrained conditions (at or below LOS E). The increased delay would generally be due to projected traffic growth between 2015 and 2030 and greater use of Second Avenue as a southbound route through the city.

The intersection of Western Avenue at Broad Street is anticipated to experience heavy congestion during the PM peak hour 2030 Project scenario. Again, the expected increase in delay and congestion at this intersection between 2015 and 2030 is likely due to projected traffic growth. 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).

5.3.3 North Sub-Area

Two configurations for Sixth Avenue and the southbound on-ramp are being considered. Option 1 proposes to build a new roadway that would extend Sixth Avenue N. from Harrison to Mercer Streets in a typical grid formation. The new roadway would have two lanes in each direction with signalized intersections at Republican and Mercer Streets. Option 2 proposes to build a new roadway that would extend Sixth Avenue N. in a curved formation between Harrison and Mercer Streets. The new roadway would have two lanes in each direction and a signalized intersection at Republican Street. The two options are shown in Exhibit 5-33. Intersection analysis results for the north end sub-area, which consists of arterials and intersections south and west of Lake Union and near Seattle Center, are shown in Exhibit 5-31. Operational results for intersections affected by the Option 2 configuration are shown in Exhibit 5-32.

Option 1

Option 2

Exhibit 5-33
North Portal Options

2015 Baseline

Under the 2015 Baseline scenario in the north area, it is assumed that the Mercer Corridor East project would convert the segment of Mercer Street from Fairview Avenue to Dexter Avenue N. into a two-way facility by widening this segment from four lanes (currently one-way eastbound) to three lanes in each direction. As part of these sub-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.

Two intersections during the AM peak hour and four intersections during the PM peak hour are expected to operate at LOS E or worse in the 2015 Baseline scenario. The intersections of Valley Street at Fairview Avenue N., and Mercer Place at Roy are also expected operate at LOS E or worse during the AM peak hour. The intersections of Mercer Street at Fairview Avenue N., Mercer Street at Westlake Avenue N., Denny Way at Aurora, Western Avenue W. at Elliott Avenue W., and Mercer Place at Elliott Avenue are similarly expected to operate at LOS E or worse during the PM peak hour. Note that even though the Mercer Street/Fairview Avenue intersection is at LOS F, its delay is expected to be substantially lower in the 2015 Baseline scenario than under existing conditions.

Analysis results for the AM peak hour show long queues at the intersection of Valley Street at Fairview Avenue N. that could potentially spill back into the adjacent intersections of Valley at Boren Avenue and Mercer Street at Fairview Avenue N. The intersection of Mercer Place at Elliott Avenue is anticipated to operate at a LOS F during the AM peak hour. Delays at this location are likely the result of heavy projected volumes in the northbound direction and substantial southbound traffic volumes turning left from Elliott Avenue to Mercer Place. Substantial queues and delays are expected for this critical intersection.

As with existing conditions, the intersection of Mercer Street at Fairview Avenue N. is expected to experience considerable delays and queuing for all approaches during the PM peak hour. This is primarily due to the heavy volumes to/from the I-5 ramps. The intersection of Mercer Street at Westlake Avenue N. is anticipated to operate with high delays for all approaches. Long queues are projected along north-south Westlake Avenue N. Long queues and high delays are also expected at the intersection of Denny Way and the SR 99 ramps. This is due to the heavy volumes entering and exiting SR 99, as well as heavy volumes along Denny Way. The queues on the southbound off-ramp are not anticipated to spill back onto SR 99. The intersection of Mercer Place at Elliott Avenue is anticipated to operate at a LOS F during the PM peak hour.

2015 Viaduct Closed (No Build Alternative)

North end congestion levels under the 2015 Viaduct Closed (No Build Alternative) scenario are generally expected to be higher than 2015 Baseline conditions for the majority of locations. While the Battery Street Tunnel would remain open in the Viaduct Closed (No Build Alternative), the SR 99 corridor would terminate at the Battery Street/Western Avenue ramps. Traffic volume estimates for this scenario show that the majority of traffic southbound on SR 99 would utilize the Broad Street and Denny Way off-ramps rather than the Battery Street 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 impacted noticeably. Heavy queuing and long backups may be particularly severe at SR 99 ramp termini intersections such as at Denny Way.

2015 Project

Under the 2015 Project scenario 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 new north-south arterial (Aurora Avenue) with east-west though movements allowed. 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 include the closure of Broad Street, extending Sixth Avenue N. to Mercer Street, and converting Sixth Avenue N. from one-way to two-way between Denny Way and Battery Street.

For the 2015 Project scenario, four intersections during the AM peak hour and nine intersections during the PM peak hour are expected to operate with delays at LOS E or worse. The intersections of Valley Street at Fairview Avenue N., Mercer Place at Elliott Avenue, Dexter Avenue at Mercer Street, and Fairview Avenue at Mercer Street are expected to operate at LOS E or worse specifically during the AM peak hour.

During the AM peak hour, the intersection of Valley Street at Fairview Avenue N. is projected to operate similarly to the 2015 Baseline scenario and to experience queues that could potentially spill back into the adjacent intersections of Valley at Boren Avenue N. and Mercer Street at Fairview Avenue N. The intersection of Mercer Place at Elliott Avenue is anticipated to operate at LOS E during the AM peak hour. Delays at this location are due to a heavy northbound through movement that conflicts with the southbound left-turn movement. In addition, queuing and delays along the north-south streets intersecting with Mercer Street are anticipated, and therefore the intersections of Dexter Avenue at Mercer Street and Fairview Avenue at Mercer Street are expected to operate at LOS E or worse.

During the PM peak hour, the intersection of Mercer Street at Fairview Avenue N. is expected to experience high delays and queuing along all approaches. This is mainly due to the heavy volumes to and from the I-5 ramps. Analysis results indicate that this intersection operates with high delays under 2015 Baseline and existing conditions. The intersection of Mercer Street at Westlake Avenue N. is expected to operate with high delays for all approaches. Long queues are projected on the north-south Westlake Avenue N. approaches in particular, similar to 2015 Baseline conditions. The intersection of Mercer Place at Elliott Avenue is anticipated to operate at a LOS F during the PM peak hour. Similar to the AM peak hour delay, this delay is primarily due to a heavy northbound through movement that conflicts with a heavy southbound left-turn movement. The intersection of Sixth Avenue at Battery Street is anticipated to operate under congested conditions due to Sixth Avenue becoming two-way. Analysis results also show that queuing and delays along the north-south streets intersecting with Mercer Street are anticipated.

An alternative north end configuration, known as Option 2, would include a modified Sixth Avenue N. alignment near Republican Street and the on-ramp to southbound SR 99. This option would align Sixth Avenue N. farther to the east between Republican Street and Mercer Street, as shown in Exhibit 5-33. For this analysis, it is assumed that the resulting intersection at Mercer Street would be unsignalized and restricted to right turns for the northbound outbound approach and right turns for the eastbound inbound movement. No westbound or northbound left turns would be allowed.

The City of Seattle is currently assessing the feasibility and safety implications of signalizing this intersection in Option 2 to allow for all movements. However, with the current assumption of no signal, a rerouting of trips accessing the southbound on-ramp to SR 99 at Republican Street and other points along Sixth Avenue from westbound SR 99 would be needed. Proposed access routes to the southbound Republican Street on-ramp would be via Harrison Street and Thomas Street from southbound Dexter Avenue, or alternatively, access southbound SR 99 via Mercer, Taylor, and Roy Streets.

Traffic operations for Option 2, in terms of delays and LOS, would not be substantially different from the original concept for Sixth Avenue N. The Sixth Avenue N. realignment would change the LOS at the Mercer Street/Dexter Avenue N. intersection in the 2015 Project scenario because of an increase in the westbound left-turn movement. The westbound left-turn volume would increase by 170 vehicles per hour in the AM peak hour and by 150 vehicles per hour in the

PM peak hour, because the volume that would have turned left at Sixth Avenue N. can no longer complete that turn. This volume was destined for either the southbound SR 99 on-ramp at Republican Street or the street grid south of the Republican Street on-ramp.

Some of the westbound left-turn volume at Sixth Avenue N. is expected to reroute to the Roy Street connection to southbound SR 99; however, before any traffic shifts there, the Roy Street approach already is projected to operate at LOS F and at 15 percent over capacity in the PM peak hour and at LOS E with 47 seconds of delay in the AM peak hour, which would offer a less desirable connection to SR 99 than the Republican Street on-ramp.

With the additional volume at Mercer Street/Dexter Avenue N., the LOS changes one grade from the 2015 Project (without Realignment) scenario in both peak hours (LOS D to LOS E in the AM peak hour and LOS E to LOS F in the PM peak hour). In the AM peak hour, some signal timing optimizations may slightly improve delays; however, in the PM peak hour the intersection does not have enough capacity to allow this movement more time without affecting other over-capacity movements.

2030 Project

Under the 2030 Project scenario most intersections are anticipated to operate much as they would in the 2015 Project scenario for the north area, with slight increases in delays due to projected traffic growth. During the AM peak, similar intersections are anticipated to operate under congested conditions as were expected in the 2015 Project scenario. Additionally, the two intersections of Dexter Avenue at Denny Way and Dexter Avenue at Aloha Street are also expected to operate at LOS E or F. The increased delays at these intersections are primarily due to the projected increase in traffic along Dexter Avenue by the 2030 horizon.

During the PM peak hour for the 2030 Project scenario, three additional intersections are expected to operate at LOS E or F, beyond those anticipated in the 2015 Project scenario. These include the intersections of Denny Way at Aurora Avenue, Dexter Avenue at Denny Way, and Ninth Avenue at Mercer Street. The intersection of Denny Way at Aurora Avenue/Battery Street/Wall Street is anticipated to operate at a LOS E during the PM peak hour, which can be attributed to traffic growth both on Denny Way and Aurora Avenue. In addition, the adjacent intersection of Dexter Avenue at Denny Way is anticipated to operate with increased delay by the 2030 horizon. 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. The intersection of Ninth Avenue at Mercer Street is anticipated to fall from LOS

D in 2015 to LOS F in 2030 due to increases in traffic for all approaches. The majority of additional queues and delays at this location are expected for the southbound Ninth Avenue approach and westbound Mercer Street.

5.4 AM and PM Peak Hour Travel Times

Key Findings

- Travel times for the routes investigated generally are not projected to vary much between the 2015 Baseline and Project scenarios, with the majority of the times expected to be within 1 minute of each other.
- The largest travel time increases between 2015 Baseline and Project conditions are expected to be on the Ballard-to-Duwamish (S. Spokane Street) route. In the AM peak hour, this generally would be a 2 minute increase, but could be up to an 8 minute increase in the PM in the northbound direction for the Project using the Alaskan Way surface street. However, in the Project scenario, using Mercer Street and the bored tunnel to travel between these locations, the travel times are projected to be only 1 to 2 minutes slower in the AM peak hour, and are expected to be the same or about 1 minute faster in the PM peak hour.
- Other routes show potential reductions in travel time as well. The greatest reduction in travel time between 2015 Baseline and Project scenarios is expected for the Woodland Park to S. Spokane Street route where up to a 1- to 4-minute decrease could be expected, depending on the direction and time period considered.
- As expected, travel times would generally increase between 2015 and 2030 Project conditions due to background growth in traffic demand.
- The greatest increases in travel times between 2015 and 2030 noted in the analysis results were for the Ballard to Duwamish and Northgate to Boeing Access Road routes, with increases of up to 5 and 6 minutes respectively.
- The Viaduct Closed (No Build Alternative) is expected to result in substantially slower travel times in comparison to the other scenarios. As an example, the Woodland Park to S. Spokane Street route is projected to experience travel times three times longer than the other options.

AM and PM peak hour travel times for routes using the SR 99 corridor are presented as a gauge for how efficient an alternative may be for providing mobility during periods of high use. The travel time routes analyzed were shown in Exhibit 2-8 in Chapter 2, Methodology. Travel times are described below for the key regional routes that were deemed appropriate for representing the primary travel patterns experienced on or adjacent to the corridor:

- South to/from downtown, represented by West Seattle to CBD via SR 99.
- North to/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 to S. Spokane Street.
- Through trips on the Elliott/Western corridors, represented by Ballard Bridge to S. Spokane Street:
    a. via Alaskan Way (or AWV if applicable).
    b. via Mercer Street, bored tunnel.
- Northgate to Boeing Access Road via I-5.
- Mercer Street: from I-5 to Elliott Avenue.

Exhibit 5-34 summarizes corridor travel times by route and direction. Exhibit 5-35 shows travel times for Option 2 for the two routes affected by the option: Ballard to S. Spokane Street via Mercer Street and the bored tunnel, and Mercer Street from I-5 to Elliott Avenue.

5.4.1 West Seattle to CBD

This route extends from the intersection of California Avenue and Alaska Junction to the CBD (Fourth Avenue and Seneca Street) and is presented for the peak direction trip only (i.e., inbound in the AM and outbound in the PM peak period).

For this route, travel times would be very similar under the 2015 Baseline and 2015 Project scenarios. The travel time increase is largely because the selected CBD destination is relatively close to the existing mid-town ramps. For travel times to points in the south CBD and Pioneer Square area from West Seattle, Project travel times would likely be faster.

Travel times between 2015 and 2030 Project scenarios generally would increase by 1 to 3 minutes.

5.4.2 Woodland Park to CBD

This route extends from N. 50th Street/SR 99 to downtown Seattle and is presented for the peak direction movement only (i.e., southbound in the AM peak and northbound in the PM peak).

As with the West Seattle to CBD route, similar travel times are expected for the 2015 Baseline and 2015 Project scenarios. For the 2030 Project scenario, travel times would increase slightly compared to 2015 Project conditions.

Exhibit 5-34. Corridor Travel Times

	2015 Baseline	Viaduct Closed (No Build Alternative)	2015 Project	2030 Project	2015 Baseline	Viaduct Closed (No Build Alternative)	2015 Project	2030 Project
	AM Peak Hour				PM Peak Hour			
West Seattle to CBD								
Inbound	21	n/a	22	23	-	-	-	-
Outbound	-	-	-	-	24	n/a	25	30
Woodland Park to CBD								
Inbound	19	n/a	18	20	-	-	-	-
Outbound	-	-	-	-	17	n/a	17	20
Woodland Park to S. Spokane Street[1]								
Southbound	15	n/a	14	15	14	47	12	13
Northbound	15	n/a	11	12	15	44	14	16
Ballard to S. Spokane Street (via Alaskan Way, AWV)								
Southbound	15	n/a	17	18	16	n/a	18	21
Northbound	17	n/a	19	19	22	n/a	30	32
Ballard to S. Spokane Street (via Mercer Street, Bored Tunnel)								
Southbound	n/a	n/a	16	16	n/a	n/a	16	20
Northbound	n/a	n/a	19	21	n/a	n/a	21	25
Northgate to Boeing Access Road								
Southbound	28	n/a	28	30	32	n/a	32	38
Northbound	28	n/a	28	32	30	n/a	29	34
Mercer Street (I-5 to Elliott)								
Westbound	9	n/a	10	11	11	n/a	11	14
Eastbound	6	n/a	8	8	11	n/a	10	14

Estimated travel times in minutes.

[1] The Woodland Park to S. Spokane Street segment was also assessed for the Viaduct Closed (No Build Alternative) scenario during the PM peak hour: 47 minutes southbound and 44 minutes northbound.

Exhibit 5-35. Corridor Travel Times for Routes Affected by Option 2

(Table to be added when data are available)

5.4.3 Woodland Park to S. Spokane Street

Travel times for this route are expected to decrease between 2015 Baseline and 2015 Project conditions. This is primarily due to improved traffic flow resulting from consolidation and relocation of corridor ramps and improved roadway geometry. In addition, the bored tunnel would be more direct (less distance) than the existing viaduct. For this travel time route, a PM peak hour travel time was also estimated for the Viaduct Closed (No Build Alternative), showing dramatically higher (i.e., three times higher) travel times than for either the 2015 Baseline or Project. In the Viaduct Closed (No Build Alternative), the assumed route through downtown was via Wall Street, Second Avenue, Madison Street, and Alaskan Way.

From 2015 to 2030 (Project scenarios), travel times would generally increase based on background growth in traffic demand.

5.4.4 Ballard Bridge to S. Spokane Street (via AWV and/or Alaskan Way)

This route reflects the travel times that trips to and from Ballard and Interbay would experience.

With the removal of the Elliott Avenue and Western Avenue access ramps to/from SR 99 under the 2015 Project scenario, travel times are expected to increase over 2015 Baseline conditions. The use of the existing Alaskan Way surface arterial for Project conditions is estimated to result in a 2 minute increase in travel time for both directions in the AM peak hour. In the PM peak hour, travel times are projected to be about 2 minutes longer in the southbound direction and 8 minutes longer in the northbound direction. By the 2030 horizon, travel times would remain similar to 2015 Project conditions or increase marginally by up to 3 minutes. Note that a large share of the peak period delay for general purpose traffic experienced along this route under both the Baseline and Project scenarios occurs on Elliott Avenue north of Denny Way and is related to the conversion of a general purpose lane to a transit lane during the peak periods.

5.4.5 Ballard Bridge to S. Spokane Street (via Mercer Street and Bored Tunnel)

This route uses Elliott Avenue to W. Mercer Place, takes Mercer Street to access the bored tunnel via either Sixth Avenue (to SR 99) or Dexter Avenue (from SR 99) and the new ramps at Republican Street. Since this path would not exist under 2015 Baseline conditions, only an estimation of 2015 and 2030 Project conditions is provided. As shown in the exhibit above, travel times for this path compare favorably for the 2015 Project when compared to the surface Alaskan Way path, i.e., this path is up to 9 minutes faster than the surface Alaskan Way path in the northbound direction in the PM peak hour. In the AM peak hour, this path is still expected to be slightly slower than the 2015 Baseline path via Elliott/Western Avenues and the viaduct; however, this path is estimated to be slightly faster than the Baseline in the PM peak hour northbound direction.

Travel times on the Mercer Street/bored tunnel path would generally increase between 2015 and 2030, based on higher traffic levels and associated mainline friction. Travel time increases in the PM peak hour would be more pronounced overall.

5.4.6 Northgate to Boeing Access Road (via I-5)

Travel times between Northgate and Boeing Access Road are generally the highest of any route examined, primarily due to the distance covered along the route. The results of the operational analysis show that implementation of the project elements by the 2015 horizon would not affect travel times noticeably compared to 2015 Baseline conditions. In fact, travel time differences between 2015 Baseline and Project conditions are expected to be less than 1 minute, on average. However, by the 2030 horizon year travel times for Project conditions would likely increase due to background traffic growth, with the most pronounced increases occurring during the PM peak hour.

5.4.7 Mercer Street (I-5 to Elliott Avenue)

East-west travel times for the Mercer Street corridor are generally similar for both 2015 Baseline and 2015 Project conditions. As part of the initial changes for Mercer Street under the 2015 Baseline scenario, the segment between Fairview Avenue and Eighth Avenue is converted to two-way. With the additional segment of Mercer Street converted to two-way operations between Eighth Avenue and Fifth Avenue N. under the 2015 Project scenario, some changes in travel times are expected as a result in changes in travel patterns and operational changes along the corridor. For the AM peak hour, travel times are expected to increase slightly from 2015 Baseline to 2015 Project conditions for both directions. However, the reverse is expected for eastbound traffic during the PM peak hour, when travel times may decrease slightly. For the 2030 Project conditions, travel times would generally be higher than for the 2015 Project scenario.

5.5 Roadway Connectivity and Access

This section gauges the provision and quality of connections between the SR 99 corridor and other streets and highways in the study area.

Key Findings

- Connections to SR 519 and local streets in the stadium area are improved under the Baseline and Project scenarios by providing new access to southbound SR 99 and from northbound SR 99 through the S. Holgate Street to S. King Street Viaduct Replacement Project, and further enhanced by this project.
- The Project would relocate access to SR 99 south of downtown. Connections would be provided from northbound SR 99 to Alaskan Way (and other arterial streets) and from Alaskan Way to southbound SR 99 south of S. King Street near S. Plummer Street. These ramps would provide improved access to the stadium area, central waterfront, Pioneer Square and southern portions of downtown compared to existing conditions, but mid-town locations would be accessed by surface streets rather than direct ramps from the viaduct.
- The northbound off-ramp to Western Avenue and southbound on-ramp from Elliott Avenue would be removed under the Bored Tunnel Alternative. SR 99 trips to and from northwest Seattle communities (Ballard, Magnolia, Belltown) would have several choices. One option would be to exit/enter SR 99 on the Alaskan Way ramps (at Plummer Street) 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 access point at Republican Street and then use Mercer Street or Harrison Street, Broad Street and Denny Way to reach the Elliott/Western corridor.
- The lightly used Battery Street ramps immediately adjacent to the Battery Street Tunnel would be closed. New consolidated ramps at Aurora Avenue/Denny Way would provide for this access under the Project.
- Connections in the South Lake Union and Queen Anne areas would be improved for the Bored Tunnel Alternative, which includes reconnecting several east-west arterial streets that are severed today. Connections to SR 99 would be provided by new ramps at Republican Street or via arterial connections north of Mercer Street (similar to existing conditions in those locations).
- Exhibit 5-36 details the connections to and from SR 99 for the existing facility, 2015 Baseline, and the 2015/2030 Project scenarios.

Exhibit 5-36. Connections Provided to and from SR 99

	Existing Facility	Baseline	Project
Stadium Area (south of S. King Street)			
SB SR 99 to Stadium Area	First Avenue off-ramp	First Avenue off-ramp	Stadium off-ramp (at S. Royal Brougham Way)
Stadium Area to NB SR 99	First Avenue on-ramp	First Avenue on-ramp	Stadium on-ramp (at S. Royal Brougham Way)
Stadium Area to SB SR 99	Arterial routes to E Marginal Way or Spokane St	Alaskan Way S. on-ramp (at King St.)	Alaskan Way S. on-ramp (at S. Plummer St.)
NB SR 99 to Stadium Area	Arterial routes from E Marginal Way or Spokane St	Alaskan Way S. off-ramp (at King St.)	Alaskan Way S. off-ramp (at S. Plummer St.)
Downtown Seattle (S. King Street – Stewart Street)			
SB SR 99 to Downtown	Denny off-ramp or Battery St. off-ramp	Denny off-ramp or Battery St. off-ramp	Harrison St off-ramp
Downtown to NB SR 99	Denny on-ramp or Battery St. on-ramp	Denny on-ramp or Battery St. on-ramp	Harrison St on-ramp
Downtown to SB SR 99	Columbia Street on-ramp	Columbia Street on-ramp	Alaskan Way S. on-ramp (at S. Plummer St).
NB SR 99 to Downtown	Seneca Street off-ramp	Seneca Street off-ramp	Alaskan Way S. off-ramp (at S. Plummer St).
Elliott and Western Corridor (Stewart Street – Denny Way)			
SB SR 99 to Belltown	Denny off-ramp Battery St. off-ramp	Denny off-ramp Battery St. off-ramp	Harrison St off-ramp
Belltown to NB SR 99	Denny on-ramp Battery St. on-ramp	Denny on-ramp Battery St. on-ramp	Harrison St on-ramp
Belltown to SB SR 99	Elliott Avenue on-ramp	Elliott Avenue on-ramp	Arterial routes to Republican on-ramp or Alaskan Way S. on-ramp (at S. Plummer St)
NB SR 99 to Belltown	Western Avenue off-ramp	Western Avenue off-ramp	Arterial routes from Republican St off-ramp or Alaskan Way S. off-ramp (at S. Plummer St)

Exhibit 5-36. Connections Provided to and from SR 99 (continued)

	Existing Facility	Baseline	Project
South Lake Union Area (north of Denny Way)			
SB SR 99 to west South Lake Union	Denny Way off-ramp Broad Street off-ramp Arterial connections	Denny Way off-ramp Broad Street off-ramp Arterial connections	Harrison St/Aurora Avenue off-ramp. Arterial connections (north of Mercer)
SB SR 99 to east South Lake Union	Denny Way off-ramp Broad Street off-ramp	Denny Way off-ramp Broad Street off-ramp	Harrison St/Aurora Avenue on-ramp.
West South Lake Union to SB SR 99	Arterial connections	Arterial connections	Republican Street on-ramp
East South Lake Union to SB SR 99	Arterial connections	Arterial connections	Republican Street on-ramp
NB SR 99 to west South Lake Union	Mercer/Dexter off-ramp Arterial connections	Mercer/Dexter off-ramp Arterial connections	Republican Street off-ramp
NB SR 99 to east South Lake Union	Mercer/Dexter off-ramp Arterial connections	Mercer/Dexter off-ramp Arterial connections	Republican Street off-ramp
West South Lake Union to NB SR 99	Arterial connections	Arterial connections	Harrison St/Aurora Avenue on-ramp
East South Lake Union to NB SR 99	Denny Way on-ramp Arterial connections	Denny Way on-ramp Arterial connections	Harrison St/Aurora Avenue on-ramp

SB = southbound, NB = northbound, EB = eastbound, WB = westbound.

5.5.1 2015 Baseline

The S. Holgate Street to S. King Street Viaduct Replacement Project is being completed prior to 2015 and is included in the 2015 Baseline conditions. The primary access difference between the 2005 existing facility and the 2015 Baseline facility is that new ramps to southbound SR 99 and from northbound SR 99 would be provided from Alaskan Way at S. King Street. In addition, by 2015, the Mercer Street project would have converted Mercer Street to two-way traffic flow between I-5 and Dexter Avenue N. and would have disconnected Broad Street from Ninth Avenue N. and reconnected it to Mercer Street at Eighth Avenue N., which would improve access to the arterial connections to Aurora Avenue.

5.5.2 Viaduct Closed (No Build Alternative)

In Scenario 1 of the Viaduct Closed (No Build Alternative) with a sudden unplanned closure, the viaduct and ramps at First Avenue S., Columbia Street, Seneca Street, Elliott Avenue, and Western Avenue would be closed. In Scenario 2 with catastrophic failure and collapse of the viaduct, the same viaduct and ramp structures would be closed, but in addition, the surface streets under the viaduct would also be unusable. In addition to the roadway directly under the viaduct, this would include the portions under the viaduct and ramps for the following streets:

- Railroad Way S.
- S. King Street
- S. Jackson Street
- S. Main Street
- S. Washington Street
- Yesler Way
- Columbia Street
- Marion Street
- Madison Street
- Spring Street
- Seneca Street
- University Street
- Elliott Avenue
- Blanchard Street
- Bell Street
- Western Avenue

With the above roadways closed, traffic backups would likely hinder adjacent roadways within the Center City area. The overall effect is that the Viaduct Closed (No Build Alternative) would severely inhibit roadway connectivity and access in the Center City area; Scenario 2 would have a more dramatic impact than Scenario 1.

5.5.3 To and From Stadium Area/SR 519

With the Project, access to the stadium area would be provided by a new interchange connecting to Alaskan Way, S. Royal Brougham Way and the East Frontage Road. Access from southbound SR 99 and to northbound SR 99 would be maintained under the alternative, though relocated from First Avenue S. to ramps that connect to the East Frontage Road in the vicinity of S. Royal Brougham Way. Access to and from the south would be via new ramps connecting to Alaskan Way at S. Plummer 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.

5.5.4 To and From Downtown Seattle

With the Bored Tunnel Alternative, the ramps to downtown would not be provided at their current locations. Instead, access would be provided from northbound SR 99 to Alaskan Way, and from Alaskan Way to southbound SR 99 south of S. King Street near S. Plummer Street. The removal of the downtown ramps would alter traffic patterns, and the Alaskan Way surface street would be expected to carry additional traffic to and from the CBD and the stadium area.

An advantage of this configuration is that the interchange location is better able to accommodate traffic flows than the current Columbia and Seneca Street ramp locations. Additionally, 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. Trips to and from the southern areas of downtown would find that the stadium area ramps provides more direct access, however. In addition, access to SR 99 for trips to and from ferry service at Colman Dock would be more direct with the stadium area ramps under the Bored Tunnel Alternative than it is with the Seneca and Columbia Street ramps today.

5.5.5 To and From Belltown/Interbay

The northbound off-ramp to Western Avenue and southbound on-ramp from Elliott Avenue would both be removed under the Bored Tunnel Alternative. Trips that currently use these ramps may instead exit/enter SR 99 on the Alaskan Way ramps (at S. Plummer Street) and continue on Alaskan Way or other downtown arterials to reach the Elliott/Western corridor in Belltown. Another option is 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 ramps immediately adjacent to the Battery Street Tunnel would be closed with the decommissioning of the Battery Street Tunnel. The Harrison Street ramps from Aurora Avenue provide good access for these trips.

5.5.6 To and From Mercer (South Lake Union Area)

For the Bored Tunnel Alternative, access in the South Lake Union and Uptown areas would be maintained, with enhanced levels of safety compared to the existing configuration. SR 99 would be lowered from the Battery Street Tunnel to approximately Mercer Street. Arterial connections directly to SR 99 in this segment would no longer be provided; instead, access would be consolidated to ramps at Harrison Street and Republican Street. A deceleration lane would be provided for the northbound off-ramp, and an acceleration lane for the southbound on-ramp, which represents a considerable operational improvement over the right angle turns on and off the facility serving these movements today.

South of Mercer Street, access on and off SR 99 would be provided at Harrison Street and Republican Street. The street grid would be connected over the top of SR 99 at John, Thomas, and Harrison Streets. Broad Street would be closed between Taylor Avenue N. and Ninth Avenue N. so that the street grid could be reconnected. 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, arterial connections to SR 99 would not change from the existing facility.

5.6 Transit Services

This section identifies the expected effects on transit services using both qualitative and quantitative information. These effects include expected changes in ridership, transit routing, coverage area, and potential effects on travel time along major transit corridors that could be affected by the project.

Travel model results were used to determine potential travel time effects on bus routes operating along SR 99 to downtown Seattle. The transit corridors include the Aurora Avenue corridor between Woodland Park and downtown Seattle, Ballard and downtown Seattle, West Seattle and downtown Seattle, and Burien and downtown Seattle. Three of the transit corridors have been identified for enhanced RapidRide service: Ballard, Aurora Avenue, and West Seattle.

Key Findings

- Under the Bored Tunnel Alternative, 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. Transit routes would likely access downtown to and from the stadium area ramps at the north end of the new S. Holgate Street to S. King Street Viaduct Replacement Project elevated facility. A shoulder transit lane would be provided on northbound SR 99 from approximately S. Holgate Street to the end of the stadium area off-ramp to allow transit vehicles to bypass potential queues emanating from the ramp terminus intersection. Routes would then continue north on Alaskan Way to connect to the downtown street grid.
- In the north end, under the Bored Tunnel Alternative, the SR 99 right side on- and off-ramps to/from Denny Way would be relocated to left-side ramps to Harrison Street and Aurora Avenue, ultimately connecting to Denny Way. Buses operating along Aurora Avenue would likely use this left-side exit to access downtown Seattle. On Aurora Avenue, right-side transit lanes would be provided between Harrison Street and Wall Street to facilitate transit flow through this area.
- Additional locations in the South Lake Union area could be served by transit using new access opportunities, and the Bored Tunnel Alternative would also improve pedestrian access to transit since it provides for pedestrian crossings of Aurora Avenue.
- General purpose traffic travel times were assessed to provide an indication of possible transit travel times. With the Bored Tunnel Alternative, peak hour travel times for inbound trips along selected transit corridors would be generally comparable to Baseline conditions for inbound trips. For those trips involving higher travel times with the Bored Tunnel Alternative versus Baseline, the greatest variations are generally between 5 and 6 minutes.
- The relatively higher travel time differences between the Baseline and the Bored Tunnel Alternative involve outbound trips. For outbound trips between downtown Seattle and West Seattle or Burien, this additional travel time would likely be attributable to vehicles having to pass through more signalized intersections under the Bored Tunnel Alternative as compared to Baseline conditions, which provides access to SR 99 within downtown.
- The highest time differential for the West Seattle and Burien corridors was for outbound trips in the AM peak hour. This is the off-peak direction and would carry significantly fewer riders.

- Outbound PM peak hour trips between downtown Seattle and Ballard for general purpose trips may increase somewhat under the Bored Tunnel Alternative due to added congestion at the Mercer Place intersection with Elliott Avenue; this would be caused by an expected increase in southbound left turns. However, these times apply to general traffic; transit vehicles would benefit from the peak period transit lane on Elliott Avenue, which would likely minimize any travel time differences between the scenarios.
- Peak hour travel times for inbound bus trips accessing downtown Seattle from Ballard are expected to be generally similar between the Bored Tunnel Alternative and Baseline scenarios.
- Peak hour travel times for inbound bus routes accessing downtown Seattle from West Seattle are expected to be generally similar for the 2015 Baseline and the Bored Tunnel Alternative. For outbound buses there would be additional travel time of between 1 and 4 minutes for the Bored Tunnel Alternative versus Baseline.
- In the Aurora Avenue corridor (Woodland Park/downtown Seattle), peak hour travel times for Baseline and the Bored Tunnel Alternative would be somewhat similar, with the Bored Tunnel Alternative trips averaging slightly faster.
- Peak hour travel times for inbound bus trips accessing downtown Seattle from Burien are expected to be generally similar for the 2015 Baseline and the Bored Tunnel Alternative.
- For some trips in the peak hour, transit vehicles would experience a relatively small amount of added travel time under the Bored Tunnel Alternative as compared to the Baseline. However, the extent of added travel time would not likely require added resources in terms of more buses on the affected bus routes.

5.6.1 Modeled Transit Ridership

Exhibit 5-37 summarizes projected daily transit ridership at three screenlines. AM peak period transit ridership is summarized in Exhibit 5-38.

Exhibit 5-37. Model-Estimated Daily Transit Ridership (person-trips) at Selected Screenlines

	Existing (2005)	2015 Baseline	2015 Viaduct Closed (No Build Alternative)	2015 Project	2030 Project
South (South of S. King Street)	56,480	98,900	95,600	95,840	165,320
Central (North of Seneca Street)	90,220	126,270	120,500	124,170	180,280
North (North of Thomas Street)	90,020	118,750	119,120	118,640	172,550

Exhibit 5-38. Model-Estimated AM Peak Period Transit Ridership (person-trips) at Selected Screenlines

	Existing (2005)	2015 Baseline	2015 Viaduct Closed (No Build Alternative)	2015 Project	2030 Project
South (South of S. King Street)	18,210	31,250	30,650	30,330	54,990
Central (North of Seneca Street)	26,940	36,320	35,450	36,050	53,670
North (North of Thomas Street)	29,310	36,330	36,570	36,340	53,750

Transit Ridership Growth between 2005 and 2015 - Baseline and Project Conditions

Between 2005 and 2015, projected daily transit demand in the Baseline scenario represents increases ranging from 32 percent at the north screenline to 75 percent in the south. The increases for the AM peak period are slightly higher, ranging from 24 percent at the north screenline to 68 percent at the south screenline. These increases reflect a variety of transit improvements expected to be implemented between the 2005 existing condition and 2015, including Link light rail to the south to Sea-Tac Airport and north to the University of Washington, and King County Metro's RapidRide BRT service from West Seattle, Ballard, and North Seattle.

Ridership growth between 2005 and 2015 with the project would generally be similar or slightly lower than Baseline depending on the screenline. For the north screenline, daily transit ridership with the project would be similar to Baseline ridership. For the central and south screenlines, daily transit ridership in 2015 with the Project would be slightly less (between 2 and 3 percent) than with the Baseline. AM peak period transit ridership in 2015 for Baseline and Project would have generally similar patterns as total daily demand.

The slight decrease in transit demand between Baseline and 2015 Project at the central and south screenlines would be likely due to anticipated changes in transit access in south downtown. With the project, bus routes from West Seattle and South King County would exit to downtown farther south than the current access locations at Columbia and Seneca Streets. While this routing change would expand the bus service coverage, it would also increase travel times for some riders. Different bus routing assumptions or arterial transit priority enhancements to improve bus travel times could potentially provide sufficient benefit to offset the relatively small projected decrease in transit ridership relative to Baseline conditions.

The relatively small variations in 2015 transit ridership at screenlines for the Baseline, Project, and Viaduct Closed (No Build Alternative) scenarios would also be reflected in mode shares for Seattle Center City. These shares, further discussed below under Transit Mode Share, would be about 36.0 percent for home-based work trips and about 9.5 percent for non-work trips.

2015 Viaduct Closed (No Build Alternative) Conditions

For the north screenline, 2015 transit ridership under Viaduct Closed (No Build Alternative) conditions would approximate the volumes under 2015 Baseline and 2015 Project conditions. The 2015 Viaduct Closed (No Build Alternative) transit ridership at the central screenline would be approximately 5 percent lower than Baseline and 3 percent lower than the Project. Without the viaduct, the congested conditions of surface streets would affect the ability of bus routes to meet demand. At the south screenline, the volumes for 2015 Viaduct Closed (No Build Alternative) conditions would be approximately 3 percent lower than Baseline but would approximate levels under the Project.

2030 Project Conditions

By 2030, total daily transit ridership in the study area is forecasted to increase substantially—about an additional 45 percent over 2015 Baseline and Project levels for the north and central screenlines, and roughly 70 percent for the south screenline. By 2030, transit riders would be able to use existing and new bus routes as well as new rail services (Link light rail and Sounder commuter rail, with each expanded according to the ST2 Plan) provided by Sound Transit. Expanded transit services would affect transit demand at each screenline.

By 2030, AM peak period transit ridership in the study area is also forecasted to increase over 2015 levels—by nearly 50 percent for the north and central screenlines. For the south screenline, the AM increase in peak period transit ridership between 2015 and 2030 would be from 75 to 80 percent, or from about 31,000 to almost 55,000.

Transit Mode Share

The projected transit ridership for 2015 and 2030 indicates gradually increasing shares of transit ridership under the Baseline and the Bored Tunnel Alternative. The transit shares for 2005, 2015, and 2030 are identified in Exhibit 5-39. The extent of ridership growth by 2015 and 2030 would be such that transit shares of total travel are expected to increase substantially. Expanded bus and rail service, particularly Link light rail service in place by 2030, would contribute to this growth in transit mode shares.

The transit share of home-base work trips (i.e., commuting to work) is estimated to grow between 2005 and 2030 from 33 percent of total trips to almost 47 percent. Under potential 2015 scenarios, the transit share would grow to about 36 percent for Baseline, Viaduct Closed (No Build Alternative), and Project scenarios.

Between 2005 and 2030, the transit share of non-work trips is estimated to grow from 8.8 to 11.1 percent of total travel. Under potential 2015 scenarios, the transit share for non-work trips would grow to about 9.5 percent for Baseline, Viaduct Closed (No Build Alternative), and Project scenarios.

Exhibit 5-39. Model-Estimated Daily Transit Mode Shares (person-trips) – To/From Seattle Center City

	Existing (2005)	2015 Baseline	2015 Viaduct Closed (No Build Alternative)	2015 Project	2030 Project
Home-Based Work	33.3	36.3	36.4	36.1	46.9
Non-Work	8.8	9.5	9.4	9.4	11.1

5.6.2 Transit Vehicle Connections

2015 Baseline

Access from SR 99 to the central part of downtown Seattle 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.

2015 Bored Tunnel Alternative

Under the Bored Tunnel Alternative, existing access ramps at Seneca and Colombia Streets would no longer be available. Transit vehicles traveling on SR 99 from West Seattle and South King County would use the new ramps located at the stadium area, and then travel north on Alaskan Way. A shoulder transit lane on northbound SR 99 from approximately S. Holgate Street to the end of the stadium area off-ramp would allow transit vehicles to bypass potential queues emanating from the ramp terminus intersection. 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 the SODO area as well as in Pioneer Square and south downtown. Buses would turn on S. Main Street or other east-west streets, and then on one of the primary north-south corridors to access the downtown street grid.

The access from the stadium area ramps would extend transit service coverage to a greater portion of the area south of the downtown Seattle core in comparison to existing conditions. This access would be complemented by improved street facilities in the south end, including three new east-west streets between S. Royal

Brougham Way and S. King Street: S. Plummer Street, S. Charles Street, and S. Dearborn Street.

For transit vehicles serving downtown Seattle from the north, the Denny Way ramps would be replaced with ramps to Harrison Street and Aurora Avenue, providing a similar connection to Denny Way. Buses operating along Aurora Avenue would likely use this left-side exit to access downtown Seattle. On Aurora Avenue, right-side transit lanes would be provided between Harrison Street and Wall Street to facilitate transit flow through this area. 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 Thomas, John, and Harrison Streets. The extension of Sixth Avenue N. to Mercer Street would improve access to southbound SR 99 from Mercer Street. These access improvements provide opportunities for potential new transit connections in South Lake Union as well as improved pedestrian access to transit.

5.6.3 Peak Hour Travel Times for Transit Corridors

The following sections identify estimated travel times for several transit corridors serving downtown Seattle. The travel demand information for 2015 does not identify transit-specific travel times. However, the information for general traffic does allow comparisons between scenarios for major transit corridors. Also, for segments of roadways that would have transit lanes, information is available on speeds and travel times for buses along with those for general purpose traffic in the same segments.

Travel time variations between the Baseline and the Bored Tunnel Alternative are summarized in Exhibit 5-40. The variations are presented for the four major transit corridors that could be affected by changes under the Bored Tunnel Alternative.

Peak Hour Travel Times – Ballard/Downtown Seattle

The estimated travel times in 2015 for general traffic along Elliott Avenue between the Ballard Bridge and Denny Way for the Baseline and Bored Tunnel Alternative are shown in Exhibit 5-40. For most trips, travel time with the Bored Tunnel Alternative would be generally the same as for the Baseline. At 2 minutes, the time difference for PM outbound trips reflects a slight travel time increase. This increase is primarily due to the added time it is expected to take for northbound traffic to travel through the Elliott Avenue/Mercer Place intersection due to the projected increase in southbound left turns. Note that the existing BAT lanes on Elliott Avenue would provide travel time advantages for transit through this corridor. Hence, most of the differences in travel time expected between the

Baseline and the project for general purpose traffic along this route would not apply to transit travel times.

Exhibit 5-40. 2015 Travel Times[1] Along Major Transit Travel Corridors

	Baseline	Project	Change	Baseline	Project	Change
	AM Peak Hour			PM Peak Hour		
Ballard to CBD[2]						
Inbound	8	8	0	8	7	-1
Outbound	7	7	0	12	14	+2
Aurora Avenue (Woodland Park to CBD)						
Inbound	19	18	-1	19	19	0
Outbound	11	12	+1	17	17	0
West Seattle to CBD						
Inbound	21	22	+1	20	17	-3
Outbound	12	17	+5	24	25	+1
Burien to CBD						
Inbound	24	25	+1	16	19	+3
Outbound	14	20	+6	22	27	+5

[1] Travel times are in minutes for general purpose traffic.

[2] Represented by travel on Elliott Avenue between the Ballard Bridge and Denny Way.

Peak Hour Travel Times – Aurora Avenue Corridor (Woodland Park/Downtown Seattle)

The estimated general purpose travel times in 2015 along the Aurora Avenue corridor for the Baseline and Bored Tunnel Alternative are shown in Exhibit 5-40. With the Bored Tunnel Alternative, the right-side Denny Way ramps on Aurora Avenue would be replaced with left-side ramps to and from Harrison Street. Additionally, right-side transit lanes would be provided along Aurora Avenue in both directions between Harrison and Wall Streets, providing transit priority through the critical Denny Way intersection. With peak hour travel time differences of approximately 1 minute or less, conditions along the Aurora Avenue corridor with the project would be generally comparable to the Baseline.

Peak Hour Travel Times – West Seattle/Downtown Seattle Corridor

The estimated travel times in 2015 along the West Seattle/downtown Seattle corridor for the Baseline and Project are shown in Exhibit 5-40. With the Bored Tunnel Alternative, direct access to downtown Seattle via Columbia and Seneca Streets would no longer be available. Some additional travel time for bus routes operating between West Seattle and downtown Seattle would be anticipated. The most variation in travel times between 2015 Baseline and 2015 Project involves outbound trips in the AM peak. For outbound trips in the AM peak, travel time under the Bored Tunnel Alternative is expected to be 5 minutes longer as compared to the Baseline. For the Bored Tunnel Alternative, traffic has to pass through more signalized intersections to reach the southbound on-ramp in the stadium area. However, this highest time differential occurs in the off-peak direction, which involves substantially fewer riders than AM inbound travel.

Travel time benefits are also expected for transit vehicles due to the provision of the shoulder transit lane for northbound SR 99 between approximately S. Holgate Street and the off-ramp terminus. In the AM peak hour, travel speeds in the shoulder transit lane are estimated at 36 mph as compared to 34 mph for travel in the general purpose lane. In the PM peak hour travel speeds in the shoulder transit lane are estimated at 41 mph as compared to 39 mph for travel in the general purpose lane.

For the PM peak, travel time differences between Baseline and the project are generally estimated to be 3 minutes or less. For inbound trips, travel time under the project would be about 3 minutes shorter than Baseline, while for the more heavily traveled outbound trips, travel time under the project would be roughly 1 minute longer than the Baseline. The longer travel time in the Baseline is likely due to the impacts of the queues from the northbound Western Avenue off-ramp, which spill back onto the SR 99 mainline and impede the traffic exiting at Seneca Street.

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

With the Bored Tunnel Alternative, direct access to downtown Seattle via Columbia Street and Seneca Street would no longer be available. For inbound trips, the travel times under the Bored Tunnel Alternative and Baseline would be generally similar. Greater variations in travel times between the Bored Tunnel Alternative and Baseline would occur for outbound trips. The greatest variation involves AM outbound trips, with travel time under the Bored Tunnel Alternative estimated at approximately 6 minutes longer than under Baseline conditions. The faster time for Baseline is likely because this is the off-peak direction for the AM period and SR 99 southbound is expected to flow at relatively high speeds. For the Bored Tunnel Alternative traffic has to pass through more signalized intersections to reach the southbound on-ramp in the stadium area. Even though this is the off-peak direction, the additional signalized intersections result in additional delay for the Bored Tunnel Alternative. However, because this is the off-peak direction it affects relatively fewer riders than the AM inbound direction trips. Also, buses operating between Burien and downtown Seattle would benefit from the shoulder transit lane on SR 99 between S. Holgate and S. King Streets in terms of lower travel time. In the AM peak hour, travel speeds in the shoulder transit lane are estimated at 36 mph as compared to 34 mph for travel in the general purpose lane. In the PM peak hour, travel speeds in the shoulder transit lane are estimated at 41 mph as compared to 39 mph for travel in the general purpose lane.

5.6.4 Level of Service Changes Affecting Transit

In addition to travel time changes along key corridors, transit service could also be affected by LOS changes at intersections with bus operations. At several locations the LOS would be generally the same in 2015 with the Project as compared to the Baseline, and in some cases, conditions would be improved. In a few cases, conditions would be at LOS F or fall below LOS D with the project. The following sections summarize results for selected locations.

At the south end of downtown Seattle, reduced LOS is projected for AM peak hour trips at First Avenue S. and Yesler Way with the Project (LOS D) compared to 2015 Baseline (LOS B). In the PM peak hour, the intersection would be LOS F with the Project as compared to LOS E under the Baseline. The intersection of Fourth Avenue S. and S. Royal Brougham Way would be LOS C in the AM peak hour for both the Project and 2015 Baseline. For PM peak hour trips, the 2015 LOS would be E for both the Project and Baseline.

At the north end of downtown Seattle, the intersection of Fifth Avenue N. and Mercer Street in the AM peak hour would be at LOS A in 2015 Baseline but LOS D with the Project. In the PM peak hour, this intersection would be at LOS C in the Baseline and LOS E with the Project. The intersection of Dexter Avenue N. and Mercer Street in the AM peak hour would be LOS C in the Baseline as compared to LOS D with the Project. In the PM peak hour, this intersection would be LOS D in the Baseline and LOS E with the Project.

5.6.5 High-Capacity Transit, HOV, and Enhanced Bus Service

Under the 2015 Bored Tunnel Alternative, a shoulder transit lane would be provided on northbound SR 99 from approximately S. Holgate Street to the end of the stadium area off-ramp to allow transit vehicles to bypass potential queues emanating from the ramp terminus intersection. Additionally, in the north end right-side arterial, transit lanes would be provided on Aurora Avenue between Harrison and Wall Streets to facilitate transit flow through this area. The primary benefit of this transit lane is anticipated to be providing priority for transit through the Denny Way intersection. Under both the Baseline and Project, BAT curb lanes are provided in both directions between W. Harrison and Wall Streets.

5.7 Truck Traffic and Freight

Key Findings

- Freight connections between SR 99 and streets in the SODO area, including the stadium area ramps and E. Marginal Way, would be improved under the Bored Tunnel Alternative.
- In the strictest sense, freight connections to the Interbay and BINMIC areas are no longer provided on SR 99 at the north end of the central waterfront (Elliott/Western ramps area). Freight traffic from Elliott/ Western would connect to Alaskan Way via Broad Street. Reconnection to SR 99 in the south end of the central waterfront would occur roughly at S. King Street. Alternatively, this freight traffic could also use Mercer Street to access the bored tunnel via the Republican Street ramps.
- Ramp connections in the South Lake Union area would be revised compared to today. Direct connections to Mercer Street (northbound) and Broad Street (southbound) would be eliminated but would be replaced by new connections to Republican Street and Harrison Street. These new ramps would involve right turns onto the cross streets and would be designed to accommodate truck movements.
- Option 2 would be less advantageous to freight mobility because trucks would have to traverse longer grades on Mercer Street and on Sixth Avenue N. than with Option 1.
- Hazardous and flammable cargo would be restricted from the bored tunnel and would have to use either Alaskan Way or I-5 to move through downtown.

5.7.1 Freight Connections

2015 Baseline

Freight traffic traveling on SR 99 to the south end of downtown Seattle would have improved access to locations in the stadium/SODO area. These improvements would be made possible by the reconfiguration of the interchange under the S. Holgate Street to S. King Street Viaduct Replacement Project. A key feature of this project would be the construction of an underpass for freight coming to and from the Port of Seattle facilities along E. Marginal Way and Alaskan Way.

In the central waterfront area, access restrictions on the Alaskan Way Viaduct would remain in effect. Access from SR 99 to the central part of downtown Seattle would continue to be provided at the Columbia Street on-ramp and Seneca Street off-ramp.

For freight vehicles accessing downtown Seattle from the north end, existing access locations would be maintained. No additional access locations would be provided for freight vehicles.

2015 Bored Tunnel Alternative

In the south section, full connections for freight are provided between SR 99 and the local arterial system around the stadium area. Northbound off-ramps and southbound on-ramps are provided for freight trips that wish to access downtown streets (or are excluded from using the bored tunnel) at S. Royal Brougham Way.

Along the central waterfront, the Bored Tunnel Alternative would maintain access to Alaskan Way from SR 99 for those freight trips serving the Interbay, Magnolia, Ballard, and Fremont areas. While the existing connections on SR 99 at Elliott Avenue/Western Avenue would no longer exist for the Bored Tunnel Alternative, freight could still connect to areas in northwest Seattle through connections from Alaskan Way to Broad Street and then to Elliott and Western Avenues. Travel times for freight would be slightly higher, as vehicles would encounter signalized intersections along Alaskan Way. Alternatively, this connection could also be made via the bored tunnel and Mercer Street.

In the north section, full connections would be provided between SR 99 and the local arterial system. 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.). Prior to the ramp, a deceleration lane would be provided to slow traffic to safely navigate the ramp's expected tight turning radius. Two options for accessing southbound SR 99 from Mercer Street have been proposed, and each would have impacts on freight operations. For both options, entering connections would be improved compared to the side-street connections provided today.

Under Option 1, eastbound or westbound freight traffic would gain access to southbound SR 99 via Sixth Avenue. After turning onto Sixth Avenue, freight traffic would then turn left at the T-intersection at Republican Street. Traffic would then proceed to the southbound on-ramp and then to SR 99, accessing the tunnel at Republican Street. A signalized intersection at Mercer Street and southbound Sixth Avenue would help facilitate access to the on-ramp for westbound freight traffic.

Under Option 2, both eastbound and westbound freight traffic from Mercer Street would be able to access southbound SR 99, although both directions present their own sets of challenges. Eastbound traffic (west of Mercer Street) would turn right onto Sixth Avenue, then left at the T-intersection at Republican Street. This is a similar route as under Option 1, except that trucks would be required to travel farther on the downgrade on Mercer Street, and subsequently farther on an upgrade on Sixth Avenue, to reach the Republican Street on-ramp to southbound SR 99. No left turns to Sixth Avenue from Mercer Street for westbound traffic would be allowed. Westbound traffic would require a very circuitous path to reach the southbound on-ramp. Westbound freight trips on Mercer Street would instead need to turn left on Dexter Avenue N., turn right on Harrison Street, cross SR 99 and turn right on Sixth Avenue to reach the Republican Street on-ramp. Due to the number of turns and tight radii at the on-ramp, some trucks may choose to bypass this maneuver and opt for another route through the corridor.

Overall, freight vehicles using the Mercer Street Underpass would encounter grades on either side of SR 99, which may slow down these vehicles for a short distance. Trucks may or may not choose to take alternate paths in this area due to this condition.

5.7.2 Ability of Design to Facilitate Freight Operations

New connections in the South Lake Union area would be designed to adequately accommodate turning trucks. In addition, with the closure of Broad Street east of Taylor Avenue N., Mercer Street and Fifth Avenue N. would likely be designated the major truck route through the area. The likely truck route connecting I-5 to the waterfront would include Mercer Street (at I-5) to Fifth Avenue N., Fifth Avenue N. to Broad Street, and Broad Street to Alaskan Way.

For the Bored Tunnel Alternative, restrictions on the transport of hazardous and flammable materials, including heating oil, are anticipated. Trucks hauling hazardous materials would likely be prohibited in the new tunnel at all times and would be rerouted to either I-5 or Alaskan Way.

5.7.3 Freight Train Operations

Minimal impacts to rail operations are foreseen. Improvements to provide separation between street and train traffic are provided by the S. Holgate Street to S. King Street Viaduct Replacement Project. A primary objective of this project is to minimize impacts to freight and passenger rail operations. If there were to be closures of the rail line, they would be temporary.

5.8 Parking

Key Findings

- The Project would eliminate approximately 80 on-street parking spaces in the south portal area. The majority of these spaces are along Railroad Way S. between Alaskan Way and Occidental Avenue S.

- The Project would remove approximately 220 on-street spaces in the north portal area. The affected spaces are predominately along John, Thomas, and Harrison Streets, where the existing parallel parking would be converted to travel lanes.
- The Project would remove about 250 off-street parking spaces in the south portal area. Approximately 40 off-street spaces would be removed in the north portal area.
- Existing parking under the viaduct would not be affected.
- There is no difference in parking effects between the two north portal area options.

Exhibit 5-41 summarizes the potential parking effects for the proposed action. The proposed action would reduce the number of parking spaces as compared to existing conditions. The Bored Tunnel Alternative would not affect any parking spaces under the viaduct because the parking spaces would remain before and after viaduct removal. Effects to parking spaces under the viaduct during construction are covered in Chapter 6, Construction. Potential future removal of spaces related to the surface street reconfiguration component of the Program is discussed in Chapter 7, Cumulative Effects.

Exhibit 5-41. Parking Effects of the Bored Tunnel Alternative

	South Portal	North Portal	Total Spaces
Existing Conditions[1]			
On-Street Spaces	210	300	510
Off-Street Spaces	250	40	290
Total Spaces Existing	**460**	**340**	**800**
Number of Spaces Removed			
On-Street Spaces	-80	-220	300
Off-Street Spaces	-250	-40	-290
Under the viaduct	**0**	**0**	**0**
Net Change	**-330**	**-260**	**-590**

[1] Spaces within the project boundaries.

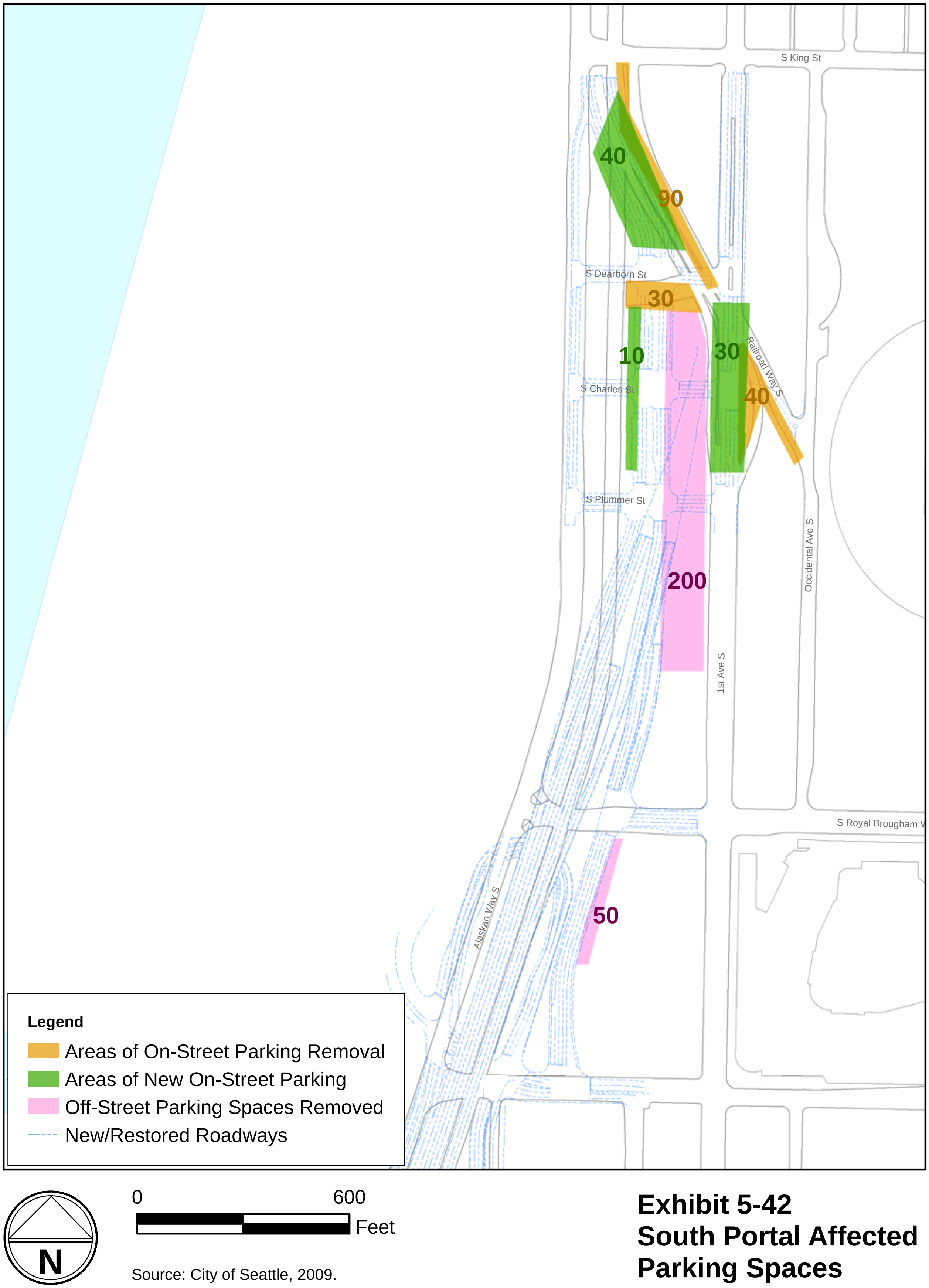
5.8.1 South Portal

The south portal area encompasses the area from approximately S. Atlantic Street to S. King Street. There are currently about 210 on-street spaces in this area that are outside of the S. Holgate Street to S. King Street Viaduct Replacement Project boundaries. Of these 210 spaces, 170 are short-term and 40 are long-term spaces. The Bored Tunnel Alternative would replace approximately 130 of the on-street spaces, with an overall loss of about 80 spaces. 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 Project. Of these spaces, about 200 are on the Washington–Oregon Shippers Cooperative Association (WOSCA) property and are currently unavailable due to S. Holgate Street to S. King Street Viaduct Replacement Project construction. 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 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 up to WSDOT or potential future property owners. Exhibit 5-42 shows the location of the parking spaces affected.

In this area, the majority of the parking losses are off-street losses (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 2006). Because parking lots are generally underutilized in the stadium area, parking spaces are not anticipated 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 under current conditions. However, a number of major parking facilities are located near the stadiums, including the Safeco Field Garage, Stadium Exhibition 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 within walking distance of the stadiums. Event-goers will continue to be encouraged to use bus and rail service and to carpool to the stadiums. The Safeco Field Transportation Management Plan and the Qwest Field Transportation Management Program both include parking reduction and transit-related goals and mitigation measures that aim to reduce the number of event attendees who require parking near the stadiums.



Source: City of Seattle, 2009.

Exhibit 5-42
South Portal Affected Parking Spaces

5.8.2 North Portal

The north portal area extends from just south of Denny Way at the Battery Street Tunnel north portal along SR 99 to Roy Street and includes some surrounding streets. There are approximately 70 on-street short-term parking spaces and approximately 230 on-street long-term spaces within the north portal project area, for a total of 300 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 80 spaces would be replaced, resulting in a loss of 220 on-street spaces, compared with existing conditions. Off-street parking also would be reduced, but only by approximately 40 spaces. In addition, as the design progresses, changes are under consideration that may allow restoration of one of the off-street parking lots, which would reduce the number off-street spaces that are lost. Exhibit 5-43 shows the location of the affected parking spaces in the north portal area.

As was the case for the south portal area, SDOT would ultimately determine how on-street parking spaces are managed, so no assumptions are made about whether the new and replaced on-street spaces would be long- or short-term spaces.

There is no difference in parking effects between Options 1 and 2.

5.9 Pedestrians

Key Findings

- Project improvements in the south, near the stadiums, include removal of the Railroad Way ramps from First Avenue S., a new roadway grid, and associated sidewalk facilities between S. Royal Brougham Way and S. King Street, which would considerably improve pedestrian mobility and accessibility in this area.
- A dedicated 25-foot-wide pedestrian and bicycle path on the east side of the new Alaskan Way, an extension of the trail constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, would greatly increase the overall pedestrian experience in the stadium and south waterfront areas, as well as the connectivity to the existing combined pedestrian/bicycle trail to Myrtle Edwards Park and the E. Marginal Way bike lanes.
- Project-related improvements north of the Battery Street Tunnel include street reconnections over SR 99 at John, Thomas, and Harrison Streets, with Mercer Street crossing under SR 99, and the removal and backfilling of Broad Street. These improvements to reconnect the grid in the Seattle Center/South Lake Union area would dramatically improve pedestrian safety, access, and mobility in the area as well.

Legend

- Areas of On-Street Parking Removal
- Areas of New On-Street Parking
- Off-Street Parking Spaces Removed
- New/Restored Roadways*

* Shows Option 1. No difference in effects compared to Option 2.

Note: Totals may not precisely match tables due to rounding.

0 600 Feet

N

Source: City of Seattle, 2009.

Exhibit 5-43
North Portal Affected Parking Spaces

- Option 1 for the north portal would provide better mobility and access for pedestrians because it provides crosswalks on all sides of a signalized intersection with Mercer Street, as well as providing an additional access point to the combined bicycle and pedestrian facility on the north side of Mercer Street. Option 2 would not provide a signalized crossing of Mercer Street at Sixth Avenue.

5.9.1 Pedestrian Facilities Provided

2015 Baseline

Pedestrian facilities under Baseline conditions are very similar to those discussed for existing conditions, with the exception of the pedestrian facilities added by the S. Holgate Street to S. King Street Viaduct Replacement Project. The S. Holgate Street to S. King Street Viaduct Replacement Project will construct combined pedestrian and bicycle facilities adjacent to Terminal 46 and on the east side of the new surface Alaskan Way extension, as well as improve sidewalk and crosswalk facilities on S. Atlantic Street. More detail on the pedestrian facilities included in the S. Holgate Street to S. King Street Viaduct Replacement Project can be found in the SR 99: S. Holgate Street to S. King Street Viaduct Replacement Project Environmental Assessment and Draft Section 4(f) Evaluation (FHWA and WSDOT 2008). No other substantial pedestrian facilities or connections are known or anticipated to be constructed by the City of Seattle within the project area within this timeframe.

Viaduct Closed (No Build Alternative)

As was noted under Baseline conditions, no additional pedestrian facilities are known or anticipated to be constructed by the City of Seattle within the project area. However, a key difference between the existing conditions, Baseline, and Viaduct Closed (No Build Alternative) is the expected increase in auto traffic on surface streets through downtown Seattle. In certain instances, the increase in auto traffic may result in an increase in intersection-related conflicts between pedestrians and autos at intersections. This could be particularly true for pedestrian crossings that occur in conflict with right-turning auto movements.

Bored Tunnel Alternative

<u>South Portal Area</u>

The Bored Tunnel Alternative would include additional pedestrian facilities on the new roadway grid between First Avenue S. and E. Marginal Way. The new east-west roadways of S. Plummer, S. Charles, and S. Dearborn Streets would include sidewalks on all approaches of the new roadway grid, except for the southern side of the Alaskan Way and S. Plummer Street intersection that services the SR 99 on- and off-ramps. The sidewalks would also provide access to the green space west of the SR 99 southbound on-ramp and the 14-foot-wide combined pedestrian and bike trail adjacent to Port of Seattle property.

A new 25-foot-wide combined pedestrian/bicycle trail would provide the primary north-south pedestrian facility in the southern portion of the project area. This proposed trail is an extension of the trail constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project that runs adjacent to the East Frontage Road. Under the Bored Tunnel Alternative, the combined pedestrian/bicycle facility would continue northward on the east side of the SR 99 northbound off-ramp to Alaskan Way and the new street grid at S. Plummer Street. The trail would remain on the east side of Alaskan Way from S. Plummer Street to S. Dearborn Street and the proposed plaza immediately north of the new Alaskan Way and S. Dearborn Street intersection. The trail would continue to S. King Street, where it would connect to the existing combined pedestrian/bicycle facility to Myrtle Edwards Park.

North Portal Area

North of the Battery Street Tunnel, pedestrian and bicycle connectivity would be improved across SR 99 and across what is currently Broad Street. The Aurora Avenue improvements would provide new crossings at John, Thomas, and Harrison Streets over SR 99, and a widened Mercer Street would cross under SR 99. In addition, Broad Street would be closed and backfilled to allow the street grid to be reconnected from approximately Taylor 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.

Option 1 provides the ability for pedestrians traveling on Sixth Avenue to connect to the combined pedestrian and bicycle trail on the north side of the redesigned Mercer Street. Option 2 is assumed to not allow any pedestrian crossing movements at the intersection of Sixth Avenue N. and Mercer Street. Under Option 2, it is expected that pedestrians would be required to cross at either Fifth Avenue N. and Mercer Street or Dexter Avenue N. and Mercer Street, depending on the walker’s desired starting point and destination.

5.9.2 SR 99 Corridor Effects on Pedestrian Mobility and Access

In the southern portion of the project area, the addition of sidewalks as part of the new roadway grid and the 25-foot-wide combined pedestrian/bicycle trail would greatly increase pedestrian mobility and accessibility between the stadium and waterfront areas, as well as connectivity to regional facilities to the north.

North of the Battery Street Tunnel, project improvements 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.

Of the two connection and extension options under consideration, Option 1 would provide better mobility and access for pedestrians because it provides crosswalks on all sides of a signalized intersection, and it provides an additional access point to the combined bicycle and pedestrian facility on the north side of Mercer Street. Option 2 does not provide pedestrian access across Mercer Street at Sixth Avenue and may require out of direction travel for pedestrians who are unaware of the crossing restriction.

5.10 Bicycles

Key Findings

- Bicycle facility improvements in the project area include new, in-street bike lanes on Alaskan Way, E. Marginal Way, and John Street within a reconnected grid system. The provision of both dedicated bicycle facilities and an improved and reconnected street grid considerably enhance overall connectivity and accessibility for cyclists.
- A dedicated 25-foot-wide pedestrian and bicycle path on the east side of Alaskan Way in the southern project area provides an off-street bicycle facility for casual bike users, as well as an extension of the existing combined pedestrian/bicycle trail in the central waterfront area and points north.
- The Mercer Street undercrossing would include bicycle and pedestrian pathways on the north side of the roadway. This off-street facility would provide casual cyclists with considerably improved east-west mobility and rider experience in the Seattle Center/South Lake Union area.
- Option 1 for the extension of Sixth Avenue N. would provide cyclists with an additional access point to the combined bicycle and pedestrian facility on the north side of the redesigned Mercer Street. Option 2 would not provide this access.

5.10.1 2015 Baseline

Bicycle facilities under Baseline conditions are expected to be largely the same as discussed for existing conditions, with the exception of the completion of the new bicycle/pedestrian overpass connecting Uptown to the waterfront at Thomas Street. No other substantial additional bicycle facilities are known or anticipated to be constructed by the City of Seattle within the project area that are not being completed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project.

5.10.2 Viaduct Closed (No Build Alternative)

As was noted under Baseline conditions, no substantial additional bicycle facilities are known or anticipated to be constructed by the City of Seattle within the project area. However, a key difference between the existing conditions, Baseline, and Viaduct Closed (No Build Alternative) is the expected increase in auto traffic on surface streets through downtown Seattle. Bicyclists riding in the street or within marked bike lanes may face increased potential for conflicts with vehicles given the higher volume of traffic.

5.10.3 Bored Tunnel Alternative

South Portal Area

The Bored Tunnel Alternative would include the 25-foot-wide combined pedestrian/bicycle trail from S. Royal Brougham Way to S. King Street, where it would connect to the existing combined bicycle/pedestrian trail to Myrtle Edwards Park.

On-street bicycle lanes would be provided in both the north and southbound directions between S. Royal Brougham Way and S. King Street. A 5-foot-wide southbound bike lane would be located on the new E. Marginal Way and an eastbound bike lane would be located on S. Plummer Street, allowing connection to both the combined pedestrian/bicycle trail that is located east of the SR 99 ramp facilities and to the 5-foot-wide northbound bike lane on Alaskan Way.

North Portal Area

Bicycle facilities in the northern project area include in-street bike lanes on John Street, between Dexter Avenue N. and Sixth Avenue N., and bicycle and pedestrian pathways on the north side of Mercer Street. In addition to the John Street bike lanes and the Mercer Street bicycle and pedestrian pathways, the new Harrison and Thomas Street crossings of Aurora Avenue would provide additional connectivity and mobility for cyclists in the Seattle Center/South Lake Union area.

Option 1 would provide the ability for cyclists riding on Sixth Avenue to connect to the combined bicycle and pedestrian trail on the north side of the redesigned Mercer Street. Option 2 would allow only right-in and right-out movements to/from Sixth Avenue N. to eastbound Mercer Street. No access to the westbound Mercer Street or the north side of Mercer Street and the combined pedestrian-bicycle facility is assumed to be provided at Sixth Avenue with the design of Option 2.

5.10.4 Bicyclist Mobility and Access

In the southern portion of the project area, the in-street bike lanes on Alaskan Way and E. Marginal Way and the 25-foot-wide combined pedestrian/bicycle trail provide additional bicycle facilities and connections in the stadium and waterfront areas. These facilities would be complementary to the combined pedestrian/bicycle trail that would be constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, which is on the western boundary of the project area adjacent to the Port of Seattle facilities.

The dedicated bike lane on John Street and the shared-use facility on Mercer Street would dramatically increase bicycle connections across SR 99 and vastly improve rider safety and overall experience in the Seattle Center/South Lake Union.

Of the two SR 99 connection and Sixth Avenue N. extension options under consideration, Option 1 would provide an additional access point from the south to the combined bicycle and pedestrian facility on the north side of Mercer Street.

5.11 Ferries

Colman Dock, located on Pier 50 and 52 on Seattle’s downtown waterfront, is the Seattle terminus for the Washington State Ferries. The passenger-only service from Vashon Island also uses Colman Dock while the service from West Seattle uses Pier 55 in the central waterfront. 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. Signal operations for the ferries were assumed to remain similar to current conditions for the future (i.e., vehicles exiting the ferries would preempt north-south traffic on Alaskan way for 180 seconds).

Key Findings

- Under the Viaduct Closed (No Build Alternative) scenario, volumes on Alaskan Way would nearly double in the vicinity of the Seattle Ferry Terminal. This would result in very poor operating conditions for vehicles entering and exiting Colman Dock, especially in the peak periods.
- In peak periods for the 2015 and 2030 Bored Tunnel Alternative scenarios, overall LOS at the Alaskan Way and Marion Street and Alaskan Way and Yesler Way intersections would improve slightly over Baseline conditions. The revised roadway with an additional lane in the northbound direction (assumed with the Bored Tunnel Alternative) would slightly improve traffic operations.
- As with 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. 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.

5.11.1 2015 Baseline

Although the delay and LOS varies some by movement, overall the intersections at Alaskan Way and Marion Street and Alaskan Way and Yesler Way perform well (LOS C or better) in both peak periods.

5.11.2 Viaduct Closed (No Build Alternative)

With the viaduct closed, surface volumes on Alaskan Way would nearly double in the vicinity of the Seattle Ferry Terminal. This would result in very poor operating conditions for vehicles entering and exiting Colman Dock, especially in the peak periods.

5.11.3 2015 and 2030 Bored Tunnel Alternative

The reconfiguration of Alaskan Way would allow the intersections at Alaskan Way and Marion Street and Alaskan Way and Yesler Way to continue perform well (LOS C or better) in both peak periods even with the anticipated increase in background traffic over that time period. As with existing ferry operations, however, 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 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.

5.12 Safety

Safety measures to compare effects and benefits of the analysis scenarios include corridor design aspects and collision history.

Key Findings

- Restoration of the street grid between Denny Way and Mercer Street in the Bored Tunnel Alternative would provide substantially improved pedestrian and bicycle access across SR 99, which is expected to dramatically 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 would consolidate access points, eliminate current conflicting weaving movements, and provide acceleration/deceleration lanes and 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 Tunnel ramps), eliminating a currently identified collision analysis location, as well as collisions within the Battery Street Tunnel.
- The Bored Tunnel Alternative would replace the current midtown ramps at Seneca and Columbia Streets with new ramps in the stadium area connecting to Alaskan Way at S. Plummer Street—this change would eliminate collisions associated with the ramp design at Seneca and Columbia Streets, which contributed to mainline queuing, merging, and weaving.
- The Bored Tunnel Alternative would eliminate the identified northbound collision analysis location at the southern end of the viaduct, roughly between S. Massachusetts Street and S. Royal Brougham Way, through improved design of the replacement roadway facility.
- The Bored Tunnel Alternative is expected to increase the total volume of traffic on Alaskan Way surface street, which could increase the number of conflicts between vehicles and pedestrians and cyclists.

5.12.1 2015 Baseline

Safety aspects of the Baseline scenario would be similar to those discussed in Chapter 4, Affected Environment (existing conditions), as the SR 99 roadway would remain as it is currently configured. In general, overall safe operation of the facility would be expected to deteriorate due to higher future year volumes and increasing congestion. Additionally, with the increasing residential, commercial, and retail development occurring in South Lake Union and the area immediately east of Seattle Center, the challenges associated with pedestrian access north of the Battery Street Tunnel would increase.

5.12.2 Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative), operations on I-5 and downtown surface streets would deteriorate considerably as drivers previously using the viaduct would have to divert to these other roadway facilities. The increase in volumes and related congestion on I-5 and the downtown surface streets is expected to increase the likelihood of vehicular accidents, as well as the potential for vehicle and pedestrian and cyclist conflicts.

5.12.3 2015 Bored Tunnel Alternative

Exhibits 5-44 and 5-45 highlight the updated design features for the project, which are discussed in the following sections.

Mainline Design Features

SR 99 is currently a controlled-access facility within the project area and would remain a controlled-access facility. The access points provided by the Bored Tunnel Alternative would be improved through better design of the ramps, fewer ramps, and fewer right-turn-on, right-turn-off access points that are associated with known crash locations. These ramps and crash locations that would be eliminated include the Seneca and Columbia Street ramps, the Western and Elliott Avenue ramps, the Battery Street ramps at the south end of the Battery Street Tunnel, and the right-on, right-off access movements from John, Thomas, and Harrison Streets north of the Battery Street Tunnel.

The Battery Street Tunnel and associated Western and Elliott Avenue ramps and the Battery Street ramps would be decommissioned, which would eliminate the currently identified collision analysis location. North of the Battery Street Tunnel, access to mainline SR 99 would be consolidated to single ramps, with distribution to other streets occurring in the street grid. Collisions associated with the existing, uncontrolled side-street connections in this area would be eliminated. John, Thomas, and Harrison Streets would be reconnected, passing over lowered SR 99 just north of the bored tunnel. These would provide pedestrian connections between Denny Way and Mercer Street, reducing (illegal) pedestrian crossings of SR 99 that occasionally occur today.

The design of the Bored Tunnel Alternative would provide 12-foot-wide lanes throughout the entire length of the tunnel, providing drivers with increased room to maneuver. This may reduce erratic driver behavior that currently occurs in transition areas and locations with narrow lanes on the existing viaduct.

As shown in Exhibit 5-44, both inside and outside shoulder widths on the Bored Tunnel Alternative would be considerably improved over the existing viaduct, providing improved sight distance for motorists. The existing viaduct typically provides 1 foot for both inside and outside shoulder width, whereas the Bored Tunnel Alternative would provide anywhere from 2 feet to 6 feet in the majority of the tunnel, to 10 feet of shoulder width for the stadium area.

Exhibit 5-44. SR 99 Mainline Design Features

Mainline Design Features	Location	Existing Facility	Bored Tunnel Alternative
Access Control	Stadium Area	Controlled vehicle access	Controlled vehicle access
	Midtown	Controlled vehicle access	Controlled vehicle access
	North	Partially controlled (right-on, right-off) access	Partially controlled (right-on, right-off) access north of Thomas Street
Maximum Grade (up or down)	Stadium Area	5%	5%
	Midtown	4%	4%
	North	5%	5%
Lane Width	Stadium Area	12–13.5 feet	12 feet
	Midtown	9.5–13 feet	12 feet
	North	10–13 feet	12 feet
Multi-level	Stadium Area	Multi-level	Multi-level/Barrier
	Midtown	Multi-level	Multi-level
	North	Barrier	Multi-level/Barrier
Inside Shoulder Width	Stadium Area	1 foot	4 feet
	Midtown	1 foot	6 feet (SB) 2 feet (NB)
	North	1 foot	6 feet (SB) 2 feet (NB)

Exhibit 5-44. SR 99 Mainline Design Features (continued)

Mainline Design Features	Location	Existing Facility	Bored Tunnel Alternative
Outside Shoulder Width	Stadium Area	1 foot	10 feet
	Midtown	1 foot	2 feet (SB) 6 feet (NB)
	North	0 feet (sidewalks)	2 feet (SB) 6 feet (NB)
Pedestrian Accommodation	Stadium Area	Pedestrians prohibited; grade-separated crossings provided	Pedestrians prohibited; grade-separated crossings provided
	Midtown	Pedestrians prohibited; grade-separated crossings provided	Pedestrians prohibited in the tunnel
	North	Sidewalks provided on both sides; undercrossings at Broad and Mercer Streets	Pedestrians prohibited; grade-separated crossings provided

The new grade-separated crossings at John, Thomas, and Harrison Street would provide additional pedestrian crossings of SR 99, as well as the redesigned Mercer Street crossing. This reconnection of the grid is expected to considerably reduce the occurrence of collisions involving pedestrians north of the Battery Street Tunnel, a previously identified pedestrian accident location.

Ramp Design Features

As shown in Exhibit 5-45, ramp design improvements as part of the Bored Tunnel Alternative mainly address design limitations of short deceleration lengths, limited vehicle storage, and high curvature. In many instances, all three of the noted design limitations are associated with a single ramp, such as the southbound Elliott Avenue and Seneca Street off-ramps.

The Bored Tunnel Alternative would eliminate the midtown area ramps of Seneca and Columbia Streets and Western and Elliott Avenues, all of which are associated with congestion and higher rates of crashes (with the exception of the southbound Elliott Avenue on-ramp). Elimination of these ramps would improve mainline operations and address design standards on the existing facility that are less than those found on newer highway facilities.

While the Bored Tunnel Alternative does have two ramps with either a reduced merge length or a reduced speed, the design of the northbound on-ramp in the stadium area and the northbound off-ramp to Republican Street would still provide improved overall design and safe operations.

Exhibit 5-45. SR 99 Ramp Design Features

Ramp Design Features	Location	Existing Facility	Bored Tunnel Alternative
Maximum Grade (up or down)	Stadium Area	6%	5–7%
	Midtown	8%	No midtown ramps provided
	North	2–3%	5–7%
Outside Shoulder Width	Stadium Area	6 feet	8 feet
	Midtown	1 foot	No midtown ramps provided
	North	N/A	2–8 feet
Location of Merged On-Ramps (left or right side)	Stadium Area	N/A	NB On-Ramp
	Midtown	Battery Street NB On, Columbia Street SB On	None
	North	N/A	SB On-Ramp
Ramp Design Limitations (short deceleration length, limited vehicle storage at termini, or high curvature)	Stadium Area	N/A	NB on reduced merge length
	Midtown	Seneca Street NB Off, Columbia Street SB On, Western Avenue NB Off, Western Avenue NB On, Western Avenue SB Off	No midtown ramps provided
	North	Denny Way SB Off, Broad Street SB Off, Mercer Street NB Off	NB Off at Republican reduced speed

5.12.4 2030 Project

With the removal of the existing viaduct and the associated removal of the midtown ramps of Columbia and Seneca Streets and Western and Elliott Avenues, an increased number of vehicles would be accommodated on the new Alaskan Way surface street and perhaps other downtown streets. This increase in vehicles may lead to increased operational congestion, and possibly increased vehicle and pedestrian and cyclist conflicts.

However, these potential impacts are expected to be mitigated by traffic signal and progression improvements and associated facility design that focuses on pedestrian and cyclist safety. Facility design associated with pedestrian and cyclist mobility include a large pedestrian promenade along the proposed Alaskan Way surface street, appropriately located and well marked crosswalks, as well as bicycle lanes and sharrows within the roadway.

5.13 Event Traffic

Key Findings

- The S. Holgate Street to S. King Street Viaduct Replacement Project and SR 519 Intermodal Access Project – Phase 2 would improve stadium access to/from the south and east, respectively, with or without the Alaskan Way Viaduct Replacement Project and Program in place. These improved connections in the south end would enhance overall capacity for events by providing more direct access to/from regional facilities (SR 99, I-90, I-5, etc.).
- The convergence of additional traffic streams into and out of the stadium area (due to new ramp connections) for the Baseline, Project, and Program scenarios may require extensive traffic management measures for key arterials near the stadiums prior to and following large events.
- Congestion levels would be similar for the Baseline, Project, and Program scenarios. Viaduct Closed (No Build Alternative) conditions would show higher levels of congestion compared to other scenarios.

5.13.1 South Portal Area

By the 2015 and 2030 horizon years, sporting and other major events at Safeco Field and Qwest Field will likely continue to draw large crowds and result in high concentrations of traffic movements into and out of the stadium area prior to and following 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 end are discussed qualitatively below in the context of the four applicable scenarios: 2015 Baseline, 2015 Viaduct Closed (No Build Alternative), 2015 Project, and 2030 Project.

2015 Baseline

The roadway network in the south end for the 2015 Baseline includes two major projects that precede the Alaskan Way Viaduct Replacement Project: (1) the S. Holgate Street to S. King Street Viaduct Replacement Project, and (2) the SR 519 Intermodal Access Project – Phase 2. When these two projects are completed, roadway connections in the south end to/from regional facilities such as SR 99 are expected to change significantly prior to completion of the Alaskan Way Viaduct Replacement Project. For example, as part of the SR 519 Phase 2 project, the connection between S. Atlantic Street and I-90/I-5 would be improved to accommodate more direct two-way access for stadium area traffic to/from the east. Also, S. Royal Brougham Way would be converted 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. For the S. Holgate Street to S. King Street Viaduct Replacement Project, new ramps to/from the south on SR 99 are introduced which add a new level of stadium access not previously provided under current conditions.

With these new connections in place, traffic congestion during events would likely be reduced compared to pre-Baseline conditions (i.e., without the S. Holgate Street to S. King Street Viaduct Replacement Project and SR 519 Intermodal Access Project) due to more direct access to major roadway facilities and generally higher levels of ingress and egress capacity. Improved options for local traffic circulation and regional access would be provided while opportunities for traffic control/management on key arterials would be maintained.

Viaduct Closed (No Build Alternative)

Under the Viaduct Closed (No Build Alternative) scenario, traffic conditions during events in the south end would be negatively affected due to the removal of regional access to/from the north via SR 99. While connections to/from I-5 would be maintained for regional access, these routes would become more congested as drivers increasingly rely on them to avoid 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.

2015 Project

While new roadway connections in the south end would be introduced by the S. Holgate Street to S. King Street Viaduct Replacement Project and SR 519 Intermodal Access Project (as described previously), changes to the street system in the stadium area would occur when the Alaskan Way Viaduct Replacement Project is completed.

Roadway elements that are specific to the project would include the following:

- First Avenue S. ramps to/from the north (SR 99) would be removed but replaced by similar connections to/from the north off of S. Royal Brougham Way.
- A new surface frontage road west of First Avenue S. and east of SR 99 (known as the East Frontage Road) would be introduced and would provide the access to/from the north.

- New intersections along First Avenue S., an extended segment of Alaskan Way, and a West Frontage Road would be introduced between S. Royal Brougham Way and S. King Street (creating three new east-west arterials and nine new intersections).
- New ramps connecting the stadium area to/from the south on SR 99 (just south of S. King Street) would be added to improve access regional access.

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. However, due to the reliance on First Avenue S. for access to/from the north and south in the modified roadway network, congestion on First Avenue S. between S. Atlantic Street and S. King Street may become more heavily concentrated for short durations before and after events.

In any case, similar opportunities for short-term traffic management and detour routing would be maintained with the new roadway network. Pedestrian movements would be managed at key crossing points near the stadiums and on major arterials similar to current practices.

2030 Project

Overall event-based traffic demands for 2030 Project conditions would likely be higher than 2015 Project event volumes, primarily due to background increases in commute and non-commute peak hour volumes by the 2030 horizon year. As such, sporting and other major events at Safeco Field and Qwest Field that occur near or around afternoon commute periods by 2030 would experience more pronounced levels of congestion compared to 2015 conditions. However, given that the roadway network would be consistent between 2015 and 2030 Project conditions in terms of improved access to regional facilities, traffic management practices in place for 2015 Project conditions should be reasonably effective by the 2030 horizon.

5.13.2 North Portal Area

As discussed in Chapter 4, Affected Environment, event traffic related to Seattle Center currently relies on Mercer Street, Denny Way, Broad Street, and various connections to/from SR 99 for ingress/egress prior to and following sporting events, concerts, festivals, etc. As more and larger events take place at Seattle Center in the future, attendance levels would generally increase and would be accompanied by larger background demands on local streets and regional facilities such as SR 99 and I-5.

No major network changes are anticipated in the north end for the Baseline scenario outside of Mercer Street conversion to two-way operations east of Ninth Avenue. Also, the Viaduct Closed (No Build Alternative) scenario would not include any appreciable differences in network characteristics beyond existing conditions other than the central waterfront viaduct section of SR 99 being unavailable for use. However, substantial modifications to the local street system are proposed under 2015 and 2030 Project scenarios which may improve access to/from and across SR 99. Changes associated with the project elements would add redundancy in the street grid and potentially reduce congestion during major events.

Event-related traffic associated with Seattle Center is discussed qualitatively below for the four applicable scenarios: 2015 Baseline, Viaduct Closed (No Build Alternative), 2015 Project, and 2030 Project.

2015 Baseline

Under Baseline conditions the street network near Seattle Center, including connections to/from SR 99, are not expected to change. However, the Mercer Corridor East Project is assumed to be completed, which converts Mercer Street into a two-way arterial between Fairview Avenue and Dexter Avenue. At-grade connections to/from SR 99 are maintained and the northbound off-ramp to Mercer/Dexter is also retained.

With no new connections in place to accommodate event trips, traffic congestion during Seattle Center events would be similar to pre-Baseline conditions (i.e., without the Mercer Corridor East Project in place). Current (existing conditions) issues related to event-based demand concentrations and capacity constraints would need to be addressed but with slightly greater requirements in terms of traffic control, directional signage, lane restrictions, etc. due to higher background traffic levels.

Viaduct Closed (No Build Alternative)

Event traffic at Seattle Center for the Viaduct Closed (No Build Alternative) scenario would present similar challenges as the Baseline in terms of high concentrations of traffic prior to and following events. Requirements for traffic control/management, directional signage, and potential lane restrictions would also be similar to Baseline conditions and existing conditions.

2015 Project

The proposed roadway elements under the 2015 Project scenario represent substantial changes to the street network near Seattle Center and areas adjacent to the South Lake Union (SLU) neighborhood. Key elements associated with the Alaskan Way Viaduct Replacement Project include the following:

- A new surface roadway between Sixth Avenue N. and Dexter Avenue N. (along the original SR 99 alignment) known as Aurora Avenue.
- Connecting roadways across SR 99 at John, Thomas, and Harrison Streets.
- SR 99 ramps to the new Aurora Avenue roadway at Harrison Street (left-side ramps).
- SR 99 ramps at Republican Street to/from the south.
- Maintain SR 99 access at Roy Street and Aloha Street.
- Two-way Mercer Street from Dexter Avenue to Fifth Avenue N. (Baseline converts Mercer Street to two-way from Fairview Avenue to Ninth Avenue).

With greater redundancy in the street network provided by the project, 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/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 and access improvements to/from SR 99 should serve event traffic more efficiently overall.

In addition, the surface Aurora Avenue configuration would allow better pedestrian access to Seattle Center from SR 99/Aurora Avenue, including those pedestrians who take transit.

2030 Project

Similar to the south end, peak hour commute and non-commute volumes by the 2030 horizon year would be higher compared to 2015 background traffic levels. As such, events at Seattle Center by 2030, especially during afternoon commute periods, would experience more pronounced levels of congestion. However, given the added network redundancy provided by the project elements (as described in the 2015 Project discussion), event-related traffic congestion levels for 2030 Project conditions would likely be lower than without the project elements in place.

5.14 Potential Tolling Effects

The operational benefits and impacts of tolling for the bored tunnel facility will be investigated as part of a larger tolling study for the Program. Specific toll-based travel demand models are being developed and refined to assess potential levels of diversion that may occur due to various toll rates and user costs. This work will feed into the financial analysis for the Program with the intent of determining potential levels of alternative funding. The results of the diversion analysis will be used to assess possible impacts on non-SR 99 facilities and provide insight as to what traffic-related mitigation measures (if any) may be needed to minimize or address the impacts of tolling on the larger street network. See Appendix S, Tolling Report for more information.

5.15 Operational Mitigation

Long-term (post-construction) transportation mitigation measures are not anticipated for the project.

5.16 Operational Benefits

Operational benefits of the Bored Tunnel Alternative can be seen both in comparison to the 2015 Baseline scenario as well as the Viaduct Closed (No Build Alternative). The Baseline itself would have improved access in the south end area in comparison to existing conditions with the addition of the stadium area ramps to/from the south. The Viaduct Closed (No Build Alternative), however, would substantially reduce mobility throughout the corridor and result in highly congested conditions along Alaskan Way surface street as well as downtown arterials. Travel times between Woodland Park and S. Spokane Street for the PM peak hour would be expected to triple compared to the Baseline. I-5 also would be expected to have increased congestion with the Viaduct Closed (No Build Alternative).

The Bored Tunnel Alternative is projected to experience some decrease in performance in overall conditions compared to the Baseline, but conditions would be substantially better than the Viaduct Closed (No Build Alternative). SR 99 through traffic is expected to operate better than Baseline due to the removal of the merging and weaving conflicts associated with the Elliott/Western ramps and the midtown ramps.

Peak hour travel times for SR 99 through trips are projected to be 9 to 25 percent faster than under Baseline depending on the peak hour and direction, and three times as fast as for the Viaduct Closed (No Build Alternative). Regarding other key peak hour travel time routes analyzed, the Bored Tunnel Alternative is projected to be about 1 minute slower than the Baseline between West Seattle and downtown Seattle due to the removal of the midtown ramps. Between Ballard and S. Spokane Street, the Bored Tunnel Alternative using the surface Alaskan Way route is expected to be 2 to 8 minutes slower than Baseline, which includes the existing Elliott/Western ramps. The Bored Tunnel Alternative's travel times along this route would be compromised due to the lack of a connection from Elliott/Western Avenues to the waterfront, causing traffic to use Broad Street, which includes an at-grade rail crossing. However, using Mercer Street and the bored tunnel, the Bored Tunnel Alternative is expected to be only 1 to 2 minutes slower in the AM peak hour, and in the PM peak hour less than a minute slower southbound, and a minute faster northbound.

Other benefits of the Bored Tunnel Alternative include the following:

- Improved mobility in the South Lake Union area due to the connection of three east/west streets across SR 99.
- Improved access from Mercer Street to southbound SR 99 as a result of the extension of Sixth Avenue N. to Mercer Street (access from westbound Mercer Street would be more direct with Option 1 than Option 2).
- The Sixth Avenue Extension would also provide a new connection between downtown and Uptown (the northbound to westbound connection would be more direct with Option 1).

Areas where the Bored Tunnel Alternative is expected to cause a decrease in performance as compared to the Baseline include the following:

- Alaskan Way is projected to experience 24 to 37 percent heavier traffic than Baseline, but still 24 to 39 percent less than with the Viaduct Closed (No Build Alternative).
- Traffic volumes would be heavier on First Avenue through Pioneer Square in comparison to the Baseline.

Concerning the two options for the Sixth Avenue Extension, Option 1 would provide more overall transportation benefit, including the following:

- Option 1 would provide all movements at Sixth Avenue and Mercer Street, whereas Option 2 would allow only right turns into and out of Sixth Avenue from/to Mercer Street.
- Option 1 would provide an additional route from downtown to Uptown, and from I-5 via westbound Mercer Street to SR 99 southbound (Option 2 would provide these movements indirectly).
- Option 1 would provide a pedestrian and bike crossing of Mercer Street at Sixth Avenue connecting to the proposed trail along the north side of Mercer Street.

Chapter 6

6.1 Construction Effects

Given the dynamic nature of construction activities, transportation effects would vary depending on the construction period. Generally, the most disruptive travel effects (i.e., substantial sustained effects) would occur during Traffic Stages 6 and 7, when SR 99's capacity would be reduced to the greatest extent and construction activities would also affect nearby surface roadways. This chapter summarizes how conditions may vary during construction. The assumed traffic stages are described below.

6.1.1 Construction Durations

The Bored Tunnel Alternative would require about 70 months of construction. This can be broken down into eight traffic stages, starting with utility work and early construction activities prior to construction of the south portal.

The following text describes the current planning for a likely construction sequence for the project elements along with the approximate construction durations. These durations have been developed as estimates based upon what is known about the design of the project at this early stage.

Traffic Stage 1

Traffic Stage 1 would last approximately 5 months, roughly from April through August 2011. Significant construction activities are shown in Exhibit 6-1. 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 from S. Holgate Street to Denny Way, and Alaskan Way surface street would have a detour route between S. King Street and S. Royal Brougham Way.

Exhibit 6-1. Traffic Stage 1 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (5 months)
Begin ground improvements and relocate existing utilities	2 months
Begin installing secant piles along First Avenue – S. King Street to WOSCA site	5 months (continues in Stages 2, 3)
Initiate the design and procurement of the tunnel boring machine	5 months (18 months total—continues through Stages 2, 3, 4)
Excavate and install secant piles – WOSCA site	5 months (continues in Stage 2)

First Avenue S. would be reduced to one lane each way between S. King Street and the WOSCA site (just north of S. Royal Brougham Way). These traffic modifications would also allow for shoring improvements at the WOSCA site scheduled to occur during Traffic Stage 1. In the north portal area, the Denny Way ramps would remain open.

Traffic Stage 1 Traffic Revisions – SR 99

For the 5 months of Traffic Stage 1, northbound and southbound traffic would not change on the existing SR 99: three lanes would be open in each direction (four lanes northbound between the First Avenue S. on-ramp and the Seneca Street off-ramp).

Traffic Stage 1 Traffic Revisions – Surface Streets

Traffic revisions in the south portal area include the following:

- First Avenue S. would be reduced to one lane in each direction from April through August 2011. No other surface street traffic revisions would be required in Traffic Stage 1. Since First Avenue S. would remain open (although at reduced capacity), no detour routes are being specified at this time. Traffic, however, would likely redistribute itself to parallel north-south streets to avoid increased congestion associated with lane closures.

Traffic Stage 2

Traffic Stage 2 would last approximately 3 months, from August to November 2011. Primary construction activities are shown in Exhibit 6-2. As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, the SR 99 mainline northbound on-ramp and southbound off-ramp at Railroad Way to and from First Avenue S. would be moved to newly constructed transitional ramp structures that would allow access to the area via S. Royal Brougham Way. Alaskan Way would continue to operate on the detour route between S. King Street and S. Royal Brougham Way.

In the Bored Tunnel Alternative Traffic Stage 2, First Avenue S. would be restricted to one lane in each direction between Railroad Way S. and S. Royal Brougham Way. In the north end, the Denny Way ramps would remain open, although Denny Way itself, along with John, Thomas, and Harrison Streets, would experience lane closures due to utility relocations. Sixth Avenue would also have restricted use due to modifications for utility relocations and some reconfiguration of Sixth Avenue.

Exhibit 6-2. Traffic Stage 2 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (3 months)
Install secant piles on First Avenue - S. King Street to WOSCA site	2–3 months (continues in Stage 3)
Demolish Railroad Way ramps	2 months
Excavate within WOSCA site and set up staging	2 months
Build and set up tunnel boring machine substation	3 months (continues in Stages 3, 4)
Excavate (12′ down) & suspend utilities on First Avenue – S. King Street to Railroad Way S.	1 month (continues in Stage 3)
North Portal: Relocate utilities on Denny Way; John, Thomas, and Harrison Streets, and Sixth Avenue N.; and widen Mercer Street	3 months (continues in Stages 3, 4, 5, 6)

Traffic Stage 2 Traffic Revisions – SR 99

- The northbound on-ramp and southbound off-ramp would be rerouted to new transition structures accessed via S. Royal Brougham Way.
- The Denny Way ramps would remain open.

Traffic Stage 2 Traffic Revisions – Surface Streets

Traffic revisions in the south portal area include the following:

- First Avenue S. would be restricted to one lane in each direction between Railroad Way S. and S. Royal Brougham Way.

Traffic revisions in the north portal area include the following:

- In the north end, although the Denny Way ramps would remain open, Denny Way itself, along with John, Thomas, and Harrison Streets, would experience lane closures due to utility relocations. Sixth Avenue would also have restricted use due to modifications for utility relocations and some reconfiguration of Sixth Avenue.

Traffic Stage 3

Traffic Stage 3 would last approximately 5 months, from November 2011 to April 2012. Primary construction activities are shown in Exhibit 6-3. As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, northbound traffic on SR 99 would continue to operate on the existing viaduct structure. Southbound traffic would operate on the new west mainline structure. The new northbound on-ramp and southbound off-ramp in the vicinity of S. Royal Brougham Way would continue to use the transition structures. Alaskan Way would continue to operate on the detour route between S. King Street and S. Royal Brougham Way.

Exhibit 6-3. Traffic Stage 3 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (5 Months)
Install secant piles on First Avenue – S. King Street to WOSCA site	2 months
Excavate/remove tiebacks, backfill with CDF on First Avenue – S. King Street to WOSCA site	1 month (continues in Stages 4, 5)
Make ground improvements along First Avenue, including excavation (12' down), utility suspension, and shoring excavation – S. King Street to WOSCA site	5 months
Bored Tunnel: Set up staging area	5 months (continues in Stage 4)
North Portal: Relocate utilities on Denny Way; John, Thomas, & Harrison Streets; and Sixth Avenue N.	5 months (continues in Stages 4, 5, 6)
Construct SR 99 detour	1 month (continues in Stages 4, 5, 6)
Build and set up tunnel boring machine substation	5 months (continues in Stage 4)

Traffic Stage 3 Traffic Revisions – SR 99

- In the north end, as in Traffic Stage 2, the Denny Way ramps would remain open.

Traffic Stage 3 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel include the following:

- First Avenue S. between S. King Street and the WOSCA site would be reduced to one lane in each direction.

Traffic revisions near the north portal of the bored tunnel include the following:

- Denny Way, along with John, Thomas, and Harrison Streets, would experience lane closures due to utility relocations.
- Sixth Avenue would have restricted use due to modifications for utility relocations and some reconfiguration of Sixth Avenue.

Traffic Stage 4

Traffic Stage 4 would last approximately 4 months, from April to August 2012. Primary construction activities are shown in Exhibit 6-4. As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, both northbound and southbound traffic on SR 99 would be shifted to the new west mainline structure.

The new northbound on-ramp and southbound off-ramp near S. Royal Brougham Way would continue to use the transition structures. Alaskan Way would continue to operate on the detour route between S. King Street and S. Royal Brougham Way.

Exhibit 6-4. Traffic Stage 4 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (4 Months)
Design & procure tunnel boring machine	4 months (started in Stage 1)
Excavate/remove tiebacks, backfill with CDF on First Avenue – S. King Street to WOSCA site	4 months (continues in Stage 5)
Build and set up tunnel boring machine substation	4 months
Construct SR 99 detour	4 months (continues in Stages 5, 6)
Bored Tunnel: Set up staging areas	4 months
North Portal: Relocate utilities on Denny Way; John, Thomas, & Harrison Streets; and Sixth Avenue N.	4 months (continues in Stages 5, 6)

Traffic Stage 4 Traffic Revisions – SR 99

- The Denny Way ramps would remain open.

Traffic Stage 4 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel include the following:

- Alaskan Way S. traffic would remain reduced to one lane in each direction, northbound and southbound.

Traffic revisions near the north portal of the bored tunnel include the following:

- Denny Way, along with John, Thomas, and Harrison Streets, would experience lane closures due to utility relocations.
- Sixth Avenue would have restricted use due to modifications for utility relocations and some reconfiguration of Sixth Avenue.
- First Avenue S. between S. King Street and the WOSCA site would continue to be reduced to one lane in each direction from April to June 2012. Temporary decking on the roadway surface would be in place on First Avenue S. in the same location between June and August 2012.

Traffic Stage 5

Traffic Stage 5 would last approximately 7 months, from August 2012 to March 2013. Primary construction activities are shown in Exhibit 6-5. As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, both northbound and southbound traffic on SR 99 would be shifted to the new west mainline structure. The new northbound on-ramp and southbound off-ramp near S. Royal Brougham Way would continue to use the transition structures. Alaskan Way would continue to operate on the detour route between S. King Street and S. Royal Brougham Way.

Exhibit 6-5. Traffic Stage 5 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (7 Months)
Excavate/remove tiebacks, backfill with CDF on First Avenue – S. King Street to WOSCA site	2 months
Construct SR 99 detour	7 months
Assemble tunnel boring machine	2 months
Drive tunnel boring machine	5 months (Continues in Stages 6, 7)

Traffic Stage 5 Traffic Revisions – SR 99

- The Denny Way ramps would remain open.

Traffic Stage 5 Traffic Revisions – Surface Streets

Traffic revisions near the north portal of the bored tunnel include the following:

- Denny Way, along with John, Thomas, and Harrison Streets, would experience lane closures due to utility relocations.
- Sixth Avenue would have restricted use due to modifications for utility relocations and some reconfiguration of Sixth Avenue.
- First Avenue S. between S. King Street and the WOSCA site would remain open for north-south traffic on a temporary decking roadway surface.

Traffic Stage 6

Traffic Stage 6 would last approximately 1 month, from March 2013 to April 2013. Primary construction activities are shown in Exhibit 6-6. During this stage the SR 99 mainline northbound and southbound would be closed at the north portal of the Battery Street Tunnel to allow for the transition to the detour roadway in the north end. However, the Elliott/Western ramps and midtown ramps would still be in operation. Alaskan Way would continue to operate on the detour route between S. King Street and S. Royal Brougham Way.

Exhibit 6-6. Traffic Stage 6 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (1 Month)
Close SR 99 in both directions (northbound and southbound) at the Battery Street Tunnel north portal	1 month
Drive tunnel boring machine	1 month (continues in Stage 7)
North Access: Tie-in detour to SR 99	1 month

Traffic Stage 6 Traffic Revisions – SR 99

- The Denny Way southbound off-ramp would be closed (northbound on-ramp could remain open).
- The Denny Way northbound on-ramp could remain open or traffic could detour using Dexter Avenue to Roy Street to northbound SR 99.
- A new connection replacing the closure of the southbound SR 99 off-ramp to Denny Way would be provided, tying into Sixth Avenue near Republican Street.

Traffic Stage 6 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel include the following:

- The Alaskan Way detour from S. King Street to S. Royal Brougham would be in operation.
- First Avenue S. between S. King Street and the WOSCA site would remain open for north-south traffic on a temporary decking roadway surface.

Traffic revisions near the north portal of the bored tunnel include the following:

- Denny Way, along with John, Thomas, and Harrison Streets, would be open.

Traffic Stage 7

Traffic Stage 7 would last approximately 33 months, from April 2013 to late December 2015. Primary construction activities are shown in Exhibit 6-7. As part of the S. Holgate Street to S. King Street Viaduct Replacement Project, both northbound and southbound traffic on SR 99 would be shifted to the new west mainline structure. The new northbound on-ramp and southbound off-ramp near S. Royal Brougham Way would continue to use the transition structures. Alaskan Way would continue to operate on the detour route between S. King Street and S. Royal Brougham Way.

Exhibit 6-7. Traffic Stage 7 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (33 Months)
Bored Tunnel: Drive tunnel boring machine, install interior concrete & interior systems work, systems commissioning	33 months
South Portal: Construct vent building	12 months
South Portal: Construct cut-and-cover tunnel connection	12 months
Excavate tunnel boring machine recovery shaft	6 months
North Portal: Construct vent building	12 months
North Portal: Construct cut-and-cover tunnel connection	15 months
Install interior systems – electrical, mechanical, fire, and life safety	18 months
Extract tunnel boring machine	1 month

Traffic Stage 7 Traffic Revisions – SR 99

- Between Mercer Street and the north portal area, SR 99 would be limited to two lanes in each direction. The speed would be reduced to 40 mph, as required with the curves associated with the shifting of the roadway to the west to accommodate construction in the existing SR 99 right-of-way.
- Denny Way southbound off- and northbound on-ramps would be closed.
- Since the Denny Way ramps would be closed, access to that area would be provided by a new southbound connection from the realigned SR 99 to Sixth Avenue; this connection would be placed somewhere between Republican Street and Thomas Street.
- Northbound access to SR 99 would be provided by an on-ramp from approximately the Republican Street alignment. This would join SR 99 as an add-lane.
- No northbound egress from SR 99 would be allowed south of Roy Street.
- Access to/from SR 99 would not be allowed from John, Thomas, or Harrison Streets.

Traffic Stage 7 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel include the following:

- Alaskan Way would be rerouted to the East Frontage Road from S. King Street to S. Royal Brougham Way, with two lanes in each direction.
- First Avenue S. between S. King Street and the WOSCA site would be open for north-south traffic on a temporary decking roadway surface.

Traffic revisions near the north portal of the bored tunnel include the following:

- Denny Way, along with John, Thomas, and Harrison Streets, would be open (but would not connect to SR 99).
- During this stage a connection would be made from southbound SR 99 to Sixth Avenue to replace the (closed) southbound SR 99 off-ramp to Denny Way.
- Sixth Avenue would also be converted from one-way to two-way operations between Denny Way and Wall Street.

Traffic Stage 8

Traffic Stage 8 would last approximately 12 months, as shown in Exhibit 6-8.

Exhibit 6-8. Traffic Stage 8 Construction Activities and Approximate Durations

Primary Construction Activity	Approximate Duration (12 Months)
Demolish and remove existing viaduct	9 months
South Portal Area: Restore surface streets	12 months
North Portal Area: Restore surface streets	12 months
Decommission Battery Street Tunnel	9 to 12 months

Traffic Stage 8 Traffic Revisions – SR 99

- The SR 99 mainline would be open and using the newly constructed bored tunnel.

Traffic Stage 8 Traffic Revisions – Surface Streets

Traffic revisions near the south portal of the bored tunnel include the following:

- 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. Demolition would occur two blocks at a time, with the middle cross-street being closed for approximately 2 weeks in duration.
- Drivers on First Avenue S. would experience lane closures necessary for street restoration. Additionally, between Railroad Way S. and S. Royal Brougham Way, traffic would be reduced to one lane in each direction.
- Alaskan Way would continue to be rerouted to the east as in Traffic Stage 7.
- The Battery Street Tunnel would be decommissioned.

Traffic revisions near the north portal of the bored tunnel include the following:

- The new left-hand ramps to/from Harrison Street and Aurora Avenue (providing connections to Denny Way) would be operational, although on Denny Way and on John, Thomas, and Harrison Streets, lanes would be restricted to support utility relocation. Sixth Avenue would also be affected.

6.1.2 Proposed Detours

Throughout the construction of the bored tunnel and associated facilities, a number of traffic detours 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. Below are descriptions of these detours for Traffic Stage 7, the stage considered to be substantially disruptive for the longest period of time.

Near the north portal area, the closure of the southbound SR 99 ramp to Denny Way requires a detour, as the existing street network would not be able to accommodate the closure of this ramp without a replacement connection. To mitigate the impacts of the closure of the southbound SR 99 Denny Way off-ramp, a new connection would be constructed from southbound SR 99 (which would be temporarily shifted to the west and reduced to two lanes in each direction as part of the construction process) to Sixth Avenue, somewhere between Republican Street and John Street.

Closure of the Railroad Avenue ramps that provide access between SR 99 and First Avenue S. would also require a substantial detour. To maintain access to and from the stadium area, a northbound on-ramp to and southbound off-ramp from SR 99 would be constructed to provide access to the area via S. Royal Brougham Way.

In addition to the detours described above, as part of the project Alaskan Way from S. King Street to the WOSCA property would be rerouted to a new alignment just east of SR 99.

6.1.3 Traffic Congestion on SR 99

Traffic impacts would likely be most severe during Traffic Stage 6 when SR 99 is closed in both directions at the Battery Street Tunnel north portal. Traffic Stage 6, however, only lasts for 1 month. This section provides a qualitative discussion of anticipated congestion levels on SR 99 through the project area for the construction period primarily defined by Traffic Stage 7. The primary measures for mainline SR 99 performance are average speeds and travel times for representative trips. Vehicle delays on SR 99 during this 33-month (estimated) construction period would be expected to increase somewhat compared to baseline conditions. The decreases in speeds and increases in travel times would be heavily influenced by temporary changes to the SR 99 configuration in the north and south, which are expected to reduce mainline capacity. Refer to Exhibits 6-9 and 6-10 for diagrams of the roadway configuration during Traffic Stage 7.

As described in the construction staging summary, northbound and southbound SR 99 under Traffic Stage 7 would be reduced to two lanes between approximately Columbia Street and the stadium area. The stadium area southbound off-ramp would also be moved from the current left-side off-ramp to First Avenue S., to a right-side off-ramp to S. Atlantic Street. Additionally, due to the narrowing to two lanes prior to Columbia Street, the Columbia Street southbound on-ramp would be provided with an acceleration lane for merging traffic. The combination of the merge lane addition plus moving the stadium area ramp to the right side eliminates one of the areas of major conflict in the facility today and would likely offset some of the impacts caused by the overall capacity reduction. In the north during Traffic Stage 7, SR 99 would be shifted to the west to provide room for construction activities. As a result of the realignment, design speeds would be reduced to 40 mph. Additionally, the current access to/from Denny Way would be detoured as outlined above.

Travel Speeds

On SR 99 in the project area between S. Atlantic Street and Mercer Street, travel speeds in both directions are expected to be very similar to Baseline conditions. 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 those in the 2015 Baseline scenario north of the Seneca Street off-ramp, about 30 to 34 mph. South of the Seneca Street off-ramp, the northbound traffic would operate about 8 mph slower than during 2015 Baseline conditions, due to the restricted capacity on SR 99 that begins in the stadium area. In the southbound direction, a comparison of travel speeds between Traffic Stage 7 and the 2015 Baseline indicates similar speed patterns, with overall speeds only slightly slower than under Baseline conditions. The addition of a merge lane for the Columbia Street on-ramp in combination with relocating the stadium area off-ramp to the right side is expected to help offset the speed impacts of the capacity reduction in this area.

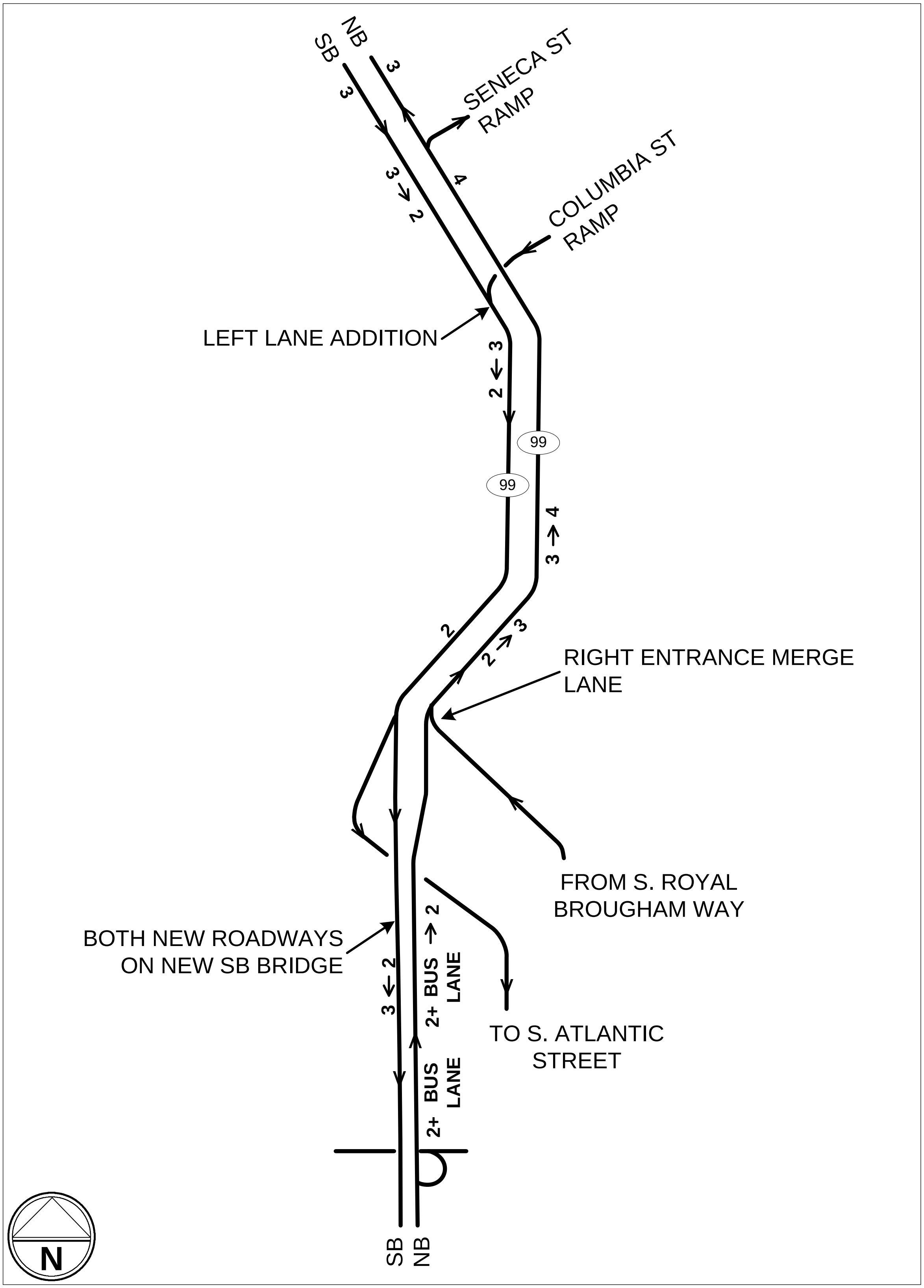


Exhibit 6-9
Roadway Configuration during Traffic Stage 7 - South End

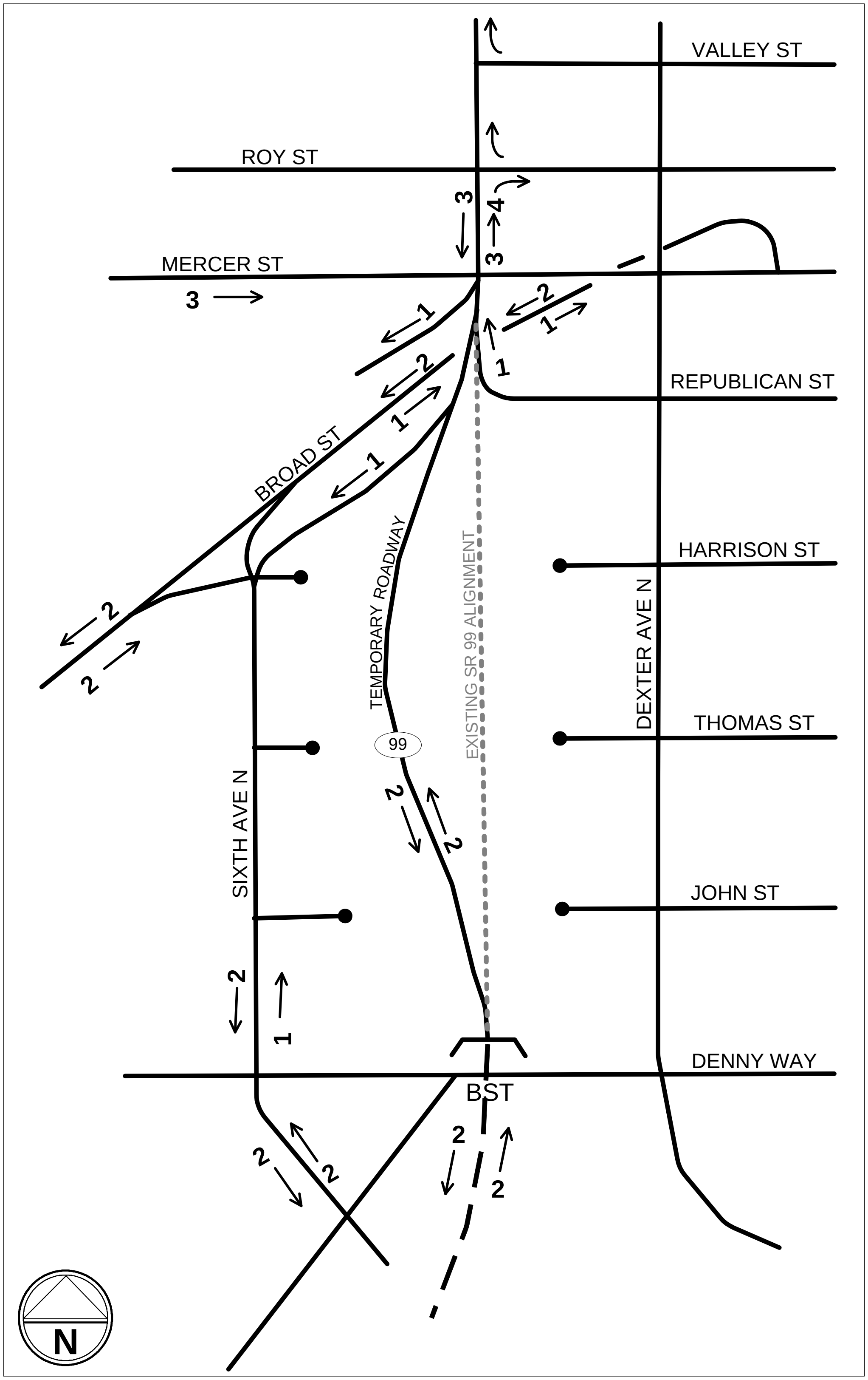


Exhibit 6-10
Roadway Configuration during Traffic Stage 7 - North End

For the AM peak hour in the northbound direction, the slow speeds (about 16 mph) predicted for the segment between the Seneca Street and Western Avenue off-ramps are pushed upstream due to the reduced capacity segment of SR 99 in the stadium area that would occur during Traffic Stage 7. As a result, northbound traffic in the segment between S. Spokane Street and S. King Street is predicted to experience much slower speeds during construction, with estimated speeds reduced from approximately 40 mph to 15 mph for this segment. However, north of the bottleneck speeds increase to approximately 30 to 35 mph for the remainder of the project area.

In the southbound direction during the AM peak hour, speeds during construction are generally similar to Baseline conditions, with some variation between segments based on the location of ramps.

Travel Times

The travel time indicator was used as a measure of the impact of project construction activities for two typical trip lengths: Woodland Park to S. Spokane Street and Ballard to S. Spokane Street via the Alaskan Way Viaduct. In the AM peak southbound direction, both of these segments are expected to have essentially the same travel time as under Baseline conditions. In the AM peak northbound direction, both segments are projected to experience an increased travel time of about 2 minutes over a total trip time of about 15 minutes. In the PM peak southbound direction, both of these segments are projected to experience about 1.5 minutes of increased travel time. In the PM peak northbound direction, the increase in travel time for both segments is expected to be 0.5 minute or less.

6.1.4 Traffic Congestion on Surface Streets

This section provides a qualitative discussion of anticipated congestion levels at intersections or intersection groupings for the construction period primarily defined by Traffic Stage 7 of the overall Bored Tunnel Alternative construction program. Vehicle delays at intersections within the three project sub-areas during this 33-month (estimated) construction period would be expected to increase somewhat compared to Baseline conditions. Such delay increases would be heavily influenced by temporary changes to the SR 99 configuration in the north and south, 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. While specific technical data are not provided in this section, conclusions drawn from preliminary analysis results are given to highlight areas where potential congestion issues may occur.

South Portal Area

Intersection traffic operations in the south portal area during critical stages of construction are likely to show similar or slightly greater levels of congestion than the Baseline scenario. Intersections affected by shifts in traffic demand away from mainline SR 99 to local arterials may experience slightly higher delays. As described in the construction staging summary, northbound and southbound SR 99 under Traffic Stage 7 would be reduced to two lanes between approximately Columbia Street and the stadium area. With this capacity reduction in effect, some trips originating from or destined to the downtown core may use the ramps to/from the south in the stadium area as a substitute for more direct access at the Seneca Street (northbound) off-ramp and Columbia Street (southbound) on-ramp.

Redistribution of traffic to local arterials would potentially cause additional congestion on major north-south routes such as Second and Fourth Avenues. Preliminary delay results reflecting the construction scenario (e.g., Traffic Stage 7) indicate that delays at the majority of intersections investigated would not change substantially compared to Baseline conditions. However, those intersections that do show potential increases in delay for the construction period are generally located along Second and Fourth Avenues and north of Main Street.

Central Area

During the construction scenario, again primarily reflecting Traffic Stage 7, traffic congestion at intersections in the central sub-area would be similar to Baseline conditions. While peak hour volumes are generally expected to increase for 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 for most of these locations. In fact, preliminary analysis results show that only key intersections at or near the SR 99 ramps to/from Seneca and Columbia Streets would experience elevated levels of congestion (LOS E or worse) compared to intersections outside of these areas. These findings are consistent with Baseline conditions, which also show fairly high delays at the on- and off-ramp intersections during the AM or PM peak hours.

North Portal Area

Preliminary analysis findings show that potential congestion impacts due to construction activity in the north end would be greater than those anticipated for the central and south sub-areas. The primary changes to the traffic network in the north end, outside of widening and conversion of Mercer Street to a two-way corridor, are the temporary removal of the Denny Way on- and off-ramps and restrictions on access to/from SR 99 south of Mercer Street. These access modifications would shift a large proportion of downtown-based peak hour traffic to upstream or downstream connections to/from the street grid. In the southbound direction, a temporary connection from SR 99 near Republican Street over to Sixth Avenue would be provided to accommodate trips into downtown and to Seattle Center and the Queen Anne and South Lake Union neighborhoods. Southbound traffic on SR 99 would also be expected to use the existing Battery Street off-ramp (just south of the Battery Street Tunnel) to a greater degree.

In the northbound direction, traffic would not be able to exit SR 99 until Roy Street. Previous access to SR 99 from the heavily used Denny Way northbound on-ramp (particularly during the PM peak hour) would likely shift to access points along Dexter Avenue at Republican Street and north of Mercer Street, and upstream to the Western Avenue on-ramp.

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 demand. Preliminary analysis data indicate that many of the affected locations near these ramp areas would operate at LOS E or worse due to substantial redistribution of Denny Way ramp traffic to alternate access to/from SR 99. In addition, east-west traffic impacts due to Mercer Street reconstruction would cause further increases in traffic volumes at critical convergence locations such as Mercer Street at Dexter Avenue and Mercer Street at Westlake Avenue.

6.1.5 Roadway Connectivity and Access

As outlined previously, eight traffic stages have been identified for the Bored Tunnel Alternative, with each stage varying in roadway connectivity and access.

During Traffic Stage 1, which would last approximately 5 months, mainline SR 99 would be open from S. Holgate Street to Denny Way. Ramp connections would be maintained, except for the Railroad Way ramps; these ramps would be removed and access would be unavailable until Traffic Stage 2. Roadway connectivity and access north of Denny Way would be unaltered.

During Traffic Stage 2, which would last approximately 3 months, the SR 99 Railroad Way northbound on-ramp and southbound off-ramp in the stadium area would be moved to newly constructed transitional ramp structures. The Denny Way ramps would remain open, as would other ramps north of the stadium area. Roadway connectivity and access north of Denny Way would be unaltered.

During Traffic Stage 3, which would last approximately 5 months, the SR 99 northbound traffic would travel on the existing viaduct, with southbound traffic using the new transition structure that would replace the Railroad Way ramps near First Avenue S. The northbound on-ramp and southbound off-ramp would be on the new transitional ramp structures. As in Traffic Stage 2, ramps north of the stadium area would remain open. Roadway connectivity and access north of Denny Way would be unaltered.

During Traffic Stage 4, which would last approximately 4 months, both northbound and southbound SR 99 would be on the temporary transition structure, with the northbound and southbound ramps open. Ramps north of the stadium area would remain open for use.

During Traffic Stage 5, which would last approximately 7 months, SR 99 northbound and southbound traffic would travel on the southbound lanes of the west mainline structure. The northbound and southbound ramps would be operational on the newly built transition structure.

Traffic Stage 6 represents the month that the SR 99 mainline would be closed in both directions. A temporary roadway along First Avenue S. would be open for north-south traffic. In the north, the Denny Way ramps would be closed.

During Traffic Stage 7, which would last approximately 33 months, the SR 99 northbound and southbound traffic would travel on the southbound mainline structure, and the northbound and southbound ramps would be open on the transition structure.

During Traffic Stage 8, which would last approximately 12 months, the SR 99 mainline would be open and using the newly constructed bored tunnel. In the north end, the Harrison Street/Aurora Avenue ramps would be operational.

Local Street Access

Construction activities would result in disruptions to several streets within the project area, most notably S. Royal Brougham Way, S. Atlantic Street, Alaskan Way S., E. Marginal Way S, First Avenue S., Denny Way, Sixth Avenue N., and John, Thomas, and Harrison Streets.

Given the closure of S. Royal Brougham Way between the existing Alaskan Way S. alignment and First Avenue S. by the S. Holgate Street to S. King Street Viaduct Replacement Project, maintaining access on S. Atlantic Street is of critical importance. This roadway would remain open throughout the construction period. A minimum of four lanes would be provided east of Colorado Avenue S., with two or more lanes connecting to E. Marginal Way S.

Construction activities would relocate Alaskan Way S. east of its current alignment and would modify connections between S. Atlantic Street and E. Marginal Way S. Temporary connections would be provided as necessary to maintain these routes throughout the construction period.

The relocated southbound off-ramp from SR 99 would direct traffic to southbound Alaskan Way S. and S. Atlantic Street. A minimum of two southbound/eastbound lanes would be maintained on these streets to accommodate these trips.

First Avenue S. would be reduced to one lane in each direction between Railroad Way S. and S. Royal Brougham Way in Traffic Stage 1 and between S. King Street and S. Royal Brougham Way in Traffic Stages 2, 3, and 4. First Avenue would then operate on a temporary decking roadway surface from Traffic Stages 4 through 7. During Traffic Stage 8, this segment of First Avenue S. would experience temporary lane closures for street restoration. Denny Way, Sixth Avenue N., and John, Thomas, and Harrison Streets would be subject to lane closures and/or restricted use in Traffic Stages 2, 3, 4, and 8 to support utility work.

Local access to businesses within the project area would be maintained throughout the construction period.

6.1.6 Transit Services

During construction, two lanes in each direction would be maintained on SR 99. Also, connections to/from SR 99 would be maintained in areas where current access exists; locations include the Seneca Street off-ramp and Columbia Street on-ramp in downtown Seattle. King County Metro bus services using SR 99 would be affected by lane reductions during the construction period. During construction, congestion is expected to increase and result in marginally slower travel speeds on SR 99. 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 help lessen the expected congestion effects.

Traffic that is projected to divert from SR 99 and use either First Avenue S. or Fourth Avenue S. would affect overall traffic operations. If no specific transit priority strategies are implemented as part of the construction mitigation program, transit operations on First and Fourth Avenues S. would likely experience degraded operations. Additionally, during corridor closures on nights and weekends during construction, buses would need to use alternate routes. Options include SR 99, First Avenue S., and Fourth Avenue S., each with various possible transit priority treatments along the alignment.

General traffic travel time variations due to construction that involve major bus corridors are identified in Exhibit 6-11. The corridors assessed are Ballard/downtown Seattle along Elliott Avenue and West Seattle/downtown Seattle and South King County (Burien/downtown Seattle) using SR 99.

Exhibit 6-11. 2015 Construction-Related Travel Times (in minutes) Along Major Transit Travel Corridors

	Baseline	Construction	Change	Baseline	Construction	Change
	AM Peak Hour			PM Peak Hour		
Elliott Avenue (Battery Street Off-Ramp to W. Mercer Place						
Inbound	5	5	0	5	5	0
Outbound	5	5	0	10	10	0
SR 99 – South End (S. Spokane Street-Seneca/Columbia Street Ramps)						
Inbound	6	10	+4	5	6	1
Outbound	3	4	+1	5	4	-1

For Elliott Avenue, travel times would be similar for Baseline and Project construction conditions. This would be the case for inbound and outbound travel in both the AM and PM peak hours. For travel along SR 99 between S. Spokane Street and the ramps at Seneca and Columbia Streets, the durations would be generally similar. The one exception would be for inbound trips in the AM peak hour. With construction, the travel time would be about 4 minutes longer than under Baseline conditions. However, this does not account for the proposed inbound transit lane leading up to the point where the northbound mainline transitions from three to two lanes (approximately S. Holgate Street). This lane would allow transit vehicles to bypass much of the potential peak period congestion and would mitigate to some degree the added delay caused by construction.

6.1.7 Truck Traffic and Freight

All traffic, including freight, would be hampered during Traffic Stages 6 and 7 of the Bored Tunnel Alternative, which are deemed to be the most disruptive stages in terms of traffic impacts. During Traffic Stage 6, which lasts for 1 month, both directions of SR 99 would be closed to traffic. Substantial traffic disruptions are anticipated in the downtown area for many hours of the day during this 1-month closure. Traffic Stage 7, however, is generally considered the most disruptive stage to traffic because it is expected to last for 33 months. Alaskan Way would operate on a detour route between S. King Street and S. Royal Brougham Way in the south. In the north the southbound Denny Way ramp would be detoured to Sixth Avenue near Republican Street, and the northbound Denny Way on-ramp would be detoured via Dexter Avenue and a new connection to SR 99 near Republican Street.

South

Freight traffic needs to access important freight facilities in the south portion of the study area, including Port of Seattle terminals along the waterfront and the Duwamish industrial area, and to access I-5 and I-90 for longer inter- and intra-region trips. Starting around April 2011, lane closures on First Avenue S. would be necessary. However, the project would maintain at least one lane northbound and one lane southbound along First Avenue S. during construction.

During Traffic Stage 6, both northbound and southbound SR 99 would be closed and traffic would need to be diverted to downtown arterials. Because of the anticipated congestion brought about by this temporary closure of SR 99, many longer-distance freight trips may be diverted to I-5 or shift to off-peak periods. During Traffic Stages 6 and 7, a detour would be provided on Alaskan Way between S. King Street and S. Royal Brougham Way to provide access to surface streets for freight traffic. A temporary roadway along First Avenue S. would be available for north-south traffic between S. King Street and the WOSCA site to provide some accessibility through the south portal area.

Traffic delays may also be incurred on those routes designated for hauling construction materials and spoils to and from the construction sites. In the south area, the primary construction material haul route would likely be SR 519 (Edgar Martinez Way) to First Avenue S. to the jobsite. First Avenue S. to the jobsite, or SR 99 to the Seneca Street off-ramp to First Avenue to the jobsite from the south may also be used as a haul route, though likely to a lesser extent. Over-legal loads to the south end of the project would likely travel via SR 599 to First Avenue S. to the jobsite. Over-legal loads traveling within the city are required to obtain a special permit, and appropriate routes are selected via the permit approval process.

Central

Freight access to and from the Seattle Ferry Terminal at Colman Dock would be maintained during all construction stages. During Traffic Stage 7, two lanes of traffic in each direction would be maintained on the Alaskan Way Viaduct (southbound structure). Due to constrained capacity under this configuration, speeds for all traffic, including eligible freight vehicles, are expected to be slower than under Baseline conditions. Access to the southbound viaduct structure would be provided via the temporary transitional ramp structures near S. Royal Brougham Way constructed during Traffic Stage 2. Access for freight would still be provided on Alaskan Way along the central waterfront.

North

During Traffic Stage 7, SR 99 would be limited to two lanes in each direction and speed would be reduced to 40 mph between Mercer Street and the north portal to accommodate realignment of SR 99. Freight traffic would no longer be able to use the Denny Way southbound off-ramp and northbound on-ramp. Access for freight to and from this area would be provided by the new connection from the realigned SR 99 to Sixth Avenue N. that would be located somewhere between Republican Street and Thomas Street. Northbound access to SR 99 would be provided by an on-ramp in the vicinity of Republican Street. Mobility and access for freight would be hampered by major construction activities in this area during Traffic Stage 7. It is likely that many freight vehicles would consider using alternate routes, such as I-5, to bypass congestion and delay caused by major construction activities in this area.

Preliminary routes designated for hauling construction materials and spoils have been identified, including I-5 to Denny Way to Dexter Avenue N. to the jobsite and I-5 to Mercer Street to the jobsite. SR 99 to and from the north is also available as a potential haul route.

Over-legal loads would likely be allowed to travel on state highways during off-peak hours during the day, 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 via the permit approval process.

Freight travel in the corridor may be hampered during project construction as construction activities may occur up to 24 hours per day, 7 days per week for the entire construction period within permitting requirements.

6.1.8 Parking

Removal of parking spaces during construction generally includes the spaces that would be permanently affected (as described in Chapter 5), plus those spaces that are needed for construction, staging, or demolition activities. Assuming viaduct demolition occurs in stages, several blocks of parking under the viaduct would be affected at a time while parking would still be available on other blocks. In the whole project area, the total number of on-street spaces that would be affected at one time during construction and demolition would be about 640 to 710 on-street spaces and about 220 to 360 off-street spaces, for a total of up to about 1,070 spaces. After viaduct demolition, it is likely that many of the spaces under the viaduct would be affected by the Alaskan Way Surface Street Improvements Project and would not necessarily be returned to use. This project is separate from the Alaskan Way Viaduct Replacement Project and is discussed in more detail in Section 7.3.4, Parking, in the Cumulative Effects chapter.

The locations of parking removals are shown in Exhibits 6-12 and 6-13. Exhibit 6-14 summarizes the parking effects during construction. In addition to the spaces shown in the table, there may be short-term (such as peak period) parking restrictions on some streets near the portals to help accommodate transit or general purpose traffic during construction.

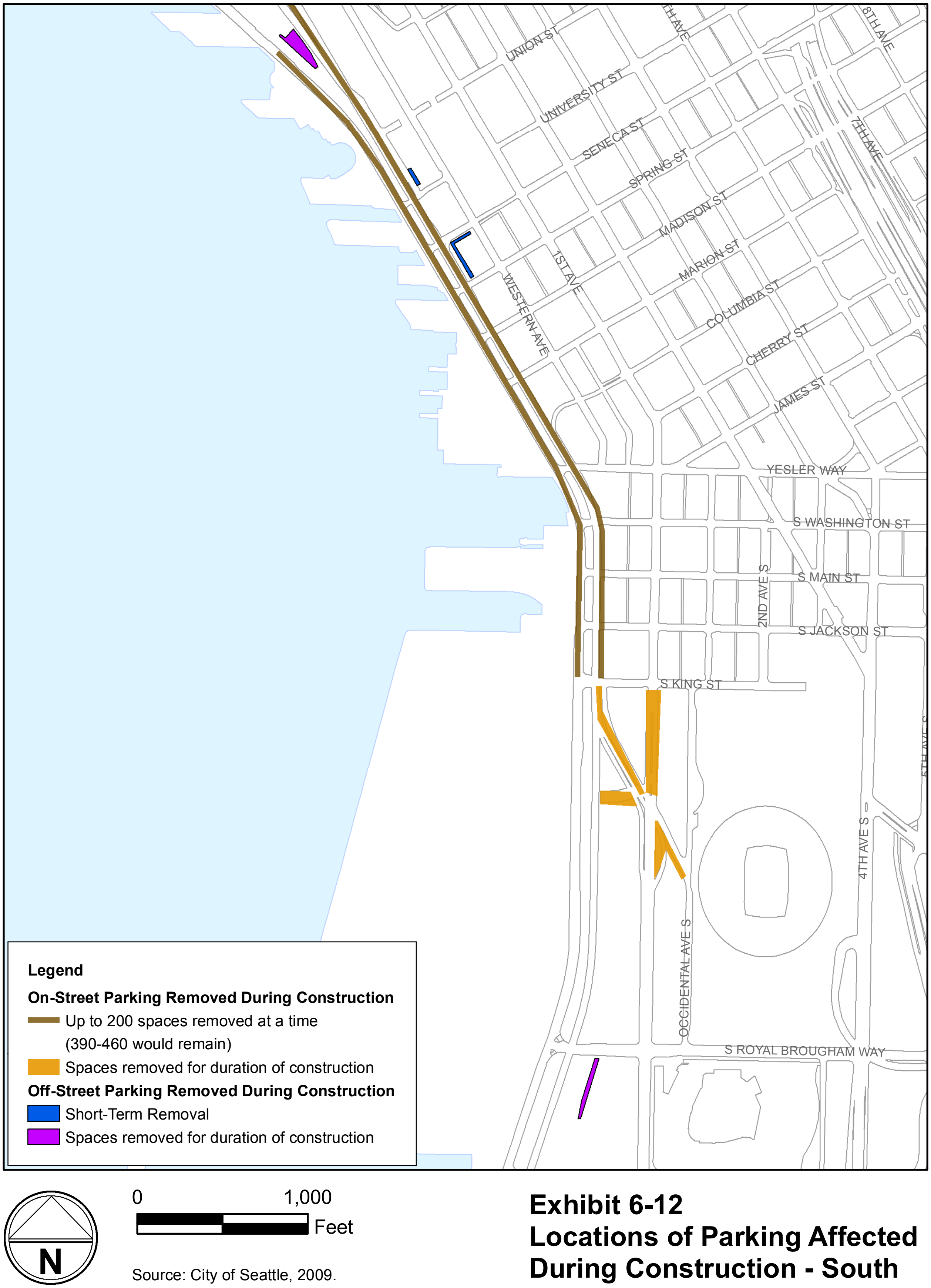
South Portal Area

In the south portal area, south of S. King Street, about 210 on-street and 50 off-street spaces would be removed during construction. Of the on-street spaces, most are short-term parking, although about 40 long-term spaces would be removed as well. The majority of the on-street parking space removals would be along Railroad Way and under the ramps. The 50 off-street spaces that would be affected are located in a public pay lot south of S. Royal Brougham Way, behind Pyramid Alehouse.

The removal of about 260 parking spaces in the south portal area is not anticipated to cause a large impact, although some drivers may be slightly inconvenienced. The on-street parking removals along First Avenue S. between S. King Street and Railroad Way 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.

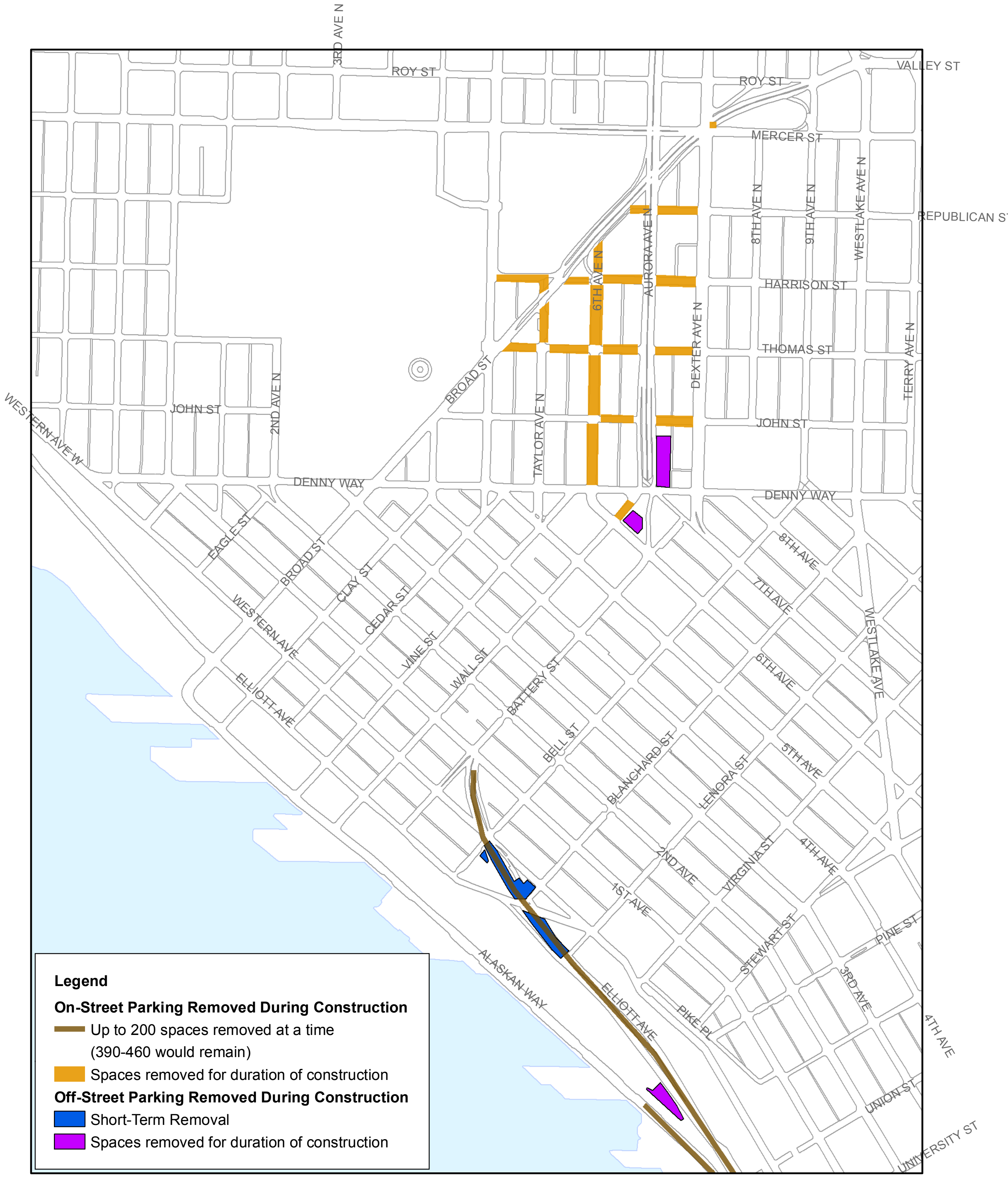
Although parking would be reduced compared to today’s conditions, ample parking is expected to be available in pay lots near the stadiums. Pay lots in the stadium area are abundant and underutilized on non-event days. The off-street parking utilization rate for the stadium area is about 31.1 percent on an average non-event weekday (PSRC 2006), 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, 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.



Source: City of Seattle, 2009.

Exhibit 6-12
Locations of Parking Affected During Construction - South



0 1,000 Feet

Source: City of Seattle, 2009.

Exhibit 6-13
Locations of Parking Affected During Construction - North

Exhibit 6-14. Construction Parking Effects of the Bored Tunnel Alternative

	On-Street Spaces			Off-Street Spaces	Total Spaces
	Short-Term	Long-Term	Subtotal		
South Portal Area	170	40	210	50	260
Central - spaces affected at the same time	130 to 200	0 to 10	130 to 200*	70 to 210	Up to 410
North Portal Area	70	230	300	100	400
Total	Up to 440	Up to 280	Up to 710*	Up to 360	Up to 1,070

* The maximum number of short- and long-term spaces would not be affected at the same time.

Central

There are approximately 590 on-street parking spaces under the viaduct from S. King Street to the Battery Street Tunnel portal and along Alaskan Way between S. King Street and Pine Street. All of these spaces would be affected at some point during viaduct demolition, but they would not all be removed at the same time. It is anticipated that two demolition crews would each work on two blocks at a time, so four blocks of parking would be affected for approximately 1 month at a time during demolition. This would affect about 130 to 200 on-street spaces at a time along Alaskan Way and under the viaduct during demolition activities. The majority of the on-street parking spaces would remain in use. Exhibit 6-15 lists the affected and available on-street parking spaces along the waterfront.

Exhibit 6-15. Effects to On-Street Parking Spaces During Viaduct Demolition – Central

	Spaces Affected at the Same Time	Spaces Remaining at Any Given Time
Under the viaduct and ramps (S. King Street to Battery Street Tunnel)	120-170	370-420
Alaskan Way surface street (S. King Street to Pine Street)	0-20	20-50
Total	130-200	390-460

Although on-street spaces along the Alaskan Way surface street are not under the viaduct, they would be affected because demolition activities would likely encroach on Alaskan Way. To maintain traffic lanes, parking would need to be restricted along several blocks of Alaskan Way. Much of the on-street parking along Alaskan Way consists of loading and taxi waiting areas. These types of spaces would likely be able to be accommodated within a block or two of their existing locations and would only be relocated for a month or two at a time.

About 70 off-street spaces in the central area (S. King Street to the Battery Street Tunnel) would be affected for the duration of construction. Refer to Exhibit 6-16 for a table of affected off-street parking spaces. Parking removals during construction would affect about 70 spaces in a public parking lot between Alaskan Way and the viaduct, north of the Seattle Aquarium. Portions of two 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, if they are affected at the same time. The number of affected off-street spaces does not include the parking lot on Pier 48 at about S. Main Street, adjacent to Pioneer Square, which may be used for contractor staging or construction worker parking. Although this lot is currently used for some public parking, the public parking is a temporary condition, and public pay parking is not an allowable permanent use on that pier.

Near Elliott and Western Avenues, up to about 140 off-street spaces in the lots under the viaduct between Lenora Street and Bell Street would be removed during demolition of this section of the viaduct. This section of the viaduct is considered to be one of the more complicated sections to remove, so removal could take several months.

Exhibit 6-16. Off-Street Parking Spaces Affected During Construction/Demolition – Central

	Affected Throughout Construction	Affected for Several Months
Pioneer Square area (S. King Street to Columbia Street)	-	-
Central Waterfront (Columbia Street to Pine Street)	70	40[1]
Elliott/Western vicinity	-	140[2]
Total	70	Up to 140 at one time[3]

Notes:
1. This represents parts of two different lots that could be affected at the same time during demolition.
2. Of the 140 spaces, 75 of these are only available to the public during evening/weekend hours.
3. The total is 140, not 180, because all of the lots would not be affected at the same time.

In addition to the public parking that would be affected during viaduct demolition, about 140 private and reserved spaces are located under or adjacent to the viaduct that are not listed in the tables above. 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 for approximately 1 month due to viaduct demolition activities. Up to four blocks could be affected at a time, or up to about 90 spaces. The private and reserved spaces are primarily used by adjacent businesses for customer and employee parking, and for loading in some cases.

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 anticipated to be restricted during viaduct demolition, so the parking and loading on the piers would remain available.

With up to about 600 parking spaces affected during viaduct demolition, it may become more difficult to find parking along the central waterfront and in Pioneer Square during demolition. This could result in drivers looking for parking spaces several blocks farther from their destinations than they would normally seek parking, or entering pay lots instead of finding on-street parking.

There are numerous off-street parking lots near the central waterfront. Based upon PSRC data from 2006 on 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. The large parking garage across from 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 of Seattle 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.

North Portal Area

In the north portal area, about 300 on-street and 100 off-street spaces would be removed during construction. Of the affected on-street parking spaces, the majority are long-term spaces, as identified previously in Exhibit 6-12. The on-street parking removals include spaces on the following streets:

- Sixth Avenue N. from Denny Way to Broad Street
- John Street from Sixth Avenue N. to Dexter Avenue N.
- Thomas Street from Broad Street to Dexter Avenue N.
- Harrison Street from Fifth Avenue N. to Dexter Avenue N.
- Republican Street from Broad Street to Dexter Avenue N.
- Dexter Avenue N. between Mercer and Broad Streets

In the north portal area, about 100 off-street spaces in two public parking lots would be affected during construction. One lot has about 80 spaces on the northeast corner of Denny Way and Aurora Avenue. The second lot, on the east corner of Sixth Avenue N. and Wall Street, has about 20 spaces.

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 property acquisitions discussion in Appendix G, Land Use Discipline Report.

Near the north portal, on-street parking would still be available within several blocks of the spaces that would be removed. Furthermore, there are numerous off-street lots within several blocks of the parking removals. Not including the lots that would be affected by project construction, over 3,100 pay spaces are available between Denny Way and Roy Street, and Fifth Avenue N. and Dexter Avenue, according to 2006 PSRC data. The 3,100 spaces takes into account the removal of spaces for Gates Foundation construction and the new Fifth Avenue Parking Garage. With the removal of 400 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 could potentially become more expensive in response to the reduction in the adjacent parking inventory.

Construction Worker Parking

The project construction workforce would consist of up to about 1,300 construction workers. The work areas for these construction workers would be located in several different locations, with concentrations near the south portal, north portal, and central waterfront as demolition is occurring. Construction workers who are not able to park within the construction zone would likely seek available long-term parking in the area, first pursuing on-street spaces, then pay lots.

Parking Mitigation

The following strategies could help minimize the use of visitor/customer parking by construction workers during project construction.

- Develop a Construction Worker Parking Plan to identify appropriate parking options for construction workers and discourage use of short-term visitor/customer parking in the project vicinity.
- Provide strong enforcement of the short-term parking regulations in the immediate project area (two- to three-block radius). The goal is to ensure a constant supply of short-term parking for customers of central waterfront businesses and to prevent use of these spaces by construction workers.

In addition to the strategies to address construction worker parking, a number of parking mitigation strategies could be implemented to address parking disruption by construction activities. However, these strategies are not anticipated to be put in effect solely for the Bored Tunnel Alternative, but would address parking effects related to the construction of the overall Program. The Program is expected to have a more substantial effect on parking, and the cumulative effects from all of the Program elements may warrant consideration for parking mitigation. This is discussed in more detail in Section 7.3.4, Parking, in the Cumulative Effects chapter. Potential parking mitigation strategies for the central waterfront area include the following:

- Provide pedestrian and parking maps in advance of and during construction for businesses (at no cost to the businesses) to mail to clients and vendors.
- Increase the short-term maximum meter time from 2 hours to at least 3 possibly 4 hours since the average trip to the waterfront is estimated at 3 to 4 hours.
- Provide a low rate for the first 4 hours and much higher rates for full-day parking use to encourage short-term visitor/customer parking and discourage long-term employee parking.
- Encourage privately held lots to institute parking pricing that rewards short-term parking.
- Build a new parking facility in proximity to the waterfront to provide short-term visitor and customer parking.
- Coordinate with private and public lots to install real-time automated overhead signs that display where parking is available as drivers enter the central waterfront zone.
- Encourage businesses to adopt parking vouchers that they could give to customers to park in designated parking lots.

6.1.9 Pedestrians

Major construction efforts are disruptive to all forms of transportation, and pedestrian travel in and around the construction zone would experience disruption of sidewalk and trail facilities use. Localized sidewalk closures for utility relocation, construction, demolition, and restoration activities would require detours of short duration and distance for pedestrians. However, the duration of disruption and out-of-direction travel would be minimized to the extent practicable to maintain pedestrian mobility and accessibility.

Traffic diverting 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 anticipated to carry increased volumes of traffic during construction.

South Portal Area

Pedestrian access in the south portal area would be maintained during all phases of construction via the combined pedestrian/bicycle trail on the west edge of the project area that runs adjacent to the Port of Seattle facilities. The combined pedestrian/bicycle facility would extend from S. King Street to S. Atlantic Street and would connect to existing pedestrian facilities requiring minimal to no out-of-direction travel.

First Avenue S. from S. Plummer Street to S. Jackson Street would experience intermittent sidewalk closures due to utility relocations during the early construction phases, as well as additional traffic on First Avenue S. due to the closures on Alaskan Way. 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 might be required to detour to parallel roadways.

East-west travel within the construction zone (S. King Street to S. Royal Brougham Way) would be restricted for a majority of the traffic stages. East-west access by pedestrians would be largely restricted to S. Atlantic Street and S. Jackson Street, due to the presence of construction staging areas and the need for temporary roadway facilities in this area.

North Portal Area

Pedestrian facilities and access in the northern project area during construction would likely be closed on both the western and eastern sides of SR 99 from approximately Mercer Street to Denny Way due to building demolition, utility relocation, construction, and restoration activities.

Pedestrians on the west side of SR 99 would be detoured to Sixth Avenue during the majority of the project's construction period. Pedestrians using sidewalks on the east side of SR 99 would be diverted to Dexter Avenue N. and associated east-west side streets to access businesses in this area. Some east-west pedestrian travel on Mercer and Broad Streets would be affected and experience restrictions during construction activities. East-west pedestrian mobility in this area is already challenging due to limited crossings of SR 99. Particular attention would be given to minimize the duration of closures and out-of-direction travel by maintaining sidewalk facilities on the opposite side of the roadway. Construction on Mercer Street would be substantially complete prior to the closure and filling of Broad Street, which would maintain pedestrian mobility across SR 99 in this area.

6.1.10 Bicycles

Generally, bicyclists would face the same lane reductions and closures as other traffic. Bicyclists riding in the street may face 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 anticipated to carry increased volumes of traffic during construction.

South Portal Area

As was noted for pedestrians, during all phases of construction bicycle access would be maintained on the combined pedestrian/bicycle trail on the west edge of the project area that runs adjacent to the Port of Seattle facilities. The combined pedestrian/bicycle facility would extend from S. King Street to S. Atlantic Street and would connect to existing bicycle facilities on either end, with minimal to no out-of-direction travel.

First Avenue S. from S. Plummer Street to S. Jackson Street would be reduced to one lane of traffic during much of the construction period. Bicyclists would have the options of continuing to use First Avenue S., using the combined pedestrian/ bike trail on the western edge of the project area, or diverting to Occidental Avenue S. in the immediate project area.

Depending on the origin or destination of the cyclist, they may choose to travel on Fourth Avenue S., sharing the roadway with other vehicular traffic. The existing in-street bicycle lanes on Second Avenue and Fourth Avenue through downtown would be maintained throughout the construction period.

As noted for pedestrians, east-west bicycle travel between S. King Street and S. Atlantic Street would be restricted during nearly all traffic stages.

North Portal Area

Generally, bicyclists would face the same lane reductions and closures as other traffic in the northern project area. However, much of the construction would take place on SR 99, where bicycle travel is not allowed; therefore, cyclists are expected to experience fewer direct impacts to north-south travel, particularly as the in-street, southbound bicycle lane 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 auto and bicycle conflicts.

East-west bicycle travel on Mercer Street would experience the same lane reductions and temporary closures as those expected for auto traffic. As noted for pedestrian travel, particular attention would be given to minimize the duration of closures and, when possible, to schedule closures during less disruptive times. Construction on Mercer Street, including the combined pedestrian/bicycle facility on the north side of the roadway, would be substantially complete prior to the closure and filling of Broad Street, which would maintain bicycle mobility across SR 99 in this area.

6.1.11 Ferries

The Seattle Ferry Terminal at Colman Dock at Pier 52 services the most Washington State Ferries customers of any terminal in the system. More recently, this terminal is also being used by passenger-only ferry service provided by King County. 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 those walking onto the ferry (PSRC 2009). 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 primary construction activities that would affect access to and from the Seattle Ferry Terminal are as follows:

- Alaskan Way would be rerouted to the east between S. Royal Brougham Way and S. King Street in Traffic Stages 1 through 7. This would become the permanent alignment in January 2014.
- Demolition of the Alaskan Way Viaduct would close sections of Alaskan Way two blocks at a time and would close selected cross streets. Ferry passengers would need to be informed of street closures and short-term detours that may affect their route 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 an alternate structure is constructed, 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.

6.1.12 Safety

Driving in a work zone is more dangerous than on other parts of the road. Drivers can become confused by unfamiliar traffic patterns, signage, and cones/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. This plan would address traffic safety and control throughout the work zone. Work zone management strategies may include using Intelligent Transportation Systems (ITS), traveler information, real-time work zone monitoring, traffic incident management, and enforcement components.

6.1.13 Event Traffic

South Portal Area

Based on existing Safeco Field patronage counts, up to 47,000 attendants 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, though typically held on Sundays, draw even larger crowds and result in greater levels of traffic demand. While a portion of patrons for both types of events travel via ferry or public transit (5,000 to 7,000 persons), 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.

Event-related access to/from the stadiums during the construction period would continue to rely on key north-south arterials such as First Avenue S. and Fourth Avenue S., but would also depend on the new two-way S. Atlantic Street facility west of First Avenue S. (The SR 519 Intermodal Access Project – Phase 2 is assumed to be completed.) Event traffic would also continue to use the SR 99 ramps to/from the north.

As discussed in Section 6.1.4, during construction of the project elements in the south end, access to/from the stadium area would be similar to existing conditions, with the exception of the SR 519 Phase 2 project, which is expected to be completed. 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 for Traffic Stages 2 through 5 and Traffic Stage 7 of the construction schedule and would result in capacity reductions on SR 99. Stadium area ramps to/from the north would be maintained, allowing for similar connections as existing conditions. However, the southbound off-ramp into the area would be temporarily directed to S. Atlantic Street, which eventually converges with heavy traffic on First Avenue S. and regional trip activity on S. Atlantic Street/SR 519 west of First Avenue S.

The results 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. Also, First Avenue S. is expected to be one lane in each direction during most of Traffic Stages 2 through 4, which may exacerbate delays related to the SR 99 capacity reductions and high concentrations of traffic during events. Despite the localized effects of the construction period, mainline traffic congestion would not be affected substantially, based on preliminary construction phase analysis results. The need for temporary detours, lane closures, and general traffic management for all modes prior to and following 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.

North Portal Area

Based on data collected in 2007 and 2008, over 5,000 events take place annually at Seattle Center, with the largest concentrations of people and traffic occurring during major Key Arena events (high-profile concerts, Seattle Storm playoff games, etc.) and large-scale weekend festivals. Attendance at regional events such as Bumbershoot, Folklife festival, and the Bite of Seattle has been documented to reach up to 60,000 persons daily. Peak loads can be as high as 17,000 person trips for a Key Arena event, and as high as 200,000 during a festival weekend such as Folklife 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.

Construction activity in the north end would cause disruptions to these major events at Seattle Center due to temporary lane closures, detours, and access modification to SR 99 ramps. For Traffic Stage 7 (deemed a worst-case snapshot), the reconfigurations of Mercer Street to a two-way arterial from Dexter Avenue to Fifth Avenue would result in temporary lane closures on Mercer Street and a general loss of east-west capacity. Also, construction of the new roadway section for Aurora Avenue between Denny Way and Harrison Street would remove the ramps to/from Denny Way and restrict access to/from SR 99 south of Mercer Street. Such changes would not only affect congestion locally on arterials such as Mercer Street, Fifth Avenue, Dexter Avenue, and Broad Street, but would result in higher levels of congestion on mainline SR 99 due to higher concentrations of on- and off-ramp volumes to designated temporary ramp connections.

In fact, preliminary traffic analysis results for weekday peak hour conditions during the construction phase indicate high levels of congestion for a number of intersections in the north end along Dexter Avenue, Westlake Avenue, and Mercer Street. With potentially even higher concentrations of traffic expected during major events at Seattle Center, congestion at local intersections in the

Seattle Center area and surrounding neighborhoods such as Queen Anne and South Lake Union may be substantial and could potentially require extensive traffic management tools to minimize vehicle queuing yet still provide efficient and safe travel options for non-motorized modes.

A full suite of measures related to signage, signal timing/operations, road closures, and detours would be critical for maintaining reasonable levels of traffic flow/circulation near the Seattle Center area during major events. In addition, Seattle Center's Fiftieth Anniversary celebration will be held from April to October 2012 and may require consideration of additional mitigation measures. Ongoing coordination with Seattle Center would help identify issues and potential mitigation measures.

6.2 Construction Mitigation

WSDOT, King County, and the City of Seattle 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.
- Funding for the Spokane Street Viaduct Widening Project, which includes a new Fourth Avenue S. off-ramp for West Seattle commuters.
- Added bus service in the West Seattle, Ballard/Uptown, and Aurora Avenue corridors during the construction period, as well as a bus travel time monitoring system.
- 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., south of downtown, 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 build upon projects already underway by King County and the City of Seattle to fully fund critical projects and advance elements of Metro's RapidRide services. Transit enhancements and improvements to the street system will play a major role in keeping people and goods moving during construction of the S. Holgate Street to S. King Street Viaduct Replacement Project, starting in 2010. 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 this project might include the following:

- Construction of temporary signals.
- Providing flaggers at certain intersections to facilitate both freight and general purpose traffic movements.

In addition, the contractor selected to construct the project will be required to prepare a traffic management plan, to be approved by the City of Seattle, to ensure that construction effects on local streets, property owners, and businesses are minimized. The traffic management plan will include at a minimum the following measures:

- Details on required street and lane closures (duration and timing).
- Proposed detours and signing plans (for vehicles, pedestrians, freight, and bicycles).
- Measures to minimize impacts on transit operations and access to/from transit facilities (in coordination with transit service providers).
- Traffic enforcement measures, including deployment of police officers.
- Coordination with emergency service providers.
- Measures to minimize traffic and parking impacts from construction employees.
- Measures to minimize effects of truck traffic for equipment and material delivery.
- Measures to minimize disruption of access to businesses and properties.
- Measures to minimize conflicts between construction activities and traffic during events. (This may or may not include stopping construction activities during certain hours.)
- Public outreach communication plan.

Chapter 7

Note to reviewers: *Chapter 7 includes evaluation of the BAT lanes north of Roy Street as part of the 2030 Program. Text discussing this is highlighted in yellow. In the next version of this report, the 2030 Program results (highlighted sections) will be discussed qualitatively in less detail. This discussion should include some selected quantitative results, and to that end please use this review cycle to decide what those will be.*

The project proposes to replace SR 99 from approximately S. Royal Brougham Way to Roy Street and remove the existing viaduct from approximately S. King Street to the Battery Street Tunnel. The project complements a number of other independent projects that improve safety and mobility along SR 99 and the Seattle waterfront, from the SODO area south of downtown to Seattle Center. Collectively, these individual projects are often referred to as the Program. This collection of projects is categorized into four groups: roadway elements, non-roadway elements, projects under construction, and completed projects. The cumulative effects of the Program are described in Section 7.1. The analysis of comprehensive cumulative effects in Section 7.2 includes the combined effect of the project (proposed action), other Program elements, and other projects that are anticipated to add to the transportation effects in the study area. Section 7.3 discusses cumulative effects during construction.

7.1 Cumulative Effects of the Program

Assessment of the cumulative effects of the Program includes an assessment of the proposed action plus Program elements that are not part of the proposed action. This section discusses the same performance measures as those in Section 5.1, but with a focus on the differences between the Program and the proposed action.

The following scenarios are compared in this section:

- 2015 Project (Bored Tunnel Alternative) compared to 2015 Partial Program (Bored Tunnel Alternative plus all Program elements except First Avenue Streetcar and King County Metro transit improvements) and 2015 Program (Bored Tunnel Alternative plus all Program elements).
- 2030 Project (Bored Tunnel Alternative) compared to 2030 Program.

The Program and Partial Program elements are described below. They are categorized into roadway elements and non-roadway elements. All of the elements are included in both the Program and the Partial Program unless otherwise noted.

Roadway Elements

Alaskan Way Surface Street Improvements

The Alaskan Way surface street would be rebuilt and improved between S. King Street and Pine Street. The new surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), five lanes (two lanes southbound and three lanes northbound) between Columbia and Marion Streets, and 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, bicycle lanes, parking/loading zones, and signalized pedestrian crossings at cross streets. The existing waterfront streetcar would be replaced by a new streetcar line running on First Avenue. The new surface street would provide a regional truck route for freight traveling to/from the Duwamish/Harbor Island/SR 519 area and the BINMIC.

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/from BINMIC and neighborhoods north of Seattle (including Ballard and Magnolia). The connector would be four lanes wide and would provide a grade-separated crossing of the BNSF mainline railroad tracks. Additionally, it would provide local street access to Pike Street and Lenora Street and integrate back into the street grid at Bell Street, which would improve local street connections in Belltown. The new roadway would include bicycle and pedestrian facilities.

Mercer Street West Corridor Improvements

The Mercer Street west corridor improvements include reconfiguring Mercer Street between Fifth Avenue N. and Elliott Avenue to accommodate two-way traffic. The route would be redesignated by the City as a regional truck route to provide vital freight connections to Ballard/Interbay. These improvements would provide access to Ballard/Interbay freight, as well as general traffic coming from Ballard and Magnolia.

Non-Roadway Elements

First Avenue Streetcar

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, Belltown, and Uptown. Additionally, it would serve many tourist and regional attractions, such as Pike Place Market, Seattle Waterfront Piers, Seattle Art Museum, Seattle Aquarium, and Olympic Sculpture Park. The First Avenue Streetcar is not included in the 2015 Partial Program scenario.

Transit Enhancements

A variety of transit enhancements will be provided to support planned transportation improvements associated with the Program. Development of the specific improvements is underway. These transit enhancements are not included in the 2015 Partial Program scenario.

Seawall Replacement

The Alaskan Way Seawall Replacement Project is a rehabilitation effort to protect the shoreline along Elliott Bay, including Alaskan Way, from seawall failure due to seismic and storm events. The project limits extend from S. Washington Street in the south to Broad Street in the north.

Alaskan Way Promenade

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 cruise ship and 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 spaces 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.

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 current roadway and safety standards. An Environmental Assessment for this project was completed in June 2008, and the Finding of No Significant Impact was published in February 2009. Construction began in mid-2009 with early utility relocations and is expected to be completed at the end of 2014. This project is included in the Baseline.

Transportation Improvements to Minimize Traffic Effects during Construction

There are several transportation improvements that are underway to help offset traffic effects during construction of the projects included in the Program. Construction or implementation of these improvements is underway and includes the following:

- Adding variable speed signs and travel time signs on I-5 to help maximize safety and traffic flow.
- Providing funding for the 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 bus travel time monitoring system.
- Upgrading traffic signals and driver information signs for the Denny Way, Elliott Avenue W./15th Avenue W., south of downtown, and West Seattle corridors to support transit and traffic flow.
- Providing information about travel alternatives and incentives to encourage use of transit, carpool, and vanpool programs.

7.1.1 Regional Context and Travel Patterns

Vehicle Miles of Travel

Key Findings

- There is little difference in VMT among the 2015 Project, Partial Program, and Program scenarios for the Seattle Center City area, although there is a marginal decrease from the 2015 Project and Partial Program to the 2015 Program. This is likely due to the conversion of a general purpose lane to a BAT lane in each direction on SR 99 north, which creates a bottleneck for general purpose traffic and reduces projected travel on SR 99 in the Center City area. This pattern generally holds true for the four-county Puget Sound region as well.
- Percentage growth in VMT (from 2015 to 2030) is higher outside of the Seattle Center City area despite the higher growth rates in jobs and population. This is likely due to the disproportionately higher number of trips to/from downtown that are expected to be accommodated by transit in the future as compared to the rest of the region.

VMT for the 2015 and 2030 scenarios is shown in Exhibit 7-1.

As shown in Exhibit 7-1, for the Seattle Center City area during the AM and PM peak period, the 2015 Project, Partial Program, and Program scenarios show approximately the same level of VMT, with a marginal decrease in the full Program. This decrease is likely due to the conversion of a general purpose lane to a BAT lane in each direction on SR 99 between Aloha Street and just south of the Aurora Bridge. This conversion creates a bottleneck for general purpose traffic and reduces projected travel on SR 99, forcing trips outside of the Center

City area. Due to growth in population and employment, both the 2030 Project and Program scenarios during the AM and PM peak periods show increases in VMT of about 4 to 5 percent over comparable 2015 Project and Program levels. Daily VMT levels increase for both the 2030 Project and Program scenarios by about 5 percent over the comparable 2015 scenarios.

Exhibit 7-1. Vehicle Miles of Travel

Performance Measure	2015			2030	
	Project	Partial Program	Program	Project	Program
Seattle Center City					
AM	416,000	416,600	414,300	432,300	430,900
PM	516,000	516,400	512,900	541,300	538,900
Daily	2,342,900	2,342,300	2,330,600	2,463,600	2,452,700
Four-County Region					
AM	15,799,100	15,787,500	15,797,900	17,665,800	17,667,500
PM	18,558,000	18,566,600	18,556,400	20,831,900	20,844,100
Daily	84,754,100	84,759,000	84,746,800	94,955,300	94,995,600

In looking at the four-county region, there is no meaningful difference in VMT among the 2015 scenarios and among the 2030 scenarios. In general, for all time periods, VMT for the 2030 Project and Program scenarios increases by about 12 percent over the comparable 2015 Project and Program scenarios. Despite the fact that population and employment are expected to grow at a faster rate in the Center City area in comparison to the four-county region as a whole, the 2015 to 2030 VMT growth rate for the four-county region is higher than that of the comparable Center City growth rate (about 4 to 5 percent). This is likely due to the increased use of transit for travel to/from the Center City area in the future, which allows the accommodation of more trips in relatively fewer vehicles.

Vehicle Hours of Travel

Key Findings

- There is no meaningful difference in VHT among the 2015 Project, Partial Project, and Program scenarios for the Center City area. This pattern also holds true for the four-county Puget Sound region.
- While percentage growth in VHT (from 2015 to 2030) is higher outside of the Center City, which is similar to the VMT pattern, VHT growth, percentage-wise, is more pronounced than what was seen for VMT. This is likely the result of greater increase in congestion in suburban communities than on Seattle streets, which are already heavily congested

during peak travel periods, as well as an increased emphasis on transit to/from the Center City area.

VHT for the 2015 and 2030 scenarios is shown in Exhibit 7-2.

Exhibit 7-2. Vehicle Hours of Travel

Performance Measure	2015			2030	
	Project	Partial Program	Program	Project	Program
Seattle Center City					
AM	16,500	16,300	16,300	18,000	17,900
PM	23,600	23,300	23,500	29,600	29,800
Daily	84,300	83,500	83,700	96,600	96,300
Four-County Region					
AM	616,400	613,500	616,100	945,600	951,000
PM	698,700	699,000	699,800	1,037,500	1,044,700
Daily	2,571,000	2,568,400	2,571,900	3,532,500	3,547,800

As shown in Exhibit 7-2, for the Seattle Center City area during the AM and PM peak period, the 2015 Project, Partial Program, and Program scenarios show approximately the same level of VHT. Due to growth in population and employment, both the 2030 Project and Program for the AM and PM peak period show increases in VHT of about 4 to 5 percent over the comparable 2015 Project and Program levels. Daily VHT levels increase for both the 2030 Project and Program scenarios by about 5 percent over the comparable 2015 scenarios.

In looking at the four-county region, there is no meaningful difference in VHT among the 2015 scenarios and among the 2030 scenarios. Again, in comparing the growth between 2015 and 2030, the growth in VHT, percentage-wise, is more pronounced than what was seen for VMT, which could be caused by increased delay due to more traffic congestion on regional streets and highways. For the AM peak period, the 2030 Project and Program VHT increases by about 54 percent over that of the comparable 2015 Project and Program scenarios. For the PM peak period, the 2030 Project and Program VHT increases about 49 percent over the comparable 2015 Project and Program scenarios. Daily VHT growth between 2015 and 2030 for the above scenarios is about 38 percent.

Vehicle Hours of Delay

<u>Key Findings</u>

- There is no meaningful difference in VHD among the 2015 Project, Partial Project, and Program scenarios for the Center City area. This pattern also holds true for the four-county Puget Sound region.

- Again for the Center City area, the 2015 Partial Program shows a slight reduction in VHD, which could be the result of a greater congestion in the 2015 Program caused by the introduction of a BAT lane on Aurora Avenue. The BAT lane causes increased congestion in the adjacent general purpose lanes, inducing a slightly greater delay in the Program over the Partial Program scenarios.
- The growth in VHD (from 2015 to 2030) is higher percentage-wise than what was seen in the VHT results, because delay continues to be a growing problem throughout the Center City area and four-county Puget Sound region.
- By 2030, the higher growth in VHD, percentage-wise, is projected to occur outside the city of Seattle, reflecting the higher number of trips to/from downtown that are expected to be accommodated by transit in the future.

VHD for the 2015 and 2030 scenarios is shown in Exhibit 7-3.

Exhibit 7-3. Vehicle Hours of Delay

Performance Measure	2015			2030	
	Project	Partial Program	Program	Project	Program
Seattle Center City					
AM	5,700	5,500	5,600	6,800	6,700
PM	10,000	9,700	10,000	15,100	15,400
Daily	24,500	23,900	24,300	33,200	33,300
Four-County Region					
AM	254,200	251,600	253,900	531,500	536,900
PM	272,800	273,000	274,000	548,100	555,000
Daily	680,200	677,800	681,400	1,370,400	1,384,900

As shown in Exhibit 7-3, forecasts of total VHD in the Seattle Center City area remain relatively constant for all the 2015 scenarios for all time periods. However, the Partial Program generally shows slightly decreased VHD than the other scenarios, including the full 2015 Program. One of the reasons the 2015 Program shows greater delay than the 2015 Partial Program is the greater congestion in the Program caused by the introduction of the BAT lane on Aurora Avenue between Aloha Street and just south of the Aurora Bridge. This BAT lane creates a bottleneck where the SR 99 mainline is reduced from three to two general purpose lanes. The expected result is increased congestion in the general purpose lanes along SR 99 leading up to this segment, inducing greater delay over the Partial Program scenario, which does not include the BAT lane.

For the four-county Puget Sound region, there is no meaningful difference in VHD among the 2015 scenarios and among the 2030 scenarios during all time periods. In comparing 2015 and 2030, the growth in VHD, percentage-wise, is more pronounced than what was seen for VHT, which could be the result of more traffic encountering more congested road conditions, particularly in the growing urban centers outside of the Center City area. For the AM peak period, the 2030 Project and Program VHD increases by about 110 percent over the comparable 2015 Project and Program scenarios. For the PM peak period, the 2030 Project and Program VHD increases by about 102 percent over the comparable 2015 Project and Program scenarios. The increase in daily VHT between 2015 and 2030 for the above scenarios is also about 102 percent. In looking at the Center City area, the increase in VHD between 2015 and 2030 is less pronounced than the full region. This is likely because a higher number of trips to/from downtown are expected to be accommodated by transit in the future in comparison to the region as a whole.

Screenline Vehicle Volumes

To evaluate cumulative effects on parallel streets and highways, AM and PM peak period and daily traffic volumes were assessed for the 2015 Project, 2015 Partial Program, 2015 Program (full), 2030 Project, and 2030 Program scenarios. The same six screenlines evaluated in Chapter 5 were used in this assessment. Exhibit 7-4 provides a comparison of the screenline totals by scenario (by time period) for the four Center City screenline locations.

Exhibit 7-4. Model-Estimated Vehicle Volumes at Screenlines

Performance Measure	2015			2030	
	Project	Partial Program	Program	Project	Program
Spokane Street Screenline (North of S. Spokane Street)					
AM Peak Hour	33,000	33,060	33,000	34,660	34,700
PM Peak Hour	37,770	36,680	36,730	38,580	38,650
Daily	468,900	469,800	469,000	497,600	498,000
South Screenline (South of S. King Street)					
AM Peak Hour	36,100	36,200	36,100	37,500	37,700
PM Peak Hour	42,100	42,400	42,200	43,600	43,900
Daily	536,800	539,000	537,600	561,600	563,800
Central Screenline (North of Seneca Street)					
AM Peak Hour	32,900	33,100	33,000	34,100	34,200
PM Peak Hour	36,800	37,200	37,000	37,900	38,100
Daily	440,400	442,500	440,400	453,900	457,000
North Screenline (North of Thomas Street)					
AM Peak Hour	39,400	38,600	38,300	40,700	40,000
PM Peak Hour	43,700	42,900	42,700	46,400	45,200
Daily	523,600	509,900	506,700	558,600	542,200

Exhibits 7-5 and 7-6 graphically compare daily volumes for the 2015 and 2030 Project versus Program scenarios at key locations on SR 99, I-5, and Alaskan Way and across selected screenlines for arterial volumes (i.e., these screenlines do not include SR 99 or I-5 volumes) at locations generally similar to the four summarized in tabular format.

Two screenlines, measuring volumes traveling east and west near Aurora Avenue in north Seattle, as outlined in Chapter 5, were also evaluated. Exhibit 7-7 shows these volumes graphically.

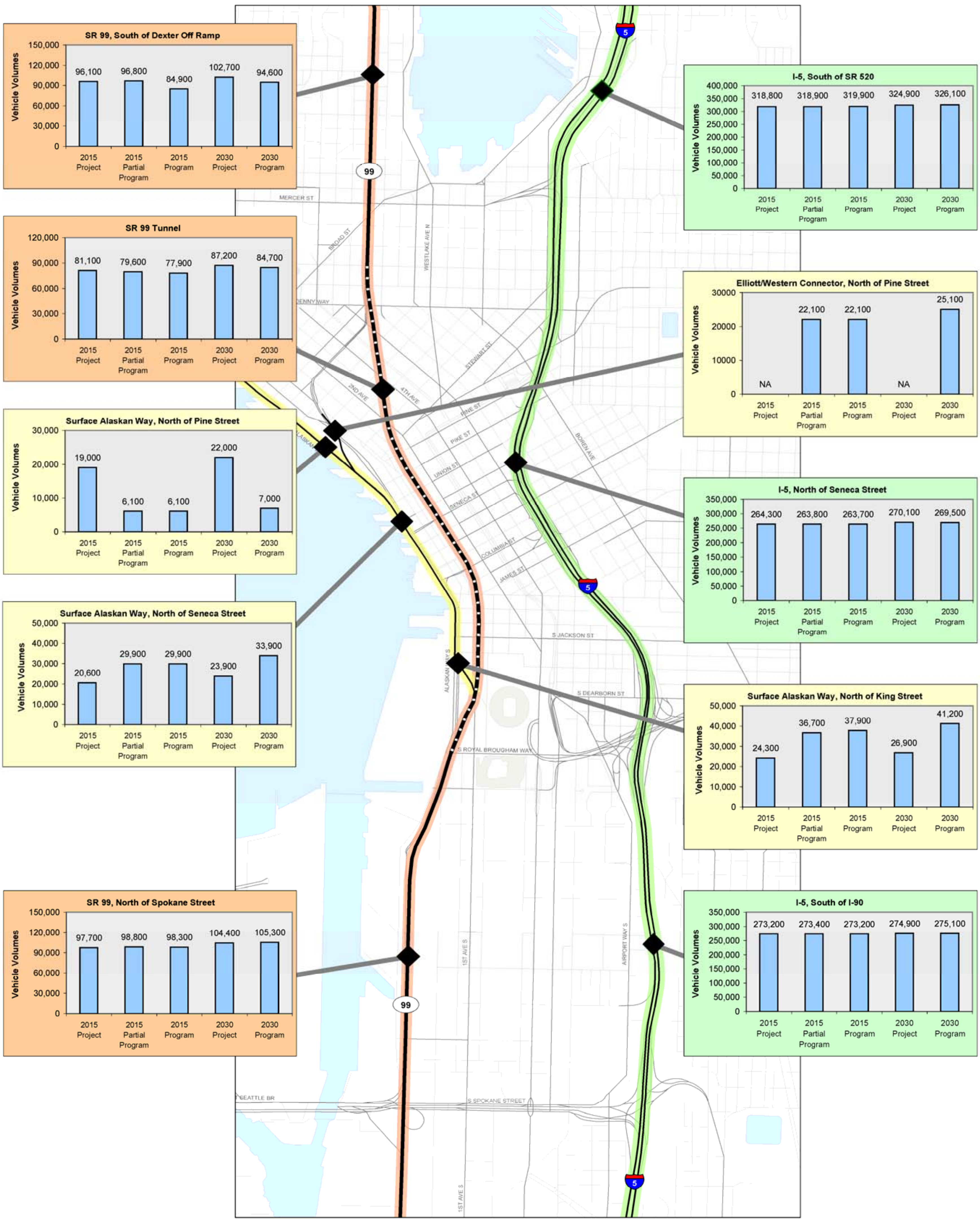
Key Findings

- The Spokane Street, south, and central screenline totals are fairly consistent across all the 2015 and 2030 scenarios. However, volumes across the screenline in the north are expected to decrease somewhat in the Program scenarios due to the conversion of a general purpose lane to a BAT lane on Aurora Avenue and the resulting capacity constraint on general purpose traffic.
- Growth in screenline volumes between the 2015 and 2030 scenarios is generally marginal because streets and highways are already congested for many hours of the day and more trips are expected to be accommodated by transit to/from and within the Center City area in the future.
- Provision for the Elliott/Western Connector for all three Program scenarios improves connectivity and access for Alaskan Way traffic, thus attracting higher demand on this facility in the Program scenarios as opposed to the Project scenarios.
- Vehicle volumes on east-west arterials north of the Ship Canal have very minor differences across all scenarios for 2015 and 2030, indicating that the differences in the roadway networks provided by the Program versus the Project scenarios do not affect east-west travel north of the Ship Canal.

Spokane Street Screenline

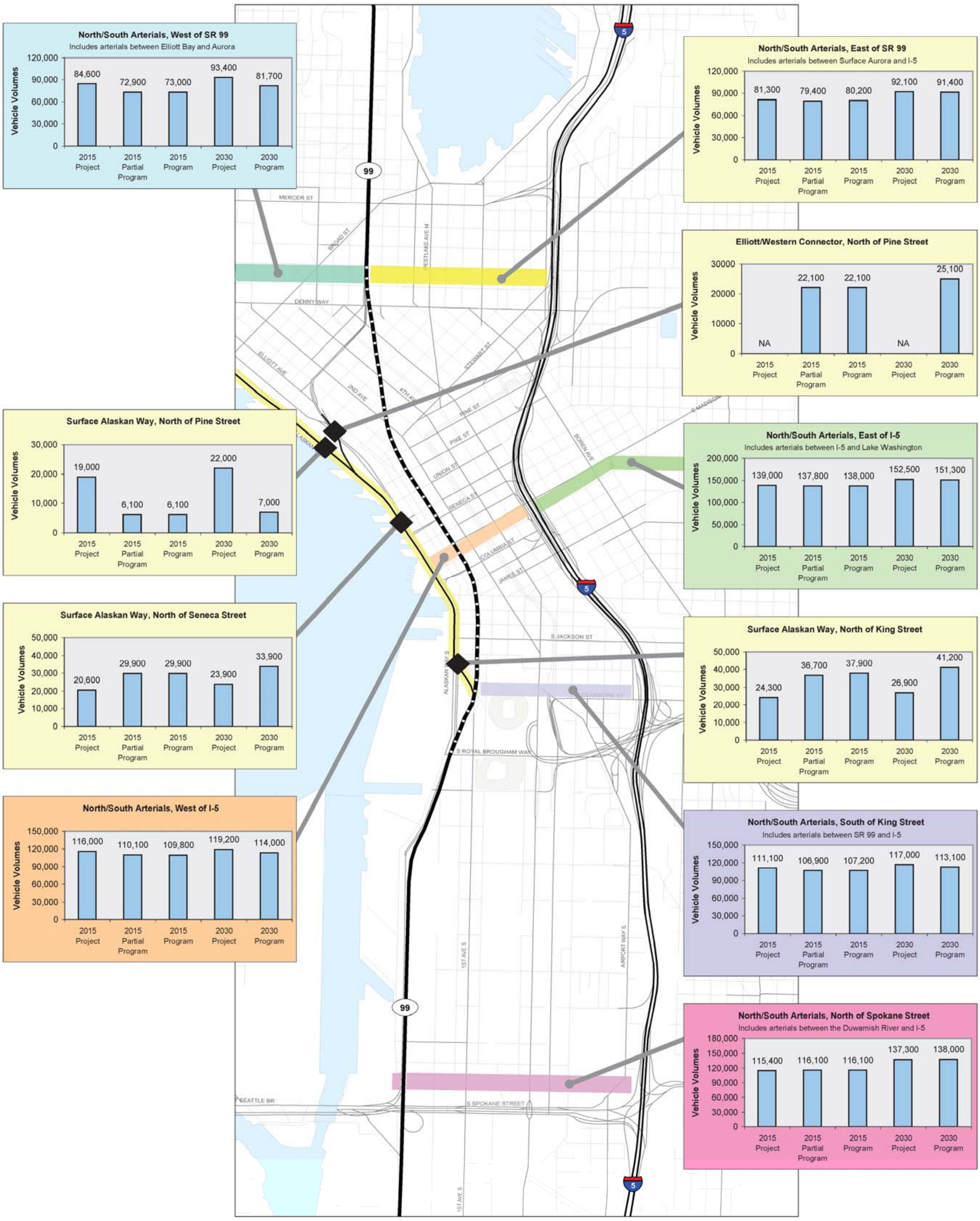
The Spokane Street screenline volumes are extremely consistent across all scenarios for the 2015 and 2030 time periods as shown in Exhibit 7-4. The growth in volume from 2015 to 2030 for all scenarios was 5 percent in the peak periods and 6 percent daily. This relatively low growth in vehicle trips is reflective of the higher transit use to/from downtown Seattle expected in the future, and the already high utilization of roadway capacity in the 2015 scenarios, which limits the amount of traffic growth that can occur. Daily traffic on the arterials shows the same pattern on this screenline as that shown in Exhibit 7-6, as does the projected volumes on SR 99 (Exhibit 7-5).

This Page Intentionally Left Blank



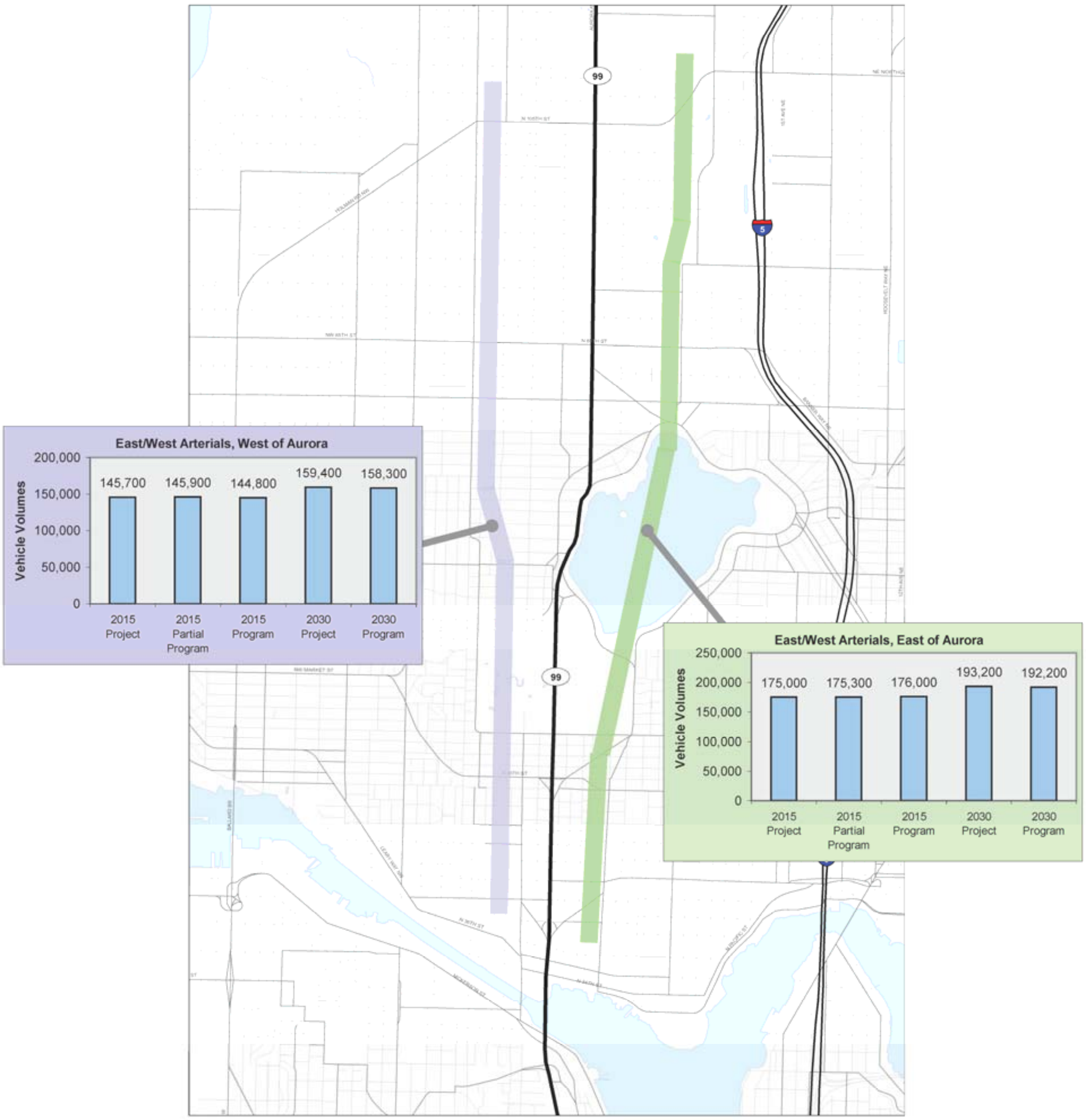
N

Exhibit 7-5
Daily Vehicle Volumes on I-5, SR 99 and Alaskan Way for 2015 Project, 2015 Partial Program, 2015 Program, 2030 Project and 2030 Program



Arterial screenlines do not include I-5 or SR 99 volumes

Exhibit 7-6
Daily Vehicle Volumes on Arterials for 2015 Project, 2015 Partial Program, 2015 Program, 2030 Project and 2030 Program



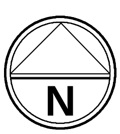


Exhibit 7-7
Daily Vehicle Volumes on Arterials in North Seattle for 2015 Project, 2015 Partial Program, 2015 Program, 2030 Project and 2030 Program

Since the Spokane Street screenline is farther from the cumulative effects elements in the Program scenarios, the volume differences between Project and Program scenarios in 2015 and 2030 are all very minor.

South Screenline

Similar to the Spokane Street screenline, as shown in the table in Exhibit 7-4, the vehicle volumes at the south screenline are fairly consistent across all the 2015 scenarios (Project, Partial Program, and Program) for all time periods. The same can also be said for the 2030 Project and Program scenarios. Growth in screenlines between 2015 and 2030 is generally marginal, as volumes for the 2030 Program are about 4 to 5 percent higher than the comparable 2015 Program scenario, regardless of time period. As with the Spokane Street screenline, the limited growth is due in part to increased transit usage and high utilization of roadway capacity. Growth in volumes for the 2030 Project scenario over the comparable 2015 Project scenario is slightly lower percentage-wise than the Program scenario (2015-2030). Increases in volume at this screenline ranges from about 3.5 to a little over 4 percent, regardless of time period. The reason that volumes between 2015 and 2030 in the Program grow slightly more than volumes in the Project is likely because the Elliott/Western Connector along with the enhanced Alaskan Way along the waterfront provide the Program with a little more capacity to grow as compared to the Project.

As shown in the graphic in Exhibit 7-6, individual streets can fluctuate greatly depending on the effects of certain scenarios regardless of the total volume across the entire screenline. A case in point is Alaskan Way both south of S. King Street and north of Seneca Street. In these locations, under the 2015 and 2030 Project scenarios, daily volumes are significantly lower than the 2015 Partial Program, Program, and 2030 Program scenarios. The higher capacity waterfront boulevard as well as the inclusion of the Elliott/Western Connector in the respective Program scenarios helps to improve capacity, connectivity, and access to the central waterfront and Alaskan Way, which attracts higher demand at this location. As seen in Exhibit 7-5, for the north-south arterials along the south screenline between SR 99 and I-5, the three Program scenarios (2015 Partial Program, 2015 Program, and 2030 Program), all show slightly lower volumes than the comparative Project scenarios. The reason these vehicle volumes are lower is the fact that Alaskan Way, which is not included in this screenline, is attracting more traffic in the Program scenarios, reducing volumes that enter, exit, or travel through downtown via other arterials.

Central Screenline

Like the results for the Spokane Street and south screenlines, the vehicle volumes at the central screenline (Exhibit 7-4) are fairly consistent across all the 2015 scenarios (Project, Partial Program, and Program) for all time periods. The same can also be said for the 2030 Project and Program scenarios. Growth in screenlines between 2015 and 2030 is generally marginal, as volumes for both the 2030 Project and Program are about 3 to 4 percent higher than the comparable 2015 scenarios, regardless of time period.

Like the Spokane Street and south screenlines, the three Program scenarios all show slightly lower volumes than the Project scenarios for north-south arterials west of I-5 (see Exhibit 7-5). Again, the reason these vehicle volumes are lower is the fact that Alaskan Way, which is not included in the screenline, is attracting more traffic in the Program scenarios, reducing volumes that enter, exit, or travel through downtown via other arterials. For north-south arterials east of I-5 though, the difference between the Project and Program scenarios is minimal, as the scenarios have much less impact in this area. Also, vehicle volumes on I-5 near the central screenline (see Exhibit 7-6) are generally the same regardless of scenario, as I-5 is at capacity many hours of the day and cannot absorb large increases in demand. Note that projected daily volumes on SR 99 through the bored tunnel (see Exhibit 7-5) are slightly less in the 2015 Partial Program as compared to the 2015 Project. This is likely due to the addition of the Elliott/Western Connector and the enhanced waterfront along Alaskan Way in the Program that attracts more of the Elliott/Western trips away from the Mercer Street/bored tunnel route in the Project.

The bored tunnel volume for the 2015 Program is projected to be lower than that of the Partial Program primarily because of the conversion of a general purpose lane to a BAT lane on SR 99 north between Aloha Street and the Aurora Bridge. This conversion creates a bottleneck for general purpose traffic and effectively constrains the volumes that can access the tunnel. The bored tunnel volumes in the 2030 Program as compared to the 2030 Project show the same pattern for the same reason.

North Screenline

Continuing the trend shown in the Spokane Street, south, and central screenlines, the vehicle volumes at the north screenline (Exhibit 7-4) are fairly consistent across all the 2015 scenarios (Project, Partial Program, and Program) for all time periods. The same can also be said for the 2030 Project and Program scenarios. Growth in screenlines between 2015 and 2030 is slightly higher than what was reflected in the south and central screenlines, which could be the result of higher population and employment growth in the South Lake Union area. Vehicle volumes for the 2030 Program are about 4.5 to 7 percent higher than the comparable 2015 Program scenario, regardless of time period. Growth in volumes for the 2030 Project scenario over the comparable 2015 Project scenario is slightly lower percentage-wise than the Program scenario (2015-2030). Increases in volume at this screenline range from over 3 to 6.5 percent, regardless of time period.

The differences among the scenarios with respect to growth in arterial traffic volume become more pronounced at the north screenline (see Exhibit 7-5). Similar to the south and central screenlines, fewer vehicles on north-south arterials west of Aurora Avenue (SR 99) cross the screenline under the 2015 Partial Program, 2015 Program, and 2030 Program in comparison to the comparable Project scenarios. However, this result is primarily due to the conversion of Mercer Street to two-way traffic between Fifth Avenue N. and Elliott Avenue in the Program scenarios, which makes Mercer Street a more attractive westbound route between SR 99 (and points east) and Elliott Avenue. In the Project scenarios, many of these westbound trips instead traveled southbound to Denny Way and then back north via Elliott Avenue, in many cases crossing the screenline twice; hence resulting in higher screenline volumes than those in the Program. Vehicle volumes on the east side of Aurora Avenue for the year 2015 are relatively consistent, while in the 2030 Project and Program scenarios, they increase about 13 percent likely due to growth in employment and population in the South Lake Union area.

Projected volumes on SR 99 south of the Dexter Avenue southbound off-ramp are similar between the 2015 Project and Partial Program but are 12 percent lower in the 2015 Program due to the constraint caused by the conversion of a general purpose lane to a BAT lane in this location. For similar reasons, the projected 2030 volumes at this location show the 2030 Program to be 8 percent lower than the 2030 Project.

North Seattle

Vehicle volumes on east-west arterials north of the Ship Canal are similar across all scenarios for all time periods. The small scale of these differences, all less than 1 percent, is due to the distance of these arterials from the locations of the projects being evaluated for cumulative effects. In addition, it indicates that the differences in the roadway networks provided by the Program versus the Project scenarios do not affect east-west travel north of the Ship Canal.

Person Throughput

Person throughput was estimated for the 2015 Project, Partial Program, and Program scenarios as well as the 2030 Project and Program scenarios for the same key screenlines as those analyzed in Chapter 5.

Key Findings

- Both the Partial Program and Program scenarios carry a marginally higher number of persons in comparison to their respective Project scenarios. This is likely due to the increase in transit service provided in the Program scenarios and improved street connections provided in the Partial Program scenario.

Exhibit 7-8 presents the person-trips per day for the 2015 and 2030 Project and Program scenarios.

Exhibit 7-8. Model-Estimated Daily Person Throughput (Person-Trips)

Performance Measure	2015			2030	
	Project	Partial Program	Program	Project	Program
South Screenline (South of S. King Street)					
AM	54,000	54,300	54,500	65,400	65,700
PM	66,600	67,000	67,100	79,000	79,600
Daily	776,900	780,800	780,700	883,600	888,400
Central Screenline (North of Seneca Street)					
AM	52,300	52,600	52,700	60,400	60,800
PM	61,500	62,000	62,000	69,900	70,400
Daily	650,300	654,100	652,700	746,600	753,300
North Screenline (North of Thomas Street)					
AM	59,100	58,300	58,000	67,800	67,400
PM	70,000	69,000	68,900	80,800	79,600
Daily	760,800	743,900	740,200	866,700	847,700

In observing the ability of the street network to carry persons (as opposed to vehicles), each of the scenarios carry roughly the same amount of persons at the study area screenlines, regardless of time period.

For the south screenline, both the 2015 Partial Program and 2015 Program scenarios carry a marginally higher number of persons in comparison to the 2015 Project scenario. This may be due to the increase in transit service and improved street connections provided in the Program scenario and Partial Program scenario.

The overall differences in person-trips among the 2015 scenarios are relatively small for the south and central screenlines. Refer to Exhibit 7-7 for a table of daily person trips. The north screenline shows higher daily person-trips for the 2015 Project scenario in comparison to the 2015 Partial Program and 2015 Program.

Similar to the screenline vehicle trip volumes, this result is primarily due to the conversion of Mercer Street to two-way traffic between Fifth Avenue N. and Elliott Avenue in the Program scenarios, which makes Mercer Street a more attractive westbound route between SR 99 (and points east) and Elliott Avenue. In the Project scenarios, many of these westbound trips instead traveled southbound to Denny Way and then back north via Elliott Avenue, in many cases crossing the screenline twice; hence resulting in a higher number of screenline person-trips than the number in the Program.

7.1.2 Traffic Operations on SR 99

Key Findings

- The 2015 Partial Program volume estimates are generally similar to the 2015 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown, modest decreases in the bored tunnel, and increases north of downtown.
- The 2030 Program volume estimates are generally similar to the 2030 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown and modest decreases in the bored tunnel and ramps in the South Lake Union area. The one exception to this is a substantial decrease in both directions on the SR 99 mainline north of downtown with the 2030 Program. This decrease is due to the conversion of one lane in each direction to a BAT lane, which substantially reduces the capacity of the mainline for general traffic.
- With implementation of the 2015 Partial Program, the mainline LOS is projected to be similar to that projected for 2015 Project.
- The mainline LOS under the 2030 Program scenario is generally expected to be similar to that projected for 2030 Project, with some improvement in LOS in the south end of the project area and some decline in LOS in the north end of the project area. Both changes in LOS between the 2030 Project and 2030 Program are mainly due to the decrease in mainline capacity with the addition of the BAT lanes north of downtown, which is expected to result in high levels of congestion. That congestion would create a bottleneck that would reduce the number of vehicles served, such that the southbound LOS would actually improve south of downtown due to the reduced volume of vehicles. In the northbound direction, more traffic is expected to divert to the expanded Alaskan Way along the waterfront to avoid the congestion in the tunnel and north of the tunnel as a result of the BAT lane conversion.

- Travel speeds for the 2015 Partial Program and 2030 Program confirm the LOS findings. Projected speeds are similar to those in the 2015 and 2030 Project, with the exception of slightly higher southbound speeds and substantially lower northbound speeds in the northern part of the project area.
- In the southbound direction, speeds are expected to decline somewhat (e.g., from 32 mph to 28 mph in the AM peak hour) between the north tunnel portal and the Aurora Bridge in the 2030 Program as compared to the Project. This is due to the constraint caused by the conversion of a general purpose lane to a BAT lane in this section. The more substantial effect of the constrained section of SR 99, however, is expected to be reflected on southbound SR 99 north of the beginning of the BAT lanes. The analyses indicate that southbound AM peak hour speeds would decrease to less than 20 mph across the Aurora Bridge as a result of the BAT lane conversion.

Alaskan Way Viaduct Mainline and Ramp Volumes

This section describes the AM peak hour, PM peak hour, and daily traffic volume estimates for the 2015 Partial Program and 2030 Program scenarios. Anticipated changes from the 2015 Project and 2030 Project are discussed in detail below.

AM Peak Hour

Exhibits 7-9 and 7-10 show the volumes in the AM peak hour for the 2015 Partial Program and the 2030 Program scenarios, respectively.

2015 Partial Program

The 2015 Partial Program volume estimates are generally similar to the 2015 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown, modest decreases in the bored tunnel, and increases north of downtown. Vehicle volumes in the bored tunnel are expected to decrease slightly to approximately 2,900 vehicles southbound and 3,500 northbound. These decreases are due to the new connection provided between Elliott and Western Avenues and Alaskan Way on the central waterfront. With the connection in place, some vehicles that would otherwise use the bored tunnel would now use the connection to the central waterfront. AM peak hour mainline ramp volumes forecasted for the 2015 Partial Program are shown in Exhibit 7-9.

2030 Program

As with the 2015 Partial Program, the 2030 Program volume estimates are generally similar to the 2030 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown and modest decreases in the bored tunnel and ramps in the South Lake Union area. The one exception is a substantial decrease in both directions on the SR 99 mainline north of downtown with the 2030 Program. This is due to the conversion of one lane in each direction to a BAT lane, which substantially decreases the capacity of the mainline. Vehicle volumes in the bored tunnel are expected to decrease slightly to approximately 2,900 vehicles southbound and 3,500 northbound. As with the 2015 Partial Program, these decreases are due to the new connection between Elliott and Western Avenues and Alaskan Way, as well as the capacity constraint on SR 99 north of the tunnel caused by the BAT lane conversion. AM peak hour mainline ramp volumes forecasted for the 2030 Program are shown in Exhibit 7-10.

PM Peak Hour

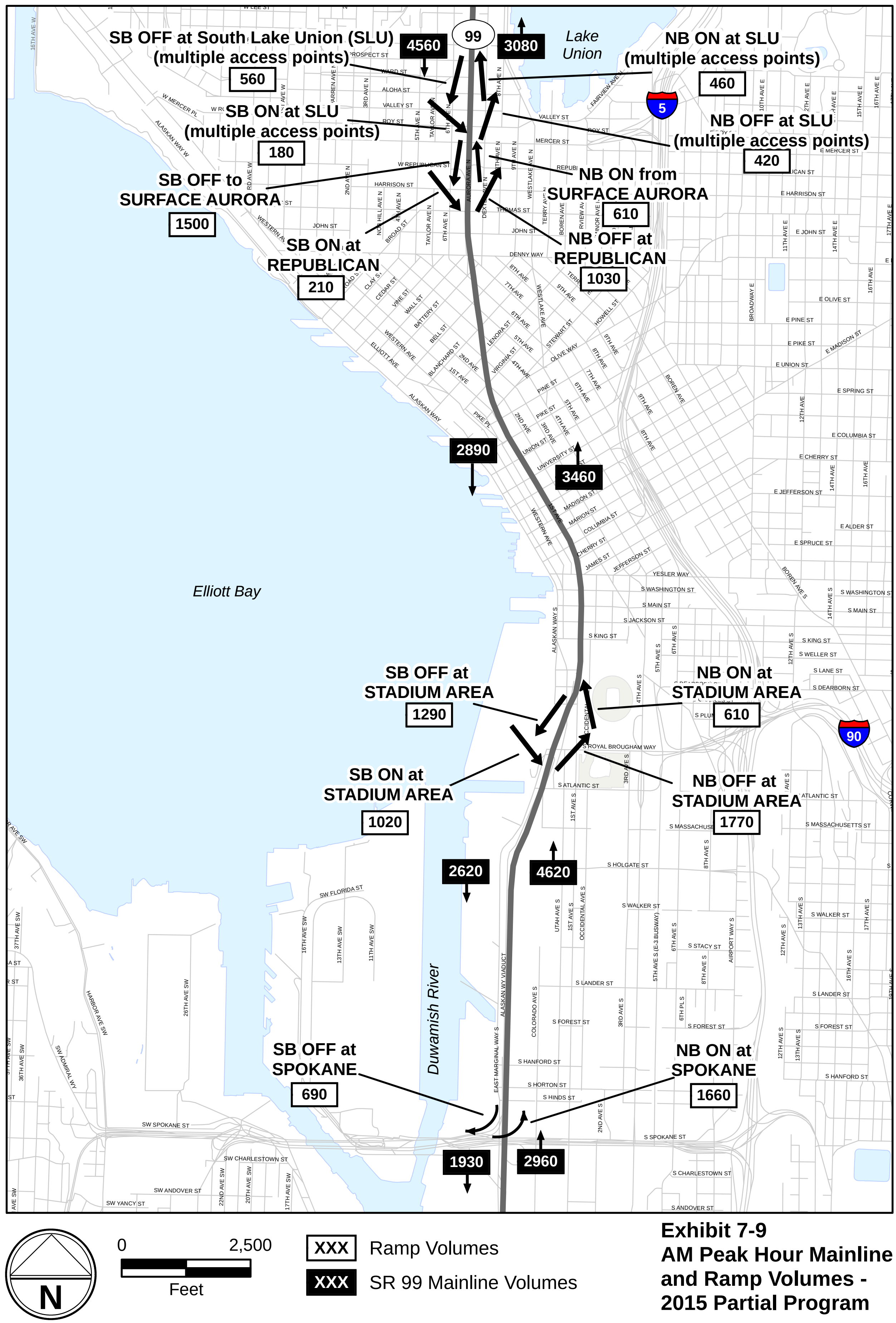
Exhibits 7-11 and 7-12 show the volumes in the PM peak hour for the 2015 Partial Program and the 2030 Program scenarios, respectively.

2015 Partial Program

As in the AM peak hour, the 2015 Partial Program volume estimates are generally similar to the 2015 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown, modest decreases in the bored tunnel, and increases north of downtown. Vehicle volumes in the bored tunnel are expected to decrease slightly to approximately 3,300 vehicles southbound and 3,900 northbound. These decreases are due to the new connection provided between Elliott and Western Avenues and Alaskan Way on the central waterfront. With the connection in place, some vehicles that would otherwise use the bored tunnel would now use the connection to the central waterfront. PM peak hour mainline ramp volumes forecasted for the 2015 Partial Program are shown in Exhibit 7-11.

2030 Program

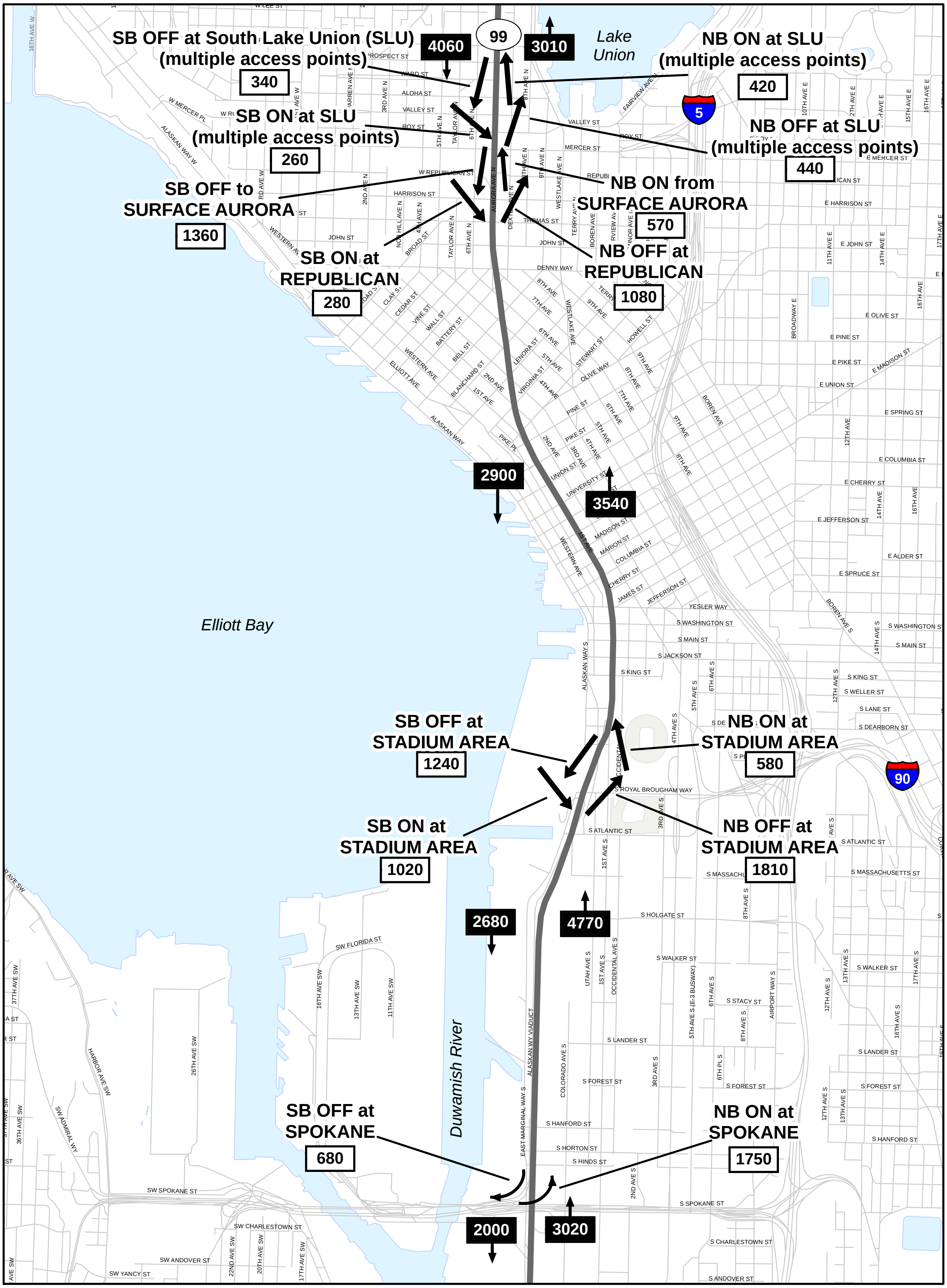
As with the 2015 Partial Program, the 2030 Program volume estimates are generally similar to the 2030 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown and modest decreases in the bored tunnel and ramps in the South Lake Union area. As in the AM peak hour, the one exception is a substantial decrease in both directions on the SR 99 mainline north of downtown with the 2030 Program. This is again due to the conversion of one lane in each direction to a BAT lane, which substantially decreases the capacity of the mainline. Vehicle volumes in the bored tunnel are expected to decrease slightly to approximately 3,400 vehicles southbound and 4,000 northbound. As with the 2015 Partial Program, these decreases are due to the new connection between Elliott and Western Avenues and Alaskan Way, as well as the capacity constraint on SR 99 north of the tunnel caused by the BAT lane conversion. PM peak hour mainline ramp volumes forecasted for the 2030 Program are shown in Exhibit 7-12.



XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 7-9
AM Peak Hour Mainline and Ramp Volumes - 2015 Partial Program



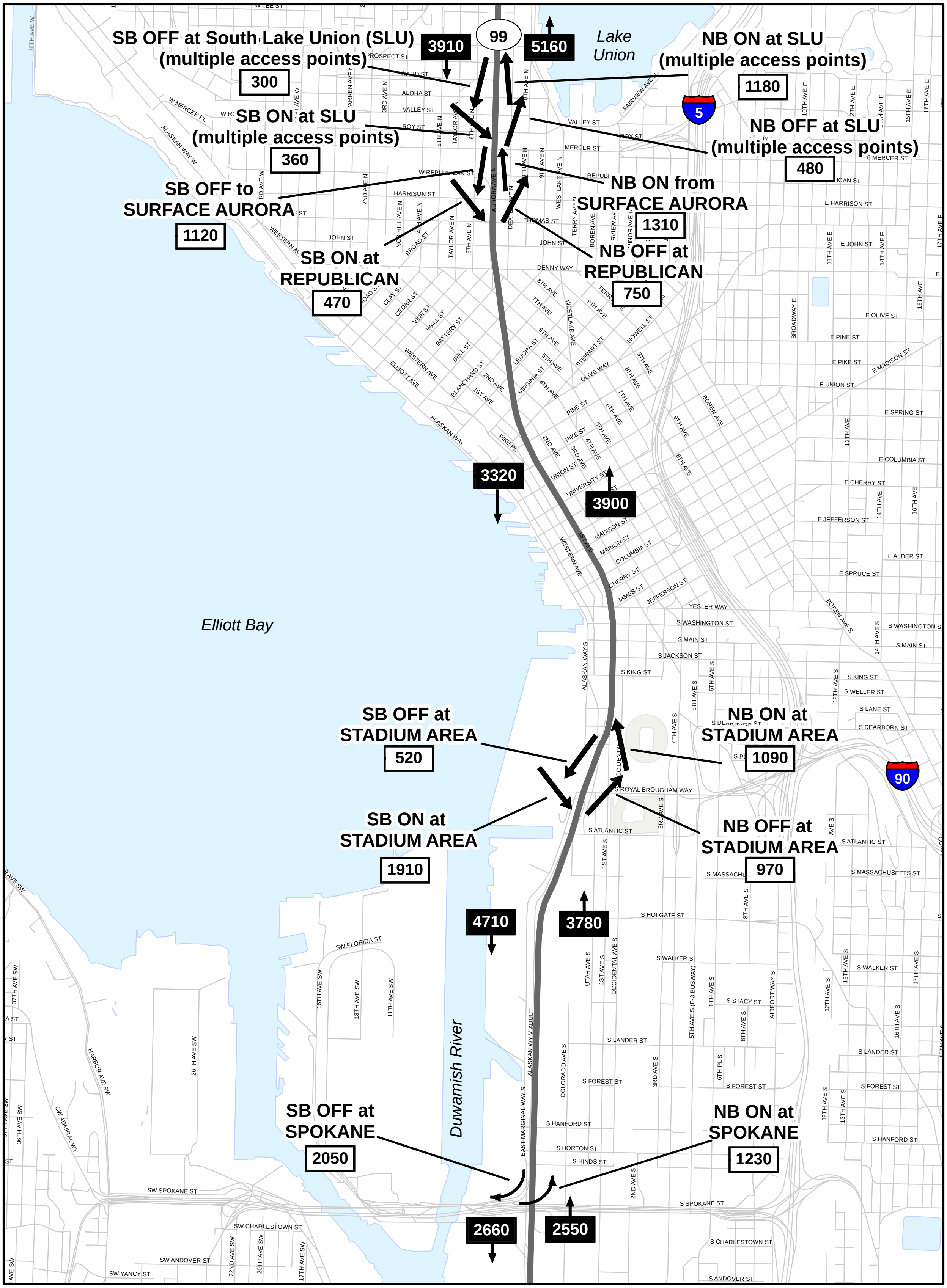
N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 7-10
AM Peak Hour Mainline and Ramp Volumes - 2030 Program



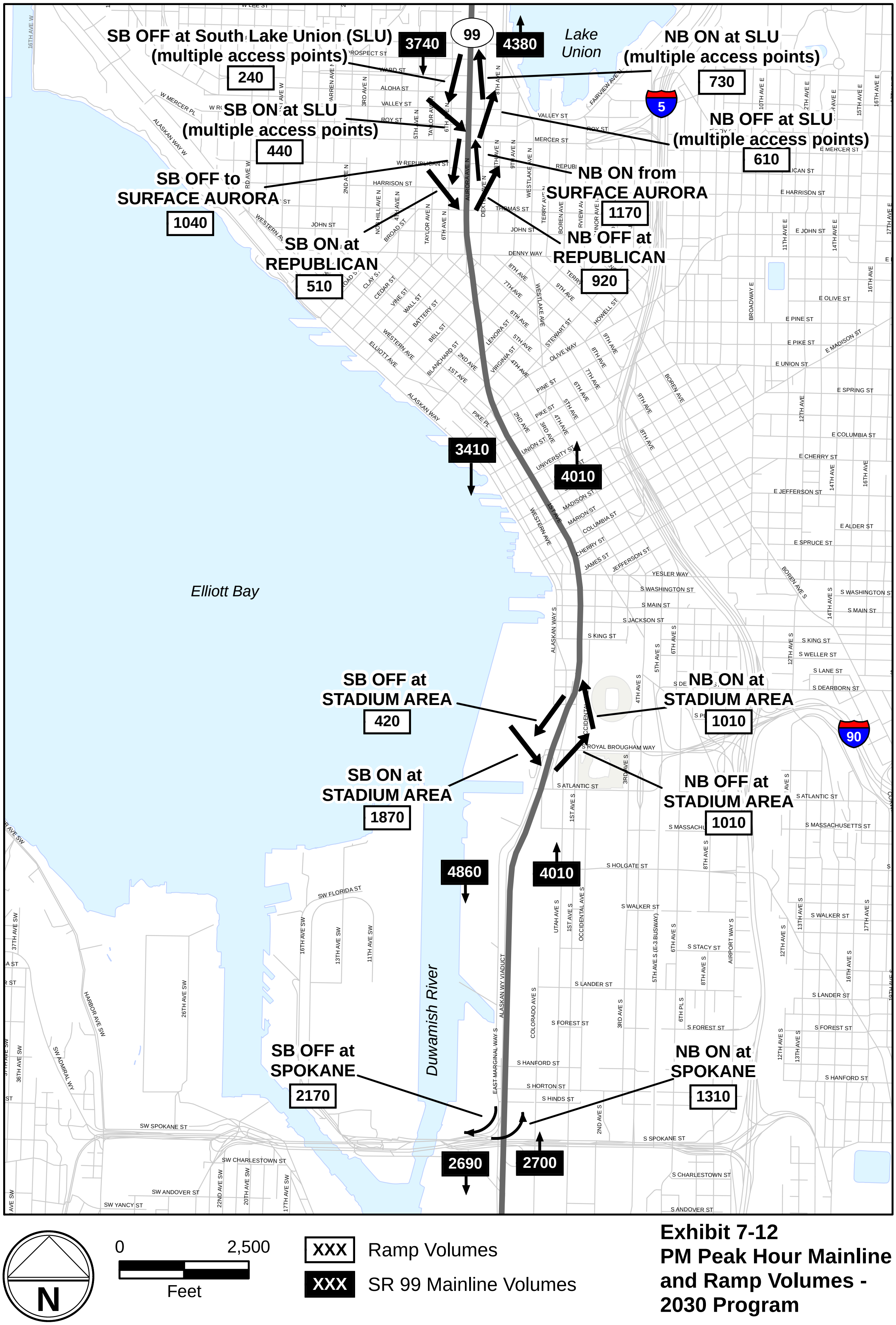
N

0 2,500
Feet

XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 7-11
PM Peak Hour Mainline and Ramp Volumes - 2015 Partial Program



XXX Ramp Volumes

XXX SR 99 Mainline Volumes

Exhibit 7-12
PM Peak Hour Mainline and Ramp Volumes - 2030 Program

Daily

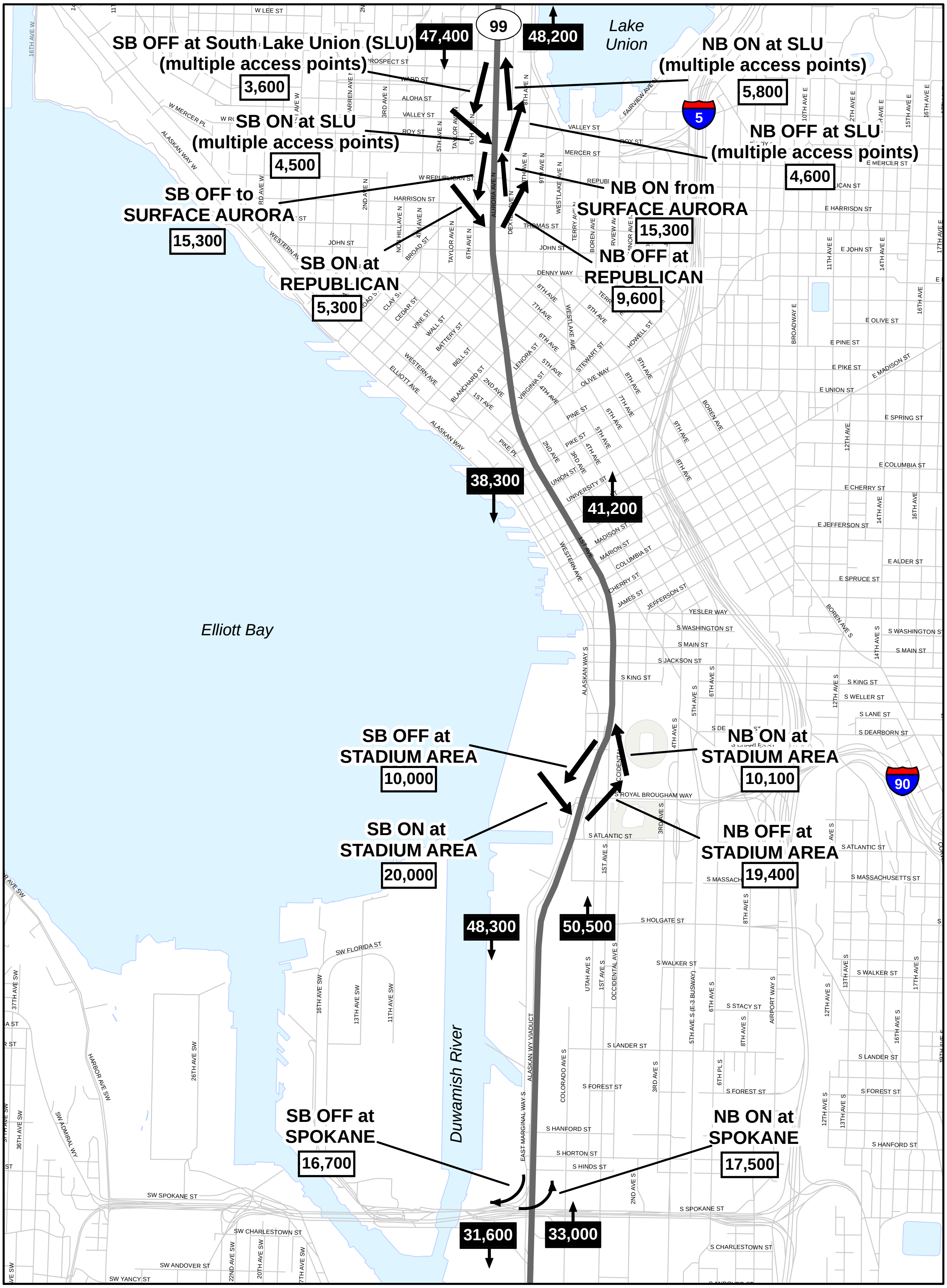
Exhibits 7-13 and 7-14 show the daily volumes for the 2015 Partial Program and the 2030 Program scenarios, respectively.

2015 Partial Program

As in the AM and PM peak hours, the 2015 Partial Program volume estimates are generally similar to the 2015 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown, modest decreases in the bored tunnel, and increases north of downtown. Vehicle volumes in the bored tunnel are expected to decrease slightly to approximately 38,300 vehicles southbound and 41,200 northbound. These decreases are due to the new connection provided between Elliott and Western Avenues and Alaskan Way on the central waterfront. With the connection in place, some vehicles that would otherwise use the bored tunnel would now use the connection to the central waterfront. Daily mainline ramp volumes forecasted for the 2015 Partial Program are shown in Exhibit 7-13.

2030 Program

As with the 2015 Partial Program, the 2030 Program volume estimates are generally similar to the 2030 Project forecasts, with modest increases in volumes for most mainline and ramp segments south of downtown and modest decreases in the bored tunnel and ramps in the South Lake Union area. As in the AM and PM peak hours, the one exception is a substantial decrease in both directions on the SR 99 mainline north of downtown with 2030 Program. This is again due to the conversion of one lane in each direction to a BAT lane, which substantially decreases the capacity of the mainline. Vehicle volumes in the bored tunnel are expected to decrease slightly to approximately 41,000 vehicles southbound and 44,000 northbound. As with the 2015 Partial Program, these decreases are due to the new connection between Elliott and Western Avenues and Alaskan Way, as well as the capacity constraint on SR 99 north of the tunnel caused by the BAT lane conversion. Daily mainline ramp volumes forecasted for the 2030 Program are shown in Exhibit 7-14.



N

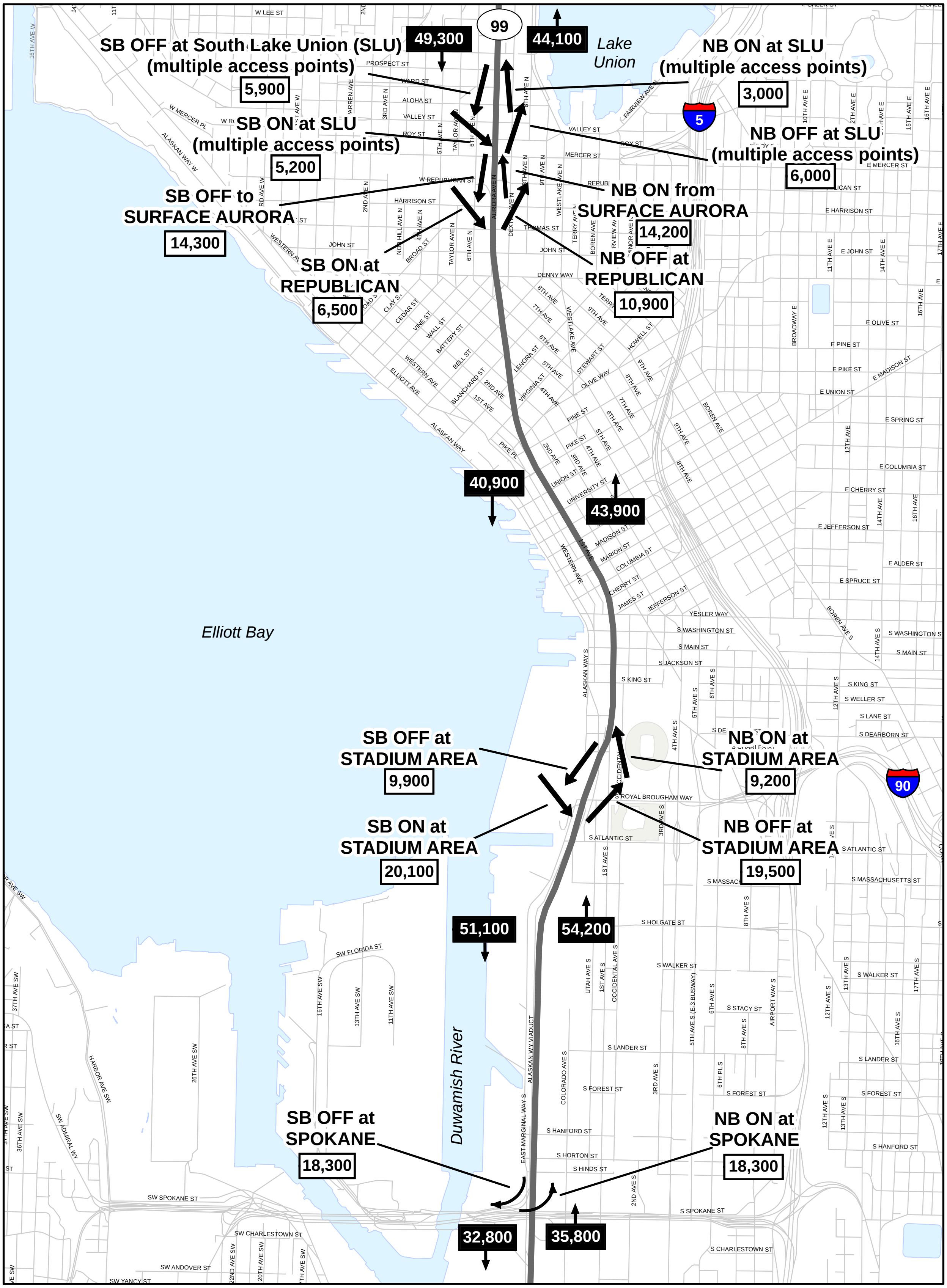
0 2,500

Feet

XXX	Ramp Volumes
XXX	SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 7-13
Daily Mainline and Ramp Volumes - 2015 Partial Program



N

0 2,500
Feet

XXX	Ramp Volumes
XXX	SR 99 Mainline Volumes

Note: Totals may not sum due to rounding.

Exhibit 7-14
Daily Peak Hour Mainline and Ramp Volumes - 2030 Program

SR 99 Mainline Level of Service

This section describes the AM and PM peak hour LOS for corridor segments under the 2015 Project, 2015 Partial Program, 2030 Project, and 2030 Program scenarios. While LOS provides a general gauge of how a facility performs overall, it is not considered a comprehensive measure for comparing scenarios for mainline conditions because ramp locations and segment arrangements may vary considerably among the scenarios. Additionally, as indicated in Chapter 2, because SR 99's posted speeds are less than the speeds on a typical freeway, the LOS as based on the HCM density ranges for freeways would likely be lower than the actual speeds on the facility. Hence, the mainline LOS results are better suited for a relative comparison between scenarios as opposed to a true indication of operating performance. Projected speeds and travel times along the facility is a better indicator of expected performance. The SR 99 mainline LOS is summarized by segment for the 2015 Project, 2015 Partial Program, 2030 Project, and 2030 Program scenarios in Exhibits 7-15 to 7-18, reflecting both directions in the AM and PM peak hours.

Exhibit 7-15. AM Peak Hour Southbound SR 99 Segment Level of Service

Southbound – AM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
Stadium on to S. Spokane Street	C	C	C	B
Midtown				
Bored Tunnel	D	D	D	D
North Corridor				
North of Bored Tunnel	E	E	F	F

Exhibit 7-16. AM Peak Hour Northbound SR 99 Segment Level of Service

Northbound – AM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
S. Spokane Street to Stadium Off-Ramp	D	D	E	E
Midtown				
Bored Tunnel	E	E	E	E
North Corridor				
North of Bored Tunnel	D	D	D	D

Exhibit 7-17. PM Peak Hour Southbound SR 99 Segment Level of Service

Southbound - PM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
Stadium on to S. Spokane Street	D	D	D	D
Midtown				
Bored Tunnel	D	D	E	E
North Corridor				
North of Bored Tunnel	E	E	E	E

Exhibit 7-18. PM Peak Hour Northbound SR 99 Segment Level of Service

Northbound - PM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
S. Spokane Street to Stadium Off-Ramp	D	D	F	E
Midtown				
Bored Tunnel	E	E	F	F
North Corridor				
North of Bored Tunnel	F	F	E	F

2015 Partial Program Level of Service

With implementation of the 2015 Partial Program, the mainline LOS is expected to be similar to that projected for the 2015 Project. The bored tunnel segment of the mainline is projected to operate at LOS D in the southbound direction during both the AM and PM peak hours, similar to the 2015 Project. Similarly, northbound operations are projected to remain at LOS E during both the AM and PM peak hours.

In the south end of the project area from approximately S. Spokane Street to the stadium off-ramp area, northbound SR 99 speeds and densities would remain at LOS D levels during both the AM and PM peak hours. Mainline performance in the southbound direction would remain at LOS C in the AM peak hour and at LOS D in the PM peak hour.

In the north end of the project area, southbound conditions are expected to remain at LOS E during both the AM and PM peak hours. Northbound conditions would remain at LOS D in the AM peak hour and at LOS F in the PM peak hour.

2030 Program Level of Service

Similar to 2015 Partial Program, implementation of the 2030 Program is generally projected to result in similar mainline traffic operations as those with the 2030 Project, with some improvement in LOS in the south end of the project area and some decline in LOS in the north end of the project area.

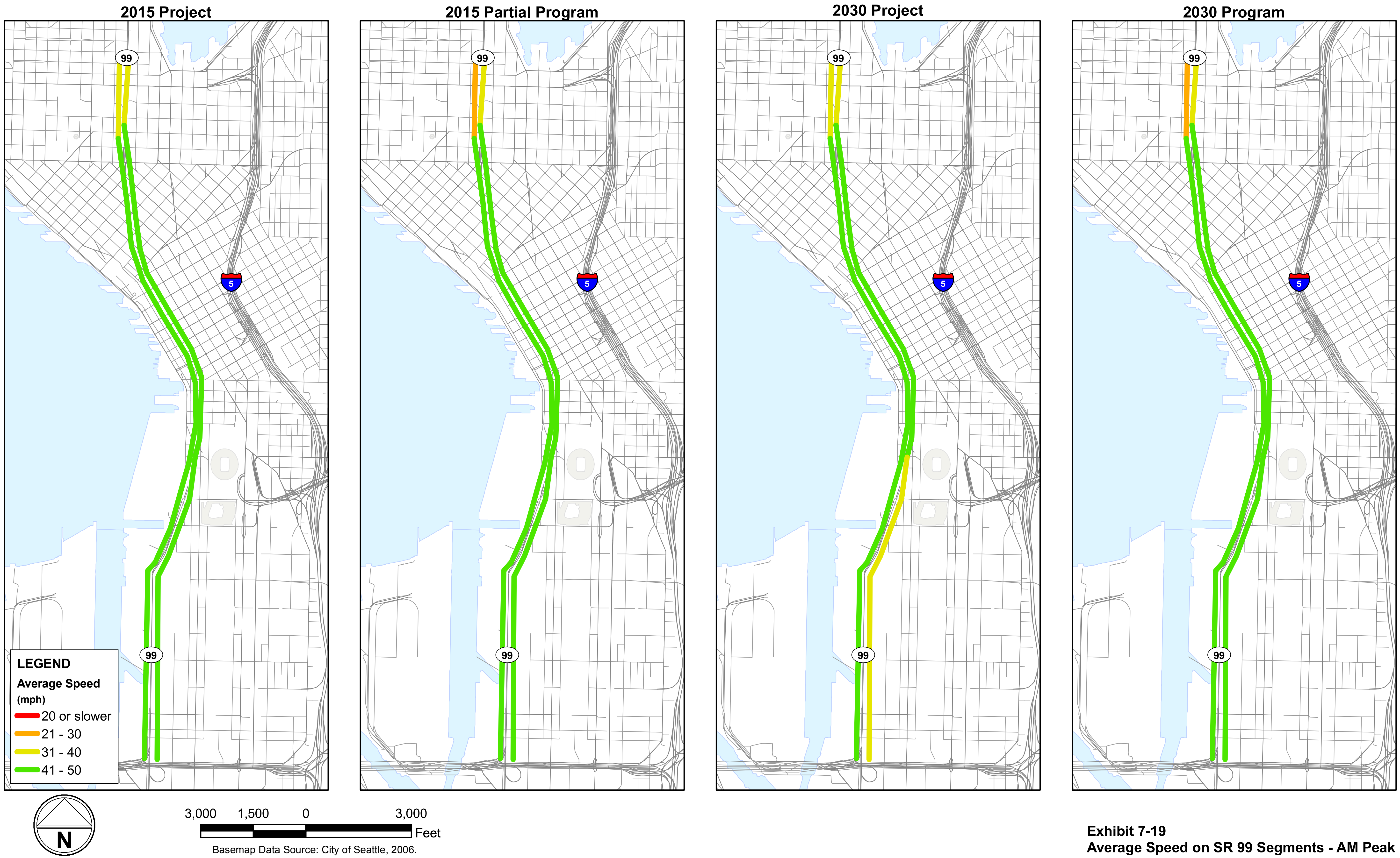
The bored tunnel segment of the mainline is projected to remain at LOS D in the southbound direction during the AM peak hour and at LOS E in the PM peak hour. Northbound operations are projected to remain at LOS E during the AM peak hour and at LOS F during the PM peak hour.

In the south end of the project area from approximately S. Spokane Street to the stadium area off-ramp, northbound SR 99 speeds and densities would remain at LOS E levels during the AM peak hour. However, during the PM peak hour, northbound mainline operations are projected to improve from LOS F to LOS E with the 2030 Program. This improvement is due to a higher number of vehicles leaving the mainline and a lower number of vehicles entering the mainline in the stadium area. This reduction in vehicles using SR 99 north of the stadium area is anticipated to occur as a result of increased capacity on Alaskan Way along the waterfront, as well as congestion on SR 99 north of downtown due to reduced capacity on the mainline with the addition of the BAT lanes. Mainline performance in the southbound direction would improve from LOS C to LOS B in the AM peak hour. This improvement is anticipated to occur due to congested operations in the north end of the project area, which would result in a bottleneck condition in which fewer vehicles are able to get through the project area. Southbound operations would remain at LOS D in the PM peak hour.

In the north end of the project area, southbound conditions are expected to remain at LOS F during the AM peak hour and at LOS E during the PM peak hour. Northbound conditions would remain at LOS D in the AM peak hour. In the PM peak hour, northbound operations would decline from LOS E to LOS F. Again, this degraded LOS is anticipated to occur as a result of reduced capacity on the mainline with the addition of the BAT lanes north of the project area.

SR 99 Mainline Speeds

This section discusses the AM and PM peak hour travel speeds for corridor segments under the 2015 Project, 2015 Partial Program, 2030 Project, and 2030 Program scenarios. As with LOS, comparing travel speeds between scenarios can present certain challenges because the ramp and segment arrangements vary among the scenarios. To assist in this comparison, the results are presented side by side graphically in Exhibits 7-19 and 7-20. The speeds are also presented in tabular format in Exhibits 7-21 to 7-24.



Basemap Data Source: City of Seattle, 2006.

Exhibit 7-19
Average Speed on SR 99 Segments - AM Peak

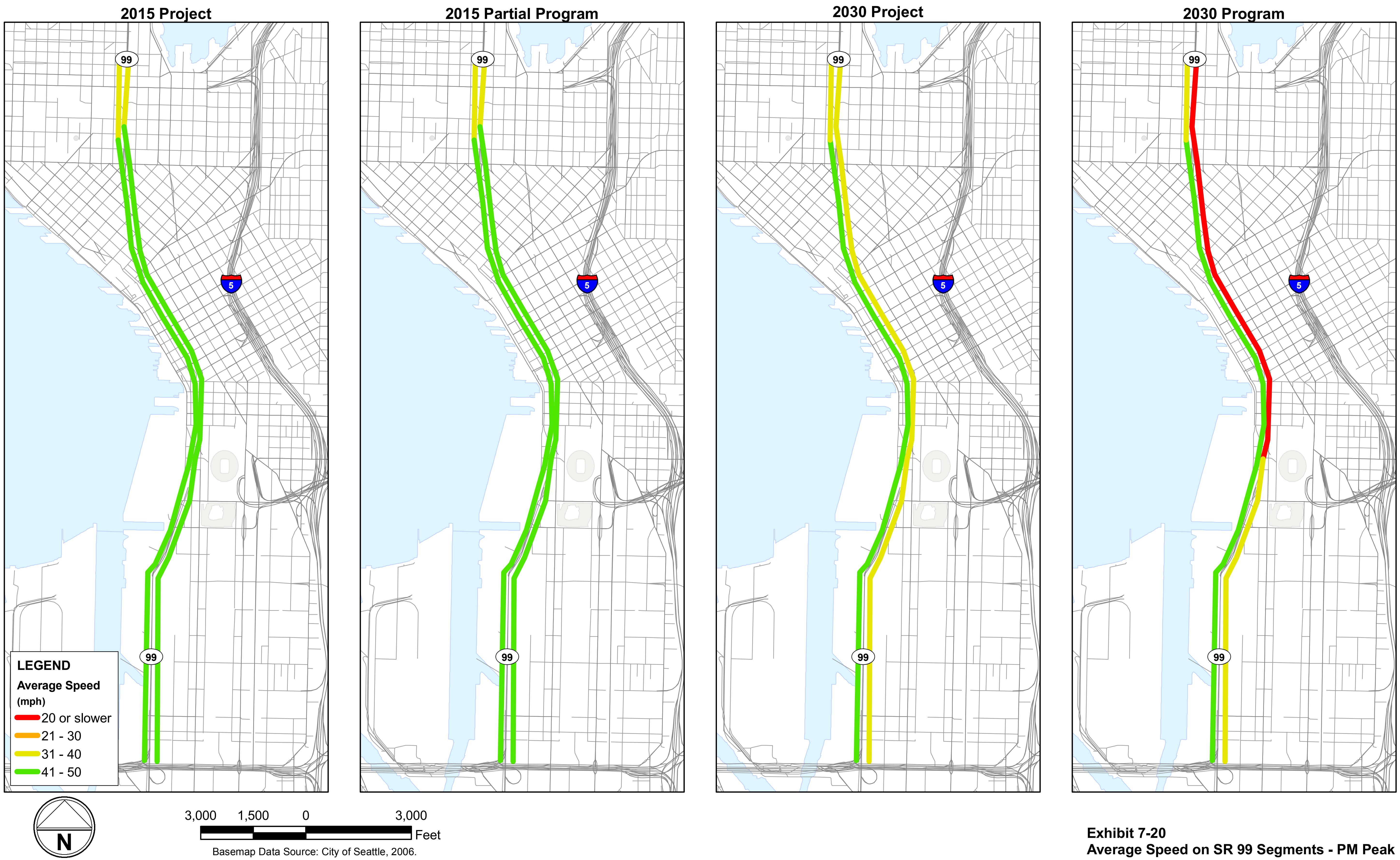


Exhibit 7-20
Average Speed on SR 99 Segments - PM Peak

Exhibit 7-21. AM Peak Hour Southbound SR 99 Segment Speeds (miles per hour)

Southbound – AM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
Stadium on to S. Spokane Street	48	48	45	48
Midtown				
Bored Tunnel	46	46	45	46
North Corridor				
North of Bored Tunnel	33	29	32	28

Exhibit 7-22. AM Peak Hour Northbound SR 99 Segment Speeds (miles per hour)

Northbound – AM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
S. Spokane Street to Stadium Off-Ramp	45	46	40	44
Midtown				
Bored Tunnel	44	44	43	44
North Corridor				
North of Bored Tunnel	35	35	35	34

Exhibit 7-23. PM Peak Hour Southbound SR 99 Segment Speeds (miles per hour)

Southbound – PM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
Stadium on to S. Spokane Street	47	46	46	45
Midtown				
Bored Tunnel	46	46	46	46
North Corridor				
North of Bored Tunnel	34	34	34	34

Exhibit 7-24. PM Peak Hour Northbound SR 99 Segment Speeds (miles per hour)

Northbound - PM	2015 Project	2015 Partial Program	2030 Project	2030 Program
South Corridor				
S. Spokane Street to Stadium Off-Ramp	47	47	32	34
Midtown				
Bored Tunnel	44	44	40	20
North Corridor				
North of Bored Tunnel	35	33	35	19

Segment travel speed results for the 2015 Partial Program and 2030 Program confirm the LOS findings, with speeds on most segments projected to be similar to those projected for the 2015 Project and 2030 Project. Southbound speeds in the bored tunnel are expected to remain at approximately 45 to 46 mph in both the AM and PM peak hours in both the 2015 Partial Program and the 2030 Program. In the northbound direction, speeds in the tunnel are expected to remain at approximately 43 to 44 mph in the AM peak hour in both the 2015 Partial Program and the 2030 Program. However, in the PM peak hour, while speeds are expected to be similar between the 2015 Project and Partial Program, the reduced mainline capacity due to the BAT lanes north of downtown is anticipated to result in substantially slower speeds with the 2030 Program (approximately 20 mph compared with 40 mph with the 2030 Project).

In the south end of the project area from S. Spokane Street to the stadium off-ramp area, speeds on SR 99 in both directions with the 2015 Partial Program are expected to be similar to the 2015 Project conditions in the AM and PM peak hours. With the 2030 Program, speeds during the AM peak hour are projected to increase in both directions compared with the 2030 Project, increasing from 45 to 48 mph in the southbound direction and from 40 to 44 mph in the northbound direction. As described previously with LOS, these increases are expected to occur as a result of more northbound vehicles using alternate routes such as Alaskan Way on the waterfront and fewer southbound vehicles being allowed to travel through the project area due to congestion north of downtown. During the PM peak hour, travel speeds are expected to remain similar to the 2030 Project in the southbound direction and to increase from 32 to 34 mph in the northbound direction.

In the north end of the project area, southbound speeds during the AM peak hour with the 2015 Partial Program are expected to be slower, at 29 mph, compared to 33 mph in the 2015 Project scenario. Northbound speeds would be similar to those in the Project scenario. In the PM peak hour, southbound speeds would be similar between the Project and Partial Program, but northbound speeds would decline from 35 to 33 mph. Speeds for the north end in the 2030 Program scenario are anticipated to follow a similar trend as that seen with the 2015 Partial Program, with an even more substantial reduction in speeds in the northbound direction during the PM peak hour (declining from 35 mph with the 2030 Project to 19 mph with the 2030 Program). Again, this reduction in speeds is mainly due to the reduced capacity on the SR 99 mainline with the addition of the BAT lanes north of downtown. Speeds in the southbound direction during the AM peak hour are expected to decline from 32 mph with the 2030 Project to 28 mph with the 2030 Program. Note that the true effect of the constrained section of SR 99 is expected to be reflected on southbound SR 99 north of the beginning of the BAT lanes. Analyses indicate that southbound AM peak hour speeds would slow to less than 20 mph across the Aurora Bridge as a result of the BAT lane conversion.

7.1.3 Traffic Operations at Key Arterial Intersections

Key Findings

- Average intersection delays and LOS for the 2015 Partial Program and 2030 Program scenarios would generally be similar to Project conditions.
- In the south end, no substantial changes are anticipated for the Partial Program or Program aside from enhanced transit service for the 2030 Program. As such, intersection operations would likely be similar to the Project scenarios.
- In the central sub-area, the Elliott/Western Connector to/from the Alaskan Way surface street is expected to draw greater north-south peak hour demands to the waterfront area. Intersection congestion could therefore increase slightly for higher volume locations on Alaskan Way.
- In the north end, the changes to Mercer Street (extension to Elliott Avenue) would not substantially affect intersection delays for the 2015 Partial Program or 2030 Program compared to Project conditions. However, the Elliott/Western Connector may slightly draw traffic away from the Mercer Street corridor and the SR 99 corridor, potentially reducing intersection delays at locations near or west of the mainline.
- Intersection operations in 2030 Program conditions are expected to remain similar to 2030 Project conditions.

South Sub-Area

Detailed results of the intersection analysis for the south sub-area are not provided in this section. However, a qualitative discussion of potential congestion hot spots and general comparisons to Project conditions is provided. Intersection performance for a selected number of study locations was evaluated using Synchro and VISSIM traffic analysis software.

2015 Partial Program

Under the 2015 Partial Program scenario, traffic patterns in the south end of the project area would be similar to the 2015 Project scenario and would reflect the relocation of the SR 99 stadium ramps and the introduction of newly created intersections in the network within the study area. With no network differences between the Project and Partial Program scenarios, similar congestion hot spots would likely arise during the PM peak hour. These intersections include First Avenue S. at S. Atlantic Street, S. Royal Brougham Way at Fourth Avenue S. and First Avenue S. at Yesler Way. Delays at each of these locations would likely reflect LOS E conditions or worse. Congestion levels for the AM peak hour would be modest by comparison, with all intersections in the south end likely operating at LOS D or better.

2030 Program

For the 2030 Program scenario, the street network in the south end of the project area would be similar to the 2015 Partial Program and 2030 Project scenarios, which again includes the full range of planned improvements included in the Baseline scenario (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 2030 Program package are transit service enhancements and increases across the King Country Metro bus system.

With little to no change in the street network between 2030 Project and 2030 Program conditions but with the proposed transit service enhancements incorporated, delays and LOS under the 2030 Program are expected to be similar to 2030 Project conditions, if not slightly improved.

Specific AM peak hour hot spots identified for the 2030 Project scenario that would operate at high levels of congestion under 2030 Program conditions include the E. Marginal Way (Terminal 46 Driveway)/S. Atlantic Street, First Avenue S./S. Atlantic Street, First Avenue S./S. Dearborn Street, and Fourth Avenue S./S. Royal Brougham Way. For PM peak hour conditions, the intersections of First Avenue S. at S. Atlantic Street and Fourth Avenue S. at S. Royal Brougham Way would also likely operate at LOS E or LOS F.

Central Sub-Area

As with the south end, no specific technical results or tables are provided in this discussion of intersection operations in the central sub-area. However, congestion levels at intersections in 2030 Program are qualitatively compared to those described in the 2030 Project discussion to highlight the similarities between the scenarios.

2015 Partial Program

Under the 2015 Partial Program scenario, removal of the downtown SR 99 on- and off-ramps would be identical to the network changes described for the 2015 Project. 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 off-ramp, and the Elliott Avenue on-ramp. Traffic would use the south end stadium area ramps or the north end interchange and take surface streets into downtown. The only congestion hot spot previously identified for 2015 Project conditions that would apply to the 2015 Partial Program scenario is the intersection of Western Avenue at Broad Street.

A new connector would be introduced in the 2015 Partial Program (versus the 2015 Project) that would provide direct access from Elliott Avenue and Western Avenue to/from the Alaskan Way surface street. This connector is expected to draw additional traffic to Alaskan Way and Elliott/Western compared to 2015 Project conditions. Congestion levels on Elliott Avenue and Western Avenue near Broad Street and at key intersections along the waterfront such as Alaskan Way at Madison Street and Alaskan Way at Columbia Street may increase as a result of the higher traffic volumes.

Some marginal reductions in delay may occur at some intersections in the central sub-area due to enhanced transit service and potential reductions in overall vehicular demand. However, such a mode shift to transit between the Project and Program scenarios is not expected to affect overall intersection delays to a degree sufficient enough to influence peak hour LOS.

2030 Program

Under 2030 Program conditions, the majority of intersections are anticipated to operate similarly to 2030 Project conditions in the central sub-area. During the AM peak hour, the only critical hot spot identified previously for the 2030 Project scenario was Second Avenue at Marion Street. Similar delays could be expected at this location for 2030 Program conditions. For the PM peak hour, the intersection of Western Avenue at Broad Street is anticipated to operate at the high levels of congestion for the 2030 Project scenario and would experience similar congestion under 2030 Program conditions.

As discussed for the 2015 Partial Program, additional intersections that may experience high levels of congestion under 2030 Program conditions could include intersections along Elliott Avenue and Western Avenue near Broad Street due to the new connection between the Alaskan Way surface street to/from Elliott Avenue and Western Avenue. Higher demands on Alaskan Way due to this new connection may increase congestion levels at key intersections along the waterfront such as Alaskan Way at Madison Street and Alaskan Way at Columbia Street.

The enhancements in transit service expected as part of the 2030 Program scenario elements may help to reduce general purpose vehicle demands on city streets and consequently result in an overall decrease in intersection delays. These effects may be more pronounced for the 2030 horizon compared to 2015 conditions due to higher overall traffic volumes and congestion levels, which may lead to greater potential for mode shift.

North Sub-Area

As discussed in Chapter 5, two configurations for Sixth Avenue N. and the southbound on-ramp are being considered in the north end, reflecting how Sixth Avenue N. is aligned between approximately Republican Street and Mercer Street. Detailed results of the intersection analysis for the north sub-area are not provided in this section; instead a qualitative discussion is provided to draw comparisons and note similarities between the Project and Program conditions for the 2015 and 2030 horizons.

2015 Partial Program

For the 2015 Partial Program scenario, network changes in the north end would be similar to those described for 2015 Project conditions. 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 the closure of Broad Street, extending Sixth Avenue to Mercer Street, and the conversion of Sixth Avenue N. from one-way to two-way between Denny Way and Battery Street. The only major difference between the Project and Partial Program elements is the extension of two-way Mercer Street from Fifth Avenue N. to Elliott Avenue under the Partial Program.

The extension of Mercer Street as a two-way arterial (to Elliott Avenue) is not expected to affect traffic distributions or congestion levels substantially in the Uptown neighborhood. For the AM peak hour, similar intersection delays would be expected for the 2015 Partial Program compared to 2015 Project conditions. Key congestion hot spots identified previously under the Project scenario include Valley Street at Fairview Avenue N., Mercer Place at Elliott Avenue, Dexter Avenue at Mercer Street, and Fairview Avenue at Mercer Street. These intersections are expected to operate at LOS E or worse during the AM peak hour.

Similar to Project conditions, the intersections of Mercer Street at Fairview Avenue N., Mercer Street at Westlake Avenue N., and Mercer Place at Elliott Avenue are expected to experience long delays and pronounced queuing during the PM peak hour. Also, the intersection of Sixth Avenue and Battery Street is anticipated to experience long delays for the 2015 Partial Program.

Option 2 in the north end would include a modified Sixth Avenue N. alignment near Republican Street and the on-ramp to southbound SR 99. As described previously in Chapter 5, this option would align Sixth Avenue farther to the east between Republican Street and Mercer Street and restrict movements at the resulting intersection with Mercer Street. No westbound or northbound left turns would be allowed at the new intersection on Mercer Street. For the 2015 Partial Program scenario, intersection delays for affected intersections under Option 2 would not be expected to change noticeably from those for the original concept for Sixth Avenue N. despite some rerouting of trips accessing the southbound on-ramp to SR 99 at Republican Street.

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 north-south route along the central waterfront. Trips originating from or destined to the Interbay and Ballard areas that may have used the SR 99 bored tunnel may shift to Elliott and Western Avenues, thereby reducing demands on east-west arterials such as Mercer Street. As a result, congestion levels at intersections in the north end may be slightly lower for locations near and/or west of the SR 99 corridor.

2030 Program

Under the 2030 Program scenario, most intersections in the north end are expected to operate at levels similar to 2030 Project conditions. During the AM peak hour, similar intersections are anticipated to operate under congested conditions as those expected to be congested in the 2030 Project scenario, which includes key hot spots such as Mercer Street at Dexter Avenue, Valley Street at Fairview Avenue, and the gateway intersection of Mercer Street at Fairview Avenue/I-5 ramps. Other locations would also operate at LOS E or worse for the 2030 Program as highlighted in the 2030 Project discussion.

During the PM peak hour for the 2030 Program scenario, similar hot spots as those described above for AM peak hour conditions would occur. However, additional locations such as Denny Way at Aurora Avenue, Dexter Avenue at Denny Way, Ninth Avenue at Mercer Street, and Denny Way at Aurora Avenue/Battery Street/Wall Street would also be included on the list of highly congested intersections during the PM peak hour.

Two scenario elements that may result in slightly lower congestion levels for the 2030 Program scenario compared to the 2030 Project include the Elliott/Western Connector and the enhanced transit service levels. The Elliott/Western Connector may potentially 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 end. Congestion levels at intersections in the north end may be slightly lower for locations near and/or west of the SR 99 corridor as result.

As discussed in the mainline operations section for the 2030 Program, northbound and southbound SR 99 from Aloha Street to the north may include a right-side transit-only lane that would essentially convert a general purpose lane into a designated bus lane. Preliminary analyses of operations including these bus lanes have shown high levels of mainline congestion that is likely to constrain inbound and outbound capacity on SR 99. The details of such constraints on intersection operations are unknown. However, in the southbound direction (particularly for the AM peak hour), this may translate to fewer trips entering the system and lower congestion levels at the north end intersections. For the northbound direction, the mainline constraint could result in spillback of northbound ramp traffic to local streets and longer delays overall during the PM peak hour.

7.1.4 Peak Hour Travel Times

Key Findings

- Travel times for the specific paths and time periods examined are not expected to change substantially from 2015 Project to 2015 Partial Program conditions. Similar consistency could be expected for the comparison of selected 2030 Project and 2030 Program travel times. Only the Ballard to Spokane Street route is discussed for the 2030 scenarios.
- While nearly all differences in travel time between the 2015 Project and the 2015 Partial Program are within 5 to 7 percent, the northbound route from Spokane Street to Ballard via SR 99, the Alaskan Way surface street, and Elliott Avenue/15th Avenue N.W. would take 6 minutes less under 2015 Partial Program conditions compared to 2015 Project conditions (PM peak hour). This 20 percent reduction in travel time is likely attributed to the new Elliott/Western Connector that is introduced to provide more direct access between the waterfront (Alaskan Way) and the Elliott Avenue and Western Avenue one-way couplet.
- Differences in travel times from Ballard to Spokane Street for the 2030 Project and 2030 Program scenarios are similar to those highlighted for the 2015 scenarios, although less pronounced in magnitude. For the AM peak hour, travel times are generally similar (within 2 to 4 percent) in both directions. For PM peak hour conditions, the northbound travel time for the 2030 Program is reduced by 2.5 minutes compared to 2030 Project conditions. This represents an 8 percent reduction from the 2030 Project to the 2030 Program and is again attributed to the new connector for Elliott Avenue and Western Avenue to/from Alaskan Way.

Peak hour travel times for the Project and Program scenarios are shown in Exhibit 7-25.

Exhibit 7-25. Corridor Travel Times for the Project, Partial Program, and Program Scenarios

	2015 Project	2015 Partial Program	2030 Project	2030 Program	2015 Project	2015 Partial Program	2030 Project	2030 Program
	AM Peak Hour				PM Peak Hour			
West Seattle to CBD								
Inbound	22	21	23	-	-	-	-	-
Outbound	-	-	-	-	25	25	30	-
Woodland Park to CBD								
Inbound	18	20	20	-	-	-	-	-
Outbound	-	-	-	-	17	15	20	-
Woodland Park to Spokane Street								
Southbound	14	14	15	-	12	12	13	-
Northbound	11	11	12	-	14	14	16	-
Ballard to Spokane Street (via Alaskan Way, Alaskan Way Viaduct)								
Southbound	17	17	18	17	18	19	21	21
Northbound	19	18	19	19	30	24	32	29
Ballard to Spokane Street (via Mercer, Bored Tunnel)								
Southbound	16	TBD	16	TBD	16	TBD	20	TBD
Northbound	19	TBD	21	TBD	21	TBD	25	TBD
Northgate to Boeing Access Road								
Southbound	28	28	30	-	32	32	38	-
Northbound	28	28	32	-	29	30	34	-
Mercer Street (I-5 to Elliott)								
Westbound	10	TBD	11	TBD	11	TBD	14	TBD
Eastbound	8	TBD	8	TBD	10	TBD	14	TBD

Estimated travel times shown in minutes.

West Seattle to CBD

As described in Chapter 5, this route extends from the intersection of California Avenue and Alaska Junction to the CBD (Fourth Avenue and Seneca Street) and is presented for the peak direction trip only (i.e., inbound in the AM and outbound in the PM peak period).

Travel times for this route would be similar between the 2015 Project and 2015 Partial Program. Travel times differences are generally no greater than 1 to 2 minutes (less than 5 to 7 percent) for either direction or time period.

Woodland Park to CBD

This route is defined by the SR 99 corridor from N. 50th Street to downtown Seattle and is described for the peak direction trip only. Travel times for the 2015 Project and 2015 Partial Program scenarios are generally similar for either the AM or PM peak hour and for both directions.

Woodland Park to S. Spokane Street

Changes to the larger roadway network as part of the 2015 Partial Program, which include the Elliott/Western Connector and the extension of two-way Mercer Street to Fifth Avenue N., would not affect travel times for this route. As a result, travel times for both directions and time periods are expected to be within 0.5 minute for the 2015 Project and the 2015 Partial Program.

Ballard Bridge to Spokane Street (via Alaskan Way Viaduct and/or Alaskan Way)

This route is defined by a north end point of Ballard and a south end point near the Duwamish area at Spokane Street and is the only travel time route for which comparisons between the 2015 and 2030 scenarios are provided.

The main network change influencing travel times along this route is the introduction of the Elliott/Western Connector in the 2015 Partial Program and 2030 Program. This 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 in the north end of Alaskan Way near Elliott Avenue at Broad Street.

Based on the analysis findings, travel times under AM peak hour conditions are generally similar between the 2015 Project and the 2015 Partial Program and between the 2030 Project and the 2030 Program, are generally similar. However, for the PM peak hour, the high concentrations of traffic through the central waterfront and to Ballard/Interbay (northbound) would provide more pronounced benefits. As a result, travel times for the 2015 Partial Program and 2030 Program scenarios are less than those for the 2015 Project and 2030 Project, respectively. In fact, for the 2030 horizon, travel times are reduced by nearly 20 percent for the 2030 Program scenario compared to the 2030 Project scenario.

Ballard Bridge to Spokane Street (via Mercer Street and Bored Tunnel)

Placeholder - waiting for data.

Northgate to Boeing Access Road (via I-5)

As mentioned in Chapter 5, travel times between Northgate and Boeing Access Road are generally the longest of any route investigated due to the distance covered along the I-5 corridor and the multiple merge/weave sections encountered between these two end points. The modeling results indicate that travel times for the 2015 Partial Program would be nearly identical to those summarized for the 2015 Project scenario. These similar travel times are expected because no major capacity enhancements are incorporated for the SR 99 corridor (outside of the Elliott/Western Connector) that would induce a shift to or away from the I-5 corridor.

Mercer Street (I-5 to Elliott Avenue)

Placeholder - waiting for data.

7.1.5 Roadway Connectivity and Access

Key Findings

- The Alaskan Way Viaduct and Seawall Replacement Program would create additional roadway connections and access opportunities that would offer more travel routes in the future.
- There would be a new roadway connecting Alaskan Way to Elliott and Western Avenues in the area between Pike and Battery Streets.
- Mercer Street would become two-way from Fifth Avenue to Elliott Avenue W. Roy Street from Aurora Avenue to Queen Anne Avenue would become two-way.

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

The Alaskan Way surface street would be six lanes wide between S. King and Columbia Streets (not including turn lanes), five lanes between Columbia and Marion Streets (three lanes northbound and two southbound) transitioning to four lanes between Marion and Pike Streets. The new street would include new sidewalks, bicycle lanes, parking and loading zones, and signalized pedestrian crossings at cross streets.

Elliott/Western Connector – Pike Street to Battery Street

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 new roadway would include bicycle and pedestrian facilities.

The Elliott-Western Connector would provide better connectivity from the waterfront to the Belltown area, which would result in improved access for vehicles and, in particular, freight traffic traveling to and from the Ballard/Interbay/Magnolia areas. This would likely generate higher traffic volumes on Alaskan Way than those experienced today, as access to SR 99 in the Belltown area would be removed by the Bored Tunnel Alternative.

Mercer Street West Corridor Improvements – Fifth Avenue to Elliott Avenue

Mercer Street would be restriped and resignalized between Fifth Avenue N. and Second Avenue W. to create a two-way street with turn pockets. In addition, Roy Street from Aurora Avenue to Queen Anne Avenue would become two-way.

The reconfiguration of the Mercer Street corridor to two-way operations between I-5 and Elliott Avenue W. would provide an improved east-west connection for trips in the north end of the study area. 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.

7.1.6 Transit Services

Key Findings

- Transit ridership for the 2015 Partial Program and 2015 Project would be similar, with a small (about 1 percent) increase under the 2015 Partial Program as compared to the 2015 Project
- Transit ridership for the 2030 Program and 2030 Project would be similar, with a small (about 1 percent) increase under the 2030 Program as compared to the 2015 Project
- Along major transit corridors, travel times for the 2015 Program would be comparable to those for the 2015 Project.
- Along two transit corridors, Ballard/downtown Seattle and Aurora Avenue/downtown Seattle, travel times for the 2030 Program would be comparable to those for the 2030 Project.
- Since the 2030 Program includes a BAT lane on Aurora Avenue between the Aurora Bridge and Aloha Street, transit travel times along the Aurora/downtown Seattle corridor would likely be less than for general purpose traffic). At 18 mph, travel speeds in the AM peak period are expected to be slow on Aurora Avenue as buses and general traffic approach the segment with the BAT lane.
- During the AM peak hour, southbound transit travel times from Bridge Way (north end of the Aurora Bridge) to the Harrison Street off-ramp to downtown are projected to be slower in the Program than in the Project due to expected back-ups leading up to the BAT lane, which would slow down transit as well as general purpose traffic.

Cumulative effects of the Program would occur under the Partial Program as well as the Full Program. The 2015 Partial Program would include the new Elliott Avenue/Western Avenue Connector and a widened Alaskan Way surface street.

Under the 2030 Full Program, northbound and southbound right-side transit lanes on SR 99 are assumed from just south of the Aurora Bridge to north of Aloha Street. Enhanced transit, such as the Delridge RapidRide line, would also be provided along with additional service hours on the West Seattle and Ballard RapidRide lines, peak-hour express routes added to South Lake Union and Uptown, and local bus changes (such as realignments and a few additions) to several West Seattle and northwest Seattle routes. The existing waterfront streetcar line would be replaced by a new streetcar line on First Avenue. In addition, there would be an extension of the South Lake Union Streetcar to connect to the new First Avenue Streetcar.

The following sections discuss the estimated effects on transit services of the 2015 Partial Program compared to the 2015 Project and the 2030 Full Program compared to the 2030 Project.

Modeled Transit Ridership

Exhibits 7-26 and 7-27 summarize projected daily and AM peak period transit ridership, respectively, at three screenlines: north, central, and south. For the daily and AM peak period, information is presented for the 2015 Project, 2015 Partial Program, 2030 Project, and 2030 Program (with BAT lanes).

Daily ridership levels for the 2015 Project and 2015 Partial Program would be comparable at each of the screenlines. For the north and south screenlines, there would be slight increase in ridership, and at the Central screenline, there would be a slight decrease in ridership. By 2030, under the Full Program, total daily transit ridership in the study area is forecasted to increase substantially, about 45 percent over 2015 levels for the north and central screenlines, and 68 percent for the south screenline. There would be higher ridership levels under the 2030 Program as compared to the 2030 Project, but the variation is small, about 1 percent. Expanded bus transit services under the King County Metro RapidRide program would affect transit demand at each screenline.

For 2015, projected AM peak hour transit demand with the Partial Program would approximate the demand under the Project. There would be higher peak hour ridership levels under the 2030 Program as compared to the 2030 Project, but the variation is small.

Exhibit 7-26. Model-Estimated Daily Transit Ridership (person-trips) at Selected Screenlines – Project and Partial/Full Program

Screenline	2015 Project	2015 Partial Program	2030 Project	2030 Full Program
South (South of S. King Street)	95,800	96,500	163,400	165,300
Central (North of Seneca Street)	124,200	124,800	177,700	180,300
North (North of Thomas Street)	118,600	119,100	170,000	172,600

Exhibit 7-27. Model-Estimated AM Peak Transit Ridership (person-trips) at Selected Screenlines – Project and Partial/Full Program

Screenline	2015 Project	2015 Partial Program	2030 Project	2030 Full Program
South (South of S. King Street)	30,300	30,500	54,500	55,000
Central (North of Seneca Street)	36,100	35,000	53,000	53,700
North (North of Thomas Street)	36,300	36,600	52,700	53,800

The transit shares for the Project and Program are identified in Exhibit 7-28. Under the 2015 scenarios, the transit share of home-based work trips would be 36 percent for the Project and Partial Program. By 2030, this share would increase to 47 percent under both the Project and the Program. The transit share of non-work trips in 2015 is estimated to be 9 percent for the Project and Program. By 2030, the transit share for non-work trips would increase to about 11 percent for the Project and Full Program.

Exhibit 7-28. Model-Estimated Daily Transit Mode Shares (person-trips) – To/From Seattle Center City – 2015 and 2030 Project and Program

	2015 Project	2015 Partial Program	2030 Project	2030 Program
Home-Based Work	36.3	36.3	46.9	47.0
Non-Work	9.4	9.4	11.1	11.2

Peak Hour Travel Times – 2015

The cumulative effects in 2015 are presented in the following sections for the major transit corridors that access downtown Seattle. Exhibit 7-29 describes the 2015 travel times for the Project and Partial Program for three major travel corridors.

Exhibit 7-29. 2015 Travel Times along Major Transit Travel Corridors

	2015 Project	2015 Partial Program	Change	2015 Project	2015 Partial Program	Change
	AM Peak Hour			PM Peak Hour		
Ballard to Denny Way						
Inbound	9	9	0	8	8	0
Outbound	8	8	0	15	16	+1
Aurora Avenue (Woodland Park to CBD)						
Inbound	18	20	+2	18	18	0
Outbound	12	12	0	17	16	-1
West Seattle to CBD						
Inbound	22	21	-1	17	17	0
Outbound	16	15	+1	25	25	0

Peak Hour Travel Times – Ballard/Downtown Seattle

Peak hour travel times for the Ballard/downtown Seattle (Denny Way) corridor would be generally the same for the 2015 Project and 2015 Program. A 1 minute increase in travel time would occur under the Program in the PM peak hour. For buses under either scenario, the travel times would likely be less due to the presence of the bus lane on Elliott Avenue.

Peak Hour Travel Times – Aurora Avenue Corridor

General traffic conditions on the Aurora Avenue corridor under the 2015 Partial Program would be comparable to the 2015 Project. Features of the 2015 Partial Program would not likely affect travel times for both general traffic and transit along this corridor.

Peak Hour Travel Times – West Seattle/Downtown Seattle Corridor

The estimated travel times for the Project and Program in 2015 along the West Seattle/downtown Seattle corridor would be generally similar. With the 2015 Project, access to downtown Seattle via Columbia Street and Seneca Street would no longer be available. General traffic conditions between West Seattle and downtown Seattle under the 2015 and 2030 Program would be comparable to the Project.

PM Peak Hour Travel Times – South King County/Downtown Seattle Corridor

The travel conditions for the Burien/downtown Seattle travel corridor would be affected by traffic characteristics in the south end of downtown, particularly the area between S. Spokane Street and S. King Street. The travel times noted above for West Seattle/downtown Seattle would apply to the Burien/downtown Seattle corridor.

Peak Hour Travel Times – 2030

The cumulative effects in 2030 are presented in the following sections for two major transit travel corridors that provide access to downtown Seattle: Ballard to Denny Way and Aurora Avenue Exhibit 7-30 describes the 2030 travel times for the Project and Program (with Aurora BAT lanes) for major transit travel corridors.

Exhibit 7-30. 2030 Travel Times along Major Transit Travel Corridors

	2030 Project	2030 Program	Change	2030 Project	2030 Program	Change
	AM Peak Hour			PM Peak Hour		
Ballard to Denny Way						
Inbound	10	9	-1	9	9	0
Outbound	8	8	0	15	19	+4
Aurora Avenue (Aurora Bridge to South Lake Union)						
Inbound		TBD			TBD	
Outbound		TBD			TBD	

Peak Hour Travel Times – Ballard/Downtown Seattle

Peak hour travel times for the Ballard/downtown Seattle corridor would be generally the same for the 2030 Project and 2030 Program. A 4-minute increase in travel time would occur under the Program in the PM peak hour. For buses under the 2030 Program, the travel times would likely be less under either scenario due to the presence of the bus lane on Elliott Avenue.

Peak Hour Travel Times – Aurora Avenue Corridor

With the 2030 Program, a transit lane would be located on Aurora Avenue between the Aurora Bridge and Aloha Street. With this facility, transit travel times would likely be less than what is identified for the 2030 Project. Estimated 2030 travel times were reviewed for Aurora Avenue north of the Aurora Bridge. At 18 mph, travel speeds in the AM peak period are expected to be slow on Aurora Avenue as buses and general traffic approach the segment with the BAT lane.

7.1.7 Truck Traffic and Freight

Key Findings

- The Elliott/Western Connector would greatly improve access for freight traffic traveling along the central waterfront (Alaskan Way). This connection would also improve freight travel time by eliminating train conflicts now experienced at Broad Street and Alaskan Way.

- Converting Mercer Street to two-way between I-5 and Elliott Avenue W. would provide improved east-west access for freight traffic, particularly streets that serve the Ballard/Interbay/Magnolia areas.
- Increases in transit services in corridors feeding SR 99 would not directly affect freight operations, although mode shift caused by the transit service expansion would likely reduce vehicle volumes on designated Seattle Center City freight routes.

2015 and 2030 Program

The combined strategies of the Project (proposed action) and other Program elements should improve freight operations through the study area.

In the central waterfront area, the Elliott/Western Connector between Alaskan Way and Elliott and Western Avenues would enhance access for freight traffic from the Magnolia, Interbay, and Ballard areas. This connector would provide two lanes in each direction, beginning at Alaskan Way and Pike Street to Elliott and Western Avenues at about Blanchard Street. A new bridge over the BNSF railroad tracks at Virginia Street would help eliminate conflicts between freight vehicles and train traffic.

The Alaskan Way promenade would feature 11-foot travel lanes, with on-street parking, bicycle lanes, and wide sidewalks. Separation of pedestrians and freight vehicles would likely enhance safety in this area.

The First Avenue Streetcar project would likely not have a substantial effect on freight operations because most freight traffic would use Alaskan Way and Elliott and Western Avenues along the central waterfront.

In the north section of the study area, the enhanced Mercer Street corridor, would improve access for freight traffic; in particular, freight trips from the Magnolia, Interbay, and Ballard areas and I-5. Under the Program definition, Mercer Street extends its two-way operations definition from Fifth Avenue N. on the east all they way to Elliott Avenue W. This may encourage the diversion of some freight traffic from the Nickerson/Westlake Avenue N. freight street.

Finally, enhanced transit services in key corridors would not likely affect freight operations. Under the Program scenario, additional service hours would be assigned to the Ballard and West Seattle RapidRide lines. The investments in more transit service beyond currently planned levels would likely increase transit ridership and reduce auto traffic in theses corridors. A new RapidRide line, the Delridge line, would be introduced to King County Metro's suite of RapidRide services. This service would help improve transit ridership and reduce auto traffic demand for communities in the Delridge Avenue S.W./White Center corridor.

7.1.8 Parking

Key Findings

- Several elements of the Program would affect parking along the waterfront, Belltown, and Uptown areas.
- The Alaskan Way Surface Street Improvements could affect about 580 on-street parking spaces along Alaskan Way and under the viaduct, although some 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.

This parking section is slightly different from the quantitative approach in Section 5.1. 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 below. No parking removals are assumed for the First Avenue Streetcar or for transit enhancements.

Alaskan Way Surface Street Improvements

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. 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 a 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 of Seattle.

Elliott/Western Connector

This project would provide a new roadway connection from Alaskan Way to Elliott and Western Avenues (between Pike and Battery Streets), which would affect the existing parking spaces in this area. This project would affect approximately 280 parking spaces, split 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.

Mercer Street West Corridor Improvements

Improvements to Mercer Street from Fifth Avenue to Elliott Avenue and improvements to Roy Street from Aurora Avenue to Queen Anne Avenue could affect on-street parking. There are currently about 250 on-street parking spaces on these sections of Mercer and Roy Streets.

Parking Mitigation

Effects on the parking supply would likely be most substantially felt during construction activities along the central waterfront and Pioneer Square. Potential mitigation measures during construction are discussed in Section 7.3.4. Although the mitigation measures would be most needed during construction, many of them could be retained and provide benefits over the longer term. These include:

- Provide a low rate for the first 4 hours and much higher rates for full-day long-term parking use to encourage short-term visitor/customer parking and discourage long-term employee parking.
- Encourage privately held parking lots to institute pricing that rewards short-term parking.
- Build a new parking facility close to the waterfront to provide short-term visitor and customer parking.
- Coordinate with private and public lots to install real-time automated overhead signs that display where parking is available as drivers enter the central waterfront zone. This is a component of the Center City Parking Program called the Electronic Parking Guidance System.
- Encourage businesses to use parking vouchers that they could give to customers to park in designated parking lots.

7.1.9 Pedestrians

Key Findings

- Program elements would improve the pedestrian environment along the waterfront.

2015 and 2030 Program

The Program elements in the central waterfront 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 provided to the west of the new Alaskan Way surface street between King Street and Pike Street. Between Marion and Pike Streets, this space would be approximately 70 to 80 feet wide.

7.1.10 Bicycles

Key Findings

- The bicycle environment would be enhanced by the waterfront promenade and the in-street bicycle lanes and sharrows proposed for the new Alaskan Way and Elliott/Western Connector roadways.
- There would be improved mobility and access in the north project area due to the new street connections over SR 99 and the pedestrian and bicycle paths on the north side of Mercer Street.

2015 and 2030 Program

The Program elements in the waterfront area would enhance the bicycle environment through the reconfiguration of a large portion of the Alaskan Way right-of-way to focus on nonmotorized transportation, with bicyclists able to use the promenade and the in-street bicycle lanes and sharrows proposed for the new Alaskan Way and Elliott/Western Connector roadways.

Bicyclists would experience improved access and mobility in the north project area as a result of the new street connections over SR 99 at John, Thomas, and Harrison Streets, as well as the pedestrian and bicycle paths on the north side of Mercer Street. The Mercer Street trail is part of the Potlatch Trail that would connect bicycle facilities in South Lake Union with the Elliott Bay Trail and attractions west of SR 99. Bicycle lanes also would be included on Roy Street.

7.1.11 Ferries

Key Findings

- Ferries passengers on foot would benefit from the enhanced pedestrian environment along the waterfront.
- Some of the vehicular 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.

2015 and 2030 Program

The cumulative effects of the Program on the Washington State Ferries is best described through reference to subgroups of passengers (walk-on passengers and passengers in vehicles).

For walk-on passengers who access the terminal on foot, the Program elements along the waterfront would enhance the pedestrian environment through the construction of a more pedestrian-focused waterfront.

For ferry passengers in vehicles, the cumulative effect of the Program elements would be limited. The new roadway configuration on Alaskan Way should slightly improve access to the terminal but the overall surface street network in downtown Seattle would remain substantially the same.

7.1.12 Safety

Key Findings

- The safety benefits of the Program would be similar to those of the project.

2015 and 2030 Program

For the 2015 and 2030 Program, the safety benefits would be similar to those of the project. However, several elements of the Program could lead to an increased potential for conflicts between vehicles and pedestrians or bicycles. The Elliott/Western Connector would result in increased traffic along Elliott Avenue, Western Avenue, and Alaskan Way, and the potential for conflicts between vehicles and pedestrians/bicycles could increase on those roadways. The Mercer Street west corridor improvements would convert Mercer and Roy Streets to two-way. Generally, two-way streets are safer for pedestrians as the traffic moves at a slower rate of speed. However, if intersections are unsignalized, crossing two-way streets can be more complicated for pedestrians, because pedestrians have to look for traffic from two directions instead of only one.

7.1.13 Event Traffic

Key Findings

- No substantial changes in the south portal area are expected beyond those attributed to the project.
- The two-way Mercer 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 the Seattle Center, the two-way system may result in slightly longer travel times and greater delays.
- The connections between the central waterfront (Alaskan Way) and Elliott/Western would greatly improve access for events and would likely shift some event traffic away from the bored tunnel to surface streets.

South Portal Area

Under the 2030 Program scenario, no substantial changes in the south end beyond those identified for the 2030 Project would occur in terms of roadway network components and connections to/from regional facilities. Therefore, no major differences for event traffic in terms of detour routing, congestion levels, and/or requirements for traffic management would result.

North Portal Area

No substantial roadway changes in the north end are expected between the 2030 Project and 2030 Program, with the exception of two elements: (1) conversion of Mercer Street (and Mercer Place) to two-way operations west of Fifth Avenue N. to Elliott Avenue and (2) new connections from Alaskan Way to/from Elliott/ Western Avenues. The Mercer Street reconfiguration would complete the two-way conversion initiated by the Mercer Corridor Project and the Alaskan Way Viaduct Replacement Project phases.

With regard to event traffic, the two-way Mercer configuration would allow more direct access to the Seattle Center parking garages 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 after events at the Seattle Center, the two-way system may result in slightly longer travel times and greater delays compared to a traditional one-way system due to the need to serve a larger number of movements at nearby intersections/signals between Queen Anne Avenue and Fifth Avenue N.

The connections between the central waterfront (Alaskan Way) and Elliott/ Western would greatly improve access for events and would likely shift some event traffic way from the bored tunnel to surface streets. Diversion to local streets may increase congestion levels slightly on Broad Street and cross streets such as First Avenue N. compared to Project conditions.

7.2 Comprehensive Cumulative Effects

The focus of the comprehensive cumulative effects analysis is on the combined effect of the project (proposed action), other Program elements, and other projects that are anticipated to add to transportation effects in the study area. This entire section is approached qualitatively. The following projects are included for consideration of comprehensive cumulative effects:

A. Roadway Elements

- Alaskan Way Surface Street Improvements – S. King Street to Pike Street
- Elliott/Western Connector – Pike Street to Battery Street
- Mercer Street Improvements – (conversion of Mercer Street from Fifth Avenue to Elliott Avenue to two-way and conversion of Roy Street from Aurora Avenue to Queen Anne Avenue to two-way)
- Battery Street Tunnel maintenance and repairs

B. Non-Roadway Elements

- Seawall Replacement
- Alaskan Way Promenade
- Transit Enhancements – (1) Delridge RapidRide and (2) additional service hours on West Seattle and Ballard RapidRide
- First Avenue Streetcar

C. Projects under Construction

- Transportation Improvements to Minimize Traffic Effects during Construction

D. Completed Projects

- Column Safety Repairs
- Electrical Line Relocation along the Viaduct's South End

E. 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
- Seattle Combined Sewer System Upgrades

F. Local Roadway Improvements

- Bridging the Gap Projects
- S. Spokane Street Widening
- SR 99/East Marginal Way Grade Separation
- Mercer Corridor Improvements from Dexter Avenue to I-5
- SR 519 Intermodal Access Project, Phase 2

G. Regional Roadway Improvements

- I-5 Reconstruction
- SR 520 Bridge Replacement and HOV Program

- I-405 Corridor Program
- I-90 Two-Way Transit and HOV Operations, Stages 1 and 2

H. Transit Improvements

- First Hill Streetcar
- University Link Light Rail Project
- RapidRide
- Sound Transit North Link
- Sound Transit East Link

I. Transportation Network Assumptions

- Change in HOV definition to 3+ for the Puget Sound region
- Sound Transit
- Other transit improvements

J. Completed, but Relevant Projects

- Central Link Light Rail (including the Sea-Tac Airport extension)
- South Lake Union Streetcar

Several projects, such as the S. Holgate Street to S. King Street Viaduct Replacement, Fourth Avenue S. Loop Ramp, and S. Spokane Street Widening, are included in the Baseline conditions, so they are not considered in this section for comprehensive cumulative effects.

Key Findings

- Comprehensive cumulative effects are generally similar to the effects of the Program.
- 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.
- As other major regional transportation improvements are completed, traffic operations on SR 99 are expected to improve.
- Intersection congestion levels under the comprehensive 2030 Program, with the combined effects of regional projects, would likely be similar to or lower than those for the 2030 Program scenario in terms of average vehicle delays and LOS.

7.2.1 Regional Context and Travel Patterns

Most of the projects considered for comprehensive 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 at least to Lynnwood in the north and a more complete King County Metro RapidRide system, coupled with additional transit service hours, would increase the person-carrying capacity of the Center City screenlines. Overall, increased transit service, whether 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.

7.2.2 Traffic Operations on SR 99

The improvements related to the Project, Program, and other area projects would have a substantial effect on traffic operations on SR 99. As discussed previously, the Bored Tunnel Alternative is expected to result in operations that are similar to or better than Baseline conditions between South Lake Union and the stadium area. On Aurora Avenue, the reduced roadway capacity with the addition of the BAT lanes is expected to result in degraded traffic operations, both for general purpose traffic and transit vehicles.

As other major regional transportation improvements are completed, traffic operations on SR 99 are expected to improve. For example, reconstruction of I-5 is 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. The additional capacity on these other facilities would help relieve demand on SR 99.

7.2.3 Traffic Operations at Key Arterial Intersections

Intersection congestion levels under the comprehensive 2030 Program, with the combined effects of regional projects, would likely be similar to or lower than the 2030 Program scenario (described previously in Section 7.1) in terms of average vehicle delays and LOS. Traffic demand and peak hour volumes along the SR 99 corridor and at intersections within the three sub-areas investigated under the Program would either remain consistent with 2030 Program levels or decrease slightly once the regional projects completed. As discussed in Section 7.1, the transit enhancements proposed for the 2030 Program may induce only minor shifts to non-automobile-based modes such as light rail or bus and, therefore, modestly affect general purpose traffic levels and congestion on arterials and highway facilities.

However, with additional transit resources and services included as part of the comprehensive regional transportation system, such as completion of the Sound Transit streetcar program in the downtown area, Link light rail extensions to the north and east, implementation of Metro's Paid Ride system, and completion of the HOV system, the mode shift to transit services would be substantially more pronounced than under the 2030 Program scenario. In principle, the ubiquity of transit services may increase overall ridership and potentially encourage a sizable portion of regional trips to shift away from conventional automobile-based alternatives (SOV, HOV, etc). In the event that major transit patronage is realized with the long-range systems in place for the comprehensive program, traffic volumes in the downtown core and on regional facilities such as SR 99 could conceivably decrease from 2030 Program levels. Consequently, intersection delays and sub-area congestion could be reduced due to lower peak hour demands on local streets and arterials.

Benefits due to improvements to regional highway corridors such as I-405, SR 520, and I-90 may also serve as a means for reducing traffic volumes along I-5 and possibly SR 99. With greater options for regional travel in terms of high-capacity corridors and alternative modes, the probability of reduced demand on the SR 99 corridor would likely increase. Again, such decreases in traffic volume for affected intersections within the sub-areas evaluated would translate to reduced levels of delay, decreased congestion, and improvements in point-to-point travel times.

7.2.4 Roadway Connectivity and Access

The combined effects of the Alaskan Way Viaduct Replacement Project and other roadway, transit, and non-roadway improvements would result in improved accessibility and connectivity. In addition to the Program elements, several projects would improve connectivity and access. The most benefits in terms of connectivity would be provided by the local roadway improvements, including the Bridging the Gap Projects, the S. Spokane Street Widening, the SR 99/East Marginal Way Grade Separation, the Mercer Street Improvements, and the SR 519 Intermodal Access Project – Phase 2.

7.2.5 Transit Services

Indirect and cumulative effects involving transit include future development of regional HCT facilities and service. With voter approval of the ST2 Plan in November 2008, Link light rail serving downtown Seattle will be extended to serve Lynnwood in the north, Redmond (Overlake) in the east, and Federal Way in the south. Also, additional trips and system capacity will be provided on

Sounder commuter rail service operating between Lakewood and downtown Seattle.

Potential new passenger-only ferry connections to downtown Seattle may be provided by the King County Ferry District. These connections would be based on the results of a feasibility study of potential expanded passenger-only ferry service within King County. Potential new routes include Ballard (Shilshole) to downtown Seattle (Pier 50) and Des Moines to downtown Seattle.

7.2.6 Truck Traffic and Freight

The combined strategies of the Project (proposed action) and other Program elements should improve freight operations through the study area, as described previously. Other projects in the vicinity would further improve conditions.

Although the SR 99/East Marginal Way Grade Separation project is included in the Baseline conditions, it is worth noting. This project, which is located on Duwamish Avenue between S. Spokane Street and E. Marginal Way, would improve freight access among the Port of Seattle terminals, UPRR and BNSF rail yards, and local manufacturers' and distribution warehouses. The lead track will be grade-separated and connect on-dock rail at the Port of Seattle's Terminal 5 (where containers are loaded directly onto trains instead of shuttled to a railyard by truck) to the mainline. It will also support industrial users in West Seattle and on Harbor Island. The project would improve safety by eliminating rail/highway conflicts at the existing at-grade crossing, reduce vehicle delay at railroad tracks by grade separation, and facilitate greater efficiencies in an area of substantial intermodal and multimodal activity.

7.2.7 Parking

Cumulative effects relating to parking would largely be experienced during construction if parking is disrupted. Effects on parking during construction are discussed in Section 7.3.4. Beyond the effects on parking related to the Program elements, none of the projects considered for comprehensive cumulative effects is anticipated to have a substantial effect on parking.

7.2.8 Pedestrians

The addition of the new roadway connections across existing pedestrian barriers such as SR 99 in the northern portion of the study 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.

7.2.9 Bicycles

The addition of new bicycle facilities in the southern portion of the study area and a substantial increase in bicycle connections across SR 99 to other major bicycle facilities 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.

7.2.10 Ferries

For walk-on ferry passengers who access the terminal on foot, the elimination of the Alaskan Way Viaduct, enhancements to the pedestrian environment adjacent to and through the Alaskan Way surface street, along with the other transit enhancements in the city such as the Link light rail system and the Third Avenue transit corridor should improve daily conditions and encourage continued increases in nonmotorized travel.

For ferry passengers in vehicles, the cumulative effect of all the projects expected to be in place when the bored tunnel is completed would be limited.

7.2.11 Safety

The overall cumulative effects related to safety would be similar to those for the Program. Several of the projects considered for cumulative effects could improve safety. For example, the SR 99/East Marginal Way Grade Separation project would eliminate rail/highway conflicts at the existing at-grade crossing. The SR 519 Intermodal Access Project – Phase 2, improvements would separate automobile, freight, pedestrian, and rail traffic to help improve mobility, pedestrian safety, and reduce the risk of collisions.

7.2.12 Event Traffic

South Portal Area

Cumulative effects on event traffic in the stadium area would be mainly driven by changes in land use and transit modes. With the initiation of Link light rail service in mid-2009, the continuing improvements to Sounder commuter rail trains on weekends, and potential future bus service enhancements, it is anticipated that more event-goers would begin to gravitate toward non-automobile transportation options as their preferred alternative for going to and from the stadiums. This transition would not be immediate; it would occur over several years.

Land use changes such as the potential development of the Qwest Field north lot could also influence traffic demands by reducing the parking supply and thereby encouraging alternative modes, such as transit and walking.

North Portal Area

Similar to the south end, event traffic impacts due to cumulative effects in the north end would be influenced primarily by changes in land use and transit modes. Future streetcar service between downtown and the Seattle Center as well as expanded RapidRide BRT service may be provided by the time the Alaskan Way Viaduct and Seawall Replacement Program is completed. Such changes in the transportation system accompanied by increased densification of land uses near the 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.

7.3 Cumulative Effects During Construction

Key Findings

- One of the benefits of the Project is that it minimizes construction effects (both Project-specific and cumulative) by allowing the existing Alaskan Way Viaduct to stay in operation until the bored tunnel is completed.
- There are a number of other major transportation projects in the vicinity of the bored tunnel that would occur during the Project's construction period.
- Disruptions due to the Project would primarily occur at or near the tunnel portals.
- Traffic patterns in the project area are complex and schedule adjustments made during the construction of any of the overlapping projects have the potential to affect other projects and traffic patterns.

This section describes qualitatively any notable cumulative effects that could occur during construction, considering the entire Alaskan Way Viaduct and Seawall Replacement Program and other projects in the general vicinity. There are numerous projects underway in the Puget Sound region that have the potential to affect a small portion of trips on the Alaskan Way Viaduct (e.g., the SR 520 bridge replacement project or the completion of the Central Link portion of the Sound Transit light rail line). This section discusses only projects that are relatively close to the bored tunnel and also occurring during the construction period of the Bored Tunnel Alternative.

For the purposes of this section of the Transportation Discipline Report, the following projects are discussed for their potential to affect the Bored Tunnel Alternative:

- Major components of the Program that are not included in the Bored Tunnel Alternative and would overlap with respect to construction timing and proximity include:
    - Alaskan Way Surface Street Improvements – S. King Street to Pike Street
    - Elliott/Western Connector – Pike Street to Battery Street
    - Mercer Street Improvements
    - Seawall Replacement
    - Alaskan Way Promenade
    - S. Holgate Street to S. King Street Viaduct Replacement
- City of Seattle projects
    - Bridging the Gap Projects
    - S. Spokane Street Widening
    - Mercer Street Corridor Program

The use of tunnel boring technology instead of a cut-and-cover method eliminates many of the construction effects in the center of the project area. Therefore, the cumulative effects due to construction of the bored tunnel and other nearby concurrent projects are best described at each end of the project area where connections need to be made to the tunnel and the tunnel boring machine enters and exits the ground, at the Elliott/Western Connector, in the area of the seawall replacement, and for the viaduct demolition activities.

7.3.1 South Portal Area

Three projects have the potential to generate construction-related effects on the Project in the vicinity of the south portal of the tunnel: S. Spokane Street Widening project, S. Holgate Street to S. King Street Viaduct Replacement Project, and the SR 519 Intermodal Access Project – Phase 2.

Although the Spokane Street Widening project is not adjacent to the south portal of the bored tunnel and it is farther away than the other two projects (about 1 mile south), it does have the potential to affect users of the SR 99 corridor and indirectly the bored tunnel. In particular, the closure of the southbound to westbound ramp from Fourth Avenue S. has the potential to divert some traffic that is current using Fourth Avenue for access to West Seattle to drive through the construction area on First Avenue. The completion of a ramp from the eastbound lanes of the Spokane Street Viaduct to Fourth Avenue S. (in particular the northbound movement) could benefit the Bored Tunnel Alternative by providing a more efficient connection to Fourth Avenue and additional incentive for drivers to avoid the construction zone on First Avenue.

Construction activities on the S. Holgate Street to S. King Street Viaduct Replacement project would overlap with the construction of the Bored Tunnel Alternative from about 2011 through 2014. In particular, the current schedules require lane closures on First Avenue between Railroad Way S. and S. King Street near the time that the S. Holgate Street to S. King Street Viaduct Replacement Project would be closing Alaskan Way from Railroad Way S. to S. Atlantic Street. If schedule adjustments during construction force the closure of Alaskan Way to occur when First Avenue S. is reduced to one lane, there would be a substantial effect on north-south traffic in the south portal 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.

The SR 519 project would be substantially complete before construction related to the Bored Tunnel Alternative begins. However, there is the potential for several months of overlap between the two projects in the vicinity of S. Royal Brougham Way and First Avenue S. Although the projects are not adjacent to each other, there is the potential for additional effects on traffic due to construction vehicles and potential lane closures on S. Royal Brougham Way.

7.3.2 Central Area

In the central waterfront area between S. Washington Street and Pike Street the Alaskan Way Seawall Replacement Project would close sections of Alaskan Way over a 3-year period between 2012 and 2015. Construction of the seawall and the associated effects on Alaskan Way are planned to be complete prior to the demolition of the Alaskan Way Viaduct. However, construction of the seawall would run concurrently with 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 that occur during construction of the Bored Tunnel Alternative.

Along with affecting general purpose traffic, there are anticipated to be effects on freight operations along Alaskan Way during project construction. WSDOT, City, and Port of Seattle will be working collectively to develop construction staging plans for the Seawall Replacement Project.

7.3.3 North Portal Area

The primary project that requires discussion in the north portal area is the Mercer Street Corridor Improvements program. In this project, the City of Seattle would be widening and modifying Mercer Street from its current one-way configuration to a two-way operation.

The Two-Way Mercer Corridor project consists of several major components. The section from Dexter Avenue to I-5 is part of the baseline conditions and is scheduled to be completed before the construction for the Bored Tunnel Alternative begins. As part of the Dexter Avenue to I-5 improvements, Broad Street would be closed between Taylor Avenue N. and Ninth Avenue N., and Mercer Street would be converted to two-way traffic between I-5/Fairview Avenue N. and Fifth Avenue N. If any delays occur, construction activities would need to be coordinated with the portions of the Bored Tunnel Alternative that affect Mercer Street.

At a later date, Mercer Street would be converted to two-way traffic operations between Elliott Avenue W. and Fifth Avenue N. The timing of this portion of the program has not yet been determined and it is unclear whether any of the construction would overlap with the Bored Tunnel Alternative.

7.3.4 Parking

The Program is expected to have a more substantial effect on parking than the Project alone, with the cumulative effects from all of the Program elements supporting consideration for parking mitigation. A number of parking mitigation strategies could be implemented to address parking disruption due to construction activities. Cumulative effects and potential mitigation strategies are discussed below.

Cumulative Effects on Parking During Construction

<u>Seawall Replacement</u>

The Seawall Replacement project is not anticipated to permanently affect parking. However, there may be substantial effects on parking during construction, depending on whether parking on the Alaskan Way surface street would be removed and whether parking under the viaduct would need to be removed to accommodate additional travel lanes under the viaduct. There are approximately 580 on-street parking spaces on the Alaskan Way surface street and under the viaduct from S. King Street to Pike Street.

In addition to the parking on Alaskan Way and under the viaduct, parking on the piers also could be affected during 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.

Alaskan Way Surface Street Improvements

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. It is likely that this project would begin work immediately after the viaduct demolition. Therefore, it is possible that the parking under the viaduct and along Alaskan Way may not return to use immediately after viaduct demolition. There are approximately 580 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 a 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 of Seattle.

Other Projects

Construction activity related to private development may occur concurrently with Project or Program construction 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 the Program.

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. 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 shortage of 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 would be available to the public. The main effect of this redevelopment on parking would be felt during construction, when 300 spaces are removed.

Parking Mitigation During Construction

Potential Mitigation Strategies for the Central Waterfront/Pioneer Square Areas

A number of parking mitigation strategies could be implemented to address the cumulative effects of parking disruption due to construction activities along the central waterfront and in Pioneer Square. Strategies such as the following would need to be coordinated between WSDOT and the City of Seattle, with input from surrounding businesses:

- Provide pedestrian and parking maps in advance of and during construction for businesses (at no cost to the businesses) to mail to clients and vendors.
- Increase the short-term maximum meter time from 2 hours to at least 3 and possibly 4 hours since the average trip to the waterfront is estimated at 3 to 4 hours.
- Provide a low rate for the first 4 hours and much higher rates for full-day long-term parking use to encourage short-term visitor/customer parking and discourage long-term employee parking.
- Encourage privately held parking lots to institute pricing that rewards short-term parking.
- Build a new parking facility close to the waterfront to provide short-term visitor and customer parking.
- Coordinate with private and public lots to install real-time automated overhead signs that display where parking is available as drivers enter the central waterfront zone.
- Encourage businesses to use parking vouchers that they can give to customers for parking in designated parking lots.

Center City Parking Program

The Center City Parking Program is SDOT's approach for addressing changes and growing demand for short-term parking in the Seattle 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 throughout the construction of the Alaskan Way Viaduct Replacement Project.

One innovative component of the Center City Parking Program is the Electronic Parking Guidance System, which uses signs to provide motorists with information about real-time parking space availability 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. The Electronic Parking Guidance System project will begin as a pilot project focused on the retail and Pike Place Market areas to test the technology and concept beginning in the spring of 2010.

To support the launch of the Electronic Parking Guidance System in spring 2010, SDOT is developing a marketing strategy and program name and branding to be used on message signs, a parking locator website, printed maps, and marketing programs for participating garages, properties, and other organizations in the Seattle Center City area.

Potential Mitigation Strategies for Construction Worker Parking

As described previously for construction worker parking for the project, the same strategies could help minimize the use of visitor/customer parking by construction workers for the overall Program:

- Develop a plan for construction worker parking to identify appropriate parking options for construction workers and discourage use of short-term visitor/customer parking in the project vicinity.
- Provide strong enforcement of the short-term parking regulations in the immediate project area (within a two- to three-block radius). The goal is to ensure a constant supply of short-term parking for customers of central waterfront businesses and to prevent use of these spaces by construction workers.

This Page Intentionally Left Blank

Chapter 8 References

AASHTO (American Association of State Highway and Transportation Officials). 1999. Guide for the Development of Bicycle Facilities, 3rd Edition.

AASHTO. 2004a. A Policy on Geometric Design of Highways and Streets, 5th Edition.

AASHTO. 2004b. A Guide for Achieving Flexibility in Highway Design, 1st Edition (2004).

Baseball Club of Seattle, LLP, and the Seattle Mariners. 2009. Safeco Field Transportation Management Plan, Plan Year March 1, 2009 to March 1, 2010.

City of Seattle. 2001. Intermediate Capacity Transit Study.

City of Seattle. 2002. Waterfront Parking Strategy Study.

City of Seattle. 2003a. Mercer Corridor/South Lake Union Transportation Study, Phase II.

City of Seattle. 2003b. City Center Circulation Report, December 2003.

City of Seattle. 2005a. Comprehensive Plan (Toward a Sustainable Seattle).

City of Seattle. 2005b. Freight Mobility Strategic Action Plan, June 2005.

City of Seattle. 2005c. Transit Plan.

City of Seattle. 2005d. Transportation Strategic Plan (TSP) Update, August 2005.

City of Seattle. 2007a. Seattle Bicycle Master Plan.

City of Seattle. 2007b. City of Seattle Center City Access Strategy.

City of Seattle. 2007c. Seattle's Industrial Lands Background Report. May 2007.

City of Seattle. 2008a. Commercial parking stall counts, April 2008.

City of Seattle. 2008b. Seattle Streetcar Network Development Report, May 2008.

City of Seattle. 2008c. Center City Parking Program Work Plan, July 2008.

City of Seattle. 2009a. Seattle Bicycling Guide Map. Summer 2009.

City of Seattle. 2009b. Basic Industries Economic Impact Analysis. July 2009. Available at: http://www.seattle.gov/economicdevelopment/pdf_files /CAI%20BasicIndustries%202009%200803%20Final.pdf. Accessed September 11, 2009.

City of Seattle traffic volume data, 2002–2004.

City of Seattle traffic volume data, 2007–2008.

City of Seattle and WSDOT. Accident data, 2002–2007.

FHWA (Federal Highway Administration). 2003. Manual on Uniform Traffic Control Devices, 3rd Edition.

FHWA and WSDOT (Federal Highway Administration and Washington State Department of Transportation). 2008. SR 99: S. Holgate Street to S. King Street Viaduct Replacement Project Environmental Assessment and Draft Section 4(f) Evaluation. June 2008.

Fehr and Peers. 2008. Alaskan Way Viaduct (AWV) Central Waterfront Travel Demand Model Documentation.

King County. 2009. King County Ferry District Demonstration Project Technical Studies Implementation/Refined Corridor Analysis. June 30, 2009.

King County Metro. 2004. Six-year Transit Development Plan.

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

King County Metro. 2007a. Strategic Plan for Public Transportation (2007-2016).

King County Metro. 2007b. Transit schedules.

KJS Associates, Inc. 1999. Washington State Ferries Systems Plan for 1999–2018, Final. June 1999.

Nelson\Nygaard Consulting Associates. 2008. Parking Count Document?

Parsons Brinckerhoff. 2005b. Alaskan Way Viaduct and Seawall Replacement Project. SR 99 Collision Analysis.

Parsons Brinckerhoff. 2006a. Memorandum: Updated SR 99 Truck Volumes. September 2006.

Parsons Brinckerhoff. 2006b. Draft Construction Transportation Management Plan. Updated November 2006. (unpublished)

Parsons Brinckerhoff. 2009. Alaskan Way Viaduct & Seawall Replacement Program Travel Demand Model Refinement and Validation Report. (July 2009).

PB. 2007. Updated Travel Forecasting Model Validation Report for Base-Year (2000). June 2007.

Port of Seattle. 2007. Letter dated October 25, 2007, to Mark Bandy, “Re: Container Truck Modeling Assumptions for the AWV South End Project.”

PSRC (Puget Sound Regional Council). 2001. Destination 2030: Metropolitan Transportation Plan for the Central Puget Sound Region.

PSRC. 2006. Parking Trends for the Central Puget Sound Region, 2004–2006.

PSRC. 2007. Travel Model Documentation.

PSRC. 2009. Puget Sound Trends. No. T4, June 2009.

Seattle Mariners. 2009. Parking information. Available at http://seattle.mariners.mlb.com/sea/ballpark/sea_ballpark_transportation.jsp?content=parking. Accessed August 28, 2009.

Sound Transit (Central Puget Sound Regional Transit Authority). 2008. Sound Transit 2 Plan.

Sound Transit. 2009. Transit schedules.

Sound Transit and King County. 2001. Evaluation of Joint Operations in the Downtown Seattle Transit Tunnel.

Transportation Research Board. 1982. National Cooperative Highway Research Report #255, Highway Traffic Data for Urbanized Area Project Planning and Design. Transportation Research Board, National Research Council.

Transportation Research Board. 2000. Highway Capacity Manual (2000 edition). Transportation Research Board, National Research Council.

Washington State Public Stadium Authority, First & Goal, Inc., and the Seattle Seahawks. 2009. Qwest Field Transportation Management Program, Plan Year 2009 to 2010.

Washington State Transportation Commission and Washington State Department of Transportation. 2006. Washington Transportation Plan 2007–2026. November 2006.

WSDOT (Washington State Department of Transportation). 1996. Alaskan Way Viaduct Project: Task 1 Report.

WSDOT. 1999. Washington State Ferries. 1999. Systems Plan for 1999–2018.

WSDOT. 2002a. Draft Flexible Transportation Package, An Integrated Program of Demand & System Management Strategies (report). December 2002.

WSDOT. 2002b. City of Seattle, and Federal Highway Administration SR 99 Truck Study (Draft).

WSDOT. 2003. Statewide System Plan.

WSDOT. 2008a. Environmental Procedures Manual. Publication number M 31-11. WSDOT Environmental and Engineering Programs, Environmental Services. Olympia, Washington. June 2008.

WSDOT. 2008b. Washington State Freight and Goods Transportation System (FGTS) 2007 Update.

WSDOT. 2009a. Washington State Ferry schedules.

WSDOT. 2009b. Design Manual. Updated January 2009.

WSDOT (Washington State Department of Transportation), City of Seattle, and U.S. Department of Transportation, Federal Highway Administration. 2004. SR 99: Alaskan Way Viaduct & Seawall Replacement Project Draft Environmental Impact Statement. Washington State Department of Transportation, Urban Corridors Office, Seattle, Washington.

WSDOT, City of Seattle, and U.S. Department of Transportation, Federal Highway Administration. 2006. SR 99: Alaskan Way Viaduct & Seawall Replacement Project Supplemental Draft Environmental Impact Statement. Washington State Department of Transportation, Urban Corridors Office, Seattle, Washington.