CHAPTER 9 - TOLLING

What's in Chapter 9?

This chapter compares the effects of the untolled Bored Tunnel Alternative to a range of tolling scenarios. Potential effects in 2015 and 2030 are discussed, as well as the potential effects of tolling the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

1 Does the Bored Tunnel Alternative include tolls?

The Bored Tunnel Alternative evaluated in this Supplemental Draft Environmental Impact Statement (EIS) is a new alternative under consideration for replacing the Alaskan Way Viaduct. As currently defined, the Bored Tunnel Alternative does not include tolls.

2 Is it possible that tolls will be implemented on the SR 99 replacement facility sometime in the future?

Yes. As described in Chapter 2, the Bored Tunnel Alternative is expected to cost approximately $1.9 billion. It is possible that approximately $400 million would be funded through tolling. During the 2009 legislative session, the Washington State Legislature passed Engrossed Substitute Senate Bill 5768, which directed Washington State Department of Transportation (WSDOT) to study whether this $400 million could be raised by tolling the new facility. WSDOT was also directed to analyze the performance of the tolled facility and the potential effects of diverted traffic on alternate routes.

The results of this initial work were reported in the *SR 99 Alaskan Way Viaduct Replacement Updated Cost and Tolling Summary Report to the Washington State Legislature*[1] (hereafter referred to as the Cost and Tolling Report), published by WSDOT in January 2010. The transportation analysis results of the Cost and Tolling Report are not presented in this chapter. Additional analysis to evaluate the potential environmental effects of tolling the Bored Tunnel Alternative has been completed since the Cost and Tolling Report was published and is presented in this chapter.

However, it is also possible that the project will rely on other funding sources. WSDOT does not currently have the authority from the Washington State Legislature to toll State Route 99 (SR 99).

3 If tolling is a possible option for the SR 99 replacement facility, why doesn't this Supplemental Draft EIS evaluate a tolled Bored Tunnel Alternative?

Legislative action is required to toll this facility, so the evaluation of the untolled Bored Tunnel Alternative in this Supplemental Draft EIS accurately reflects the current status of the project. Including a tolled alternative in this Supplemental Draft EIS would be premature for three additional reasons (see below).

1. A tolled alternative would impede the decision-making process by blurring the distinction between the alternatives.

This Supplemental Draft EIS is intended to inform the lead agencies' decision-making process as they choose a replacement for the Alaskan Way Viaduct along the central waterfront. This is done by documenting the potential environmental effects of the Bored Tunnel Alternative, and making an apples-to-apples comparison of these effects with the potential effects of the Viaduct Closed, Cut-and-Cover, and Elevated Structure Alternatives. Tolling one or more of these alternatives makes this apples-to-apples comparison difficult, since the effects of tolling, in some cases, cannot be separated from the effects of the replacement facility.

2. None of the facilities require tolling to operate, yet all of the facilities could operate if tolled.

Since tolling is not a required element of any of the alternatives, but could be applied to any alternative, if needed, it is better evaluated as a design option available to all alternatives, rather than as an integral part of the design of any individual alternative.

3. Unlike the design of the replacement facilities, the tolling approach is expected to change as needed in the future.

Tolling is a revenue-generation and traffic management strategy that must have the flexibility to adapt to changing travel patterns. These changes will require additional analysis and public involvement. The decisions regarding toll approach, therefore, are necessarily on a shorter-term planning horizon than choosing the replacement facility for the viaduct and should not be paired with a facility in the form of an alternative.

4 Why is tolling evaluated in this Supplemental Draft EIS?

If the Washington State Legislature decides to use tolling to fund a portion of the project, potential effects of tolling need to be evaluated and documented. This Supplemental Draft EIS evaluates the potential effects of three toll scenarios, as explained below in Question 6, to the extent that tolling is understood at this time.

What were the key findings of the Cost and Tolling Report?

The Cost and Tolling Report determined that generating up to $400 million through tolling SR 99 is feasible and that some traffic would divert from the tunnel to local streets and I-5, but travel times would stay the same or increase slightly.

The Cost and Tolling Report is available at www.wsdot.wa.gov.

What is the difference between the terms alternative and scenario in the discussion of tolling?

The three build alternatives considered in this EIS are the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative, and the Elevated Structure Alternative. This chapter examines several toll scenarios, which are hypothetical tolling configurations evaluated to determine potential effects. If the Washington State Legislature decides to authorize tolling on the SR 99 replacement facility, the eventual tolling configuration may resemble one of the scenarios evaluated in this chapter, or it may have an entirely different configuration.

1 WSDOT. 2010.

5 Have tolls been used on other highways in Washington?

History of Tolling in Washington State

Toll collection to financially support transportation projects is not new to Washington. In fact, 14 bridges in the state have been financed with bonds, from Seattle to Spokane to Vancouver, each with toll collections used to reimburse either part or all of the cost.

The First Tolls

Before 1933, Washington was one of only a few states that had not sold bonds to finance transportation projects. With no debt, Washington had financed transportation facilities strictly on a pay-as-you-go basis. However, the state found it increasingly difficult to accumulate enough money through gas tax revenues to finance transportation projects needed to meet the demands of a rapidly growing population and economy.

In 1937, increasing public pressure compelled the Washington State Legislature to recognize the need for bridges spanning the Tacoma Narrows and Lake Washington. Lawmakers passed a law creating the Washington Toll Bridge Authority and gave it full powers to finance, construct, and operate toll bridges. This promise of a steady and reliable revenue stream, backed by the bonding authority of Washington State, resulted in financing for two bridges: the Tacoma Narrows Bridge in Tacoma and the Lacey V. Murrow Memorial Bridge in Seattle, both of which opened to traffic in July 1940.

The History of the Tacoma Narrows Bridge Tolls

When the 1940 Tacoma Narrows Bridge ("Galloping Gertie") opened, the traveling public paid a 55-cent toll for a car and driver (and another 15 cents per passenger), averaging $0.83 per vehicle per direction. The bridge proved to be a quicker and more convenient way to cross the Narrows than the existing ferry. It also proved to be less expensive per trip. At the time, the average ferry fare was $0.89 per direction.

After Galloping Gertie collapsed on November 8, 1940, a new and much safer Tacoma Narrows Bridge opened on October 14, 1950. The replacement Tacoma Narrows Bridge ("Sturdy Gertie") opened with a $1.10 round trip toll, which today would equate to $8.64. Tolls were suspended in 1965 once the construction financing had been repaid. The current bridge is the fifth longest suspension bridge in the United States. Engineers designed the current bridge to carry 60,000 cars per day. However, by the late 1990s, it was handling an average of more than 90,000 vehicles per day, hence the need for the second Tacoma Narrows Bridge.

The new parallel span of the Tacoma Narrows Bridge opened to traffic on July 16, 2007, with much fanfare and free-flowing traffic. The opening reintroduced tolling to the state. The opening also heralded the state's first electronic tolling system. The initial toll was set at $3.00 for non-transponder payments and $1.75 for electronic transponder Good To Go!™ account holders. As of July 2010, the toll was $4.00 for non-transponder payments and $2.75 for transponder payments.

SR 167 HOT Lanes

On May 3, 2008, a high-occupancy toll (HOT) lanes pilot project opened in Washington on State Route 167 (SR 167), providing solo drivers a new option for driving on this often congested highway. Solo drivers may now pay an electronic toll to drive in the HOT lane, gaining a faster, more reliable trip than the carpool lane offers.

The HOT lane runs in each direction of SR 167 for 9 miles between Auburn and Renton. Toll rates are based on a dynamic tolling system, increasing and decreasing with the level of congestion on the highway to ensure that traffic in the HOT lane always flows freely, while carpools have the same fast and reliable trip they have previously experienced in the high-occupancy vehicle (HOV) lanes.

SR 520 Urban Partnership

In spring 2011, WSDOT will begin tolling on State Route 520 (SR 520). This project is part of the Lake Washington Urban Partnership, a collaborative effort between WSDOT, King County, the Puget Sound Regional Council (PSRC), and the Federal Highway Administration (FHWA) to explore innovative ways to help manage congestion on SR 520.

Future of Tolling in Washington

WSDOT has a balanced, integrated program to address traffic congestion and mobility in urban corridors across the state. The program includes adding capacity strategically, operating efficiently to get the most use out of the existing roads and infrastructure, and managing demand by offering more commute choices. The use of tolls based on variable pricing is an important tool for improving highway efficiency.

For future toll projects in Washington, tolls would be collected electronically with no need for manual toll booths. Thus, traffic flow would not be interrupted for toll collection—tolls would be paid automatically by means of prepaid electronic toll accounts. Those without prepaid accounts would have their license plates photographed and would receive a bill in the mail, which would include a surcharge above the original toll amount. Those failing to pay the bill would be fined.

In addition to the Alaskan Way Viaduct Replacement Project and tolls on SR 167 and SR 520 mentioned above, tolling is being considered for several current and potential projects, including the following:

- Columbia River Crossing (Interstate 5 [I-5])
- Eastside Corridor (Interstate 405 [I-405] and SR 167) Tolling Study
- State Route 509 (SR 509)
- Interstate 90 (I-90) HOT lanes

Transportation 2040, the PSRC's long-range transportation plan for the central Puget Sound region, recommends moving toward the implementation of new user fees, including tolls. The plan also recommends exploring a gas tax replacement, such as charges for vehicle miles traveled, and other pricing approaches to fund and manage the transportation system. The *Transportation 2040* financial strategy assumes a nexus between the tax, fee, or toll and the use of the revenues. The strategy of implementing tolls

What are examples of previous toll bridges in Washington State?

Examples of previous toll bridges include the SR 104 Hood Canal bridges, the SR 520 Evergreen Point Floating Bridge, the I-90 Lacey V. Murrow (Lake Washington) Floating Bridge, the SR 303 Fox Island Bridge, and the I-5 Vancouver-Portland Bridge.

What are HOT lanes?

HOT lanes (high-occupancy toll lanes) are like high-occupancy vehicle (HOV) lanes but they also offer an option for solo drivers to avoid congestion on the general-purpose traffic lanes. By paying an electronic toll, anyone with a Good To Go!™ transponder can experience a more reliable trip in the carpool lane, even when driving alone.

Carpools of two people or more, vanpools, transit, and motorcycles use HOT lanes just like an HOV lane, there is no toll for these users and they do not need a transponder.

What were the key tolling-related findings of Transportation 2040?

Transportation 2040 found tolling, in combination with increased transit, non-motorized facilities, and strategic expansion of highway facilities, to be an effective strategy to improve efficiency and raise revenue as the central Puget Sound region grows by 1.5 million new residents by the year 2040.

As appropriate for long-range Regional Transportation Plans, the *Transportation 2040 Final EIS* did not identify specific impacts from tolled projects or cumulative impacts from multiple tolled projects occurring at once. Identification of direct impacts and cumulative impacts from tolling will occur as individual projects are studied for implementation.

Transportation 2040 is available online at www.psrc.org.

would start with developing HOT lanes on existing highways and tolling new highway and bridge facilities in their entirety as they are implemented. Eventually, in the later years of the plan, the intent is to manage and finance the highway network as a system of fully tolled facilities. Transportation 2040 was adopted in May 2010 by the PSRC General Assembly, which includes the region's counties, cities and towns, ports, tribes, transit agencies, WSDOT, and the Washington State Transportation Commission.

6 What are some possible tolling options for the Bored Tunnel Alternative?

The Cost and Tolling Report analyzed five toll scenarios (Toll Scenarios A through E) for the Bored Tunnel Alternative. The scenarios were designed to generate the $400 million needed to fulfill the state's funding commitment and to test the effects of two variables: geographic boundary and toll rate.

- **Geographic boundary** – Toll Scenarios A, C, and E evaluated charging tolls only in the tunnel, while Toll Scenarios B and D evaluated charging tolls for drivers using segments of SR 99 located north and south of the new bored tunnel to get to or from downtown Seattle. The geographic boundaries of the proposed toll scenarios are shown in Exhibit 9-1.

- **Toll rate** – Toll Scenario C evaluated the highest toll rates, while Toll Scenario E evaluated the lowest toll rate. Toll rates evaluated for Toll Scenarios A and B and D fell between the rates for Toll Scenarios E and C. The range of toll rates considered is shown in Exhibit 9-2. Toll rates are expected to vary by time of day (rates would be higher for more congested times of day) and direction for segment tolls discussed below for Scenarios B and D (rates would be higher for traffic entering downtown Seattle in the morning and leaving downtown Seattle in the afternoon) according to a set schedule so that drivers would know in advance what they could expect to pay to travel on tolled segments of SR 99. Tolls would vary by the day of the week, with weekend tolls being lower than tolls at the same time of day on a weekday. The average toll rate per transaction shown in Exhibit 9-2 provides a basis of comparison between the scenarios, but does not reflect a specific toll that a user would pay. For example, under Toll Scenario A, users traveling at an uncongested time of day on a weekend paid a toll of $0.84. Conversely, under Toll Scenario A, users traveling at a congested time of day on a weekday paid a toll of $3.37. Added together, the average toll paid by all users of the facility under Toll Scenario A equaled $2.16.

Exhibit 9-2
Range of Toll Rates Evaluated per Scenario
in 2008 dollars

SCENARIO	*Low*	*Average*	*High*
A	$0.84	$2.16	$3.37
B	$0.84	$1.88	$3.37
C	$0.84	$2.44	$4.21
D	$0.84	$2.17	$3.37
E	$0 – no tolls off-peak	$1.87	$2.35

Brief descriptions of the five toll scenarios follow. For a more detailed description, refer to the Cost and Tolling Report.

- Toll **Scenario A** would toll only the bored tunnel at the rates shown in Exhibit 9-2, a medium toll rate.

- Toll **Scenario B** would apply the same tolls to the bored tunnel as assumed under Toll Scenario A. In addition, Toll Scenario B would charge a toll for drivers using the segments of SR 99 located north and south of the bored tunnel to access downtown. This type of toll is referred to as a segment toll. With this scenario, drivers would be charged a toll if they used any portion of SR 99 between the Spokane Street Viaduct and the bored tunnel, or if they used any portion of SR 99 located between Denny Way and the Aurora Bridge.

- Toll **Scenario C** would toll the bored tunnel with the rates shown in Exhibit 9-2, high toll rates designed to maximize funding potential.

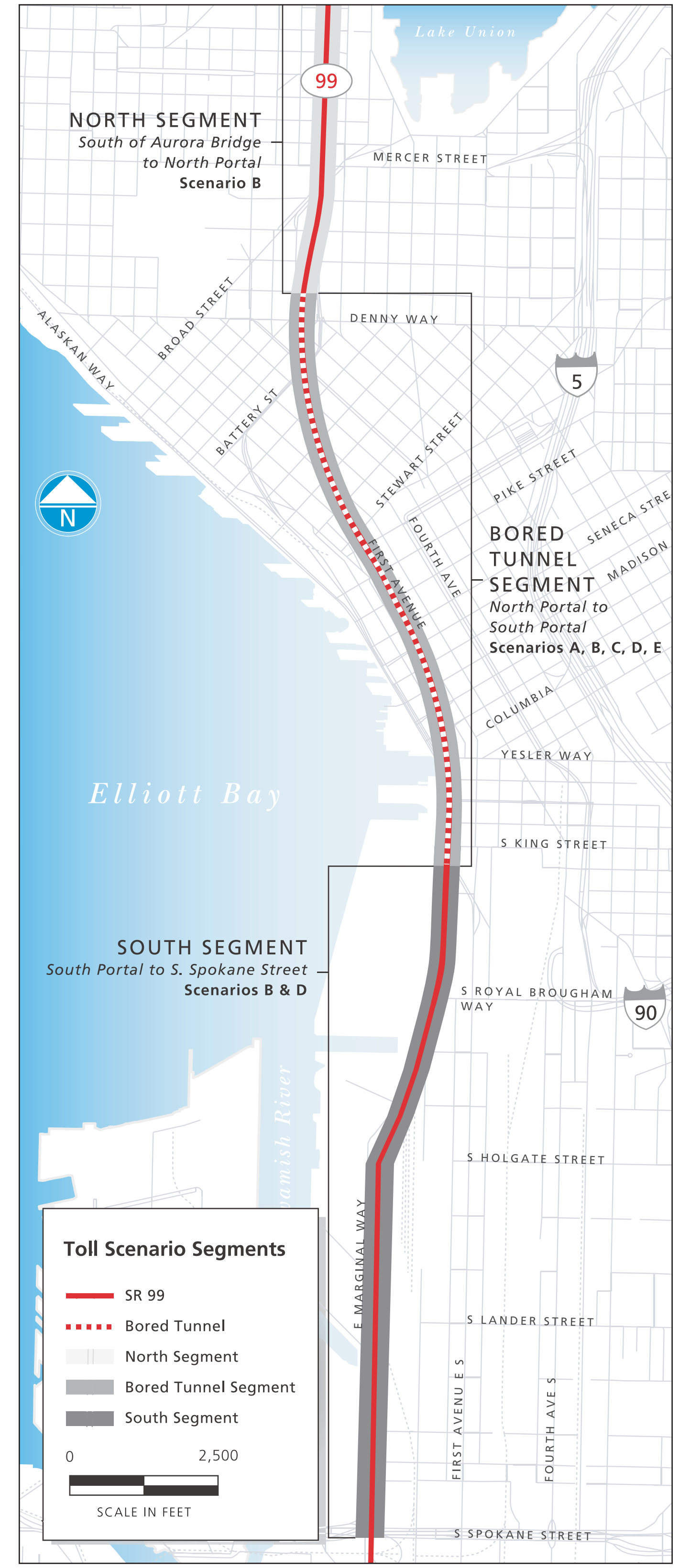


Exhibit 9-1

Where were tolls charged in the Toll Scenarios?

All scenarios charged a toll for vehicles as they entered the bored tunnel. Scenarios B and D also charged a toll for vehicles using the SR 99 ramps at Denny Way and near the stadiums to access downtown Seattle.

- Toll **Scenario D** includes the toll rates shown in Exhibit 9-2, a medium toll rate, between the rates for Toll Scenarios A and C. It also includes a segment toll for drivers who travel on the portion of SR 99 located between the Spokane Street Viaduct and the bored tunnel. A toll would not be charged on SR 99 between Denny Way and the Aurora Bridge.

- Toll **Scenario E** includes the toll rates shown in Exhibit 9-2, low toll rates sufficient to minimize congestion in the tunnel during peak travel periods only. This would have minimize toll-induced diversion of traffic, but would generate less revenue.

This chapter compares the results of the travel modeling and transportation analysis for the untolled Bored Tunnel Alternative and Toll Scenarios A, C, and E, in 2015. The untolled Bored Tunnel Alternative includes the bored tunnel and associated portal improvements as described in this Supplemental Draft EIS. Toll Scenarios A, C, and E were chosen for the analysis because they represent a medium, high, and low toll rate, respectively. The toll rates for Scenarios B and D fall within the range of the tolls proposed under Scenarios C and E.

Anticipated effects of tolling the Bored Tunnel Alternative in 2030 are similar to the effects discussed for 2015 and are discussed briefly in Question 12.

7 Before tolling would be implemented on the SR 99 replacement facility, what work would be done to optimize the selected toll scenario?

Scenarios A, C, and E were constructed to test the revenue generating capability of tolling SR 99. While the scenarios provide a range of toll rates, they have not been optimized for operation. If the Washington State Legislature authorizes tolling on SR 99, the City and State would work together to design a toll scenario that balances the need for revenue generation with the need for optimal operating conditions, both on SR 99 and city streets. Therefore, the analysis results presented below for Bored Tunnel Toll Scenarios A, C, and E are likely to be more conservative than the results of an optimized toll scenario.

8 How would Toll Scenarios A, C, and E affect regional travel?

Three common metrics are often used to report systemwide transportation performance: vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle hours of delay (VHD). A comparison of the toll scenarios for each of these three measures is discussed below.

Vehicle Miles Traveled

VMT measures how many miles vehicles travel on a roadway network. Exhibit 9-3 shows VMT for the Seattle Center City area as well as the broader four-county region. For both the region and Seattle Center City, modeling results show a less than 1 percent difference between the tolled scenarios and 2015 Bored Tunnel.

Exhibit 9-3
2015 Vehicle Miles Traveled

			BORED TUNNEL		
	Existing Viaduct	Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
Seattle Center City					
AM	433,100	427,100	427,800	427,600	426,300
PM	537,500	530,700	531,800	529,900	529,000
Daily	**2,432,700**	**2,407,500**	**2,400,700**	**2,397,000**	**2,409,800**
Four-County Region					
AM	18,028,300	18,021,600	18,034,800	18,035,200	18,030,100
PM	21,233,700	21,230,700	21,244,800	21,245,700	21,239,800
Daily	**97,233,000**	**97,225,200**	**97,260,400**	**97,259,500**	**97,255,500**

Vehicle Hours Traveled

VHT indicates the total number of hours traveled on the roadway network. Exhibit 9-4 shows VHT for the Seattle Center City area as well as the broader four-county region.

Exhibit 9-4
2015 Vehicle Hours Traveled

			BORED TUNNEL		
	Existing Viaduct	Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
Seattle Center City					
AM	16,800	17,200	18,200	18,400	17,600
PM	23,200	24,600	26,200	26,700	25,100
Daily	**87,200**	**88,600**	**93,800**	**94,900**	**89,700**
Four-County Region					
AM	747,200	747,800	749,600	749,800	748,800
PM	858,100	859,300	862,200	863,000	860,800
Daily	**3,311,100**	**3,313,800**	**3,322,600**	**3,324,000**	**3,316,900**

Generally, VHT is projected to increase as tolls are applied to SR 99 and are more apparent in the Seattle Center City area than in the region, where the change is less than 1 percent of all regional VHT. For 2015 Bored Tunnel Toll Scenarios A and C, VHT in the Seattle Center City area is projected to increase between 5 and 9 percent when compared to the untolled 2015 Bored Tunnel, whereas projected VHT increases for 2015 Bored Tunnel Toll Scenario E are approximately 2 percent. VHT increases at a greater rate than VMT because the traffic diverting from the tolled facility is generally using slower facilities, such as surface streets, and is entering the transportation network where some intersections are already at capacity and where minor changes in traffic volumes can increase delay.

Vehicle Hours of Delay

VHD measures the number of hours that travelers spend traveling on roadways at less than optimum speeds (typically near or at the speed limit). VHD is often used as an indicator of congestion. Exhibit 9-5 shows VHD for the Seattle Center City area as well as the broader four-county region.

Exhibit 9-5
2015 Vehicle Hours of Delay

			BORED TUNNEL		
	Existing Viaduct	Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
Seattle Center City					
AM	5,300	5,700	6,400	6,600	5,900
PM	9,100	9,900	11,300	11,800	10,400
Daily	**22,700**	**24,400**	**28,600**	**29,600**	**25,100**
Four-County Region					
AM	253,500	254,200	255,300	255,400	254,800
PM	271,700	272,800	275,000	275,600	273,900
Daily	**678,200**	**680,300**	**686,500**	**687,700**	**682,300**

In general, VHD increases as the toll rate increases because more drivers are expected to divert from SR 99 to slower routes, such as surface streets, to avoid the toll. As more traffic diverts from SR 99, congestion and delay on these alternate routes increases, as discussed below in Question 10. For the scenarios considered, VHD is lowest for Bored Tunnel Toll Scenario E, followed by Bored Tunnel Toll Scenarios A and C. The projected increase in VHD, for all toll scenarios considered in the four-county region is not meaningfully different from VHD projected

How might the effects of tolling be different if the Alaskan Way Viaduct and Seawall Replacement Program (Program) network were analyzed?

The Program network includes the other independent projects associated with the Alaskan Way Viaduct and Seawall Replacement Program, such as a rebuild Alaskan Way surface street and the Elliott/Western Connector, which would link the waterfront to Belltown. These improvements would provide an attractive alternative to the bored tunnel for some drivers, which could lead to increased diversion from SR 99 if it were tolled.

What is the 2015 Bored Tunnel?

The 2015 Bored Tunnel refers to the transportation network that includes the bored tunnel and associated portal improvements described in this Supplemental Draft EIS for the Bored Tunnel Alternative. As currently defined, the Bored Tunnel Alternative does not include tolls. The 2015 Bored Tunnel does not include the Program network that includes the Bored Tunnel Alternative plus the independent projects associated with the Alaskan Way Viaduct and Seawall Replacement Program.

What area does Seattle Center City refer to?

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

What are VMT, VHT, and VHD?

- Vehicle miles traveled (VMT) measures how many miles vehicles travel on the roadway network.
- Vehicle hours traveled (VHT) indicates the total number of hours travelers spend on the roadway network.
- Vehicle hours delay (VHD) measures the number of hours that travelers spend traveling on roadways at less than optimum speeds. VHD is often used as an indicator of congestion.

for the untolled 2015 Bored Tunnel. For the Seattle Center City area, VHD in 2015 is projected to increase between 3 percent and 20 percent when compared to untolled 2015 Bored Tunnel. In general, all-day tolling results in the highest modeled increase in VHD, while peak period tolling results in relatively minor increases in VHD. During peak periods, I-5 and surface streets become more congested, so an uncongested trip through the bored tunnel becomes more attractive to drivers, even if they must pay a toll. Thus, less traffic is projected to divert from the bored tunnel during peak periods. Conversely, during non-peak periods, I-5 and surface streets become less congested and, therefore, more attractive to drivers, so more vehicles are projected to divert to these routes during non-peak periods. All-day tolling is projected to result in more diversion from SR 99 to slower facilities, such as city streets, and, therefore is expected to cause more delay.

9 How would Toll Scenarios A, C, and E affect SR 99 traffic conditions?

Travel speeds, travel times, and SR 99 vehicle volumes were analyzed to compare the effects of the 2015 Bored Tunnel to the Bored Tunnel Toll Scenarios.

Travel Speeds

As shown in Exhibits 9-6 and 9-7, with the 2015 Bored Tunnel Toll Scenarios considered, the bored tunnel is projected to operate at equal or higher speeds than the untolled 2015 Bored Tunnel. Faster speeds are expected in the bored tunnel with the Toll Scenarios because SR 99 volumes are reduced due to drivers diverting from the bored tunnel to avoid the toll.

Modeling results indicate that traffic speeds on SR 99 north and south of the bored tunnel portals are most affected by tolling in the peak direction during the peak period, with average speeds reduced between 7 and 13 miles per hour depending on the toll scenario. Tolled operations would cause some drivers to divert from SR 99 to surface streets just before entering the bored tunnel. Modeling results indicate that vehicle queues would back up onto the SR 99 mainline from the off-ramps, which would degrade SR 99 operations and decrease speeds. As noted previously in a sidebar, this chapter discusses the expected traffic modeling results from the specific combination of variables analyzed for Bored Tunnel Toll Scenarios A, C, and E. This discussion should not be interpreted to suggest that all SR 99 toll scenarios would result in degraded SR 99 performance. It is possible that a bored tunnel toll scenario could be created with a different combination of variables to result in improved SR 99 performance under tolled conditions.

Travel Times on SR 99

Exhibit 9-8 shows modeled travel times for selected locations during the AM and PM peak hours for the untolled 2015 Bored Tunnel and the toll scenarios considered. The following list presents general observations regarding the relative differences in travel times between the 2015 Bored Tunnel and Bored Tunnel Toll Scenarios A, C, and E:

- For most trip pairs analyzed, modeling results show travel times are 1 to 2 minutes longer for Bored Tunnel Toll Scenarios A and C as compared to the 2015 Bored Tunnel.
- For two trip pairs analyzed (West Seattle to downtown and Woodland Park to downtown), modeling results show travel times are 3 to 4 minutes longer for Bored Tunnel Toll Scenarios A and C as compared to the 2015 Bored Tunnel.
- For trips using Alaskan Way (Ballard to S. Spokane Street), modeling results show travel times are 1 to 3 minutes longer for Bored Tunnel Toll Scenarios A and C as compared to the 2015 Bored Tunnel.
- Routes to and from the Central Business District on SR 99 (as opposed to routes using the bored tunnel) generally are projected to have higher travel time increases than through routes traveling through the bored tunnel.
- Drivers using the bored tunnel for 2015 Bored Tunnel Toll Scenarios A and C are projected to have slightly longer travel times than they would for the 2015 Bored Tunnel due to expected backups on the SR 99 mainline. These back-ups would be due heavier off-ramp volumes just before the bored tunnel, which would increase delay at intersections at the ramp termini. Strategies that would reduce this congestion would be employed and would likely result in travel times that would be similar to the untolled facility.

SR 99 Vehicle Volumes

With Bored Tunnel Toll Scenarios A and C, the model estimates roughly 40,000 to 45,000 of more than 86,000 total daily trips projected to use the bored tunnel with the untolled 2015 Bored Tunnel would remain in the bored tunnel, as shown in Exhibit 9-9.

With Bored Tunnel Toll Scenarios A and C, the model predicts that the remaining 40,000 to 45,000 trips would shift to I-5 and city streets, as described in Question 10.

10 How would Toll Scenarios A, C, and E affect adjacent roadways such as I-5 and city streets?

Modeling results indicate tolling SR 99 would cause traffic to shift to I-5 and city streets. As noted in Question 9, model projections show 40,000 to 45,000 daily trips shifting to other facilities with the 2015 Bored Tunnel Toll Scenarios A and C as follows:

- 14,000 to 15,000 more vehicles are projected to use I-5.
- 16,000 to 18,000 more vehicles are projected to travel on north-south downtown city streets west of I-5.
- 10,000 to 12,000 additional daily vehicles are projected on north-south arterials east of I-5.

What is the AM peak hour and the PM peak hour?

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

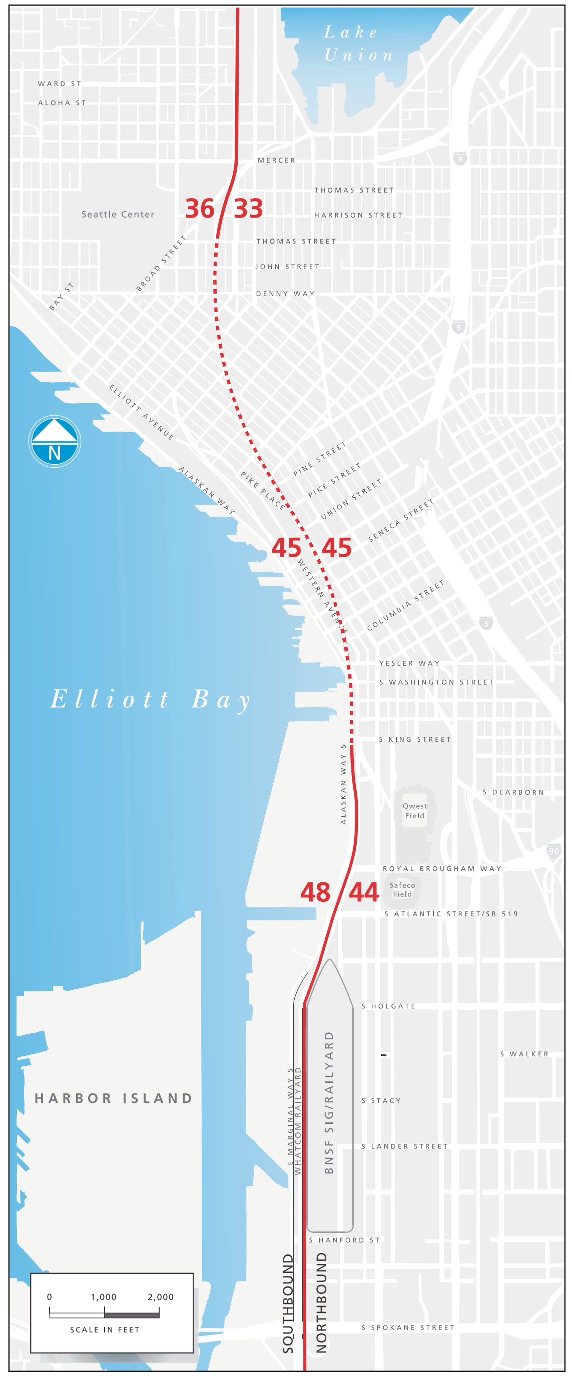
What are some variables that affect the performance of SR 99 under tolled conditions?

- Toll rate
- Duration of tolling – peak period only or all day
- Portion of SR 99 tolled – bored tunnel only or bored tunnel plus additional segments
- Year of analysis – 2015 or 2030
- Traffic volume on untolled SR 99 – tolls would not improve performance of SR 99 if traffic is flowing freely
- Inclusion of Alaskan Way Viaduct & Seawall Replacement Program element in analysis – improved Alaskan Way surface street and Elliott/Western Connector
- Configuration of off-ramps from SR 99 to downtown – ability to accommodate the volume of diverted traffic without backing up onto mainline SR 99.

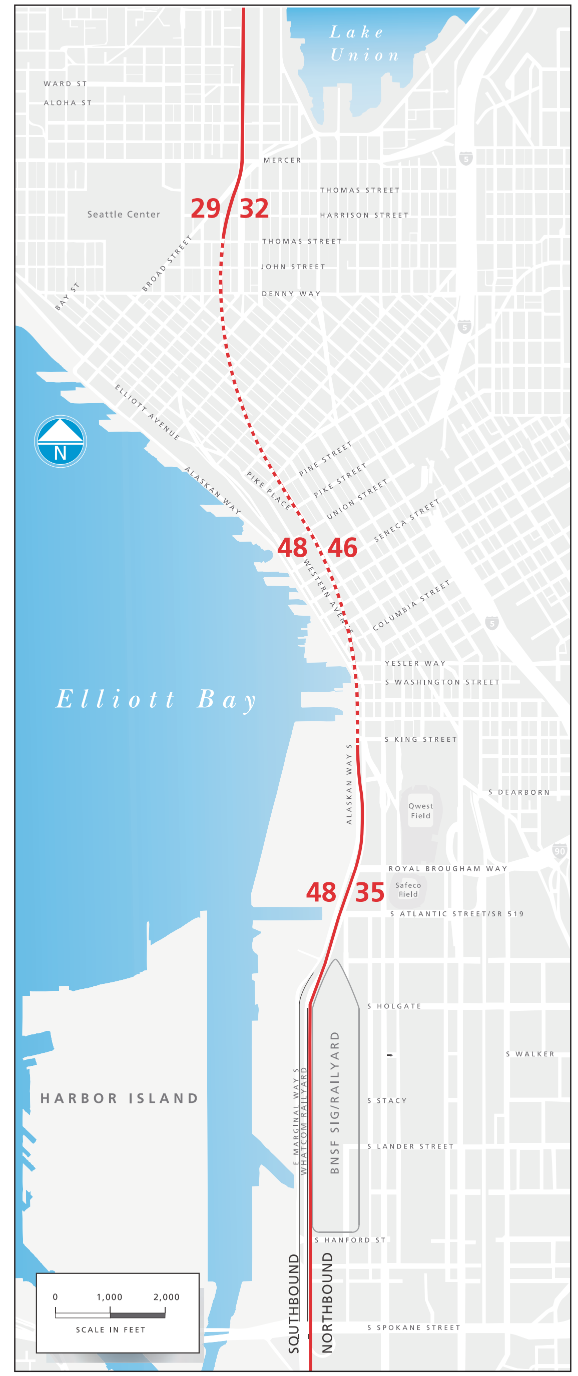
2015 Bored Tunnel Travel Speeds for Toll Scenarios – AM Peak

2015 Existing Viaduct

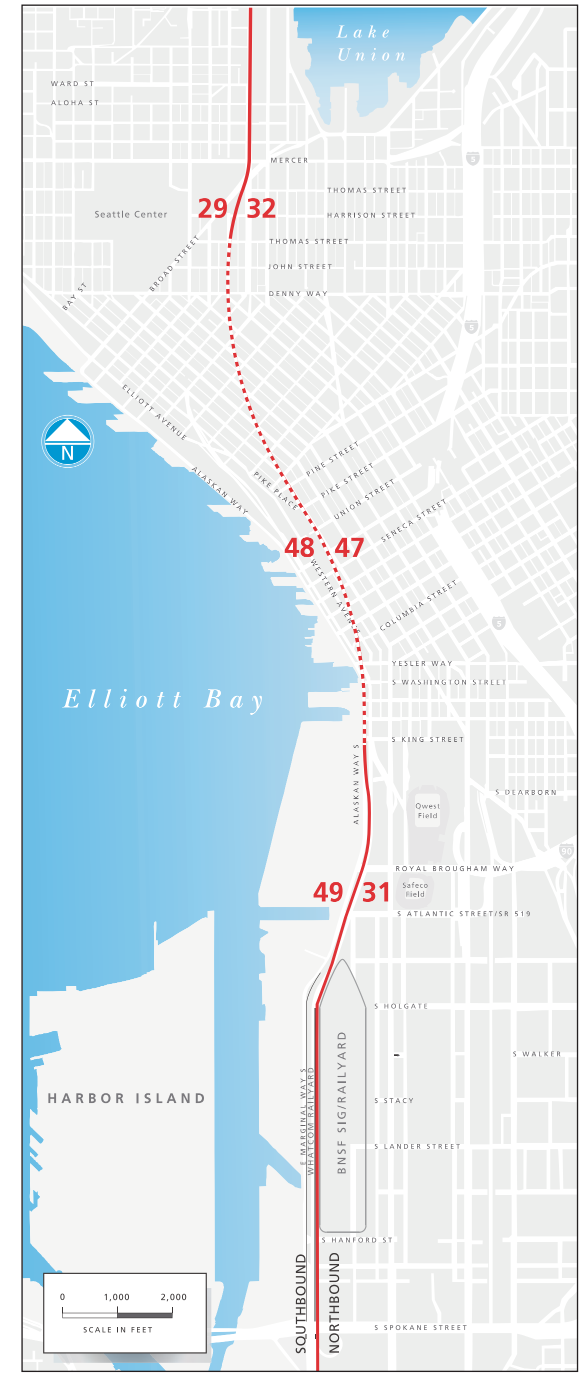
Bored Tunnel



Bored Tunnel Toll Scenario A



Bored Tunnel Toll Scenario C



Bored Tunnel Toll Scenario E

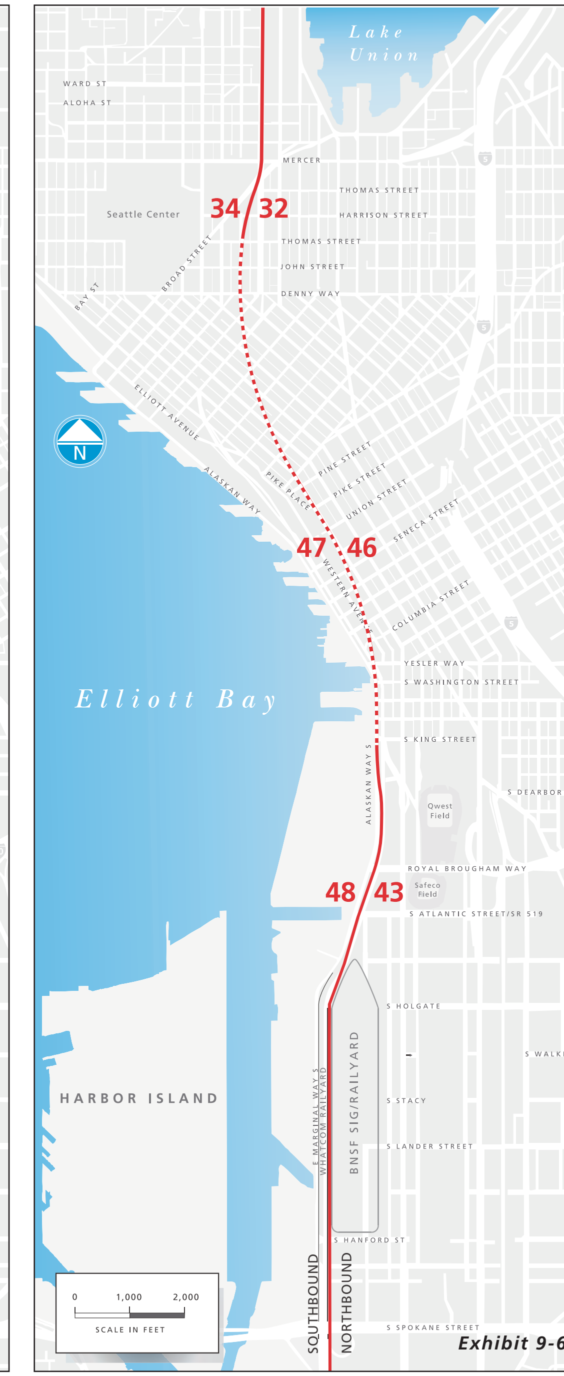
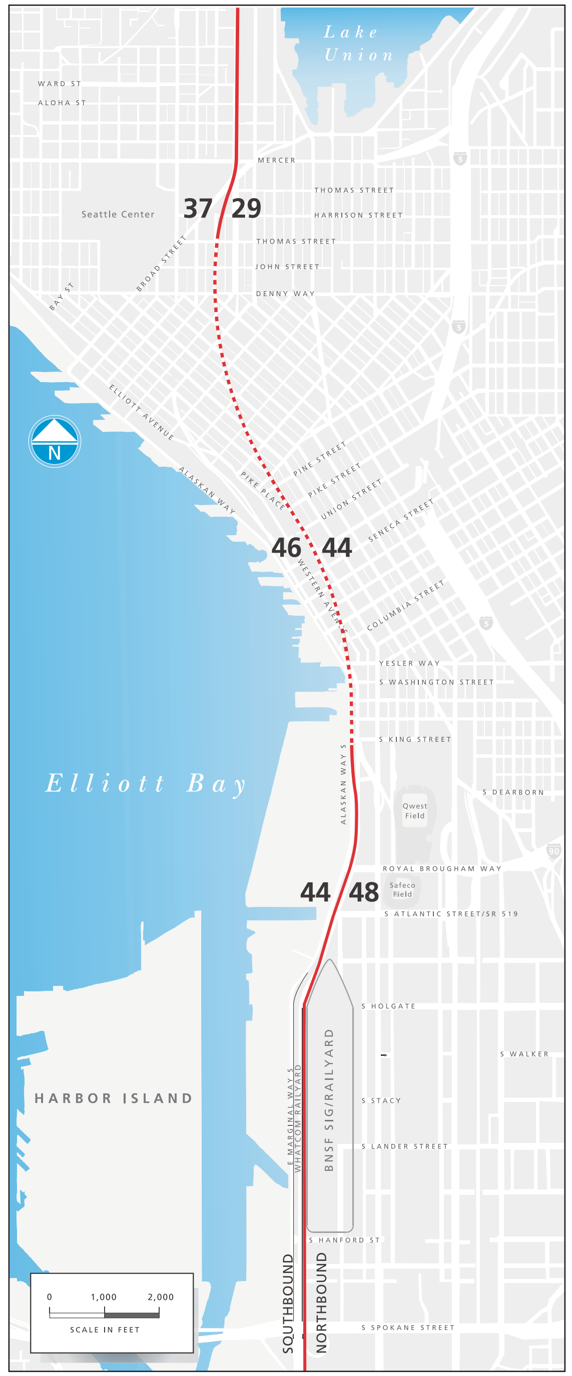


Exhibit 9-6

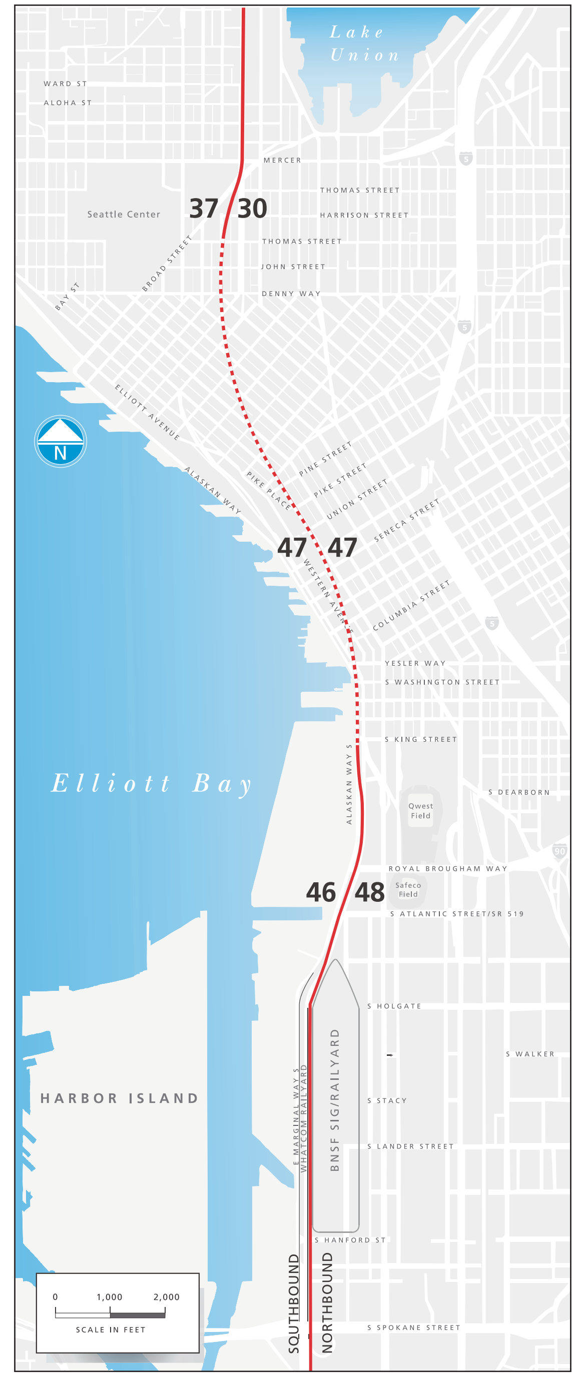
2015 Bored Tunnel Travel Speeds for Toll Scenarios – PM Peak

2015 Existing Viaduct

Bored Tunnel



Bored Tunnel Toll Scenario A



Bored Tunnel Toll Scenario C

Bored Tunnel Toll Scenario E

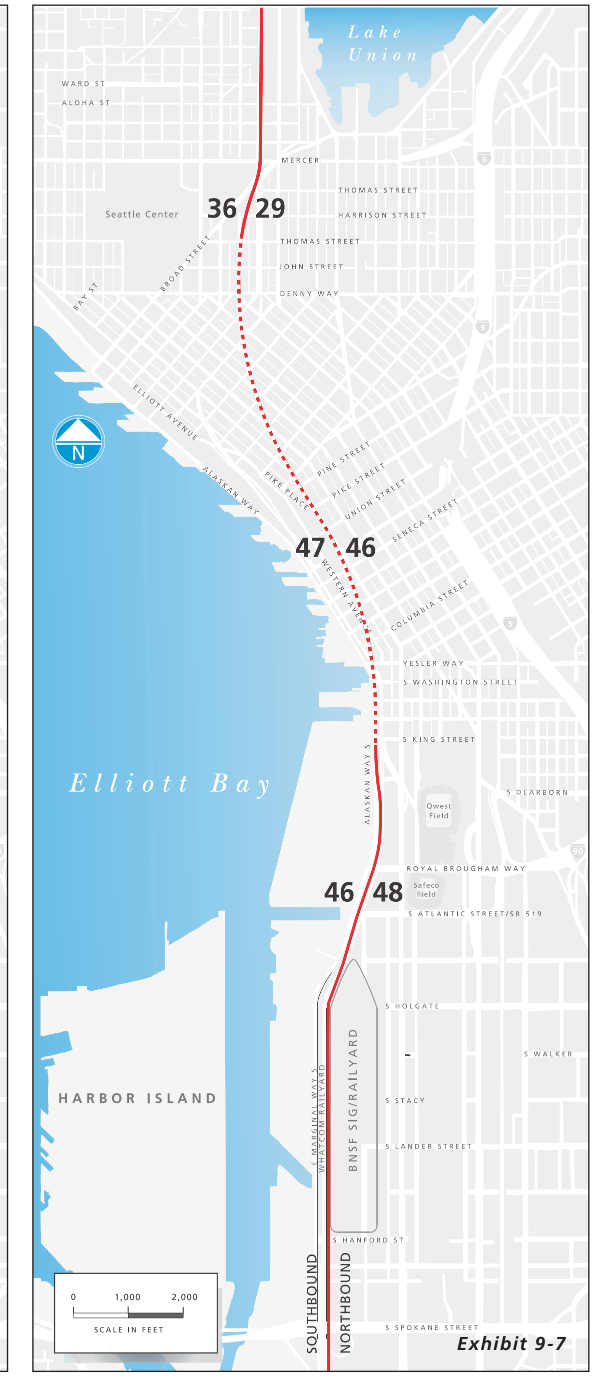


Exhibit 9-7

Bored Tunnel Travel Time Comparison

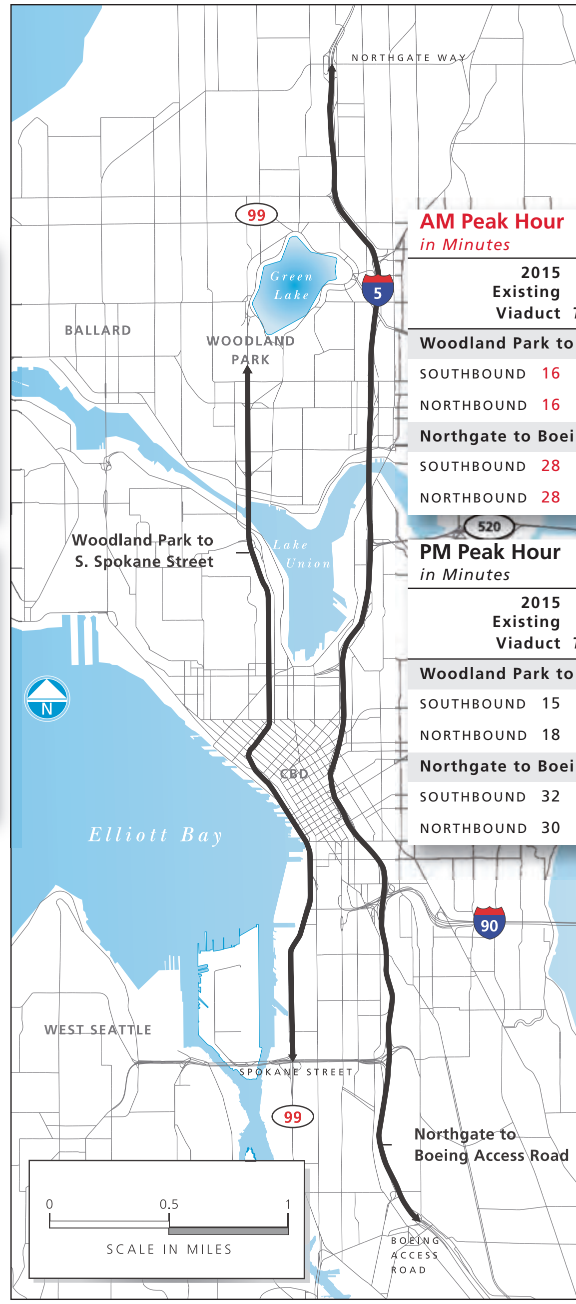
2015 Bored Tunnel vs. Toll Scenarios A, C, E

AM Peak Hour
in Minutes

	2015 Existing Viaduct	*2015 Bored Tunnel*	*2015 TOLL A*	*C*	*E*
West Seattle to Downtown Central Business District					
NORTHBOUND	20	***23***	*25*	*26*	*24*
Woodland Park to Downtown Central Business District					
SOUTHBOUND	19	***18***	*20*	*22*	*18*

PM Peak Hour
in Minutes

	2015 Existing Viaduct	*2015 Bored Tunnel*	*2015 TOLL A*	*C*	*E*
West Seattle to Downtown Central Business District					
NORTHBOUND	25	***21***	*21*	*21*	*21*
Woodland Park to Downtown Central Business District					
SOUTHBOUND	15	***16***	*17*	*17*	*16*

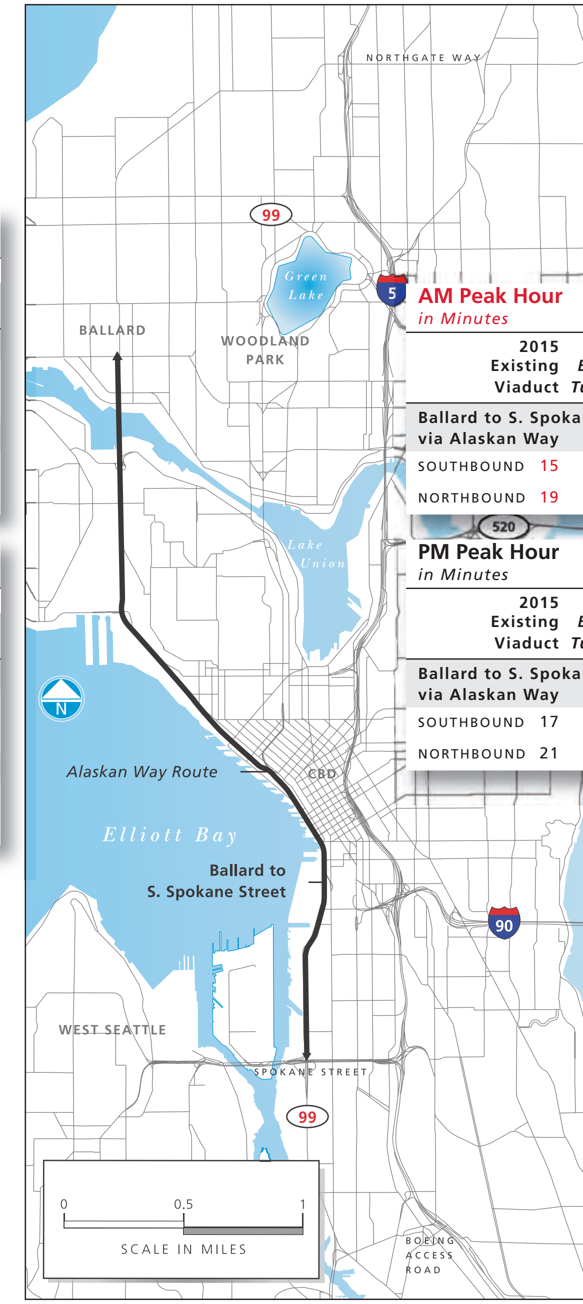


AM Peak Hour
in Minutes

	2015 Existing Viaduct	*2015 Bored Tunnel*	*2015 TOLL A*	*C*	*E*
Woodland Park to S. Spokane Street					
SOUTHBOUND	16	***14***	*15*	*15*	*14*
NORTHBOUND	16	***12***	*12*	*12*	*12*
Northgate to Boeing Access Road					
SOUTHBOUND	28	***28***	*29*	*29*	*29*
NORTHBOUND	28	***28***	*29*	*30*	*29*

PM Peak Hour
in Minutes

	2015 Existing Viaduct	*2015 Bored Tunnel*	*2015 TOLL A*	*C*	*E*
Woodland Park to S. Spokane Street					
SOUTHBOUND	15	***12***	*12*	*12*	*12*
NORTHBOUND	18	***14***	*14*	*13*	*14*
Northgate to Boeing Access Road					
SOUTHBOUND	32	***32***	*34*	*34*	*33*
NORTHBOUND	30	***30***	*31*	*31*	*30*



AM Peak Hour
in Minutes

	2015 Existing Viaduct	*2015 Bored Tunnel*	*2015 TOLL A*	*C*	*E*
Ballard to S. Spokane Street – via Alaskan Way					
SOUTHBOUND	15	***15***	*16*	*17*	*15*
NORTHBOUND	19	***20***	*21*	*21*	*20*

PM Peak Hour
in Minutes

	2015 Existing Viaduct	*2015 Bored Tunnel*	*2015 TOLL A*	*C*	*E*
Ballard to S. Spokane Street – via Alaskan Way					
SOUTHBOUND	17	***16***	*18*	*17*	*16*
NORTHBOUND	21	***22***	*25*	*25*	*24*

Exhibit 9-8

2015 Daily SR 99 Volumes

2015 Existing Viaduct | *Bored Tunnel* | *Bored Tunnel Toll Scenario A* | *Bored Tunnel Toll Scenario C* | *Bored Tunnel Toll Scenario E*

Exhibit 9-9

- North of Seneca Street, the number of vehicles traveling on Alaskan Way each day is projected to increase by 6,000 to 7,000 vehicles.

Modeling results indicate this diverted traffic would have little effect on I-5 trips (increases of 2 minutes or less), but would have a larger effect on trips using north-south arterials through downtown on streets such as Second and Fourth Avenues, as discussed below in this question. Slower travel times are modeled because vehicle volumes are expected to increase on these streets, resulting in increased congestion and delay at specific intersections, as discussed in the text below. These effects would not be not acceptable as part of a long-term tolling solution. Therefore other scenarios would be evaluated and reasonable optimization measures would be applied and analyzed before tolling would be implemented.

Modeling results show diversion with Bored Tunnel Toll Scenario E to be considerably less than Bored Tunnel Toll Scenarios A and C, with only 9,000 daily vehicles expected to shift away from SR 99. As a result, modeling results show downtown arterials west and east of I-5 are each projected to experience an increase of approximately 3,500 daily vehicles with Bored Tunnel Toll Scenario E, while roughly 2,500 daily vehicles are added to I-5. Correspondingly, the analysis of travel times and congested intersections on city streets shows minimal change under Bored Tunnel Toll Scenario E.

The modeled diversion for the peak periods is expected to be proportionately less than for daily traffic, with 24 to 42 percent of the SR 99 volumes expected to shift to other facilities during peak periods for Bored Tunnel Toll Scenarios E, C, and A. As mentioned previously, during peak periods, I-5 and surface streets become more congested, so an uncongested trip through the bored tunnel becomes more attractive, even though it would be tolled. Thus, less traffic is projected to divert during peak periods. Conversely, during non-peak periods, I-5 and surface streets become less congested and therefore, more attractive, so more traffic is projected to divert during non-peak periods. Exhibit 9-10 shows the locations of screenlines key arterials. Exhibit 9-11 compares daily projected volumes at the key arterials shown on Exhibit 9-10. Exhibit 9-12 compares vehicle volumes on Alaskan Way, and Exhibit 9-13 compares volumes at three locations on I-5.

Exhibit 9-11
Comparison of 2015 Vehicle Volumes at Screenlines
as shown in Exhibit 9-10

			BORED TUNNEL		
	Existing Viaduct	Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
Harrison Street *Streets between Elliott Bay & Aurora*	103,500	106,500	129,100	131,300	113,700
Harrison Street *Streets between Aurora & I-5*	71,600	81,600	82,200	80,500	83,200
Seneca Street *Streets between Alaskan Way & I-5*	117,100	117,100	133,300	135,200	120,600
Seneca Street *Streets between I-5 & Lake Washington*	138,300	139,100	150,200	152,000	143,000
S. King Street *Streets between SR 99 & I-5*	81,000	103,200	118,400	120,100	107,000
S. Spokane Street *Streets between SR 99 & I-5*	109,800	114,100	128,200	131,000	117,100

Exhibit 9-12
Comparison of 2015 Vehicle Volumes at Screenlines on Alaskan Way

			BORED TUNNEL		
	Existing Viaduct	Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
North of Pine	11,700	15,100	21,800	22,300	16,700
North of Seneca	10,200	15,800	22,400	22,900	17,300
South of S. King	26,500	30,300	36,400	36,900	32,600

Exhibit 9-13
Comparison of 2015 Vehicle Volumes at Screenlines on I-5

South of SR 520	317,800	318,300	320,400	320,700	318,300
North of Seneca	262,600	263,900	277,700	279,100	266,300
South of I-90	270,400	272,800	281,300	282,400	274,100

Exhibits 9-14 to 9-16 compare the modeled 2015 AM peak hour, PM peak hour, and daily vehicle volumes for Second and Fourth Avenues for the untolled 2015 Bored Tunnel to Bored Tunnel Toll Scenarios A, C, and E. In 2015, Bored Tunnel Toll Scenarios A and C are projected to result in 7,000 additional daily vehicle trips on Second and Fourth Avenues, a 20 percent increase over the 2015 Bored Tunnel. Bored Tunnel Toll Scenario E, however, is projected to result in substantially less traffic diversion to Second and Fourth Avenues than Bored Tunnel Toll

Screenline Locations
** includes Aurora Avenue*
Exhibit 9-10

Scenarios A and C. The effects of this additional traffic are discussed below and shown in Exhibits 9-14 through 9-19.

Exhibit 9-14
2015 AM Peak Hour Volumes on Second & Fourth Avenues North of Seneca Street
Vehicles per hour

	Existing Viaduct	BORED TUNNEL Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
Second Avenue	1,100	1,130	1,390	1,410	1,300
Fourth Avenue	1,960	2,050	2,270	2,290	2,170
Total	**3,060**	**3,180**	**3,660**	**3,700**	**3,470**

Exhibit 9-15
2015 PM Peak Hour Volumes on Second & Fourth Avenues North of Seneca Street
Vehicles per hour

Second Avenue	1,370	1,440	1,620	1,650	1,530
Fourth Avenue	1,910	2,030	2,260	2,300	2,160
Total	**3,280**	**3,470**	**3,880**	**3,950**	**3,690**

Exhibit 9-16
2015 Average Weekday Volumes on Second & Fourth Avenues North of Seneca Street
Vehicles per weekday

Second Avenue	13,200	13,600	16,700	17,100	14,300
Fourth Avenue	20,500	21,900	25,300	25,400	22,600
Total	**33,700**	**35,500**	**42,000**	**42,500**	**36,900**

As shown in Exhibit 9-17, modeling results show the diverted traffic on Second and Fourth Avenues would increase travel times by 4 to 8 minutes for traffic traveling in general-purpose lanes under Bored Tunnel Toll Scenarios A and C, but only by 1 to 2 minutes under Bored Tunnel Toll Scenario E. This travel time increase is a result of increased delay at the following intersections along Second and Fourth Avenues: Second and Marion, Second and Spring, Second and Pine, Second and Virginia, Fourth and Columbia, Fourth and Madison, Fourth and Marion, Fourth and Spring, and Fourth and Seneca. These effects would not be not acceptable as part of a long-term tolling solution. Therefore other scenarios would be evaluated and reasonable optimization measures would be applied and analyzed before tolling would be implemented.

Exhibit 9-17
General-Purpose & Transit Travel Times on Second & Fourth Avenues
for the 2015 Bored Tunnel & Bored Tunnel Toll Scenarios in minutes

	AM PEAK Bored Tunnel	TOLL SCENARIO A	C	E	PM PEAK Bored Tunnel	TOLL SCENARIO A	C	E
Second Avenue – Wall Street to S. Royal Brougham Way								
Southbound – General Purpose	**11**	17	19	13	**14**	18	20	15
Southbound – Transit	**13**	13	13	13	**14**	16	16	14
Fourth Avenue – S. Royal Brougham Way to Battery Street								
Northbound – General Purpose	**12**	14	15	13	**12**	15	16	14
Northbound – Transit	**14**	15	15	15	**14**	14	15	14

Traffic Operations at Key Arterial Intersections

As shown in Exhibits 9-18 and 9-19, more intersections are shown as congested or highly congested under the Toll Scenarios than under either the 2015 Existing Viaduct or 2015 Bored Tunnel Scenarios. Under Toll Scenarios A, C, and E, these additional congested intersections would lead to increased travel times on surface streets, as described above.

11 How would Toll Scenarios A, C, and E affect transit?

As shown previously in Exhibit 9-17, modeling results indicate that increased congestion on Second and Fourth Avenues would result in transit trip increases of 1 to 2 minutes.

Modeled Transit Riders

As shown in Exhibit 9-20, modeling results show the impact of tolling on transit ridership appears to be negligible. Modeling results indicate that transit priority treatments on Second and Fourth Avenues and peak period restrictions on Third Avenue for traffic in general-purpose lanes would minimize the transit travel time increases expected from increased diverted traffic. However, modeling results indicate the increased transit travel times would result in slightly lower ridership. These effects would not be not acceptable as part of a long-term tolling solution. Therefore, other scenarios would be evaluated and reasonable optimization measures would be applied and analyzed before tolling would be implemented.

Exhibit 9-20
Comparison of Model-Estimated Transit Riders (Person-Trips) **at Selected Screenlines for the 2015 Bored Tunnel & 2015 Bored Tunnel Toll Scenarios**

	2015 Existing Viaduct	BORED TUNNEL Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
South Screenline – South of S. King Street					
AM	31,320	30,780	30,570	30,600	30,720
PM	99,180	97,000	96,000	96,000	96,900
Central Screenline – North of Seneca Street					
AM	36,690	36,370	36,480	36,540	36,460
PM	126,890	124,800	123,400	123,200	125,000
North Screenline – North of Thomas Street					
AM	36,410	36,510	36,520	36,550	36,550
PM	118,710	118,800	118,400	118,400	118,900

Transit Mode Share

As shown in Exhibit 9-21, modeled transit mode share is similar between the 2015 Bored Tunnel and the 2015 Bored Tunnel Toll Scenarios. Since transit routes are designed to serve trip to downtown, while the tunnel is designed to serve trips through downtown, the impact of tolls on transit share is negligible.

Exhibit 9-21
Comparison of Model-Estimated 2015 Daily Transit Mode Shares To and From Seattle's Center City for the Bored Tunnel Toll Scenarios

	2015 Existing Viaduct	BORED TUNNEL Bored Tunnel	Toll Scenario A	Toll Scenario C	Toll Scenario E
Home-based work	34.2%	34.2%	34.1%	34.1%	34.2%
Non-work	8.9%	8.8%	8.7%	8.7%	8.8%

12 How would Toll Scenarios A, C, and E affect traffic conditions in 2030?

Modeling results show systemwide measures (VMT, VHT, and VHD) exhibit diversion patterns similar to those discussed for 2015 with respect to the relative differences between tolled and untolled operations. The primary difference exhibited by 2030 estimates is an overall increase in travel as the region and the city grow over time.

With respect to modeled vehicle volumes on key facilities and arterials (see Exhibits 9-22 through 9-25), the relative differences between the 2030 Bored Tunnel Toll Scenarios and the 2030 Bored Tunnel exhibit the same pattern in 2030 as the 2015 analysis.

Congested Intersections AM Peak

2015 Existing Viaduct | *2015 Bored Tunnel* | *2015 Bored Tunnel Toll Scenario A* | *2015 Bored Tunnel Toll Scenario C* | *2015 Bored Tunnel Toll Scenario E*

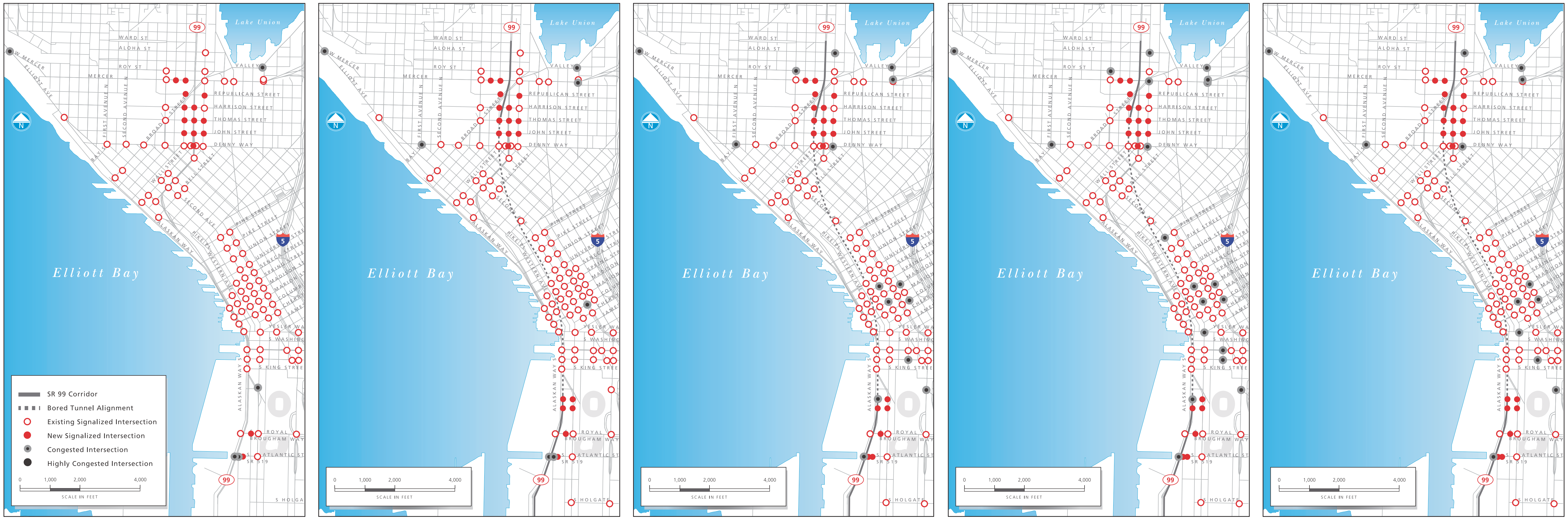


Exhibit 9-18

Exhibit 9-23
Comparison of 2030 Vehicle Volumes at Screenlines
as shown in Exhibit 9-10

	Viaduct Closed	Bored Tunnel	BORED TUNNEL Toll Scenario A	Toll Scenario C	Toll Scenario E
Harrison Street *Streets between Elliott Bay & Aurora*	113,700	117,800	138,800	141,100	124,500
Harrison Street *Streets between Aurora & I-5*	79,500	92,000	94,300	94,800	93,500
Seneca Street *Streets between Alaskan Way & I-5*	143,000	120,400	135,000	136,400	123,500
Seneca Street *Streets between I-5 & Lake Washington*	167,400	152,800	164,400	166,000	156,000
S. King Street *Streets between SR 99 & I-5*	124,100	110,700	125,100	126,500	114,300
S. Spokane Street *Streets between SR 99 & I-5*	162,600	136,400	147,900	150,000	138,700

Exhibit 9-24
Comparison of 2030 Vehicle Volumes at Screenlines On Alaskan Way

	Viaduct Closed	Bored Tunnel	BORED TUNNEL Toll Scenario A	Toll Scenario C	Toll Scenario E
North of Pine	23,000	17,800	23,600	24,100	19,000
North of Seneca	23,300	18,600	24,300	24,700	19,800
South of S. King	47,300	32,600	38,000	38,500	34,600

Exhibit 9-25
Comparison of 2030 Vehicle Volumes at Screenlines on I-5

South of SR 520	324,900	324,400	325,800	326,300	324,700
North of Seneca	283,200	269,900	283,400	284,500	272,000
South of I-90	286,600	274,300	282,600	283,600	275,700

13 How would tolls work on the Cut-and-Cover Tunnel and Elevated Structure Alternatives?

In general, it would be somewhat more complicated to toll the Cut-and-Cover Tunnel and Elevated Structure Alternatives as compared to the Bored Tunnel Alternative due to the larger number of access points along the tolling route. Both the Cut-and-Cover Tunnel and Elevated Structure Alternatives would provide access to SR 99 via a southbound Elliott Avenue on-ramp and northbound Western Avenue off-ramp. Additionally, the Elevated Structure Alternative would provide access to SR 99 via a southbound on-ramp at Columbia Street and a northbound off-ramp at Seneca Street. Because traffic using the Columbia and Seneca ramps will only use a

Congested Intersections PM Peak

2015 Existing Viaduct | *2015 Bored Tunnel* | *2015 Bored Tunnel Toll Scenario A* | *2015 Bored Tunnel Toll Scenario C* | *2015 Bored Tunnel Toll Scenario E*

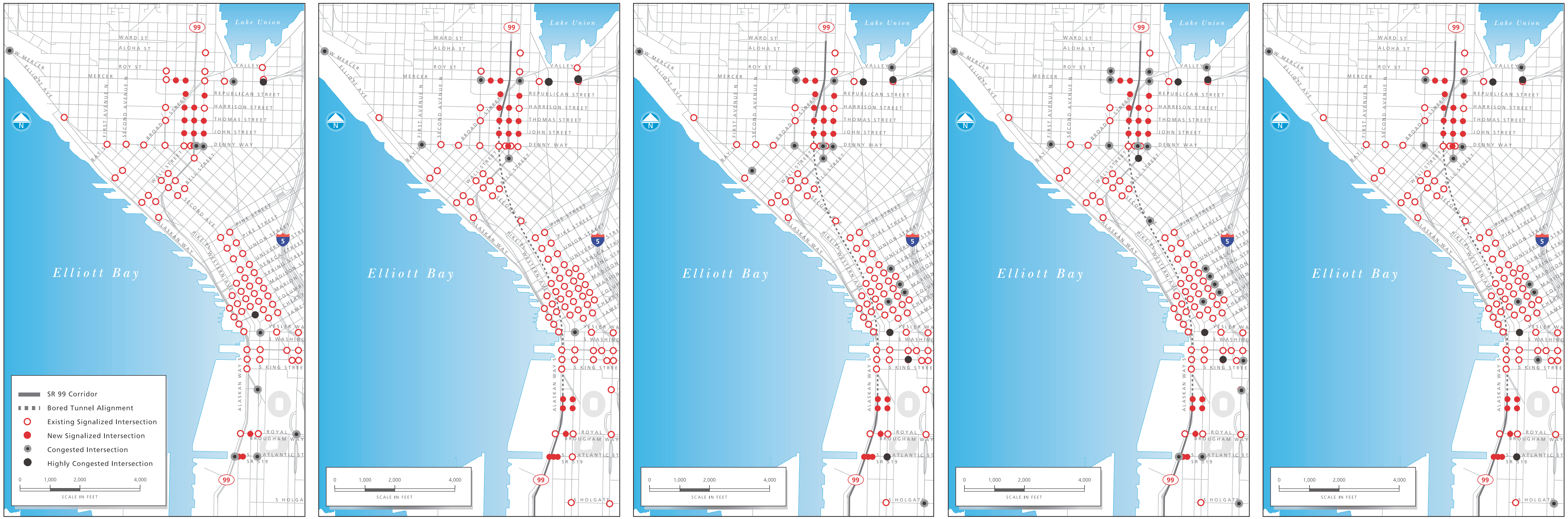


Exhibit 9-19

portion of the corridor, and because their diversion route is relatively short (i.e., taking First Avenue or Alaskan Way to the new Stadium ramps), it is assumed that the toll rate for traffic using these ramps would be less than the rate for traffic passing through downtown on the structure.

Untolled Traffic Volumes

Daily traffic volumes on SR 99 through the south and central sections are projected to be highest for the Elevated Structure Alternative followed by the Cut-and-Cover Tunnel and Bored Tunnel Alternatives. Projected volumes in these areas are highest with the Elevated Structure Alternative because it is the only alternative that provides the Columbia and Seneca ramps and the Elliott and Western ramps, which increases travel demand. North of Virginia Street, near the Battery Street Tunnel, SR 99 daily volumes with the Bored Tunnel Alternative are expected to be higher than the other alternatives. With the Bored Tunnel Alternative, traffic volumes would increase near the Battery Street Tunnel because the Battery Street Tunnel would be closed and replaced with a new bored tunnel that would have wider lanes and shoulders and less abrupt curves. North of the Battery Street Tunnel, vehicle volumes are slightly higher with the Bored Tunnel Alternative than the other two alternatives because it improves mobility for east-west travel, resulting in increased travel demand in this area.

Traffic Diversion Due to Tolling

With untolled conditions, surface streets are projected to carry less traffic under the Cut-and-Cover Tunnel and Elevated Structure Alternatives than the Bored Tunnel Alternative. Therefore, if a toll were applied to SR 99, it is assumed that more traffic would divert to the city streets under these alternatives, compared to the Bored Tunnel Alternative, as the surface streets would have more capacity to accommodate diverted traffic. However, even though a higher volume of traffic may divert to surface streets due to more available surface street capacity under the tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives, the resulting surface street volumes would likely be similar across all three alternatives (except along

What are congested and highly congested intersections?

For the traffic analysis conducted for this project, congested intersections are intersections that may cause drivers considerable delay. A driver might wait about 1 or 2 minutes to travel through a traffic signal at a congested intersection. At a highly congested intersection a driver might wait 2 minutes or more to get through the traffic signal.

2030 Daily SR 99 Volumes

Bored Tunnel *Bored Tunnel Toll Scenario A* *Bored Tunnel Toll Scenario C* *Bored Tunnel Toll Scenario E*

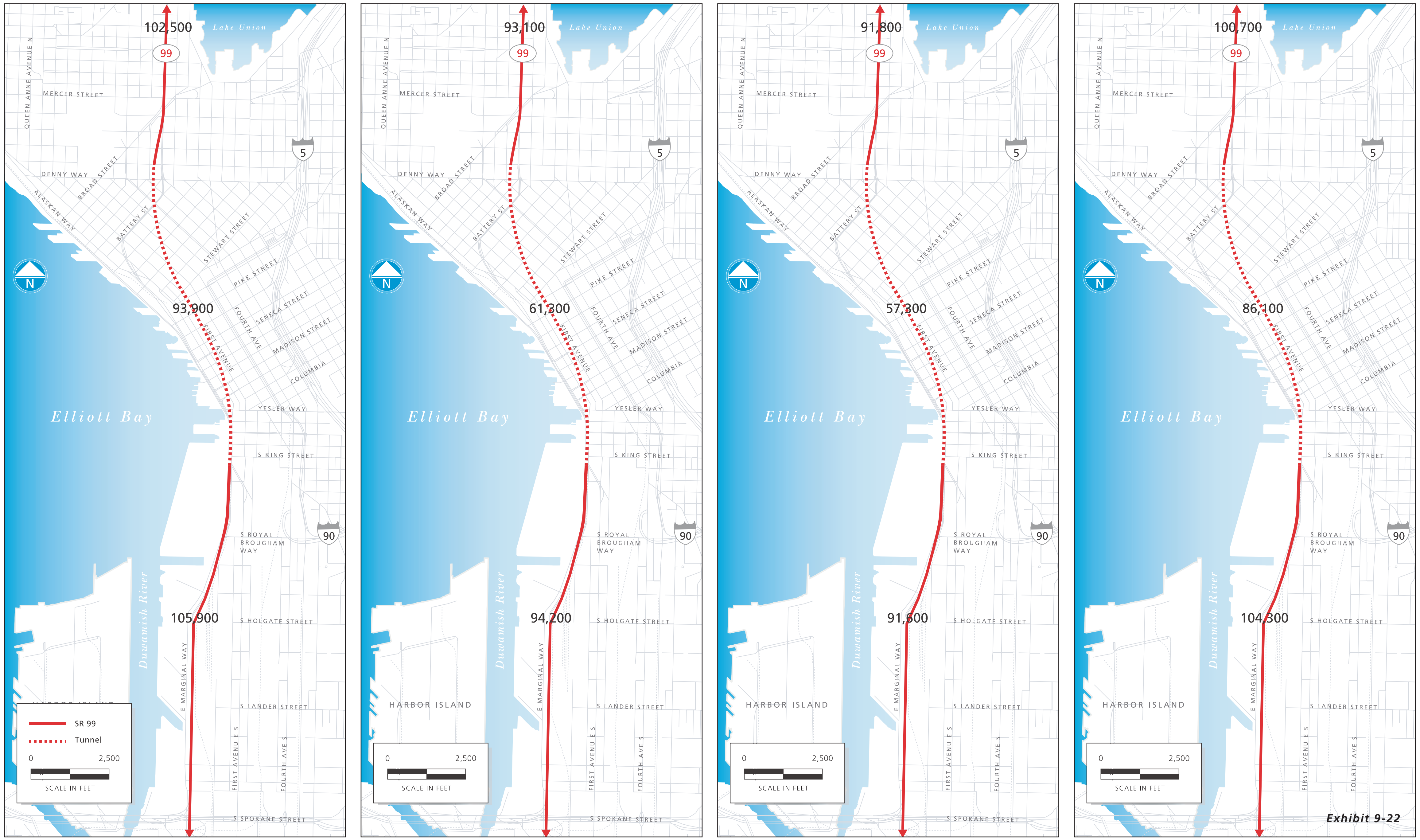


Exhibit 9-22

Elliott and Western Avenues north of Battery Street, which would likely be lower under the Bored Tunnel Alternative because it does not have ramps to/from SR 99 at this location). Therefore, tolling the Cut-and-Cover Tunnel and Elevated Structure Alternatives would likely result in similar effects on the transportation network as those discussed above for the tolled Bored Tunnel Alternative.

14 What types of other environmental effects would Toll Scenarios A, C, and E have for the Bored Tunnel Alternative?

This section discusses potential environmental effects that could result from the toll scenarios. The discussion below draws upon the transportation analysis presented above. Potential effects from traffic diverting from SR 99 and increased congestion on local streets were considered for the following environmental disciplines:

- Environmental justice
- Historic and cultural resources
- Air quality
- Energy and greenhouse gases
- Noise

Other elements of the environment were assumed to be relatively unaffected by the toll scenarios and are, therefore, not included in this discussion. More detailed analysis will be developed if tolling is incorporated into the Alaskan Way Viaduct and Seawall Replacement Project.

Environmental Justice

Introduction

Evaluation of the potential for tolling to result in disproportionately high and adverse impacts on low-income and minority populations is an emerging field of study. The following section examines some of the common issues in this field and includes a preliminary evaluation based on the toll scenarios analyzed above.

Potential impacts on low-income and minority populations fall into two categories:

1 Impacts of Diverted Traffic

As discussed in the Transportation section (Chapter 2), diverted traffic would result in increased congestion and delay on untolled routes parallel to SR 99, such as Second and Fourth Avenues. Transit service would be affected by this increased traffic. Further study is needed to determine whether low-income and minority populations are more likely to be affected by this altered transit service.

2 Impacts of Toll Payment or Avoidance

As discussed below, environmental justice analyses have evaluated the net effect of tolling on low-income populations, weighing the potential burden of toll payment against the potential benefit of improved travel times on the tolled facility or by the provision of untolled travel alternatives on the facility, such as transit, or untolled alternate routes, such as Second and Fourth Avenues.

Travel Times on the Facility

Other studies of tolling have concluded that effects upon low-income populations would not be disproportionately high and adverse because tolling often results in improved trip reliability and higher speeds, which are benefits that offset the burden of the tolls. While the current analysis shows most trips would take about 1 or 2 minutes longer than the untolled bored tunnel, this increased travel time does not take into consideration reasonable measures to optimize operation that would be applied to a tolled facility and nearby untolled alternate routes to improve trip times. Reasonable measures could include queue bypasses and intersection timing. Although the preliminary analyses of Toll Scenarios A, C, and E have not shown an improvement in trip reliability, either on SR 99 or on the viable alternate untolled routes through downtown Seattle, the effects shown in this analysis would not be not acceptable as part of a long-term tolling solution. Therefore other scenarios would be evaluated and reasonable optimization measures would be applied and analyzed before tolling would be implemented.

Untolled Alternate Routes

Transit service does not currently use SR 99 between Seneca Street and Denny Way and no transit service is currently planned to use the bored tunnel, so using transit instead of driving through the bored tunnel is not applicable at this time. However, transit service could use the bored tunnel in the future. As noted above in the discussion of diverted traffic on city streets, travel times on untolled parallel streets such as Second and Fourth Avenues are expected to become longer. As noted previously, these travel times do not account for optimization measures that would be applied to untolled alternate routes prior to implementing tolling on SR 99.

Background Information

In 2009, the University of Washington and the Washington State Transportation Center published a research paper entitled: *The Impacts of Tolling on Low-Income Persons in the Puget Sound Region*. The paper asserts: "Tolls may be progressive, regressive, or neutral, depending on the social and geographic characteristics of the town or region and the structure of the tolling regime. The distributional effects must be evaluated on a site and project specific basis."[2, 3, 4, 5]

In "*International Experiences with Congestion Pricing*,"[6] Anthony May considers the equity component of congestion pricing. He cites older studies which argue that congestion pricing is a regressive measure that has greater impacts on lower-income drivers, but indicates this population is more likely to travel by bus or foot. May concludes that the most inequitable effects are dependent on the pricing scheme implemented and would likely impact a small percentage of lower-income drivers. He suggests that the only way to address the issue of equity is to invest some of the toll revenue in public transport rather than solely to improve the road infrastructure. The preliminary scenarios evaluated in this chapter do not invest toll revenue in public transport.

It should be noted, however, that tolling schemes to provide needed improvements would supplant existing revenue generation methods, which are also largely

2 Santos and Rojey. 2004.

3 Elliasson and Mattsson. 2006.

4 Prozzi et al. 2007.

5 Plotnick. 2009.

6 May. 1993.

regressive. A research paper by Genevieve Giuliano found five of the six taxes supporting the existing highway system are themselves regressive.[7]

Other WSDOT Reports and Projects

As noted above, more detailed analysis will be developed if tolling is incorporated into the project. Examples of more detailed environmental justice analyses are provided below in discussions of other WSDOT reports and projects.

Urban Partnership SR 520 Variable Tolling Project

WSDOT conducted in-depth review and analysis of tolling impacts to environmental justice populations for its Urban Partnership SR 520 Variable Tolling Project and published the Environmental Justice Discipline Report in March 2009. The report stated that since the toll would be the same amount for all users, regardless of income, low-income users would have to spend a higher proportion of their income on the toll. However, focus group interviews of low-income drivers for the Urban Partnership SR 520 Variable Tolling Project indicated that many low-income drivers believed that a $3.50 toll would be worth it for a faster, more reliable trip. This is consistent with other studies on the equity of HOT lanes, which also found that many lower income people supported congestion pricing if it ensured a faster, more reliable trip. Researchers hypothesized in these studies that lower income people who worked for hourly wages or depended on child care would choose to pay a toll to avoid losing wages or paying high late fees at their child care facilities. For many lower income people who are juggling multiple jobs and child care, traffic delays may pose an even bigger burden than a toll.[8]

According to WSDOT's SR 520 telephone survey, nearly 51 percent of low-income respondents said they would not use transit to avoid paying the toll. More than 53 percent of those who said they would not use transit indicated that transit service is not frequent enough on their routes. Nearly 56 percent said they live or work too far from transit. Of those low-income respondents who said they would use transit to avoid paying the toll, 63 percent said that it would greatly increase their travel time.

Untolled routes were a more desirable alternative to paying the toll for survey respondents. More than 64 percent of low-income respondents said they would use an untolled route if they wanted to avoid paying the toll. However, of those low-income respondents who said they would use an untolled route, 67 percent said it would greatly increase their travel time. Nearly 97 percent said it would greatly increase their travel distance, which would add to the cost of their trip in the form of additional fuel and wear and tear on their vehicle.

SR 167 HOT Lanes

On May 3, 2008, the SR 167 HOT lanes pilot project opened. From 2005 to 2007, WSDOT conducted several technical studies and public opinion research surveys to understand who currently uses SR 167, how the pilot project would affect travel behaviors, and the public's perception of HOT lanes. The results of these surveys were published in the *SR 167 8th Street East Vicinity to South 277th Street Vicinity Southbound HOT Lane* Environmental Justice Technical Report.[9]

The survey results indicated that time savings, consistency, and trip reliability were viewed as important benefits to all populations, including low-income populations that have specific time constraints. These people responded that the cost of the toll on a periodic basis, or even for a few days a week, would be less than the financial penalty incurred by sitting in congestion and being late.

The report further concluded there would not be any disproportionate adverse effects on low-income users of the new HOT lane, largely because they can still travel to their destination without having to take an alternate route within the travelshed to avoid a toll. Also, according to the survey results, some low-income users may not pay as often to use the HOT lanes but are still very supportive. Low-income populations that use carpools will continue to be able to use the HOT lane for free. Traffic modeling indicated that the inclusion of HOT lanes would improve travel times in the general-purpose lanes and users should not experience a travel time penalty. In addition, carpools, vanpools, transit, and toll-paying single-occupancy vehicles would benefit from improved travel times in the HOT lane.

Acquisition of Transponders

As discussed above in Question 5, future toll projects in Washington State, including the Alaskan Way Viaduct Replacement Project, would collect tolls electronically. Electronic toll collection requires use of a transponder linked to a payment account in order avoid paying a surcharge.

Setting up a transponder account could be present a financial burden for low-income drivers and could be challenging for populations with limited English proficiency. According to the telephone survey results conducted for the SR 520 project, more than 25 percent of low-income respondents indicated that they would not be able to use a credit, debit, or checking account to prepay their account.[8] Similar conditions exist for the Alaskan Way Viaduct Replacement Project.

In order to address these concerns, WSDOT has or will be deploying the following measures over the next year to make transponders more accessible for environmental justice populations:

- Establish two new walk-up Customer Service Centers in Seattle and Bellevue. Both locations will be transit accessible. Drivers will be able to purchase *Good To Go!*™ transponders, establish prepaid accounts, and pay outstanding toll bills with cash or Electronic Benefit Transfer (EBT) (Quest) cards issued by DSHS at these centers.

- Establish short-term and/or long-term relationships with retail outlets at convenient locations, such as grocery stores, convenience stores, or pharmacies throughout the region where transponders can be purchased.

- Share information with and through other public service providers. This information will be provided in Chinese, Korean, Japanese, Russian, Spanish, and

7 Guiliano. 1994.

8 WSDOT. 2009.

9 WSDOT. 2008.

Vietnamese. These are the same languages that the Department of Licensing uses for translation of driver education materials.

- Promote other forms of transportation. This could include but is not limited to transit options and rideshare opportunities such as those on Rideshareonline.com, carpoolworld.com, and commuteseattle.com as well as vanpool providers.

As noted above, the option also would exist for users to forgo transponder acquisition and instead be billed by mail. This option would include a surcharge, but would not require transponder acquisition or account prepayment.

Travelshed Demographics

This section considers the bored tunnel travelshed to determine the characteristics of the population that would be most affected by tolling the bored tunnel. Even though discussions of environmental justice usually examine the effects to both low-income and minority populations, the following discussion focuses only on low-income populations, since the effects of toll payment do not differ with minority status. The following discussion focuses on automobile users of the bored tunnel, their geographic distribution and their demographic composition.

Exhibit 9-26 shows the census tracts most likely to be affected by tolling the bored tunnel. Relative to other tracts in the travelshed, these are the tracts with a high number of users that may be affected by a toll and a high percentage of households below the federal poverty level in 2000, which is the most recent data available.

Exhibit 9-26
2015 Bored Tunnel Travelshed Poverty Levels

Census Tract	Daily Trips	% of households below federal poverty level in 2000	Neighborhood
93.00	4,312	28.0	SODO/Georgetown
73.00	2,104	40.3	South Lake Union
109.00	1.176	19.3	Georgetown
107.00	628	31.7	Delridge
80.01	456	20.6	Belltown
100.00	432	17.5	Beacon Hill
268.01	414	15.4	White Center
13.00	362	18.6	Licton Springs
276.00	304	17.8	Burien
265.00	280	38.7	White Center
4.01	275	17.0	Bitter Lake
292.01	238	18.0	Renton Boeing Area
94.00	193	16.0	North Beacon Hill
101.00	182	16.2	Genesee
271.00	164	18.3	North Tukwila/Highline Medical Center
110.00	137	18.7	South Beacon Hill
103.00	116	15.6	Columbia City
305.01	105	32.3	Auburn north
300.04	102	16.3	Star Lake
602.00	101	23.9	Tacoma piers
308.01	100	16.8	Auburn south
118.00	97	16.6	Rainier Beach
626.00	84	19.2	Tacoma Mall
91.00	82	49.6	International District

It should be noted that the trip totals shown in Exhibit 9-26 include trips originating both from the home and from the workplace. Many of the tracts are primarily residential, so the poverty levels of the tunnel users would correspond to the poverty levels of the tract residents. Other tracts, such as tract 93 (SODO/Georgetown), contain many land uses besides residential that have been added since the 2000 census. For these tracts, the poverty level of the tract residents is less informative of the poverty level of potential bored tunnel users, since many of the trips would be made from the workplace instead of the home.

Environmental Justice Issues Associated with Other Tolling Impacts

As noted below, the toll scenarios are not likely to result in adverse effects on air quality and noise. Therefore, environmental justice populations in the study area would not be likely to bear a disproportionate burden of these effects. Effects on historic resources and energy and greenhouse gases are also analyzed below, but are not considered to have effects on environmental justice populations.

Conclusion

Tolling a transportation corridor has the potential to result in disproportionately high and adverse impacts on low-income and minority populations.

FHWA directs WSDOT to apply two criteria to determine whether an effect is disproportionately high and adverse:

1 Low-income and/or minority populations will predominately bear the effects; or

2 Low-income and/or minority populations will suffer the effects and the effects will be considerably more severe or greater in magnitude than the adverse effects suffered by the general population.

Low-income or minority (and limited English proficient) populations would not predominately bear the effects. The toll would be charged to all users. However, tolls would be appreciably more severe for low-income users, because low-income users would have to spend a higher proportion of their income on the toll.

Previous analyses of the equity of tolling have concluded that effects of tolling on low-income populations would not be disproportionately high and adverse for the following reasons:

1 Tolling often results in improved to trip reliability and higher speeds, which are benefits that offset the burden of the tolls, and

2 There are viable options to avoiding the toll.

While the current analysis shows most trips would take about 1 or 2 minutes longer than the untolled bored tunnel, this increased travel time does not take into

What is a travelshed?

The trip origins of all bored tunnel users are referred to collectively as the travelshed.

consideration reasonable measures to optimize operation that would be applied to a tolled facility and nearby untolled alternate routes to improve trip times. Reasonable measures could include queue bypasses and intersection timing. Although the preliminary analyses of Toll Scenarios A, C, and E have not shown an improvement in trip reliability, either on SR 99 or on the viable alternate untolled routes through downtown Seattle, the effects shown in this analysis would not be not acceptable as part of a long-term tolling solution. Therefore, other scenarios would be evaluated and reasonable optimization measures would be applied and analyzed before tolling would be implemented.

However, based on the analysis of Scenarios A, C, and E, it appears that tolling SR 99 could have the potential of a disproportionately high and adverse effect on some low-income populations, especially those without access to transit or who are dependent on their cars, unless proper optimization measures are implemented.

Historic and Cultural Resources

The primary operational effect of a tolled Bored Tunnel Alternative versus an untolled Bored Tunnel Alternative on historic resources would be potential congestion from increased car and truck traffic in the historic districts and in the vicinity of other historic resources due to diversion from the tolled facility.

Diverted traffic would filter along the north-south streets throughout the downtown area, with particular impacts on Alaskan Way and on First Avenue/First Avenue S. This street runs along the western portion of Pioneer Square, on the eastern edge of the Pike Place Market and through Belltown. Pioneer Square, the Pike Place Market and the central waterfront piers are dependent on visitor traffic, and the character of these areas is defined by high levels of pedestrian activity, which could be affected by the additional diverted vehicular traffic.

Air Quality

Relative to the untolled Bored Tunnel Alternative, the tolled Bored Tunnel Alternative would result in additional diverted traffic, as discussed above. This additional diverted traffic would lead to slightly increased VMT, VHT, and VHD, which help inform the air quality analysis by providing an areawide summary of how many vehicles are producing emissions and for how long.

Potential Regional Impacts

Slightly increased VMT, VHT, and VHD would have a negligible effect on the amounts of ozone precursors emitted into the atmosphere from vehicular traffic. These changes in traffic conditions are unlikely to cause or exacerbate a violation of the ozone National Ambient Air Quality Standards (NAAQS) in the region, based on current and projected ozone levels and the anticipated change in regional emission rates under the toll scenarios.

Potential Local Impacts

Under all tolling conditions, vehicle trips would increase by up to a third at intersections in the project area. The increased vehicular trips through already congested intersections would increase CO and PM levels at sensitive land uses located near intersections. However, these changes in localized traffic conditions are unlikely to cause a violation of the CO or PM NAAQS in the region, based on current and projected CO and PM levels and anticipated increases in congestion under each tolling condition.

Traffic volumes on SR 99 are expected to decrease under all tolled alternatives. Therefore the concentrations of CO and PM emitted from the tunnel portals and tunnel operations buildings would be lower than Bored Tunnel Alternative and would be below the NAAQS.

Energy and Greenhouse Gases

Potential Regional Impacts

As discussed above, the toll scenarios are expected to slightly increase VMT, VHT, and VHD within the four-county region, relative to the untolled Bored Tunnel Alternative. This increase would result in very small overall reductions in average network speed of approximately 0.2 percent under Bored Tunnel Toll Scenario A, 0.2 percent under Bored Tunnel Toll Scenario C, and less than 0.1 percent under Bored Tunnel Toll Scenario E, as compared to the untolled Bored Tunnel Alternative. The slight increase in VMT under all of the toll scenarios and slight decrease in overall network speed within the estimated speed range are expected have negligible effects on regional energy usage and greenhouse gas emissions.

Potential Local Impacts

As discussed above, the toll scenarios would increase VMT, VHT, and VHD within the Seattle Center City, relative to the 2015 Existing Viaduct and the untolled Bored Tunnel Alternative. This increase would result in an overall reduction in average network speed of approximately 5 percent under Bored Tunnel Toll Scenario A, 6 percent under Bored Tunnel Toll Scenario C, and less than 1 percent under Bored Tunnel Toll Scenario E, as compared to the untolled Bored Tunnel Alternative. The increase in VMT under all of the toll scenarios and the decrease in overall network speed within the estimated speed range is expected to result in increased energy usage and greenhouse gas emissions of approximately 8 percent under Bored Tunnel Toll Scenario A, 9 percent under Bored Tunnel Toll Scenario C, and 1 percent under Bored Tunnel Toll Scenario E, as compared to the untolled Bored Tunnel Alternative. Energy use would increase compared to the 2015 Existing Viaduct. Energy usage rates are based on rate factors estimated using EPA's MOVES model. MOVES is EPA's new emission modeling system that allows the user to estimate criteria pollutant and greenhouse gas emission factors and energy usage rates.

Noise

Noise effects were qualitatively assessed based on changes in traffic volumes.

Scenarios A and C

Traffic volumes on SR 99 are expected to decrease by approximately one-quarter under Bored Tunnel Toll Scenarios A and C, relative to the untolled Bored Tunnel Alternative, which would result in slightly lower traffic noise levels at noise-sensitive sites located immediately adjacent to the bored tunnel portals. Noise levels would continue to be lower than the 2015 Existing Viaduct.

Under Bored Tunnel Toll Scenarios A and C, traffic volumes on Alaskan Way would increase by approximately one-half, relative to the untolled Bored Tunnel Alternative, which would result in slightly higher traffic noise levels at noise-sensitive sites located along the waterfront, near Alaskan Way. Because SR 99 traffic would be underground, noise levels would be substantially lower than the 2015 Existing Viaduct.

Diverted traffic under Bored Tunnel Toll Scenarios A and C would increase traffic volumes on downtown city streets by approximately one-tenth, relative to the untolled Bored Tunnel Alternative. These increases in downtown traffic would be present throughout much of the downtown street network but would result in no noticeable change in traffic noise levels at noise-sensitive sites located near downtown city streets. Noise levels would continue to be similar to the 2015 Existing Viaduct.

Scenario E

Traffic volumes on SR 99 are expected to decrease by less than one-fifth under Bored Tunnel Toll Scenario E, relative to the untolled Bored Tunnel Alternative, which would not result in a noticeable change to traffic noise levels at noise-sensitive sites located immediately adjacent to the bored tunnel portals. Noise levels would be slightly lower than the 2015 Existing Viaduct.

Under Bored Tunnel Toll Scenario E, traffic volumes on Alaskan Way would increase by approximately one-tenth, relative to the untolled Bored Tunnel Alternative, which would not result in a noticeable change in traffic noise levels at noise-sensitive sites located along the waterfront, near Alaskan Way. Because SR 99 traffic would be underground, noise levels would be substantially lower than the 2015 Existing Viaduct.

Traffic avoiding tolls at the bored tunnel under Bored Tunnel Toll Scenario E would increase traffic volumes on downtown city streets by approximately one-tenth, relative to the untolled Bored Tunnel Alternative. This increase in traffic would result in no noticeable change in traffic noise levels at noise-sensitive sites located near downtown city streets. Noise levels would continue to be similar to the 2015 Existing Viaduct.

15 What types of other environmental effects would tolling have for the Cut-and-Cover Tunnel and Elevated Structure Alternatives?

Potential environmental effects under the tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives would be similar to the tolled Bored Tunnel Alternative. As discussed above, traffic would divert from SR 99 to avoid paying tolls, which would result in increased congestion on local streets. This diverted traffic and increased congestion would have the potential to result in effects on the disciplines of environmental justice, historic and cultural resources, air quality, energy and greenhouse gases, and noise, similar to the effects discussed above for the Bored Tunnel Alternative.