
SAFECO FIELD

# CHAPTER 5 - PERMANENT EFFECTS

## What is in Chapter 5?

*This chapter describes the long-term project effects of the No Build Alternative, Bored Tunnel Alternative (Preferred), Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative, with and without tolls.*

### 1 What happens if the viaduct isn't replaced?

The hills and water around Seattle and the Puget Sound are beautiful to look at, but they have a constraining effect on where people can live and work. They also constrain our transportation facilities. There are only two north-south highway routes through downtown Seattle: Interstate 5 (I-5) and State Route 99 (SR 99) on the existing viaduct. With I-5 already at capacity during peak periods and throughout much of the day, SR 99 plays a critical role in the regional transportation system. From the perspective of Seattle and surrounding communities, the proposed build alternatives to replace the viaduct are similar, so this question focuses on what would happen in the long run (by 2030) if the viaduct is closed and isn't replaced. This is also the "No Action" alternative required by the National Environmental Policy Act (NEPA).

The viaduct serves traffic headed into and out of downtown Seattle and traffic traveling through the downtown area. A large portion of travelers using the viaduct, 44 percent, are heading to or coming from Seattle's downtown central business district. Approximately 23 percent of travelers travel through downtown and are destined for nearby locations just north or south of downtown, such as south of downtown (SODO), Capitol Hill, Queen Anne, or South Lake Union. The remaining 33 percent of travelers are making longer-distance through trips, such as trips from Ballard to Burien. This means that the majority of trips, 56 percent, are through trips. The people and businesses in all these areas depend on SR 99 directly for their daily travel, or indirectly, as SR 99 takes trips that otherwise would crowd other regional roadways such as I-5.

Seattle and surrounding areas have had the viaduct to depend on for more than half a century, and it is reflected in the land use patterns we see today. Land use and transportation planning in the Puget Sound area are coordinated by the Puget Sound Regional Council (PSRC) in accordance with state and federal requirements. The Council recently adopted "VISION 2040," a long-range strategy to guide growth and development in the four-county area (King, Pierce, Snohomish, and Kitsap counties).[1] This plan is supported by "Transportation 2040," the region's long-range transportation plan.[2] These plans were developed jointly over 4 years through a public process involving local governments and agencies in the four-county area. Transportation 2040's highest priority is to maintain, preserve, and operate the region's transportation system and specifically includes replacing the Alaskan Way Viaduct.

If the viaduct is closed and the central waterfront portion of SR 99 not replaced, trips that would have used the roadway would need to find other routes. Because alternative routes are longer and already congested, we expect that some travelers would change their travel patterns or avoid the trip entirely. In addition, land use and development patterns would adapt to different degrees of accessibility. Without the viaduct, the trips to and from the downtown core would not change much because of the wide range of alternative routes, but through trips (i.e., trips between districts north and south of downtown in the primary travelshed) would change to a greater degree because the only other highway route through downtown Seattle, I-5, is already congested. Hence, land use in downtown is not likely to change (mostly because it is already built out), but some jobs and households would be redistributed between areas north and south of downtown. These areas include the Seattle neighborhoods of South Lake Union, Uptown, Queen Anne, Magnolia, Ballard, and Fremont. To the south, areas affected include SODO, West Seattle, Duwamish, and Burien.

Without a replacement for the viaduct, initial estimates show nearly 2,000 jobs moving between the areas north and south of the viaduct, with a net increase of jobs in the south. Population would also be redistributed with an increase of nearly 1,000 households in the southern area. This is a small percentage of the total population and employment in these areas, but if it is triggered by the closure of SR 99, redistribution of this nature would be burdensome for those affected and would have what can be considered severe economic consequences. In addition, many transit routes to and from downtown Seattle are on SR 99 or nearby parallel streets such as First Avenue S., Dexter Avenue, and Elliott and Western Avenues. Without the viaduct, this transit access would be greatly impeded. Further, the loss of the viaduct would also eliminate one of only three truck routes through downtown, and increased vehicle volumes on downtown streets would degrade conditions for vehicles, bicycles, and pedestrians.

**Additional information on 2030 Viaduct Closed (No Build Alternative)**

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

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

1 PSRC 2009.

2 PSRC 2010.

From an analytical perspective, it is accurate and easy to write "some travelers would change their travel patterns" and "some jobs and households would be redistributed." This means some people, families, and businesses would find their situation so untenable that they would move away and their lives would be changed. While the net change in land use may be small, the disruption to some individuals and communities would be substantial.

These outcomes assume that the viaduct is closed and simply not replaced. However, rather than forcing people to tolerate or adapt to this condition, it is likely the transportation agencies serving the Seattle area would develop other alterations or improvements to transportation facilities and systems. These improvements would be responding to a new set of transportation needs and likely evaluated under additional environmental review. Transportation and land use plans might also be revised. In summary, not replacing the Alaskan Way Viaduct would have a significant adverse effect, and it would require many years for the area businesses and residents to adjust.

## TRANSPORTATION

**2 What conditions were modeled for the traffic analysis?**
Several conditions were modeled to understand the effects of the alternatives.

- **2030 Viaduct Closed –** This represents the No Build Alternative. The 2030 Viaduct Closed assesses 2030 traffic conditions if the viaduct were closed in 2030 between the First Avenue S. ramps and the Battery Street Tunnel ramps. However, for reasons discussed in Question 1 of this chapter, certain aspects of the transportation network such as travel times, travel speeds, and congested intersections were not evaluated.

- **2030 build alternatives with and without tolls –** Traffic conditions were evaluated for the Bored Tunnel, Cut-and-Cover Tunnel, and Elevated Structure Alternatives with and without tolls.

**3 How do the SR 99 lane configuration and access points compare among the alternatives?**
Exhibit 5-1 compares proposed access points between the existing SR 99 roadway and the proposed build alternatives.

Proposed access points are the same for each of the build alternatives with or without tolls.

The Elevated Structure Alternative provides access that most closely resembles connections provided by the existing viaduct. Compared to the existing facility, the Elevated Structure Alternative would remove the northbound on-ramp and southbound off-ramp at Battery Street and change access points north of Denny Way. The Cut-and-Cover Tunnel Alternative provides similar connections as the Elevated Structure, only it would remove the Columbia and Seneca ramps. Access to and from downtown from the south would be provided by the northbound off-ramp and southbound on-ramp to Alaskan Way S. just south of S. King Street, provided as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. In addition to the access changes described above, the Bored Tunnel Alternative would remove the northbound Elliott Avenue off-ramp and southbound Western Avenue on-ramp. Drivers that currently use these ramps could either use Alaskan Way or the bored tunnel and Mercer Street to access SR 99 as shown in Exhibit 5-2.

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

**4 How would regional travel patterns compare?**
Several metrics were used to understand and compare the effects the alternatives would have to the regional transportation network. The information presented below compares the following for the Viaduct Closed and build alternatives:

*Exhibit 5-1*
**Alternatives Comparison – SR 99 Ramp Connections**

| CONNECTIONS | RAMP CONNECTIONS FOR ALTERNATIVES | | | |
|---|---|---|---|---|
| **To/From** | **Existing** | **Bored Tunnel** | **Cut-&-Cover Tunnel** | **Elevated Structure** |
| Stadium Area | A northbound on-ramp and southbound off-ramp currently provide access to First Avenue S. near Railroad Way S. | The existing ramps to First Avenue S. would be replaced with a northbound on-ramp and southbound off-ramp near S. Royal Brougham Way. In addition, a northbound off-ramp and southbound on-ramp would be provided to Alaskan Way S. just south of S. King Street as part of the S. Holgate Street to S. King Street Viaduct Replacement Project. | Same connections as the Bored Tunnel Alternative | Same connections as the Bored Tunnel Alternative |
| Downtown Seattle | A northbound off-ramp is located at Seneca Street and a southbound on-ramp is located at Columbia Street. | The Columbia and Seneca Street ramps would be removed. Access to and from downtown from the south would be provided by the northbound off-ramp and southbound on-ramp to Alaskan Way S. just south of S. King Street. | Same connections as the Bored Tunnel Alternative | The Columbia and Seneca ramps would be rebuilt in addition to the ramps provided near the stadium area. |
| Elliott & Western Corridor | SR 99 connections are provided by a northbound off-ramp at Western Avenue, a southbound on-ramp at Elliott Avenue, a northbound on-ramp near Battery Street, and a southbound off-ramp at Battery Street. | The existing ramps would not be replaced. Instead, drivers heading to or from SR 99 and northwest Seattle (including Ballard, Interbay, and Magnolia) could access SR 99 via Mercer Street and new ramps at Republican Street, or drivers could connect to SR 99 by traveling on Alaskan Way. | The Battery Street ramps would be removed. The Western Avenue northbound off-ramp and the Elliott Avenue southbound on-ramp would be replaced with new ramps in a similar location as the existing ramps. | Same as the Cut-&-Cover Tunnel Alternative |
| South Lake Union | Access is provided by a northbound on-ramp and southbound off-ramp at Denny Way, a northbound off-ramp at Mercer Street, a southbound off-ramp at Broad Street, and several side street connections. | Existing ramps to Denny Way and the southbound off-ramp to Broad Street would be replaced with ramps that provide access to Aurora Avenue near Harrison Street. A southbound on-ramp and northbound off-ramp at Republican Street would replace street connections between John and Mercer Streets and the northbound off-ramp to Mercer Street. | The Denny Way ramps would be rebuilt in their current location. Side street connections between John and Aloha Streets would be replaced by a northbound off-ramp to Republican Street and improved right turn on and off connections at Roy Street. | Same as the Cut-&-Cover Tunnel Alternative |

- Vehicle miles of travel
- Vehicle hours of travel
- Vehicle hours of delay

### Vehicle Miles Traveled

Vehicle miles of travel (VMT) measures how many total miles all vehicles travel on a roadway network on an average weekday. Exhibit 5-3 shows VMT for the downtown Seattle Center City area, as well as for the broader four-county region.

*Exhibit 5-3*
**2030 Daily Vehicle Miles of Travel**
*in Daily Miles Traveled*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Seattle Center City** | | | | | | |
| 2,371,400 | 2,521,600 | 2,534,400 | 2,545,400 | 2,540,000 | 2,556,600 | 2,551,200 |
| **Four-County Region** | | | | | | |
| 110,820,300 | 109,471,700 | 109,541,400 | 109,497,900 | 109,506,800 | 109,668,400 | 109,696,600 |

**What is the project study area for transportation effects?**

The traffic study area for this project is roughly bordered by I-5 to the east, Elliott Bay to the west, S. Spokane Street to the south, and Valley Street to the north. This area includes I-5, SR 99, the Spokane Street Viaduct, SR 519, and many city streets.

**What area does Seattle Center City refer to?**

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

Among the alternatives, the Viaduct Closed would have the lowest VMT in the Seattle Center City. VMT is lowest with the Viaduct Closed because there would be less roadway capacity in Seattle. This would increase congestion on adjacent routes including I-5 and city streets, which would cause drivers to eliminate trips or avoid the area. Of all the alternatives, VMT for the Viaduct Closed is highest in the four-county region. In this case, VMT is highest for Viaduct Closed because drivers would redistribute to other less direct routes, increasing VMT in the four-county region.

Among the build alternatives, VMT across the four-county region is about equal with and without tolls. These results suggest that various SR 99 build alternatives have little effect on the number of vehicle miles traveled in the region.

Differences among the build alternatives at the local, Seattle Center City level are minor and vary by just over 1 percent. VMT is expected to be highest for the Non-Tolled Elevated Structure Alternative and lowest for the Non-Tolled Bored Tunnel Alternative. VMT would be highest for the Non-Tolled Elevated Structure because it provides more access to and from SR 99 of any of the build alternatives evaluated. Conversely, the Non-Tolled Bored Tunnel Alternative is expected to have the lowest VMT because it provides less access than the other build alternatives. Within the Seattle Center City, differences between the tolled build alternatives and the non-tolled build alternatives are less than one half of 1 percent, which suggests that tolling has very little if any effect on the number of vehicle miles traveled in the local area. The reason why tolling has a very small effect on VMT is that routes drivers might choose to take to avoid the tolls would require traveling a similar distance as SR 99.

**Vehicle Hours Traveled**

Vehicle hours of travel (VHT) indicates the total number of hours traveled on the roadway network on an average weekday. Exhibit 5-4 shows daily VHT for the downtown Seattle Center City area as well as the broader four-county region.

## SR 99 Access To and From Northwest Seattle

*With the Bored Tunnel*


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

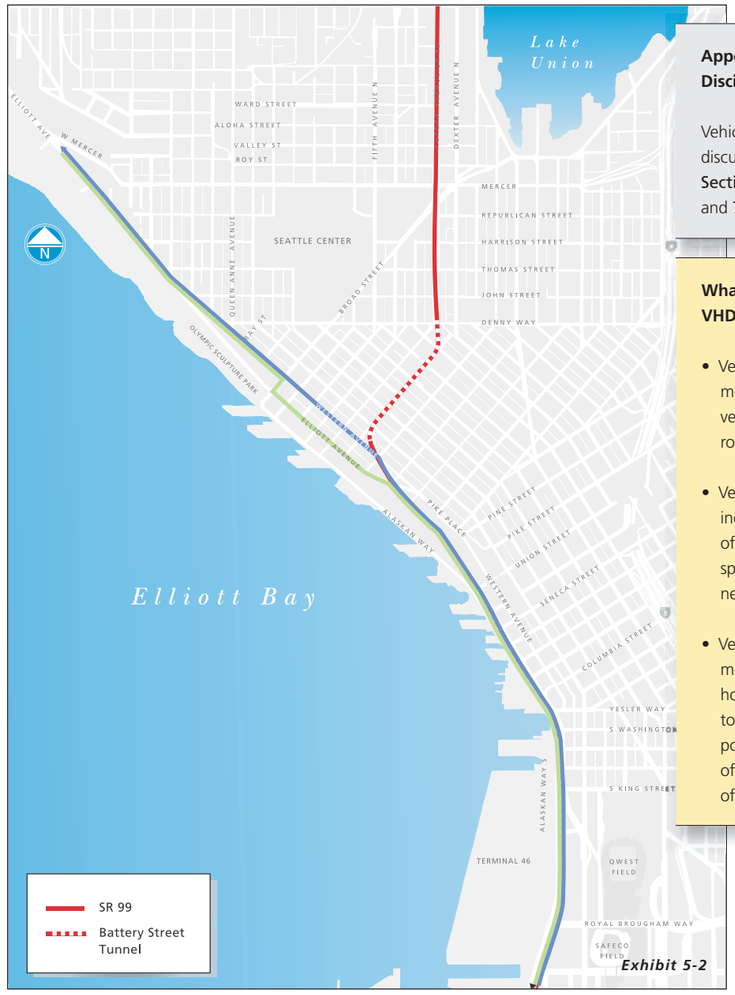



*Exhibit 5-2*

**Appendix C, Transportation Discipline Report**

Vehicle miles traveled are discussed in *Appendix C*, Sections 5.1.1, 7.2.1.1, 7.2.2.1, and 7.2.3.1.

**What are VMT, VHT, and VHD?**

- Vehicle miles of travel (VMT) measures how many miles vehicles travel on the roadway network.
- Vehicle hours of travel (VHT) indicates the total number of hours that travelers spend on the roadway network.
- Vehicle hours delay (VHD) measures the number of hours lost by travelers due to traveling at less than the posted speed limit. VHD is often used as an indicator of congestion.

***Exhibit 5-4***
**2030 Daily Vehicle Hours of Travel**
*in Daily Hours Traveled*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Seattle Center City** | | | | | | |
| 107,400 | 101,000 | 107,900 | 99,500 | 107,500 | 99,700 | 109,100 |
| **Four-County Region** | | | | | | |
| 4,436,100 | 4,402,800 | 4,415,500 | 4,402,300 | 4,409,500 | 4,427,900 | 4,440,500 |

In the four-county region and the Seattle Center City, VHT is highest with the Viaduct Closed and tolled build alternatives. Differences among the alternatives in VHT at the regional four-county level are less than 1 percent, which suggests that SR 99 has very little effect on VHT in the four-county region. Within the Seattle Center City, differences are more pronounced. VHT is highest with the tolled build alternatives and the Viaduct Closed. For Viaduct Closed and the tolled build alternatives, VHT would increase because adjacent roadways would be more congested, which would increase delay for many trips in Seattle area. VHT is expected to increase by about 7 percent for the Tolled Bored Tunnel compared to the Non-Tolled Bored Tunnel. VHT for the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure is expected to increase by 8 and 9 percent, respectively.

**Vehicle Hours of Delay**

Vehicle hours of delay (VHD) measures the number of hours lost by travelers due to traveling at less than the posted speed limit during an average weekday. VHD is often used as an indicator of congestion. Exhibit 5-5 shows daily VHD for the Seattle Center City area as well as for the broader four-county region.

***Exhibit 5-5***
**2030 Daily Vehicle Hours of Delay**
*in Daily Hours Delay*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Seattle Center City** | | | | | | |
| 41,300 | 33,300 | 38,700 | 31,000 | 37,600 | 31,100 | 38,900 |
| **Four-County Region** | | | | | | |
| 1,385,800 | 1,355,000 | 1,364,400 | 1,353,700 | 1,358,700 | 1,374,900 | 1,384,900 |

*Note: The four-county region comprises King, Pierce, Snohomish, and Kitsap counties.*

VHD is highest for Viaduct Closed for the four-county region and Seattle Center City. VHD is highest with the Viaduct Closed because drivers would redistribute to other less direct routes that would become more congested if the viaduct were closed, which would increase total delay in the transportation system. The increase in vehicle delay is much more pronounced at the local, Seattle Center City level than within the broader four-county region. VHD would be lowest with the Non-Tolled Cut-and-Cover Tunnel because this alternative maintains direct access to the Elliott and Western transportation corridor, but it eliminates access at Columbia and Seneca Streets. This combination of access elements improves travel speeds and reduces delay compared to the Non-Tolled Elevated Structure and Bored Tunnel Alternatives.

In all cases, tolling the build alternatives increases delay both locally and regionally. Tolling is expected to increase delay because drivers would divert to other routes that are more congested. The total number of hours of delay is expected to be similar among the tolled build alternatives in the local Seattle Center City area.

### 5 How would vehicle volumes and person throughput compare?

**Vehicle Volumes at Screenlines**

Traffic volumes were analyzed throughout the transportation system located in the study area. The analysis captured combined traffic volumes on I-5, SR 99, and local streets at specific locations called screenlines, shown in Exhibit 5-6. The results of the screenline analysis at three locations in the study area are provided in Exhibit 5-7.

***Exhibit 5-7***
**2030 Daily Vehicle Volumes at Screenlines**
*Daily Volume*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **South Screenline – South of S. King Street** | | | | | | |
| 515,800 | 559,000 | 561,500 | 565,500 | 565,100 | 572,800 | 566,800 |
| **Central Screenline – North of Seneca Street** | | | | | | |
| 447,500 | 491,100 | 490,800 | 498,600 | 492,800 | 502,200 | 487,900 |
| **North Screenline – North of Thomas Street** | | | | | | |
| 538,000 | 578,000 | 572,200 | 569,200 | 559,200 | 569,600 | 556,300 |

Exhibit 5-7 shows that vehicle volumes would be substantially lower across all three screenlines with the Viaduct Closed. Vehicle volumes would decrease with the Viaduct Closed because SR 99 would not be replaced through downtown, which would substantially reduce roadway capacity.

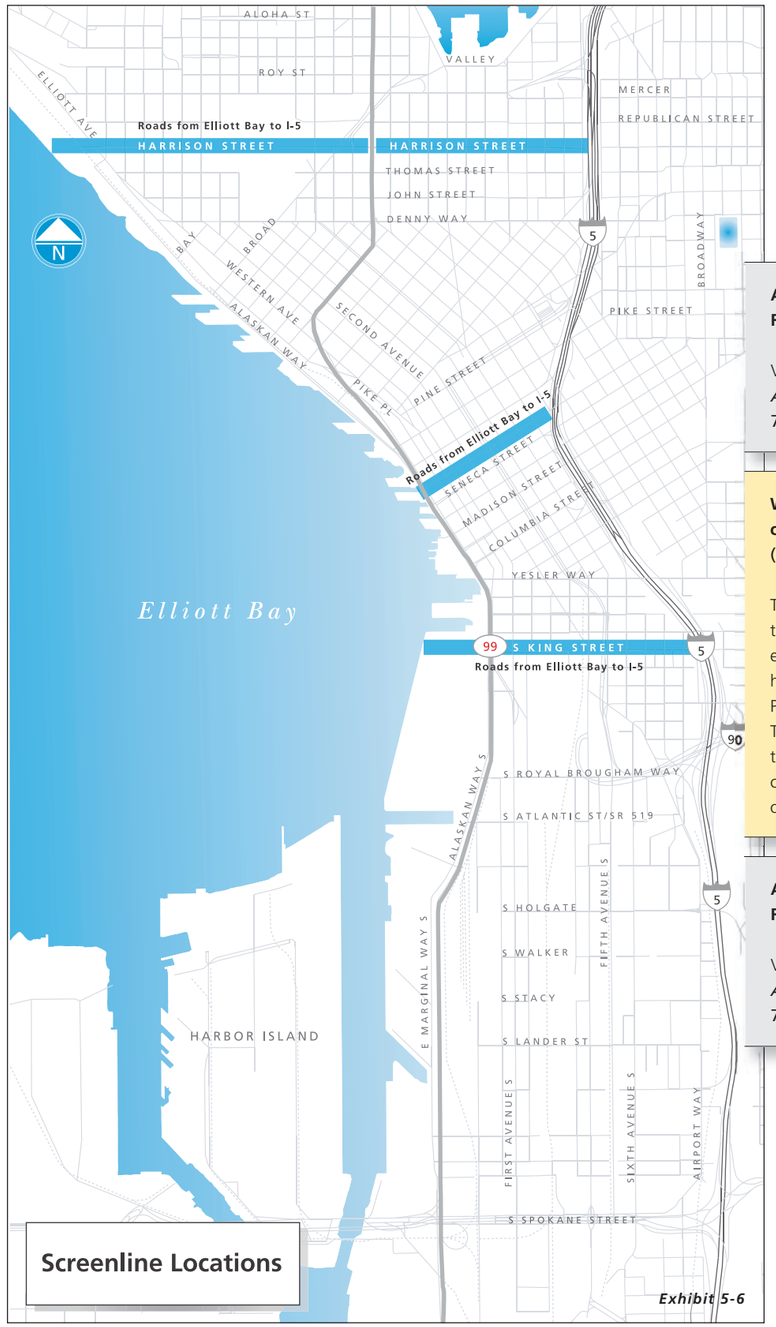



***Exhibit 5-6***

**Appendix C, Transportation Discipline Report**

Vehicle Hours of Travel is discussed in *Appendix C*, Sections 5.1.2, 7.2.1.2, 7.2.2.2, and 7.2.3.2.

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

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

**Appendix C, Transportation Discipline Report**

Vehicle Hours of Delay is discussed in *Appendix C*, Sections 5.1.3, 7.2.1.3, 7.2.2.3, and 7.2.3.3.

Across the south and central screenlines, differences in vehicle volumes among the tolled and non-tolled build alternatives vary by up to 2 percent. Vehicle volumes are expected to be highest with the Non-Tolled Elevated Structure across the south and central screenlines. Vehicle volumes would be highest with this alternative because it is the only alternative that provides ramps at Columbia and Seneca Streets that get travelers closer to desired destinations in central downtown.

Across the north screenline, differences in vehicle volumes among the tolled and non-tolled build alternatives vary by up to 4 percent. The Non-Tolled Bored Tunnel Alternative is expected to carry the highest vehicle volumes across the north screenline because the Battery Street Tunnel, just south of this location would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions for drivers, and vehicle volumes in this area would increase.

For the build alternatives, in nearly all cases, vehicle volumes for the non-tolled alternatives are expected to be higher than the tolled alternatives. These reductions in vehicle volumes across the transportation network for the tolled alternatives are likely attributed to people who choose to eliminate trips or change their destination to avoid proposed tolls.

***Vehicle Volumes for the Tolled and Non-Tolled Bored Tunnel***

In most cases, the Tolled Bored Tunnel is expected to carry fewer vehicles than the Non-Tolled Bored Tunnel. Small differences of 1 percent or less in vehicle volumes between the tolled and non tolled Bored Tunnel are likely attributed to people who choose to eliminate trips or change their destination to avoid tolls.

Across the south screenline, the Tolled Bored Tunnel is expected to carry slightly more vehicles than the Non-Tolled Bored Tunnel. Across the central screenline, the Tolled Bored Tunnel is expected to carry slightly fewer vehicles than the Non Tolled Bored Tunnel. However, in both cases differences are less than one half of 1 percent.

North of Denny Way, the Non Tolled Bored Tunnel is expected to carry about 1 percent more vehicles than the Tolled Bored Tunnel. These results indicate that tolling has very little effect on the total number of vehicles expected to travel in the project area; however, the distribution of traffic across SR 99, I-5 and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. The number of vehicles that would divert from SR 99 and the effects to other routes are discussed in Questions 6 through 11 in this chapter.

***Vehicle Volumes for the Tolled and Non-Tolled Cut-and-Cover Tunnel***

The Tolled Cut-and-Cover Tunnel is expected to carry fewer vehicles than the Non-Tolled Cut-and-Cover Tunnel. Small differences of up to 2 percent in vehicle volumes between the tolled and non tolled Cut-and-Cover Tunnel are likely attributed to people who choose to eliminate trips or change their destination to avoid tolls.

Across the south screenline, the Non-Tolled Cut-and-Cover Tunnel is expected to carry slightly more vehicles than the Tolled Cut-and-Cover Tunnel; however, differences are less than one half of 1 percent. Across the central screenline, the Non-Tolled Cut-and-Cover Tunnel is expected to carry about 1 percent more vehicles than the Tolled Cut-and-Cover Tunnel. North of Denny Way, the Non-Tolled Cut-and-Cover Tunnel is expected to carry about 2 percent more vehicles than the Tolled Cut-and-Cover Tunnel. These results indicate that tolling has very little effect on the total number of vehicles expected to travel in the project area; however, the distribution of traffic across SR 99, I-5 and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. The number of vehicles that would divert from SR 99 and the effects to other routes are discussed in Questions 6 through 11 in this chapter.

***Vehicle Volumes for the Tolled and Non-Tolled Elevated Structure***

The Tolled Elevated Structure is expected to carry fewer vehicles than the Non-Tolled Elevated Structure. Small differences in vehicle volumes of 2 percent or less between the tolled and non tolled Elevated Structure are likely attributed to people who choose to eliminate trips or change their destination to avoid tolls.

Across the south screenline, the Non-Tolled Elevated Structure is expected to carry about 1 percent more vehicles than the Tolled Elevated Structure. Across the central screenline, the Non-Tolled Elevated Structure is expected to carry about 3 percent more vehicles than the Tolled Elevated Structure. North of Denny Way, the Non-Tolled Elevated Structure is expected to carry about 2 percent more vehicles than the Tolled Elevated Structure. These results indicate that tolling has very little effect on the total number of vehicles expected to travel in the project area; however, the distribution of traffic across SR 99, I-5 and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. The number of vehicles that would divert from SR 99 and the effects to other routes are discussed in Questions 6 through 11 in this chapter.

**Person Throughput at Screenlines**

Person throughput is similar to assessing vehicle volumes, though the output focuses on the number of people traveling through the transportation network at specific screenlines rather than the vehicle volumes. Person throughput was evaluated for the alternatives at the same locations as vehicle volumes, and the results of the analysis are shown in Exhibit 5-8.

***Exhibit 5-8***
**2030 Person Throughput at Screenlines**
*Daily Volume*

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

**Appendix C, Transportation Discipline Report**

Screenline vehicle volumes and analysis are discussed in *Appendix C*, Sections 5.1.5, 7.2.1.5, 7.2.2.5 and 7.2.3.5.

Person throughput at screenlines is discussed in *Appendix C*, Sections 5.1.4, 7.2.1.4, 7.2.2.4, and 7.2.3.4.

The results for the person throughput analysis show similar trends as those discussed earlier in Question 5 for vehicle volumes. Because these trends were discussed in the previous section, this text provides an overview of the results with less detail.

Exhibit 5-8 shows that person throughput would be substantially lower across all three screenlines with the Viaduct Closed. Person throughput would decrease with the Viaduct Closed because SR 99 would be closed for safety reasons, which would reduce total person throughput through Seattle's transportation network.

Across the south and central screenlines, differences in person throughput among the tolled and non-tolled build alternatives vary by as much as to 2 percent. Person throughput is expected to be highest with the Non-Tolled Elevated Structure across the south and central screenlines. Person throughput would be highest with this alternative because it provides more access to and from SR 99 than any of the build alternatives evaluated.

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

For the build alternatives, in nearly all cases, person throughput for the non-tolled alternatives is expected to be higher than for the tolled alternatives. However, person throughput varies between the tolled and non-tolled build alternatives by a small amount (3 percent or less), which suggests that tolling has very little effect on the total number of people expected to use the transportation network in the project area; however, the distribution of traffic across SR 99, I-5, and city streets would change if SR 99 is tolled because fewer drivers would travel on SR 99 and are expected to divert to I-5 and city streets. Reductions in person throughput across the transportation network for the tolled alternatives are likely attributed to people who choose to eliminate trips or change their destination to avoid proposed tolls.

### 6 How would SR 99 mainline and ramp volumes compare?

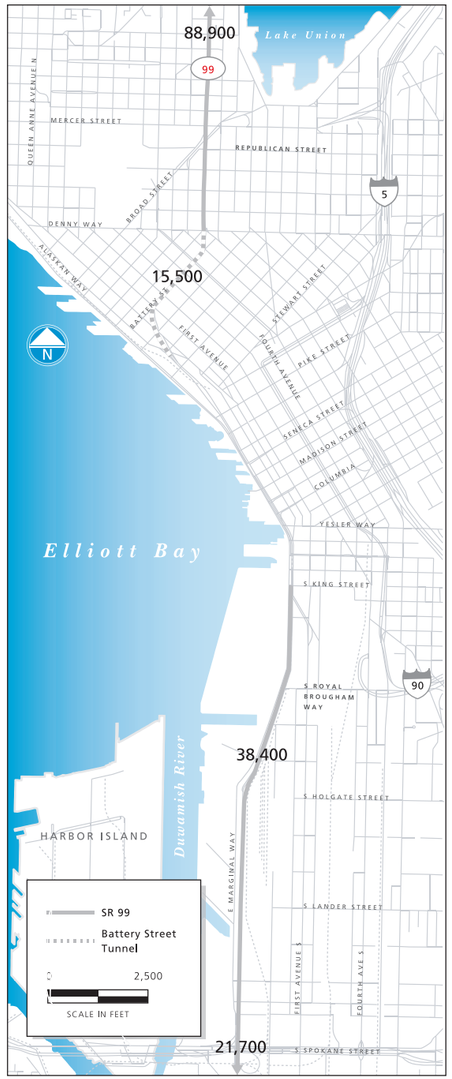
Exhibits 5-9 and 5-10 compare average daily traffic volumes on the SR 99 mainline and ramps. If SR 99 is not tolled, daily traffic volumes on SR 99 through the south and central sections are projected to be lower for the Bored Tunnel than for the other alternatives, because the Columbia and Seneca ramps and the Elliott and Western ramps would be removed and access would be provided at different locations. North of Virginia Street, near the Battery Street Tunnel, SR 99 daily volumes with the Non-Tolled Bored Tunnel are expected to be higher than with the other alternatives. Traffic volumes would increase near the current location of the Battery Street Tunnel, because the Battery Street Tunnel would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less-abrupt curves. This would improve conditions for drivers, and additional traffic would be expected to use the tunnel.

Even though SR 99 volumes are expected to decrease in the southern and central sections with the Non-Tolled Bored Tunnel Alternative, vehicle volumes across the transportation system are expected be similar among all of the build alternatives. As discussed previously in Question 5 and shown in Exhibit 5-7, the Non-Tolled Bored Tunnel is expected to carry fewer vehicles each day (about 2 to 2.5 percent) than the Non Tolled Cut-and-Cover Tunnel and Elevated Structure.

If SR 99 is tolled, SR 99 mainline and ramp volumes would change substantially, since many drivers are expected to divert from SR 99 to other routes such as I-5 and city streets to avoid the toll. For each of the tolled alternatives, tolls would only be charged for through trips, so many northbound drivers are expected to divert from SR 99 near the stadiums or avoid SR 99 by getting on north of

**2030 SR 99 Mainline Volumes**

*Viaduct Closed*




*Non-Tolled Bored Tunnel*


**Appendix C, Transportation Discipline Report**

SR 99 vehicle and ramp volumes are discussed in ***Appendix C***, **Sections 5.2.1, 7.3.1.1, 7.3.2.1,** and **7.3.3.1**.

## 2030 SR 99 Mainline Volumes

*Tolled Bored Tunnel*


*Non-Tolled Cut-&-Cover Tunnel*


*Tolled Cut-&-Cover Tunnel*


*Non-Tolled Elevated Structure*


*Tolled Elevated Structure*


***Exhibit 5-9***

Denny Way. Similarly, many southbound drivers are expected to divert from SR 99 north of Denny Way or avoid SR 99 by getting on near or south of the stadiums. Tens of thousands of drivers are expected to divert, and much of this diversion is expected to occur during off-peak travel times when other routes, such as city streets and I-5, are able to accommodate additional vehicles. These added vehicles could increase the number of hours that city streets and I-5 are congested each day. In order to avoid major disruption of traffic patterns and to protect the integrity and viability of adjacent activities on the waterfront and in downtown Seattle, WSDOT and the City will implement a long-term tolling solution to minimize the amount of diverted traffic to optimize operation of the transportation network as described in Chapter 8, Question 1. For the tolled alternatives, the Elevated Structure is expected to carry the highest vehicle volumes in the south and central areas, followed by the Bored Tunnel and Cut-and-Cover Tunnel. North of Virginia Street, the Tolled Bored Tunnel is expected to carry the most vehicles, because the Battery Street Tunnel would be closed and replaced with the new bored tunnel, which would have wider lanes and shoulders and less abrupt curves.

### 7 How would traffic conditions on I-5 compare?

I-5 vehicle volumes south of SR 520 show less than a 1 percent difference among the alternatives, as shown in Exhibit 5-11. I-5 vehicle volumes for the Viaduct Closed show up to a 5 percent increase over the proposed build alternatives near Seneca Street and south of I-90. This increase is to be expected, since SR 99 would be closed. For the non-tolled alternatives, I-5 vehicle volumes show very little variation among the build alternatives (less than one half of 1 percent) near Seneca Street and south of I-90. If the build alternatives are tolled, additional vehicles are expected to divert to I-5 near Seneca and south of I-90. Near Seneca Street, traffic volumes on I-5 would increase by about 4 percent for the tolled build alternatives compared to the non-tolled build alternatives. I-5 volumes south of I-90 are expected to increase by 2 or 3 percent with the tolled build alternatives. Trips that divert to I-5 because of tolls on SR 99 are expected to divert primarily during off-peak travel times when I-5 can accommodate additional vehicles. Additional traffic on I-5 during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route.

***Exhibit 5-11***
**I-5 Daily Vehicle Volumes in 2030**

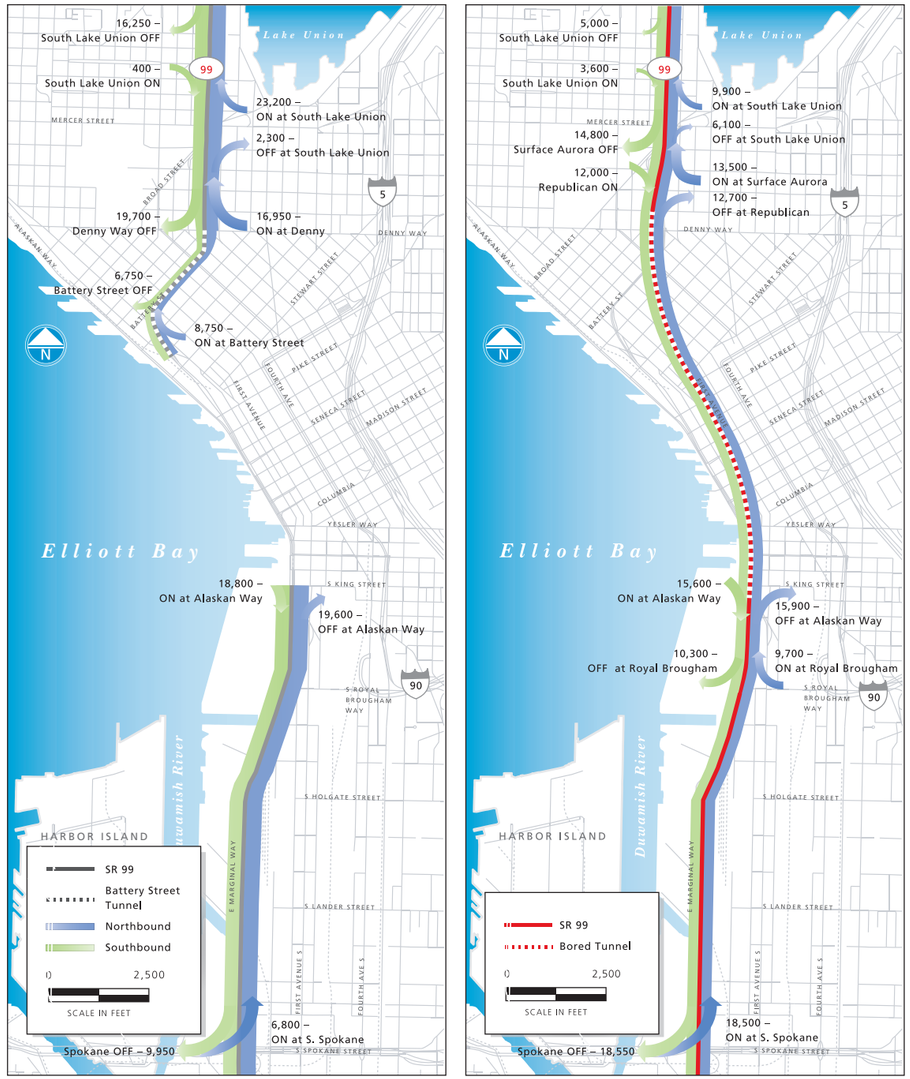
| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **I-5 Just South of I-90** | | | | | | |
| 281,900 | 268,200 | 276,700 | 268,200 | 277,100 | 266,700 | 273,000 |
| **I-5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

### 8 How would traffic conditions on area streets compare?

Exhibits 5-12 and 5-13 show the intersections that would operate with congested conditions for the tolled and non-tolled build alternatives. Exhibits 5-14 and 5-15 indicate the number of congested intersections for the tolled and non-tolled build alternatives. If the build alternatives are tolled, increased congestion and delay is expected at many intersections in the project area. This congestion and delay would be caused by higher volumes of vehicles expected on city streets as drivers choose to divert from SR 99 to avoid tolls. The text in Questions 9, 10, and 11 explains how daily vehicle volumes would increase on city streets in the south, central, and north project areas if the build alternatives were tolled, and the effects of these increases. The effects of vehicle volume increases due to tolling would be most pronounced in the central (or downtown) area. If the build alternatives are tolled, effects to surface streets would be mitigated as discussed in Chapter 8, Question 1.

## 2030 SR 99 Ramp Volumes

*Viaduct Closed* | *Non-Tolled Bored Tunnel*

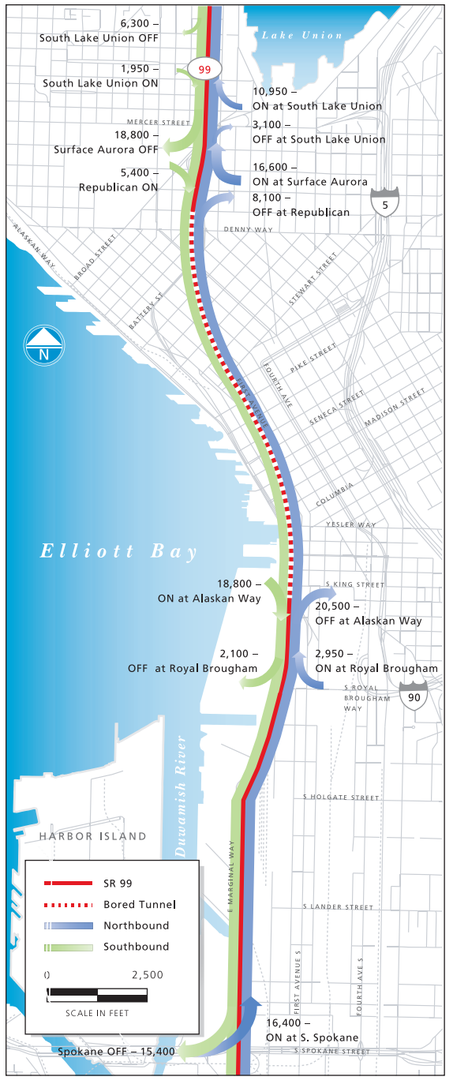



**Appendix C, Transportation Discipline Report**

Vehicle volumes on I-5 are presented in *Appendix C*, Sections 5.1.6, 7.2.1.6, 7.2.2.6, and 7.2.3.6.

## 2030 SR 99 Ramp Volumes

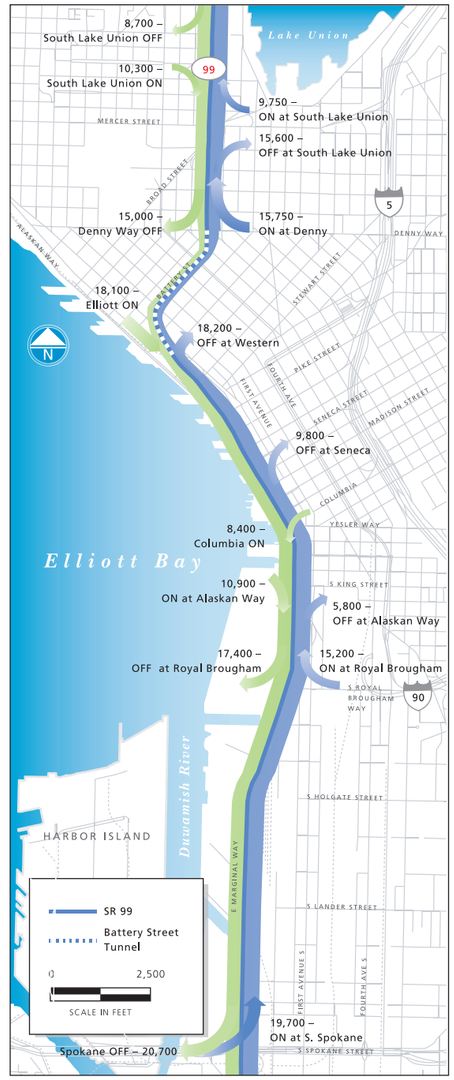
*Tolled Bored Tunnel*




*Non-Tolled Cut-&-Cover Tunnel*


*Tolled Cut-&-Cover Tunnel*


*Non-Tolled Elevated Structure*




*Tolled Elevated Structure*

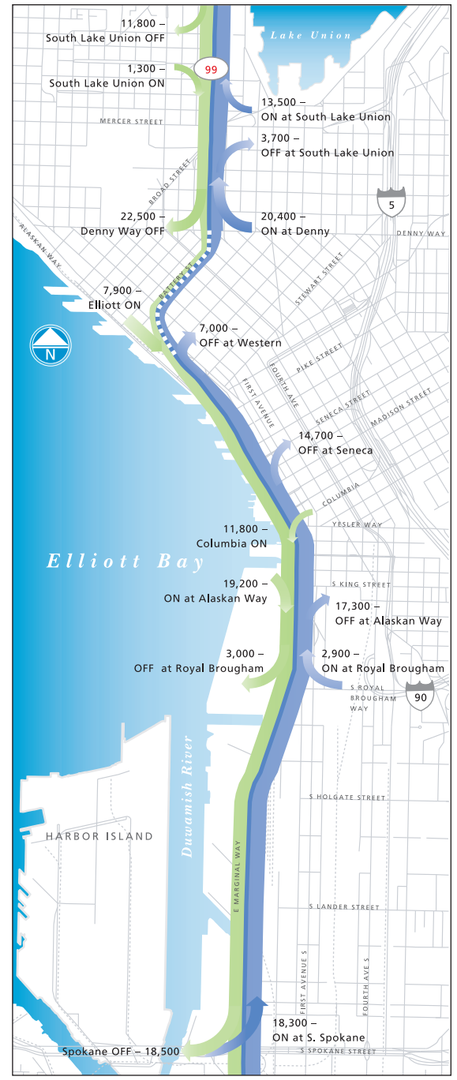



*Exhibit 5-10*

*Exhibit 5-14*
**Congested Intersections during the AM Peak Hour[1]**

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

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

*Exhibit 5-15*
**Congested Intersections during the PM Peak Hour[1]**

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

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

### 9 How would conditions compare on city streets south of S. King Street?

Exhibit 5-16 shows the location of screenlines and Exhibit 5-17 shows expected daily vehicle volumes on city streets south of S. King Street for the alternatives.

*Exhibit 5-17*
**2030 Daily Vehicle Volumes for Screenlines South of S. King Street**
*Daily Volume*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Streets just north of S. Spokane Stree between the Duwamish River & I-5** | | | | | | |
| 139,300 | 117,000 | 128,100 | 115,900 | 129,300 | 115,000 | 122,600 |
| **Streets just south of S. King Street between SR 99 & I-5** | | | | | | |
| 124,100 | 109,400 | 124,100 | 98,200 | 119,900 | 94,600 | 116,800 |

***Expected Conditions for the Non-Tolled Build Alternatives***
For the non-tolled build alternatives, vehicle volumes on city streets in the south are expected to be slightly higher for the Bored Tunnel than the other two build alternatives as shown in Exhibit 5-17. The reason for this is that the Bored Tunnel does not provide ramps to Elliott and Western Avenue, which would cause more drivers to travel on city streets. Despite increased traffic volumes on city streets with the Non-Tolled Bored Tunnel, a similar number of intersections are expected to be congested as the other build alternatives, as shown in Exhibit 5-18.

*Exhibit 5-18*
**Congested Intersections in the South Area[1]**
*South of S. King Street*

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **AM Peak Hour** | 3 | 1 | 6 | 4 | 4 | 3 |
| **PM Peak Hour** | 4 | 5 | 2 | 6 | 2 | 7 |

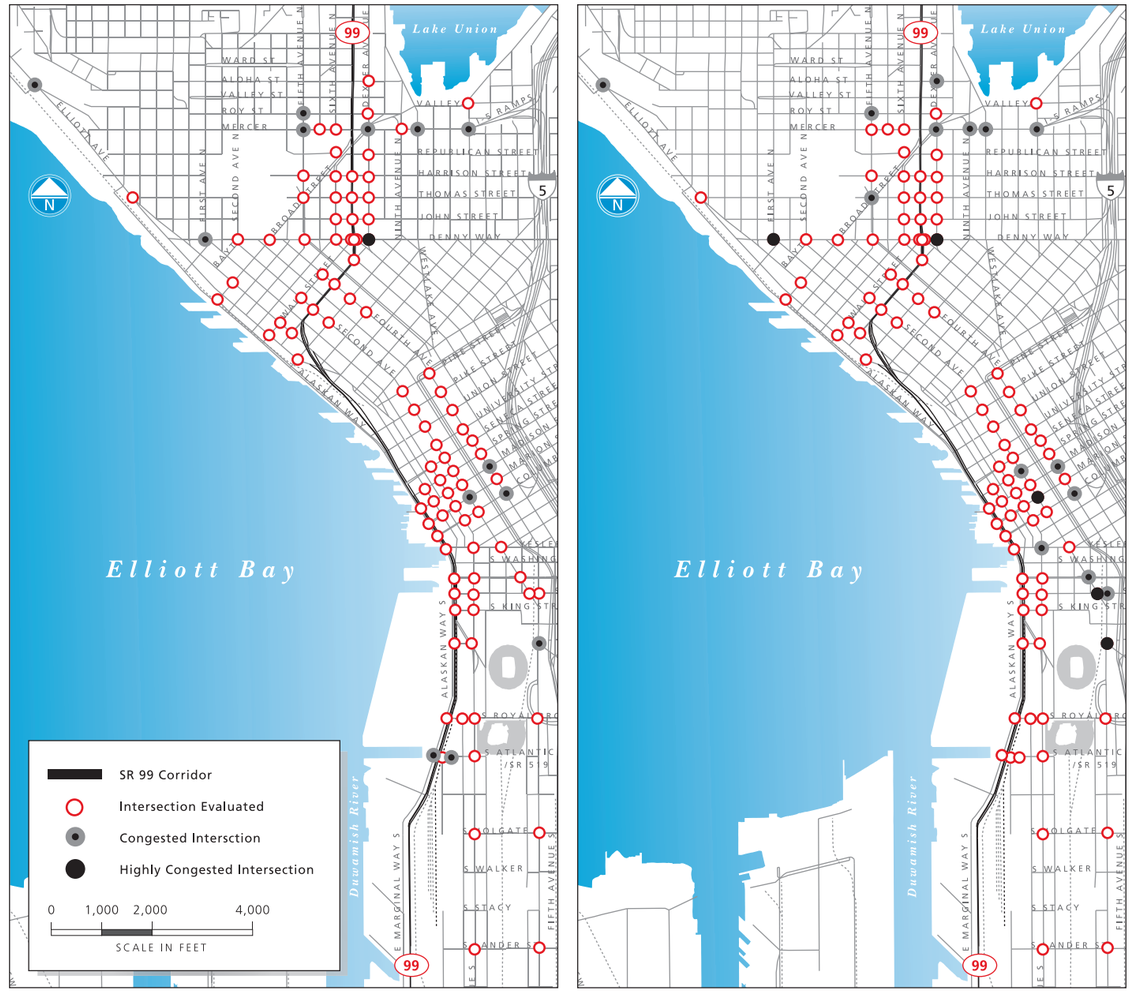
1 *Information is not provided for Viaduct Closed because conditions would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of the number of congested intersections are not appropriate.*

***Expected Conditions for the Tolled Build Alternatives***
Exhibit 5-17 shows that vehicle volumes on city streets in the south are expected to increase by several thousand vehicles per day if the build alternatives are tolled. However, the total number of congested intersections is expected to decrease during the morning commute by one or two intersections if SR 99 is tolled. Intersections along S. Atlantic Street are expected to be less congested if SR 99 is tolled because fewer vehicles would use the on-ramp in this area to get onto SR 99. Instead, many drivers would avoid this on-ramp and use non-tolled routes to reach their destinations.

During the evening commute, a similar number of intersections are expected to be congested with Tolled Bored Tunnel as compared to the Non-Tolled Bored Tunnel. For the other build alternatives, four or five additional intersections are expected to be congested if the build alternatives were tolled. For all of the tolled build alternatives, the location of the congestion would shift from the streets located near the SR 99 ramps to the intersection of Fourth Avenue S. and Airport Way and intersections on First Avenue if the build alternatives were tolled. Congestion would shift due to fewer vehicles using the SR 99 ramps to avoid paying tolls on SR 99.

## 2030 Congested Intersections – AM Peak Hour[1]

*Non-Tolled Bored Tunnel* | *Tolled Bored Tunnel*




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

**Congested Intersections for Viaduct Closed**

As discussed in **Question 1** of this chapter, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore, predictions of intersection conditions are not appropriate and are not shown in exhibits.

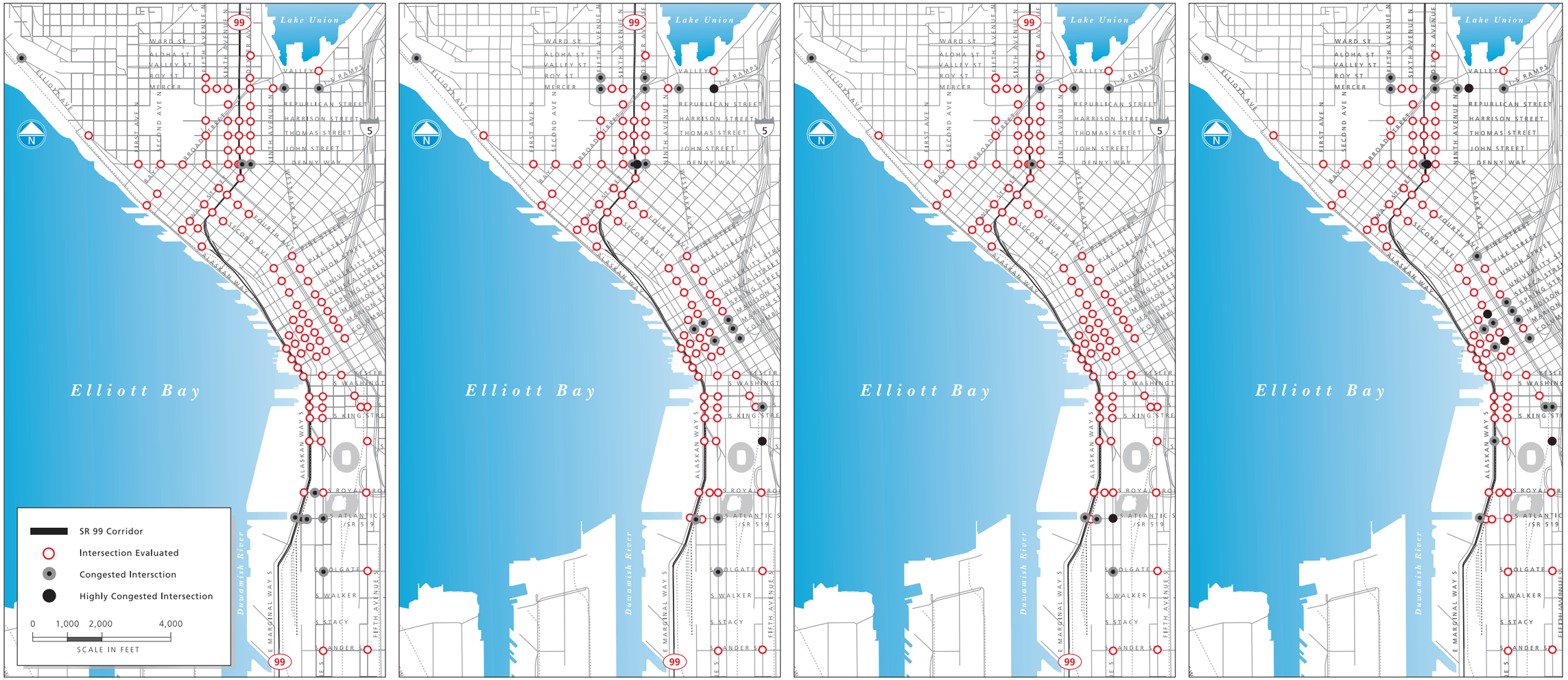
## 2030 Congested Intersections – AM Peak Hour[1]

*Non-Tolled Cut-&-Cover Tunnel*

*Tolled Cut-&-Cover Tunnel*

*Non-Tolled Elevated Structure*

*Tolled Elevated Structure*




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

***Exhibit 5-12***

**Appendix C, Transportation Discipline Report**

Congested intersections are discussed in ***Appendix C***, Sections 5.3 and 7.4.

## 10 How would conditions compare for Alaskan Way and streets north of S. King Street?

### Conditions on Alaskan Way

Exhibit 5-19 shows expected daily vehicle volumes on Alaskan Way.

*Exhibit 5-19*
**Daily Vehicle Volumes on Alaskan Way in 2030**

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

***Expected Conditions for the Non-Tolled Build Alternatives***

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

***Expected Conditions for the Tolled Build Alternatives***

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

Even though daily vehicle volumes on Alaskan Way would substantially increase if SR 99 is tolled, these increases are not expected to substantially increase intersection congestion on Alaskan Way during peak travel hours as indicated previously in Exhibits 5-12 and 5-13.

### Conditions on Streets North of Seneca Street

Exhibit 5-20 shows expected daily vehicle volumes on city streets just north of Seneca Street for the alternatives.

*Exhibit 5-20*
**Daily Vehicle Volumes in 2030 for Screenlines North of Seneca Street**
*Daily Volume*

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

***Expected Conditions for the Non-Tolled Build Alternatives***

For the non-tolled build alternatives, the Bored Tunnel is expected to have higher daily vehicle volumes on city streets north of Seneca Street. Increased vehicle volumes are expected on city streets north of Seneca Street due to access changes proposed with the Non-Tolled Bored Tunnel Alternative that would eliminate the Elliott and Western ramps. Increased vehicle volumes on city streets through downtown are expected to result in a few additional congested intersections for the Non-Tolled Bored Tunnel, as compared to the other two build alternatives. During the morning commute, three additional congested intersections are expected through downtown and one to three additional intersections are expected to be congested during the evening commute as indicated in Exhibits 5-12, 5-13, and 5-21. Travel times in the general purpose travel lanes on Second and Fourth Avenues are expected to be up to 2 minutes longer with the Non-Tolled Bored Tunnel Alternative as compared to the other build alternatives, as shown in Exhibits 5-22 and 5-23.

## 2030 Congested Intersections – PM Peak Hour[1]

*Non-Tolled Bored Tunnel*


*Tolled Bored Tunnel*


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

**What are congested and highly congested intersections?**

For the traffic analysis conducted for this project, congested intersections are intersections that may cause drivers considerable delay. A driver might wait about 1 or 2 minutes to travel through a traffic signal at a congested intersection. At a highly congested intersection, a driver might wait 2 minutes or more to get through the traffic signal. Traffic analysts use the phrase Level of Service (LOS) to describe intersection delay. The information presented on congested intersections in this text captures intersections expected to operate at LOS E and F in 2030.

## 2030 Congested Intersections – PM Peak Hour[1]

*Non-Tolled Cut-&-Cover Tunnel*

*Tolled Cut-&-Cover Tunnel*

*Non-Tolled Elevated Structure*

*Tolled Elevated Structure*


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

***Exhibit 5-13***

***Exhibit 5-21***
**Congested Intersections in the Central Area**
*S. King Street to Denny Way*[1]

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| AM Peak Hour | 3 | 8 | 0 | 7 | 0 | 12 |
| PM Peak Hour | 6 | 13 | 3 | 9 | 5 | 19 |

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

***Exhibit 5-22***
**AM Peak Hour Travel Times for the General Purpose Lanes on Second & Fourth Avenues**[1]
*in Minutes*

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Second Avenue – Wall Street to S. Royal Brougham Way** | | | | | | |
| Southbound | 15 | 20 | 14 | 20 | 14 | 21 |
| **Fourth Avenue – S. Royal Brougham Way to Battery Street** | | | | | | |
| Northbound | 12 | 21 | 12 | 21 | 12 | 21 |

***Exhibit 5-23***
**PM Peak Hour Travel Times for the General Purpose Lanes on Second & Fourth Avenues**[1]
*in Minutes*

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

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

***Expected Conditions for the Tolled Build Alternatives***

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

Among the tolled build alternatives, congestion is expected to increase and cause drivers considerable delay during the morning and evening commutes at multiple intersections as indicated in Exhibits 5-12, 5-13, and 5-21. Most of these intersections are located on Second and Fourth Avenues. As a result, travel times in the general purpose travel lanes on Second and Fourth Avenues are expected to increase by 5 to 9 minutes during peak commute hours. Travel times for the tolled build alternatives are expected to be similar among the tolled build alternatives, as indicated in Exhibits 5-22 and 5-23.

### 11 How would conditions compare for streets from Denny Way north?

Exhibit 5-24 shows expected daily vehicle volumes on city streets north of Thomas Street for the alternatives.

***Exhibit 5-24***
**Daily Vehicle Volume in 2030 for Screenlines North of Thomas Street**
*Daily Volume*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Streets between Elliott & Aurora Avenue, north of Thomas Street** | | | | | | |
| 113,700 | 92,200 | 107,300 | 95,000 | 106,600 | 95,700 | 107,800 |
| **Streets between Aurora Avenue & I-5, north of Thomas Street** | | | | | | |
| 79,500 | 89,800 | 93,500 | 87,800 | 93,500 | 87,300 | 95,200 |

***Expected Conditions for the Non-Tolled Build Alternatives***

For the non-tolled build alternatives, daily vehicle volumes on streets north of Thomas Street are expected to be similar, as shown in Exhibit 5-24. The Non-Tolled Bored Tunnel is expected to have a similar number of congested intersections as the other build alternatives during the evening commute, and three additional congested intersections during the morning commute, as shown in Exhibits 5-12 and 5-13 and listed in Exhibit 5-25. During the morning commute, additional congestion and congested intersections are expected on Mercer Street with the Non-Tolled Bored Tunnel because more vehicles are expected to travel on this route to travel to and from


***Exhibit 5-16***

northwest Seattle due to the loss of the Elliott and Western ramp connections to SR 99.

Travel times on Mercer Street vary somewhat among the non-tolled build alternatives during the morning and evening commute, as shown in Exhibits 5-26 and 5-27. These variations are due to the different roadway configurations proposed for the Non-Tolled Bored Tunnel Alternative as compared to the proposed design for the Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives. The different roadway designs lead to different traffic patterns, which may vary travel times and routing.

***Exhibit 5-25***
**Congested Intersections from Denny Way North[1]**

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| AM Peak Hour | 8 | 10 | 5 | 10 | 5 | 10 |
| PM Peak Hour | 9 | 17 | 9 | 14 | 9 | 13 |

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

***Exhibit 5-26***
**AM Peak Hour Travel Times on Mercer Street[1]**
*in Minutes*

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **Mercer Street – I-5 to Elliott Avenue** | | | | | | |
| Westbound | 12 | 12 | 8 | 8 | 9 | 10 |
| Eastbound | 8 | 9 | 9 | 9 | 10 | 11 |

***Exhibit 5-27***
**PM Peak Hour Travel Times on Mercer Street[1]**
*in Minutes*

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED- | TOLLED |
| **Mercer Street – I-5 to Elliott Avenue** | | | | | | |
| Westbound | 14 | 13 | 11 | 12 | 11 | 12 |
| Eastbound | 13 | 15 | 16 | 18 | 15 | 15 |

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

### *Expected Conditions for the Tolled Build Alternatives*

If the build alternatives are tolled, daily vehicle volumes on city streets north of Denny Way are expected to increase by several thousand vehicles per day as drivers divert from SR 99 to avoid paying tolls. Vehicle volumes at screenlines are expected to be similar among the tolled build alternatives.

Increased vehicle volumes on streets north of Denny Way will increase congestion and cause drivers considerable delay at multiple intersections, as indicated in Exhibits 5-12, 5-13, and 5-25. The effects of increased congestion would be most pronounced during the evening commute as drivers leave downtown and avoid paying tolls on SR 99 by connecting to it north of Denny Way. As shown in Exhibits 5-26 and 5-27, travel times on Mercer would stay the same or increase by a minute or two if the build alternatives were tolled.

## 12 How would SR 99 travel speeds compare?

### Travel Speeds Overview

Exhibit 5-28 compares average SR 99 travel speeds for the build alternatives.

***Exhibit 5-28***
**Average SR 99 Travel Speeds During Peak Hours in 2030[1]**

| | Southbound | | Northbound | |
|---|---|---|---|---|
| | PEAK HOURS | | | |
| Alternative | AM | PM | AM | PM |
| Non-Tolled Bored Tunnel | 41 | 38 | 41 | 38 |
| Tolled Bored Tunnel | 37 | 40 | 36 | 40 |
| Non-Tolled Cut-&-Cover Tunnel | 32 | 39 | 40 | 34 |
| Tolled Cut-&-Cover Tunnel | 34 | 36 | 33 | 38 |
| Non-Tolled Elevated Structure | 36 | 38 | 39 | 39 |
| Tolled Elevated Structure | 35 | 36 | 30 | 31 |

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

Among the non-tolled build alternatives, the Bored Tunnel is expected to operate with average SR 99 travel speeds that are equal to or faster than speeds for the Cut-and-Cover Tunnel and the Elevated Structure Alternatives. Because the Non-Tolled Bored Tunnel would have fewer access points, SR 99 volumes are expected to be lower than for the other build alternatives, which would increase speeds. Fewer access points also result in fewer weaving motions than other build alternatives, which would improve traffic flow and increase traffic speeds. Finally, the Non-Tolled Bored Tunnel replaces the Battery Street Tunnel with a new tunnel that has wider lanes and shoulders and less-abrupt curves, which will increase speeds on this section of SR 99.

For the same reasons discussed above, the Tolled Bored Tunnel is expected to operate with average SR 99 travel speeds that are equal to or faster than speeds for the Tolled Cut-and-Cover Tunnel and the Tolled Elevated Structure Alternatives.

Travel speeds for the build alternatives for specific sections of SR 99 are shown in Exhibits 5-29 and 5-30 and explained in the text below. For all of the build alternatives, drivers will experience slowing in the stadium area and north of the Battery Street Tunnel if SR 99 is tolled. Congestion is expected to increase in these areas and slow travel speeds as drivers exit SR 99 to avoid paying a toll to travel through downtown.

### Travel Speeds for the Tolled and Non-Tolled Bored Tunnel

Drivers will experience slowing at the tunnel portals during peak travel hours if the Bored Tunnel is tolled because many drivers are projected to exit SR 99 to avoid paying the toll. Because of this, traffic queues are expected to increase at the on and off-ramps near the tunnel portals during peak commute hours, which will increase congestion and reduce speeds. Once drivers are in the tunnel, they will be able to travel slightly faster through the Tolled Bored Tunnel, because it would carry fewer vehicles than the Non-Tolled Bored Tunnel.

During the morning commute, drivers would experience slower travel speeds with a Tolled Bored Tunnel than with the Non Tolled Bored Tunnel for northbound trips heading into downtown from the south. For this direction of traffic, travel speeds are projected to be 26 miles per hour for the Tolled Bored Tunnel and 45 miles per hour for the Non-Tolled Bored Tunnel. Slower travel speeds are also expected for the Tolled Bored Tunnel than the Non-Tolled Bored Tunnel for southbound trips heading into downtown from north of Denny Way. For this direction of traffic, travel speeds are expected to be

**Travel Speeds for Viaduct Closed**

As discussed in **Question 1** of this chapter, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore predictions of travel speeds are not appropriate and are not shown in exhibits.

**Appendix C, Transportation Discipline Report**

Travel speeds are discussed in *Appendix C*, Sections 5.2.3, 7.3.1.3, 7.3.2.3, and 7.3.3.3.

18 miles per hour for the Tolled Bored Tunnel and 30 miles per hour for the Non-Tolled Bored Tunnel. During the evening commute, travel speeds are expected to be similar for the Bored Tunnel with or without tolls.

**Travel Speeds for the Tolled and Non-Tolled Cut-and-Cover Tunnel**

Drivers will experience slowing at the tunnel portals if the Cut-and-Cover Tunnel is tolled, because many drivers are projected to exit SR 99 to avoid paying the toll. Because of this, traffic queues are expected to increase at the on- and off-ramps near the tunnel portals, which will increase congestion and reduce speeds. Once drivers are in the tunnel, they will be able to travel slightly faster through a Tolled Cut-and-Cover Tunnel, because some traffic is expected to divert from the tunnel and use other routes to avoid the toll.

During the morning commute, slower travel speeds are expected for the Tolled Cut-and-Cover Tunnel than the Non-tolled Cut-and-Cover Tunnel for northbound trips heading into downtown from the south. For this direction of traffic, travel speeds are projected to be 17 miles per hour for the Tolled Cut-and-Cover Tunnel and 46 miles per hour for the Non-Tolled Cut-and-Cover Tunnel. During the evening commute, this same northbound trip is expected to be 35 miles per hour for the Tolled Cut-and-Cover Tunnel and 42 miles per hour for the Non-Tolled Cut-and-Cover Tunnel.

Slightly slower travel speeds are also expected for southbound traffic north of Denny Way. For this direction of traffic during the morning commute, speeds for the Tolled Cut-and-Cover Tunnel are expected to be 10 miles per hour and 16 miles per hour for the Non-Tolled Cut-and-Cover Tunnel. During the evening commute southbound travel speeds are expected to be 21 miles per hour for the Tolled Cut-and-Cover Tunnel and 33 miles per hour for the Non-Tolled Cut-and-Cover Tunnel.

**Travel Speeds for the Tolled and Non-Tolled Elevated Structure**

Like the other alternatives, drivers will experience slowing near the stadiums and north of Denny Way if the Elevated Structure is tolled, because many drivers are projected to exit SR 99 to avoid paying the toll. Because of this, traffic queues are expected to increase at the on- and off-ramps near the stadiums and north of Denny Way, which will increase congestion and reduce speeds. However, once drivers are on the elevated structure, they will be able to travel slightly faster if SR 99 is tolled, because some traffic is expected to divert from SR 99 to avoid the toll.

During the morning commute, slower travel speeds are expected for the Tolled Elevated Structure than the Non-Tolled Elevated Structure for northbound trips heading into downtown from the south. For this direction of traffic, travel speeds are projected to be 9 miles per hour for the Tolled Elevated Structure and 47 miles per hour if it is not tolled. During the evening commute, this same northbound trip is expected to be 10 miles per hour for the Tolled Elevated Structure and 47 miles per hour if it is not tolled. Substantially decreased travel speeds for the Tolled Elevated Structure in this location is due to long queues of vehicles that are expected to increase congestion near the south end ramps, which will back traffic up onto the SR 99 mainline, substantially reducing speeds in this area.

Slightly slower travel speeds are also expected for southbound traffic north of Denny Way. For this direction of traffic during the morning commute, speeds are expected to be 10 miles per hour for the Tolled Elevated Structure and 16 miles per hour for the Non-Tolled Elevated Structure. During the evening commute, southbound travel speeds are expected to be 20 miles per hour for the Tolled Elevated Structure and 34 miles per hour if it is not tolled.

## 2030 SR 99 Travel Speeds – AM Peak Hour[1]

*Non-Tolled Bored Tunnel* | *Tolled Bored Tunnel*


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

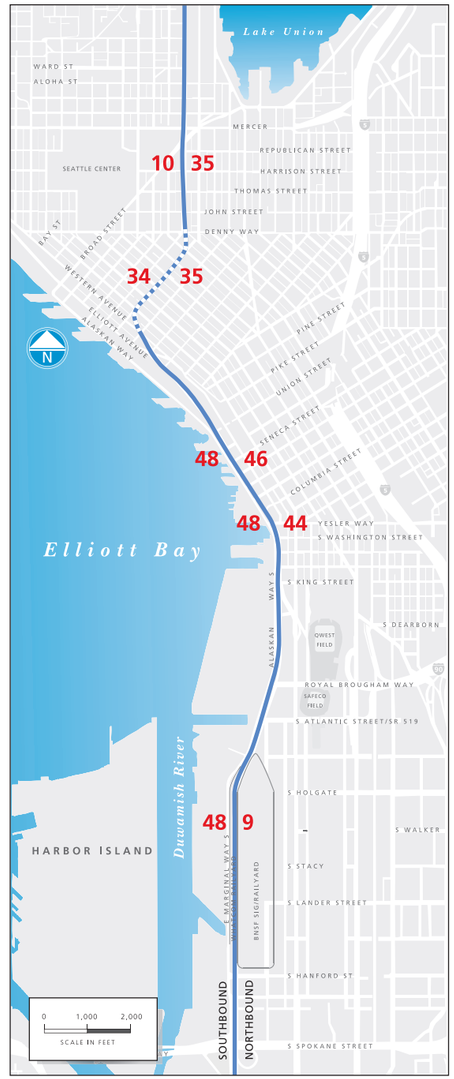
## 2030 SR 99 Travel Speeds – AM Peak Hour[1]

*Non-Tolled Cut-&-Cover Tunnel*


*Tolled Cut-&-Cover Tunnel*


*Non-Tolled Elevated Structure*


*Tolled Elevated Structure*




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

***Exhibit 5-29***

## 13 How would SR 99 travel times compare?

### SR 99 Travel Times Overview

Travel times for key routes during the AM and PM peak hours are shown in Exhibit 5-31. In most cases, travel times are expected to be longer with the tolled alternatives than the non-tolled alternatives. Tolling is expected to increase travel times because many vehicles are expected to divert to surface streets using SR 99 ramps near the stadiums and north of Denny Way to avoid the toll. This diversion will increase congestion in these sections of SR 99, which will increase travel times.

### West Seattle Trips to and from Downtown

During the morning commute, drivers heading in to downtown Seattle are expected to have similar travel times of 32 or 33 minutes with any of the tolled alternatives. During the evening commute, it is expected to take drivers using the Tolled Bored Tunnel 31 minutes to travel from downtown to West Seattle, compared to 29 and 25 minutes, respectively, for the Tolled Cut-and-Cover Tunnel and the Tolled Elevated Structure. Travel time differences among the alternatives are due largely to variations in downtown access between the alternatives. The Tolled Elevated Structure is expected to be the fastest trip because this alternative includes ramps at Columbia and Seneca, which is a more direct route to central downtown than the other two build alternatives.

For the non-tolled build alternatives, travel times from West Seattle to downtown during the morning commute are expected to be 26 minutes for the Non-Tolled Bored Tunnel compared to 23 and 20 minutes, respectively, for the Non-Tolled Cut-and-Cover Tunnel and Non-Tolled Elevated Structure. During the evening commute, travel times leaving downtown are expected to be 27 minutes for the Non-Tolled Bored Tunnel, compared to 24 minutes for the Non-Tolled Cut-and-Cover Tunnel and 22 minutes for the Non-Tolled Elevated Structure. Again, differences in travel times are mostly related to variations in access among the alternatives. Travel times are expected to be fastest for the Non-Tolled Elevated Structure because of the more direct access provided to central downtown by the Columbia and Seneca ramps.

### North Seattle Trips to and from Downtown

For the tolled alternatives, during the morning commute drivers heading from north Seattle into downtown are expected to have a travel time of 27 minutes with the Tolled Bored Tunnel, compared to a travel time of 32 and 35 minutes, respectively, with the Tolled Elevated Structure and Cut-and-Cover Tunnel. The Bored Tunnel is expected to have faster travel times due to additional street connections provided north of Denny Way, as compared to the other two build alternatives.

During the evening commute, drivers leaving downtown and heading to north Seattle are expected to have travel times of 23 minutes with the Tolled Bored Tunnel, as compared to 20 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure. The Tolled Bored Tunnel is expected to have increased travel times compared to the other two alternatives because of additional intersections located on Aurora Avenue from Denny Way to the northbound on-ramp to SR 99.

For the non-tolled alternatives, drivers heading from north Seattle into downtown during the morning commute are expected to have a travel time of 22 minutes with the Non Tolled Bored Tunnel, as compared to a travel time of 24 minutes with the Non-Tolled Cut-and-Cover Tunnel or Elevated Structure. As discussed previously, the Bored Tunnel is expected to be slightly faster due to additional street connections provided north of Denny Way as compared to the other two alternatives.

For the evening commute, drivers leaving downtown are expected to have similar travel times of 17 to 18 minutes with the non-tolled alternatives.

### SR 99 Through Trips

In most cases, SR 99 through trips are expected to be fastest for the Tolled or Non-Tolled Bored Tunnel Alternative as compared to the other tolled or non-tolled build alternatives. The Bored Tunnel is expected to have

## 2030 SR 99 Travel Speeds – PM Peak Hour[1]

*Non-Tolled Bored Tunnel* | *Tolled Bored Tunnel*


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

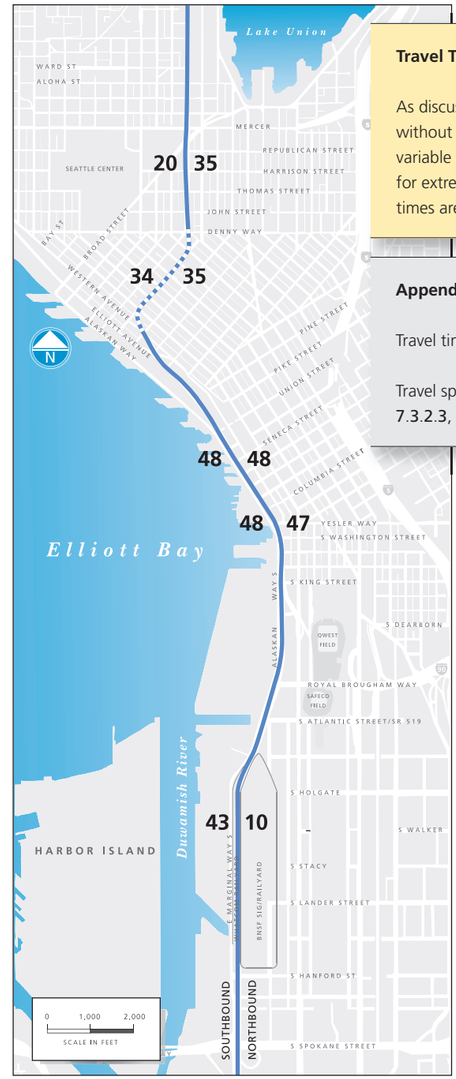
## 2030 SR 99 Travel Speeds – PM Peak Hour[1]

*Non-Tolled Cut-&-Cover Tunnel*


*Tolled Cut-&-Cover Tunnel*


*Non-Tolled Elevated Structure*


*Tolled Elevated Structure*




**Travel Times for Viaduct Closed**

As discussed in **Question 1** of this chapter, traffic conditions without the viaduct would be extremely congested, resulting in variable and unstable conditions. Traffic models are not designed for extremely congested conditions; therefore predictions of travel times are not appropriate and are not shown in exhibits.

**Appendix C, Transportation Discipline Report**

Travel times are discussed in *Appendix C*, Section 5.4 and 7.5.

Travel speeds are discussed in *Appendix C*, Sections 5.2.3, 7.3.1.3, 7.3.2.3, and 7.3.3.3.

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

***Exhibit 5-30***

## 2030 Travel Times Comparison

*NON-TOLLED/TOLLED*

### West Seattle Trips to and from Downtown

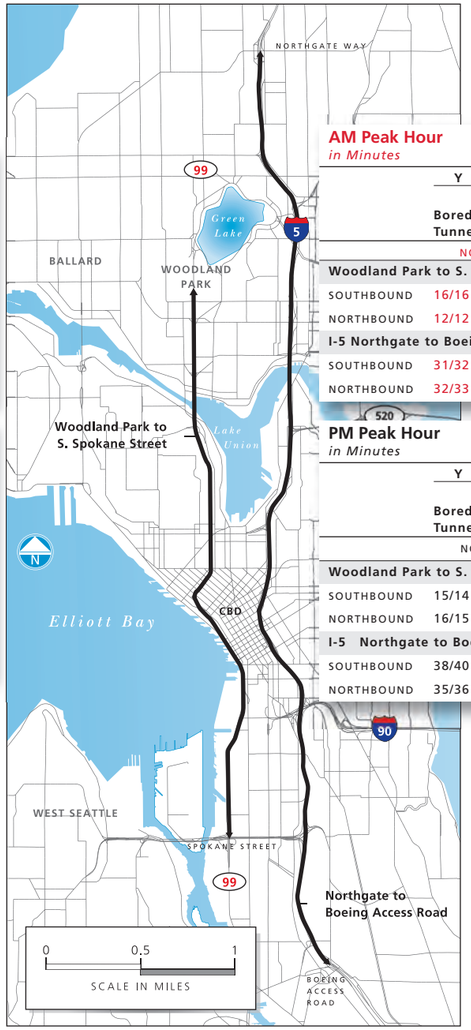

**AM Peak Hour**
*in Minutes*

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

**PM Peak Hour**
*in Minutes*

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

### North Seattle Trips to and from Downtown



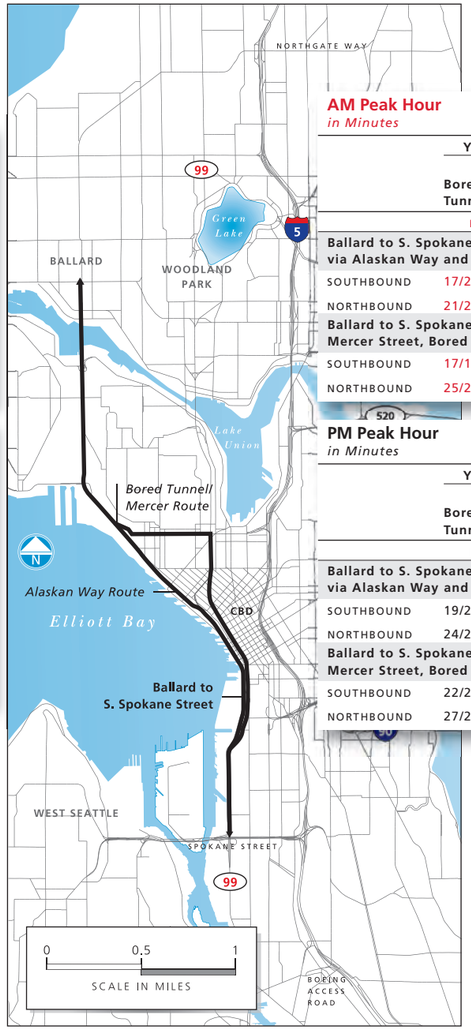

**AM Peak Hour**
*in Minutes*

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

**PM Peak Hour**
*in Minutes*

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

### SR 99 Through Trips




**AM Peak Hour**
*in Minutes*

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

**PM Peak Hour**
*in Minutes*

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

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

***Exhibit 5-31***

faster travel times for through trips because it would have fewer access points, which would reduce traffic volumes on SR 99. Fewer access points would also result in fewer weaving motions than other build alternatives, which reduce travel times. In addition, the Bored Tunnel replaces the Battery Street Tunnel with a new tunnel that has wider lanes and shoulders and less-abrupt curves, which will increase speeds on this section of SR 99.

For the tolled alternatives, SR 99 through trips are expected to be the fastest with the Tolled Bored Tunnel Alternative. During the morning commute, travel times for southbound trips are expected to be 16 minutes for the Tolled Bored Tunnel compared to 22 minutes and 21 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively. Travel times for northbound trips are expected to be 12 minutes for the Tolled Bored Tunnel compared with 14 and 22 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively.

During the evening commute, travel times for southbound traffic are expected to be 14 minutes for the Tolled Bored Tunnel compared with 16 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure. Northbound travel times are expected to be 15 minutes for the Tolled Bored Tunnel and Cut-and-Cover Tunnel and 19 minutes for the Tolled Elevated Structure. Travel times are expected to be slower with the Tolled Cut-and-Cover Tunnel and Elevated Structure because slower speeds are expected for these alternatives through downtown and near the stadiums and north of Denny Way, as compared to the Tolled Bored Tunnel.

For the non-tolled build alternatives, travel times for SR 99 through trips are expected to be fastest with the Non-Tolled Bored Tunnel, although differences among the non-tolled build alternatives are less pronounced than they are for the tolled alternatives. During the morning commute, travel times are expected to be 16 minutes for the Non-Tolled Bored Tunnel compared to 19 and 20 minutes for the Non-Tolled Elevated Structure and Cut-and-Cover Tunnel, respectively. Travel times for northbound trips are expected to be similar among the non tolled alternatives at 12 minutes for the Non-Tolled Bored Tunnel and Cut-and-Cover Tunnel and 13 minutes for the Non Tolled Elevated Structure.

During the evening commute, travel times for southbound traffic are expected to be 14 minutes for the Non-Tolled Cut and-Cover Tunnel compared with 15 minutes for the Non Tolled Bored Tunnel and Elevated Structure. Northbound travel times are expected to be 16 minutes for the Non-Tolled Bored Tunnel and Elevated Structure and 17 minutes for the Cut-and-Cover Tunnel.

**Northwest Seattle Trips through Downtown**

The Bored Tunnel Alternative with or without tolls does not replace the Elliott and Western ramps, which results in longer travel times for this alternative as compared to the Cut-and-Cover Tunnel and Elevated Structure Alternatives with or without tolls. With the Bored Tunnel, drivers could choose to get to northwest Seattle either by exiting SR 99 near the stadiums and continuing north on Alaskan Way, or they could choose to travel through the bored tunnel and exit SR 99 using ramps at Republican Street to connect with Mercer Street.

For the tolled alternatives, southbound travel times during the morning commute are expected to be 18 to 20 minutes for the Tolled Bored Tunnel compared to 15 and 16 minutes for the Tolled Elevated Structure and Cut-and-Cover Tunnel, respectively. Northbound trips are expected to take 24 to 27 minutes with the Tolled Bored Tunnel, compared to 17 and 26 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively. The Tolled Elevated Structure is expected to have longer travel times for this trip compared to the Tolled Cut-and-Cover Tunnel because of traffic back-ups expected due to the ramps at Columbia and Seneca Streets.

During the evening commute, southbound travel times ranging from 23 or 24 minutes are expected for the Tolled Bored Tunnel compared to 16 or 17 minutes for the Tolled Cut-and-Cover Tunnel or Elevated Structure, respectively. Northbound travel times of 27 minutes are expected for the Tolled Bored Tunnel compared to 23 and 25 minutes for the Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively.

In most cases, travel times are expected to be faster for the non-tolled build alternatives than the tolled build alternatives, as shown in Exhibit 5-31. For the non-tolled build alternatives, southbound travel times during the morning commute are expected to be 17 minutes for the Non-Tolled Bored Tunnel compared to 16 and 15 minutes for the Non-Tolled Cut-and-Cover Tunnel and Non-Tolled Elevated Structure, respectively. Northbound trips are expected to take 21 to 25 minutes with the Non-Tolled Bored Tunnel, compared to 15 and 16 minutes for the Non-Tolled Cut-and-Cover Tunnel and Non-Tolled Elevated Structure, respectively.

During the evening commute, southbound travel times ranging from 19 to 22 minutes are expected for the Non-Tolled Bored Tunnel compared to 21 or 20 minutes for the Non-Tolled Cut-and-Cover Tunnel or Non-Tolled Elevated Structure, respectively. Northbound travel times of 24 to 27 minutes are expected for the Non-Tolled Bored Tunnel compared to 23 and 25 minutes for the Non-Tolled Cut-and-Cover Tunnel and Elevated Structure, respectively.

**I-5 Trips**

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

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

### 14 How would conditions for transit compare?

Downtown transit access to and from the south would likely be similar to existing conditions for the Elevated Structure Alternative with and without tolls, since the Columbia and Seneca ramps would be rebuilt and transit could continue to use these ramps as they do today to access downtown and SR 99 (although transit would have the option to use the ramps to Alaskan Way S. as well). For the tolled and non-tolled tunnel alternatives, downtown transit access to and from the south would change, since the Columbia and Seneca ramps would be relocated and buses would likely access downtown via the new ramps on Alaskan Way S., and then use S. Main Street and/or S. Washington Street to access the north-south Third Avenue bus "spine." The new ramps would extend transit service coverage to a larger portion of the downtown area, particularly the Pioneer Square area. Because transit access would be provided a few blocks south of where it is today, transit travel times to areas near the southern portion of downtown could decrease, while transit travel times to areas toward the central or north areas of downtown could increase. Travel times for selected trips are provided in Exhibit 5-32.

For transit vehicles serving downtown Seattle from the north, transit access is expected to be comparable for the build alternatives. For the Tolled and Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives, transit would access downtown via ramps to Denny Way, similar to existing conditions. For the Tolled and Non-Tolled Bored Tunnel Alternative, access would be provided via the ramps to Aurora Avenue at Harrison Street. Here, transit would be required to merge from the left-lane on- or off-ramp to the right transit-only lane that would be provided in both directions to Third Avenue. The transit-only lane would allow transit to bypass potential queues forming at intersections; however, transit would be required to travel through three additional traffic signals on Aurora Avenue between Harrison Street and Denny Way.

In the central waterfront area, the Tolled and Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives include replacing the waterfront streetcar, which would benefit transit along the waterfront.

#### *Transit Travel Times*

Transit travel times are compared in Exhibit 5-32. If the build alternatives were tolled, slower transit travel times would be expected for transit traveling on Second Avenue, Fourth Avenue, and to and from West Seattle. For the Tolled Cut-and-Cover Tunnel and Tolled Elevated Structure, slower transit travel times also would be expected for southbound trips coming into downtown from north Seattle via Aurora Avenue because unlike the Bored Tunnel, these alternatives would not provide a transit-only lane beginning at Harrison Street. Transit travel times would slow with tolling due to increased congestion on city surface streets caused by drivers avoiding the tolled portion of SR 99. If the build alternatives were tolled, travel time increases on Second and Fourth Avenues would not be as pronounced for transit as they would be for other traffic, because transit-only lanes are provided on Second and Fourth Avenues. On Second Avenue, transit travel times would increase by 1 or 2 minutes compared to the non-tolled build alternatives. Transit travel times on Fourth Avenue would be expected to increase by up to 5 minutes compared to the non-tolled build alternatives. There are two explanations for these travel time increases:

## 2030 Transit Travel Times Comparison

***NON-TOLLED/TOLLED***


**AM Peak Hour**
*in Minutes*

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

**PM Peak Hour**
*in Minutes*

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

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

***Exhibit 5-32***

**Appendix C, Transportation Discipline Report**

Transit information is discussed in *Appendix C*, Section 5.6 and 7.7.

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

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

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

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

***Transit Ridership***

The Viaduct Closed is expected to carry the fewest number of transit riders of any of the alternatives considered, as shown in Exhibit 5-33. Of the three screenlines evaluated, the Viaduct Closed would affect transit ridership most across the central screenline where the number of transit riders would be 9 to 12 percent less than the build alternatives. Transit ridership is expected to be lower with the Viaduct Closed because operating conditions in the corridor for all vehicles traveling on highways and arterials, including buses, would be worse than for any of the tolled or non-tolled build alternatives.

***Exhibit 5-33***
**2030 Daily Transit Riders at Screenlines**
*in Number of Riders*

| Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| **South Screenline – South of S. King Street** | | | | | | |
| 160,800 | 164,900 | 164,400 | 166,500 | 166,900 | 165,400 | 166,400 |
| **Central Screenline – North of Seneca Street** | | | | | | |
| 162,400 | 178,000 | 177,300 | 180,400 | 179,300 | 182,100 | 180,300 |
| **North Screenline – North of Thomas Street** | | | | | | |
| 165,400 | 168,400 | 168,000 | 166,700 | 165,700 | 167,600 | 166,800 |

Tolling the alternatives is expected to change transit ridership by up to 1 percent. This suggests that based on our modeling assumptions, tolling does not have much effect on people's decision to take transit.

***Transit Mode Share***

Exhibit 5-34 compares expected transit mode share among the alternatives.

***Exhibit 5-34***
**2030 Daily Transit Mode Share To & From Seattle's City Center**
*in Percentages*

| | Viaduct Closed | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|---|
| | | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED | NON-TOLLED | TOLLED |
| Work Trips | 39.6 | 41.0 | 41.0 | 40.9 | 41.0 | 40.6 | 40.6 |
| Non-Work-Related Trips | 9.8 | 10.1 | 9.9 | 10.0 | 9.8 | 10.0 | 9.8 |

Results for daily transit mode share are similar among the alternatives. This suggests that the overall demand for transit is similar among the alternatives and they have very little effect on transit mode share.

**15 How would access change for drivers, bicyclists, and pedestrians?**

Access provided for drivers, bicyclists, and pedestrians would be the same for each of the build alternatives regardless of whether or not they are tolled.

**How would access compare for drivers headed into or out of downtown from the south?**

Downtown access to and from the south would be enhanced for the Tolled or Non-Tolled Elevated Structure Alternative as compared to the Tolled or Non-Tolled Bored Tunnel or Cut-and-Cover Tunnel Alternatives, since drivers would be able to continue to use rebuilt ramps at Columbia or Seneca Streets, or drivers could choose to use ramps to Alaskan Way S.

For the tunnel alternatives, downtown access to and from the south would change and would be provided via Alaskan Way just south of S. King Street. An advantage of this configuration is that Alaskan Way is able to better accommodate and distribute SR 99 traffic flows than the downtown streets adjacent to the Columbia and Seneca ramps. With this configuration, drivers would be able to travel from Alaskan Way to the downtown street grid using any of several cross streets, including S. Jackson Street, S. Main Street, Yesler Way, and Columbia, Marion, Madison, and Spring Streets, rather than being concentrated to single locations at Columbia and Seneca Streets.

Because access would be less centrally located to downtown than the existing ramps, trips destined to the central and northern portions of downtown would have to travel a few additional blocks on city streets rather than on SR 99, which may increase their travel times, as discussed in Question 13 of this chapter. Conversely, drivers heading to and from the southern areas of downtown would find that the new ramps provide more direct access, since these drivers would no longer need to backtrack from the Seneca off-ramp to their destination.

**How would access compare for drivers heading into or out of downtown from the north?**

Conditions for drivers heading into or out of downtown from the north would change only slightly compared to existing conditions for any of the build alternatives evaluated. For any of the build alternatives, similar access is provided. With the Tolled or Non-Tolled Cut-and-Cover Tunnel or Elevated Structure, access to and from downtown would be provided via rebuilt ramps at Denny Way, which would be similar to access provided today. For the Tolled or Non-Tolled Bored Tunnel, access to Denny Way would be provided via ramps near Harrison Street. Between Harrison Street and Denny Way, drivers would

**What is transit mode share?**

Transit mode share indicates the percentage of trips made using transit for trips that originate in or are destined for Seattle's Center City area.

Transit ridership and mode share are based on relative availability and convenience of transit compared to other means of travel.

travel through three new signalized intersections at John, Thomas, and Harrison Streets that would provide a connected street grid.

**How would access compare for drivers heading to or from northwest Seattle (Ballard, Interbay, and Magnolia)?**
The Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure would rebuild the existing on- and off-ramps at Elliott and Western Avenues, so access would be similar to what is provided today. The Tolled or Non-Tolled Bored Tunnel would remove the on- and off-ramps at Elliott and Western Avenues. Drivers coming from northwest Seattle could access SR 99 either by traveling on Mercer Street and connecting to a new ramp at Republican Street, or by traveling on Alaskan Way to a new on ramp near S. King Street. In some cases, these access changes may increase travel times, as discussed previously in Question 13 and shown in Exhibit 5-31.

**How would access for freight compare?**
Conditions for freight with the Tolled or Non-Tolled Elevated Structure and Cut-and-Cover Tunnel would be similar but slightly improved as compared to existing conditions, because the lanes and ramps on SR 99 would be wider than they are today. With the Tolled or Non-Tolled Bored Tunnel Alternative, lane and ramp widths would also increase; and for many freight trips, conditions would be similar to existing conditions. An exception is that for freight traveling to or from northwest Seattle, the route would change. Drivers could travel on Mercer Street to access the ramps at Republican Street, or they could access the southern portion of SR 99 via Alaskan Way. Proposed access changes and tolling could affect travel times for freight, similar to general traffic, as described in Question 13 and shown in Exhibit 5-31.

Hazardous and flammable cargo would be restricted from using either the Bored Tunnel or the Cut-and-Cover Tunnel. This type of cargo is not permitted in the Battery Street Tunnel today. Instead of traveling on SR 99 through downtown, freight carrying hazardous or flammable cargo would be required to use another route, such as the Alaskan Way surface street or I-5 potentially affecting 55 to 70 tanker trucks per day. For the Tolled or Non-Tolled Elevated Structure Alternative, hazardous and flammable cargo would continue to be restricted from using the Battery Street Tunnel, similar to existing conditions.

**How would access compare for ferry traffic?**
Access to the Seattle Ferry Terminal would be similar for all of the build alternatives. As with existing ferry operations, service disruptions due to issues with vessels, terminals, or demand spikes associated with peak summer holiday traffic would likely still cause some disruption to traffic operations along Alaskan Way near Marion Street and Yesler Way. Fewer vehicles are expected to travel on Alaskan Way with the non tolled build alternatives as compared to the tolled build alternatives. A discussion of conditions on Alaskan Way for the tolled and non-tolled build alternatives is provided in Question 10.

**How would access compare for event traffic?**
During special events at the stadiums (Qwest and Safeco Fields), conditions are expected to be similar for the build alternatives, since similar improvements are proposed. If the build alternatives are tolled, congestion on streets near event areas would likely be higher than if the build alternatives are not tolled, since drivers are expected to divert from SR 99 to surface streets near the stadiums and Seattle Center area if SR 99 is tolled. A discussion of effects to area surface streets due to tolling is provided in Questions 8, 9, 10, and 11.

For events at Seattle Center, the Tolled or Non-Tolled Bored Tunnel Alternative is expected to provide the best package of improvements to accommodate event traffic. The Bored Tunnel Alternative provides an additional surface street connection in the north at John Street compared to the other build alternatives. The surface street offers drivers and pedestrians more travel options when large volumes of event traffic increase congestion on area streets.

**How would access compare for pedestrians?**
All of the build alternatives provide improved pedestrian conditions in the south and north areas by providing improvements between S. Royal Brougham Way and S. King Street and connecting the street grid north of Denny Way. In the north section, the Tolled or Non-Tolled Bored Tunnel Alternative offers somewhat better pedestrian connections compared to the other build alternatives, because it connects an additional east-west street at John Street.

In the central waterfront area, the Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative offers substantially improved conditions for pedestrians due to the combination of removing the existing viaduct, substantially widening the existing pedestrian promenade along the waterfront, and building a connection to and from Victor Steinbrueck Park near the Pike Place Market. The Tolled or Non-Tolled Bored Tunnel Alternative would also remove the viaduct, which would provide opportunities to improve pedestrian conditions in the future, although improvements to Alaskan Way along the waterfront are not proposed as part of the Tolled or Non-Tolled Bored Tunnel Alternative. The Tolled or Non-Tolled Bored Tunnel Alternative provides the most available space along the waterfront to provide pedestrian amenities; unlike the other alternatives, it does not propose to locate a streetcar along the waterfront. In the central waterfront area, the Tolled or Non-Tolled Elevated Structure Alternative would continue to provide limited opportunities to improve pedestrian conditions.

**How would access compare for bicyclists?**
All of the build alternatives provide improved bicycle conditions in the south and north areas due to proposed improvements associated with replacing the viaduct between S. Royal Brougham Way and S. King Street and connecting the street grid north of Denny Way. North of Denny Way, the Tolled or Non-Tolled Bored Tunnel Alternative would provide an additional east-west connection at John Street compared to the other two build alternatives.

In the central waterfront area, the Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative offers the most improved conditions for bicyclists due to the combination

**Appendix C, Transportation Discipline Report**

Truck traffic and freight are discussed in *Appendix C*, Sections 5.7 and 7.8.

Ferry conditions are discussed in *Appendix C*, Sections 5.11 and 7.12.

Event traffic discussed in *Appendix C*, Sections 5.13 and 7.14.

Effects to pedestrians are discussed in *Appendix C*, Sections 5.9 and 7.10.

Effects to bicyclists are discussed in *Appendix C*, Sections 5.10 and 7.11.

of removing the existing viaduct, adding dedicated bicycle lanes on the surface street, and providing a wider pedestrian/bicycle path than currently exists along the waterfront. The Tolled or Non-Tolled Bored Tunnel Alternative would also remove the viaduct, which would provide opportunities for improved bicycle conditions in the future; however, improvements to Alaskan Way along the central waterfront are not proposed as part of the Tolled or Non-Tolled Bored Tunnel Alternative and will be designed and implemented by the City as part of the broader Alaskan Way Viaduct and Seawall Replacement Program. In the central waterfront area, the Tolled or Non-Tolled Elevated Structure Alternative offers limited opportunities to improve conditions for bicyclists, although dedicated bicycle lanes would be provided along Alaskan Way.

## OTHER PERMANENT EFFECTS

### 16 How would noise levels compare?

#### Noise Effects Overview

The analysis of noise effects compares the modeled year 2030 noise levels with the year 2015, which is used to represent existing conditions. Noise from traffic and the diverse activities of city dwellers is a normal part of life in the project area. Existing outdoor noise levels in 2015 are expected to range from 61 to 80 A-weighted decibels (dBA) in the project area (both for short durations and over a 24-hour period). These noise levels are typical for major downtown metropolitan areas. Noise levels tend to be about 10 dBA quieter during the nighttime and early morning hours (midnight to 6:00 a.m.).

To compare how noise levels would change, and in accordance with FHWA guidance, traffic noise levels were modeled at 70 sites for both existing conditions expected in 2015 and the year 2030 for each of the build alternatives, with and without tolls. This comparison is shown in Exhibits 5-35 and 5-36. For the Bored Tunnel and Elevated Structure Alternatives, the difference between the tolled and non-tolled modeling results is within 2 dBA. For the Cut-and-Cover Tunnel Alternative, there is one location where the non-tolled noise level would be 3 dBA higher, but all other locations are within 2 dBA. A change of 2 dBA or less is not noticeable to most listeners, so noise levels between the tolled and non-tolled conditions for each alternative would be very similar. None of the build alternatives would have vibration impacts during operation.

Traffic noise levels currently approach or exceed FHWA noise abatement criteria[3] at 53 of the 70 sites, which represent approximately 4,578 residential units, 1,612 hotel rooms, 120 shelter beds, 1 church, 1 school, 12 parks or public spaces, and 8 commercial use areas. Exhibit 5-37 compares noise effects among the tolled and non tolled build alternatives. The tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives are expected to reduce the number of sites that would approach or exceed FHWA noise abatement criteria and the tolled and non-tolled Elevated Structure Alternatives would increase the number of affected sites. The FHWA noise criterion is 67 dBA for residences, parks, schools, churches, and similar areas and 72 dBA for developed land such as commercial buildings. One site, an apartment building adjacent to the Elliott Avenue on-ramp, currently exceeds the severe noise impact criterion of 80 dBA at sensitive land uses.

***Exhibit 5-37***
**Range of Noise Effects Compared to 2015 Existing Viaduct**

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

Measures for noise abatement as required by federal regulations (23 CFR 772) were evaluated for each alternative to determine what measures are feasible and reasonable. These measures include the following:

- **Traffic management –** measures include time restrictions, traffic control devices, signing for prohibition of certain vehicle types (e.g., motorcycles and heavy trucks), modified speed limits, and exclusive lane designations. For example, speed limits could be reduced, but a reduction of 10 to 15 miles per hour would be required to decrease traffic noise by 5 dBA. Implementation of these measures for the sole purpose of noise mitigation would not be reasonable.

- **Land acquisition for noise buffers or barriers –** in an urban area such as the study area, this would require relocating numerous residents and businesses and would not be reasonable for the purpose of noise mitigation.

- **Realigning the roadway –** the alignment is defined by available right-of-way and the design features of the project. The cost of realigning the roadway would not be reasonable exclusively as an operational noise mitigation consideration.

- **Noise insulation of buildings –** this measure does not apply to commercial and residential structures and is not eligible for federal funding.

- **Noise barriers –** to be effective, noise barriers would have to block access to the surface streets. There are no feasible mitigation measures to reduce traffic noise levels because the surface streets provide local access to downtown and the waterfront throughout the central waterfront.

None of these measures were identified to be feasible and reasonable for any of the build alternatives. Non-traditional measures, such as using noise-absorbing materials, were considered during design and rejected as ineffective and prohibitively expensive.

**Appendix F, Noise Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in Chapter 2 of *Appendix F*. This report also contains details on the noise measurement locations, modeling results, and information about mitigation. The feasibility and reasonableness of noise abatement measures is discussed in *Appendix F*, Section 5.5.

**What is dBA?**

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

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

**How does WSDOT evaluate what measures are feasible and reasonable?**

WSDOT evaluates many factors to determine whether measures would be feasible and reasonable. Determination of engineering feasibility includes evaluating whether measures could be constructed in a location to achieve a noise reduction of at least 7 dBA at the closest receptors and a reduction of 5 dBA or more at most of the first row of receptors. Determination of reasonableness includes determining the number of sensitive receptors benefited by at least 3 dBA; the cost-effectiveness of the measure; and concerns such as aesthetics, safety, and the desires of nearby residents. This approach is consistent with FHWA noise abatement requirements; WSDOT noise policy adopts the FHWA criteria.

3 USDOT 1982.

## Change in Noise Levels – Tolled Alternatives

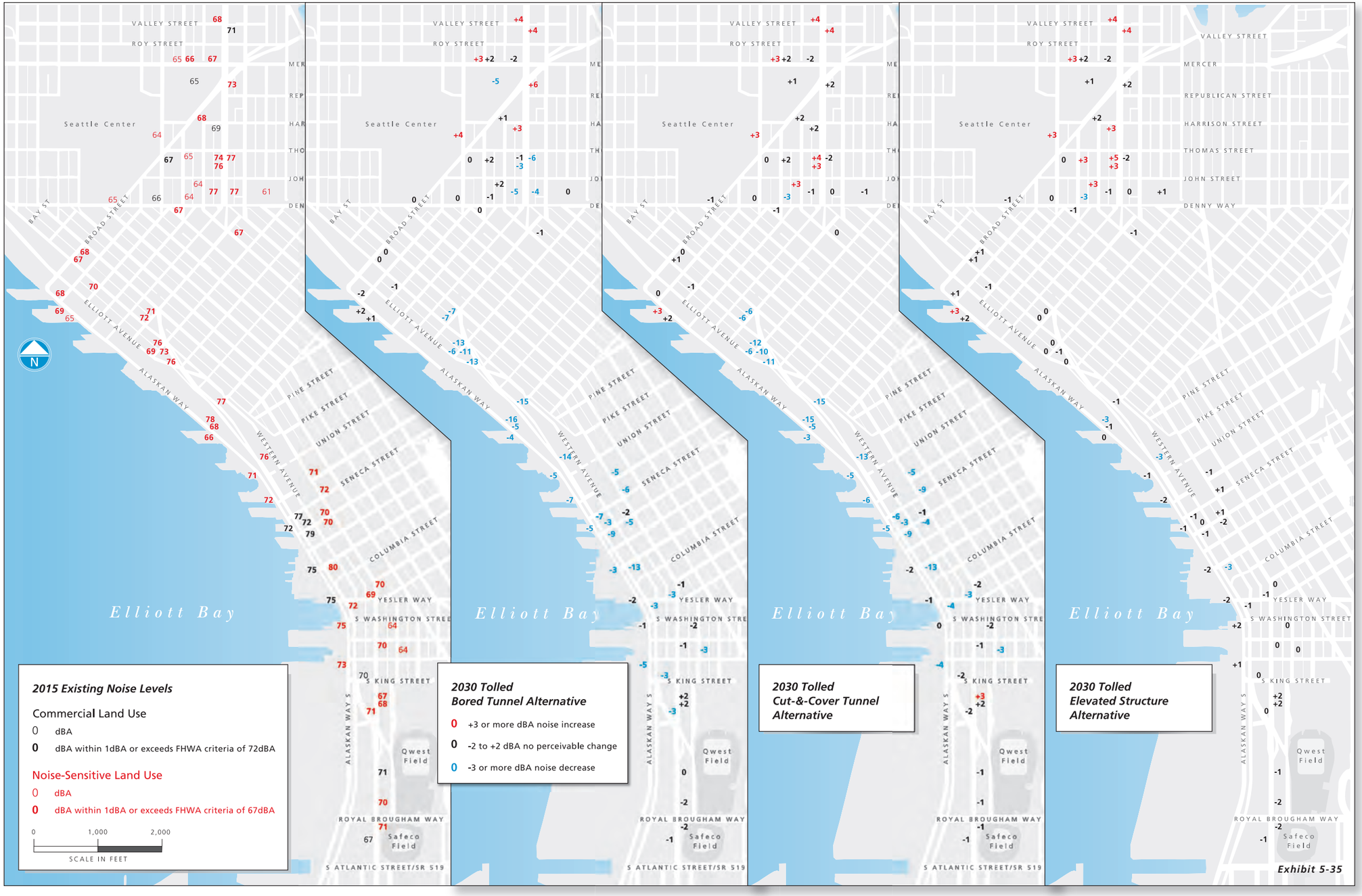



*Exhibit 5-35*

## Change in Noise Levels – Non-Tolled Alternatives

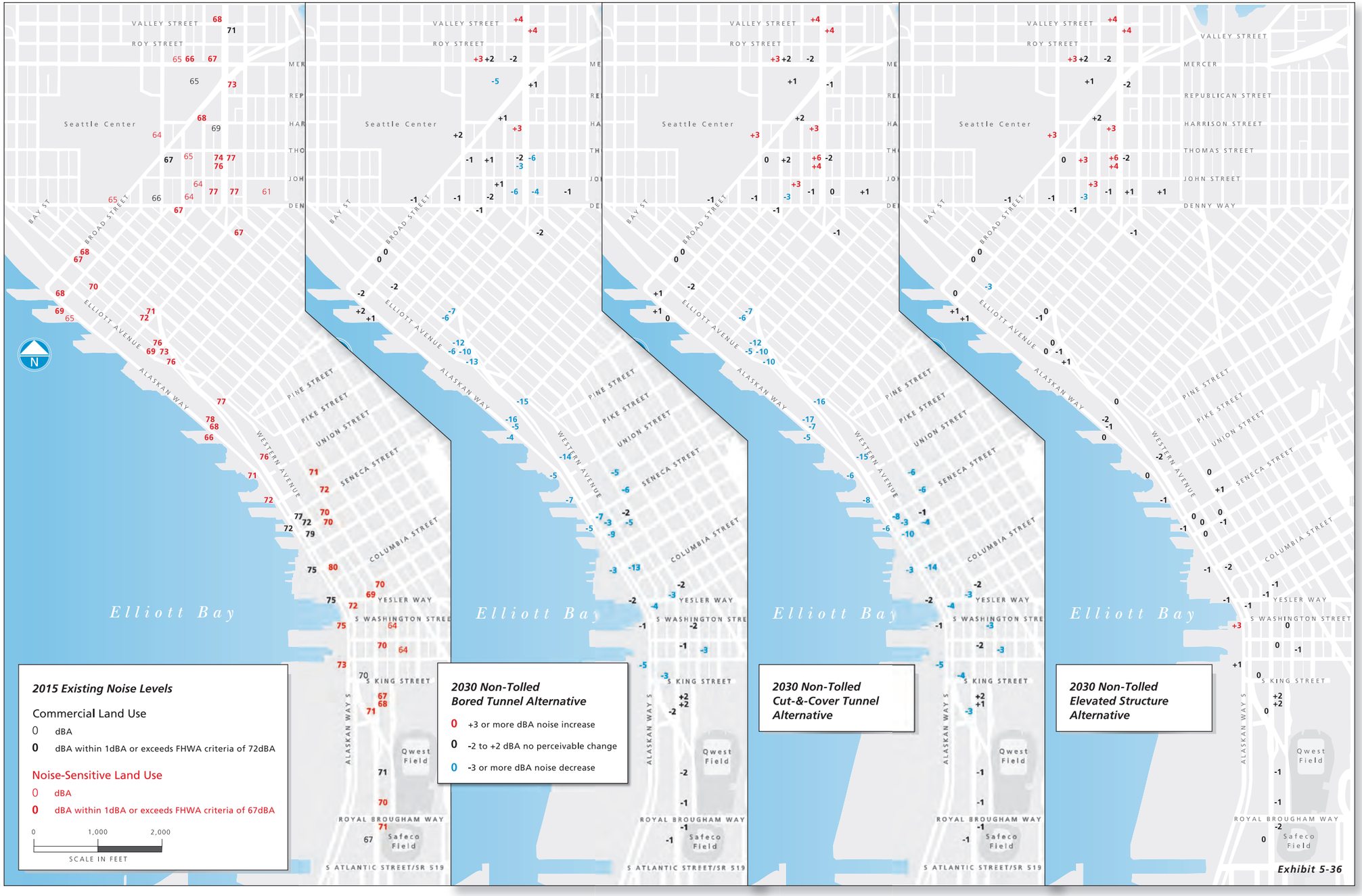



Exhibit 5-36

**Noise Effects for the Tolled and Non-Tolled Bored Tunnel**
The loudest hour traffic noise levels with the Bored Tunnel Alternative would range between 60 and 75 dBA at the modeled locations. Out of the 70 sites modeled, the 2030 Tolled Bored Tunnel has one additional site where traffic noise levels would approach or exceed FHWA noise abatement criteria, compared to the non-tolled conditions. With the Tolled Bored Tunnel, the 41 sites that were found to approach or exceed FHWA noise abatement criteria represent approximately 3,453 residential units, 1,286 hotel rooms, 120 shelter beds, 1 church, 1 school, 11 parks or public use spaces, and 5 commercial use areas. With the Non-Tolled Bored Tunnel, the 40 sites represent approximately 3,705 residential units, 1,286 hotel rooms, 120 shelter beds, 1 church, 1 school, 11 parks or public spaces, and 3 commercial use areas. None of these sites would exceed the severe noise impact criterion of 80 dBA at sensitive land uses. The number of modeled sites that exceed the noise abatement criteria would be reduced by 12 sites with the Tolled Bored Tunnel and 13 sites with the Non-Tolled Bored Tunnel compared to existing conditions.

***South Area***
Noise levels were studied at 9 locations near the south portal of the Bored Tunnel Alternative. The noise levels would remain the same or decrease by up to 5 dBA in 2030 at 7 locations and would increase by 2 dBA at 2 locations. Noise levels would exceed FHWA noise abatement criteria at 6 of the 9 sites for the Non-Tolled Bored Tunnel, which represent approximately 135 residential units, 220 hotel rooms, and 2 parks or public spaces. In addition to these 6 sites, 1 additional site, a commercial use area, would exceed FHWA noise abatement criteria with the Tolled Bored Tunnel Alternative. Noise levels with the Bored Tunnel Alternative would range from 66 to 71 dBA at modeled locations in the south portal area.

***Central Waterfront***
With the either the Tolled or Non-Tolled Bored Tunnel, noise levels along Seattle's central waterfront, would decrease at all 31 locations studied between S. Jackson Street and the Battery Street Tunnel. In the vicinity of Alaskan Way and Broad Street, noise levels at 2 sites would increase by 1 to 2 dBA and noise levels at 4 sites would remain the same or decrease by 1 to 2 dBA. Traffic noise levels would continue to be typical of an urban area.

Noise levels were modeled and found to approach or exceed the FHWA noise abatement criteria at 19 of the 37 modeled sites for both the Tolled and Non-Tolled Bored Tunnel, as compared to 29 of 37 sites that would approach or exceed FHWA criteria today. For the Tolled Bored Tunnel, the 19 sites represent approximately 2,977 residential units, 353 hotel rooms, 120 shelter beds, 5 parks or public open space uses, and 2 commercial use areas. The 19 sites for the Non-Tolled Bored Tunnel represent approximately 3,289 residential units, 353 hotel rooms, 120 shelter beds, 4 parks or public open space uses, and 2 commercial use areas. Noise levels with the either the Tolled or Non-Tolled Bored Tunnel would range from 61 to 74 dBA at modeled locations in the central waterfront area.

***North Area***
At the north tunnel portal, future noise levels are expected to vary depending on location. At some sites, noise levels would decrease by up to 6 dBA, and at other sites noise levels are predicted to stay the same or increase by 1 to 6 dBA. With the Tolled Bored Tunnel, traffic noise levels were found to approach or exceed the FHWA noise abatement criteria at 16 of the 24 modeled sites, which is an increase of 4 sites compared to existing conditions. The 16 sites represent approximately 341 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. With the Non-Tolled Bored Tunnel, traffic noise levels modeled were found to approach or exceed the FHWA noise abatement criteria at 15 of the 24 modeled sites, which represent approximately 281 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. Noise levels with either the Tolled or Non-Tolled Bored Tunnel would range from 60 to 75 dBA at modeled locations in the north area.

***Ventilation System Noise***
The Tolled or Non-Tolled Bored Tunnel would require a ventilation system with several ventilation stacks, which would be included as part of the tunnel operations buildings proposed at the tunnel portals. At the south portal, the tunnel operations building would be located on the block bounded by S. Dearborn Street, Alaskan Way S., and the new Railroad Way S. access road. At the north portal, the tunnel operations building would be located between Thomas and Harrison Streets on the eastside on Sixth Avenue N. The ventilation fans would be designed not to exceed either 60 dBA at the nearest commercial uses or 57 dBA at the property line of the nearest residential use during normal operations. Ventilation fans must be routinely tested in emergency mode operation, which is subject to the property line noise limits. Testing of ventilation fans would likely occur during normal daytime hours, and these periodic tests are not expected to have a noticeable effect to ambient noise levels in the area. Fans that are normally operated during nighttime hours would be designed not to exceed 47 dBA at the property line of the nearest residential use.

**Noise Effects for the Tolled and Non-Tolled Cut-and-Cover Tunnel**
The loudest hour traffic noise levels were found to range from 61 and 79 dBA at the modeled locations with the Tolled Cut-and-Cover Tunnel and 61 and 80 dBA with the Non Tolled Cut-and-Cover Tunnel. Out of the 70 modeled sites, the number of sites approaching or exceeding FHWA noise abatement criteria would be 43 with the Tolled Cut-and-Cover Tunnel and 40 with the Non-Tolled Cut-and-Cover Tunnel. With the Tolled Cut and-Cover Tunnel, the 43 sites represent approximately 3,596 residential units, 1,395 hotel rooms, 120 shelter beds, 1 church, 1 school, 12 parks or public use spaces, and 5 commercial use areas. None of these sites would exceed the severe noise impact criterion of 80 dBA at sensitive land uses. With the Non-Tolled Cut-and-Cover Tunnel, the 40 sites represent approximately 3,541 residential units, 1,257 hotel rooms, 120 shelter beds, 1 church, 1 school, 10 parks or public spaces, and 4 commercial use areas. Two of these sites located just north of John Street are

**Noise Effects to Low-Income and Minority Populations**

**Question 26** in this chapter discusses possible noise effects to low-income and minority populations.

predicted to have noise levels of 80 dBA, which is the severe noise impact criterion at sensitive land uses. These locations have a lot of traffic noise from vehicles entering and exiting SR 99 just north of the Battery Street Tunnel as well as surface street traffic. The number of modeled sites that would exceed the noise abatement criteria would be reduced by 10 sites with the Tolled Cut-and-Cover Tunnel and 13 sites with the Non-Tolled Cut-and-Cover Tunnel compared to existing conditions.

***South Area***

Noise levels were studied at 9 locations near the south portal of the Cut-and-Cover Tunnel Alternative. The noise levels would decrease by 1 to 4 dBA in 2030 at 7 locations and would increase by 2 or 3 dBA at 2 locations with the Tolled Cut-and-Cover Tunnel. With the Non-Tolled Cut-and-Cover Tunnel, noise levels would decrease by 1 to 5 dBA in 2030 at 7 locations and would increase by 1 or 2 dBA at two locations. Noise levels would exceed FHWA noise abatement criteria at 6 of the 9 sites with both the Tolled and Non-Tolled Cut-and-Cover Tunnel, which represent approximately 135 residential units, 220 hotel rooms, and 2 parks or public spaces. Noise levels with the Cut-and-Cover Tunnel would range from 66 to 70 dBA at modeled locations in the south portal area.

***Central Waterfront***

With the Tolled Cut-and-Cover Tunnel, noise levels along Seattle's central waterfront would decrease at 30 of the 31 locations studied between S. Jackson Street and the Battery Street Tunnel, and one location near S. Washington Street would remain the same. With the Non-Tolled Cut-and-Cover Tunnel, noise levels would decrease at all 31 locations studied. For both the Tolled and Non-Tolled Cut-and-Cover Tunnel, noise levels in the vicinity of Alaskan Way and Broad Street would increase by 1 to 3 dBA at three sites, and noise levels at three other sites would remain the same or decrease by 1 to 2 dBA. Traffic noise levels would continue to be typical of an urban area.

Noise levels were modeled and found to approach or exceed the FHWA noise abatement criteria at 21 of the 37 modeled sites for the Tolled Cut-and-Cover Tunnel and 18 of the 37 modeled sites for Non-Tolled Cut-and-Cover Tunnel, as compared to 29 of 37 sites that approach of exceed FHWA criteria today. For the Tolled Cut-and-Cover Tunnel, the 21 sites represent approximately 3,120 residential units, 462 hotel rooms, 120 shelter beds, 6 parks or public open space uses, and 3 commercial use areas. The 18 sites for the Non-Tolled Cut-and-Cover Tunnel represent approximately 3,065 residential units, 324 hotel rooms, 120 shelter beds, 3 parks or public open space uses, and 2 commercial use areas. Noise levels with the Tolled Cut-and-Cover Tunnel would range from 61 to 75 dBA at modeled locations in the central waterfront area, and from 61 to 74 dBA with the Non-Tolled Cut-and-Cover Tunnel.

***North Area***

At the north tunnel portal, changes in future noise levels vary depending on location. At some sites, noise levels would decrease by as much as 3 dBA, and at other sites noise levels are predicted to stay the same or increase up to 4 dBA with tolls or up to 6 dBA without tolls. With both the Tolled and Non-Tolled Cut-and-Cover Tunnel, traffic noise levels were found to approach or exceed the FHWA noise abatement criteria at 16 of the 24 modeled sites, which is an increase of four sites compared to existing conditions. The 16 sites represent approximately 341 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. Noise levels with the Tolled Cut-and-Cover Tunnel would range from 61 to 79 dBA at modeled locations in the north area or 61 to 80 dBA for the Non-Tolled Cut-and-Cover Tunnel.

***Ventilation System Noise***

The Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative would require a ventilation system, which would be included as part of the tunnel operations buildings proposed at the portals of the cut-and-cover tunnel along the waterfront. At the south portal, the tunnel operations building would be located on the block bounded by S. Dearborn Street, Alaskan Way S., and the new Railroad Way S. access road. At the north portal, the tunnel operations building would have ventilation stacks and be located between Alaskan Way and SR 99 just north of Pike Street. There would also be a ventilation and maintenance building at each end of the Battery Street Tunnel.

The ventilation fans would be designed and operated as described for the Tolled or Non-Tolled Bored Tunnel Alternative.

**Noise Effects for the Tolled and Non-Tolled Elevated Structure**

The loudest hour traffic noise levels would range between 61 and 79 dBA at the modeled locations with the Tolled Elevated Structure and 61 and 80 dBA with the Non-Tolled Elevated Structure. Out of the 70 sites modeled, both the 2030 Tolled and Non-Tolled Elevated Structure were found to approach or exceed FHWA noise abatement criteria at 57 sites. These sites represent approximately 4,730 residential units, 1,715 hotel rooms, 120 shelter beds, 1 church, 1 school, 14 parks or public use spaces, and 8 commercial use areas. None of these sites would exceed the severe noise impact criterion of 80 dBA at sensitive land uses with the Tolled Elevated Structure. However, two sites are predicted to have noise levels of 80 dBA with the Non-Tolled Elevated Structure. The number of modeled sites that would exceed the noise abatement criteria would increase by 4 sites with either the Tolled or Non-Tolled Elevated Structure compared to existing conditions.

***South Area***

Noise levels were studied at 9 locations near the south end of the Elevated Structure Alternative. The noise levels would remain the same or decrease by up to 2 dBA in 2030 at 6 locations and would increase by 1 or 2 dBA at 3 locations. Noise levels would exceed FHWA noise abatement criteria at 6 of the 9 sites under both the Tolled and Non-Tolled Elevated Structure, which represent approximately 135 residential units, 220 hotel rooms, and 2 parks or public spaces. Noise levels would range from 66 to 74 dBA at modeled locations in the south area with

the Tolled Elevated Structure, or from 67 to 74 dBA without tolls.

***Central Waterfront***

Noise levels along Seattle's central waterfront with both the Tolled and Non-Tolled Elevated Structure would be within 3 dBA of the existing conditions. Traffic noise levels would continue to be typical of an urban city.

Noise levels were modeled and found to approach or exceed the FHWA noise abatement criteria at 35 of the 37 modeled sites for the Elevated Structure Alternative with or without tolls. These sites represent approximately 4,254 residential units, 782 hotel rooms, 120 shelter beds, 8 parks or public open space uses, and 6 commercial use areas. Noise levels with the Tolled Elevated Structure would range from 64 to 78 dBA at modeled locations in the central waterfront area, and from 63 to 79 dBA with the Non-Tolled Elevated Structure.

***North Area***

At the north end of the project area, changes in future noise levels vary depending on location. At some sites, noise levels would decrease by up to 3 dBA and at other sites noise levels are predicted to stay the same or increase up to 5 dBA with tolls or up to 6 dBA without tolls. With both the Tolled and Non-Tolled Elevated Structure, traffic noise levels modeled were found to approach or exceed the FHWA noise abatement criteria at 16 of the 24 sites, which is an increase of four sites compared to existing conditions. The 16 sites represent approximately 341 residential units, 713 hotel rooms, 1 school, 1 church, 4 parks or public open space uses, and 2 commercial or other less noise-sensitive use. Noise levels with the Tolled Elevated Structure would range from 61 to 79 dBA at modeled locations in the north area or 61 to 80 dBA with the Non-Tolled Elevated Structure.

***Ventilation System Noise***

The Tolled or Non-Tolled Elevated Structure Alternative would have a ventilation and maintenance building at each end of the Battery Street Tunnel. As described for the other alternatives, the ventilation fans would be designed not to exceed either 60 dBA at the nearest commercial uses or 57 dBA at the property line of the nearest residential use during normal operations. Fans that are normally operated during nighttime hours would be designed not to exceed 47 dBA at the property line of the nearest residential use.

**17 How would views change for the alternatives?**

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

There would be few indirect effects to views because the area is already a densely developed urban environment and few if any changes to the urban context of the project are expected. With the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, to the extent that the existing viaduct has been perceived as a barrier to waterfront uses, new development on vacant or under-used property or redevelopment may take place around the new Alaskan Way surface street. These changes could slightly change views toward Seattle.

**Appendix D, Visual Quality Discipline Report and Appendix E, Visual Simulations**

The methodology used for visual assessment is described in ***Appendix D***, **Chapter 2**. **Chapter 5** provides additional information on visual effects. ***Appendix E*** contains the visual simulations.



**Visual Simulations Looking Northwest on First Avenue S.**

***Exhibit 5-38***

**Bored Tunnel Alternative**
The Bored Tunnel Alternative would remove the existing viaduct, improving views at the surface throughout downtown. Drivers using the bored tunnel would not experience the panoramic views provided by the existing viaduct.

***South Area***
The Bored Tunnel Alternative would connect to the newly replaced SR 99 structure at S. Royal Brougham Way. At this point, occupants of northbound vehicles would have similar views of the downtown skyline as they do today, as shown in Exhibit 5-38. As northbound vehicles begin descending into the tunnel, views of downtown and Elliott Bay would become blocked. Occupants of southbound vehicles exiting at the south portal would see the Port of Seattle (Terminal 46) and industrial facilities as they emerge from the tunnel.

Views for people on the surface streets in the south portion of the project area would improve by removing the existing viaduct, as shown in Exhibit 5-39. Views to the west would include Terminal 46 and surface streets more prominently. Near the south portal, the existing elevated ramps along Railroad Way S. at First Avenue S. would be removed. This change would likely cause people to feel that the Pioneer Square and stadium areas are more connected visually. The proposed tunnel operations building is expected to be approximately 65 feet tall with vent stacks extending up to 30 feet above the roof. Zoning in this area now allows building heights of up to 65 feet, and the height of stacks is exempt from zoning restrictions.

Many of the people traveling to the south portal area would be attending events at Qwest or Safeco Fields. For fans congregating around Safeco Field, views would not change much. Inside the stadium, the 300 level would continue to have unobstructed views to the west. Viewers looking northwest and north would see the transition of SR 99 to the tunnel portal, although this view could be obstructed in the future by private development. The downtown skyline would continue to be the main feature for views to the north. For attendees at Qwest Field events, views toward Elliott Bay and down Railroad Way S. from the upper level of the west side of the stadium would be improved by removing the existing viaduct and the ramps to First Avenue S.

***Central Waterfront***
Once inside the tunnel, both northbound and southbound vehicle occupants would no longer have the scenic views of the central waterfront and downtown that they do today, as shown in Exhibit 5-40.

Removing the existing viaduct would transform the relationship that the neighborhoods east of the viaduct have to the central waterfront. Views of the Pioneer Square Historic District from the waterfront would be unobstructed for the first time since the early 1950s. Historic brick buildings, high-rise buildings, and other features (such as parking lots) would face viewers along the waterfront. Views down streets that are perpendicular to the existing viaduct would no longer be obstructed by the viaduct. These views would be framed by buildings primarily of the same period with similar materials and architectural style, together with complementary elements

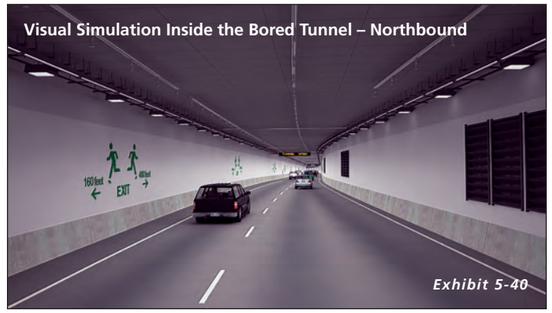


Exhibit 5-40





**Visual Simulations Looking North at S. Royal Brougham Way**
Exhibit 5-39

of the streetscape, including sidewalks, street trees, and the roadway itself. The Pioneer Square Historic District has a large number of visitors, and people likely would find the area more appealing after the existing viaduct is removed. Viaduct removal supports policies in the Pioneer Square Neighborhood Plan to improve the connection of east-west streets to the waterfront, by improving views and pedestrian connections.

Views from buildings that face the existing viaduct would no longer be obstructed by the viaduct, as shown in Exhibit 5-41. Views from buildings east of the viaduct would have more open foreground views of the waterfront; middle ground views of Elliott Bay, Puget Sound, West Seattle, Alki Point, and Magnolia; and distant views of the Kitsap Peninsula Hills and the Olympic Mountains. Buildings on perpendicular streets to the east would have improved views down the streets.

At the north end of the central waterfront is the Pike Place Market Historic District. Views from the market and Victor Steinbrueck Park toward the waterfront would no longer be obstructed by the viaduct.

Views for pedestrians on the waterfront and piers along Alaskan Way toward downtown Seattle would no longer have the visual barrier of the viaduct between the waterfront and downtown. From a distance near the ends of the piers and from ferries and other vessels in Elliott Bay, downtown towers loom above the existing viaduct, and the views would not change dramatically.

***North Area***

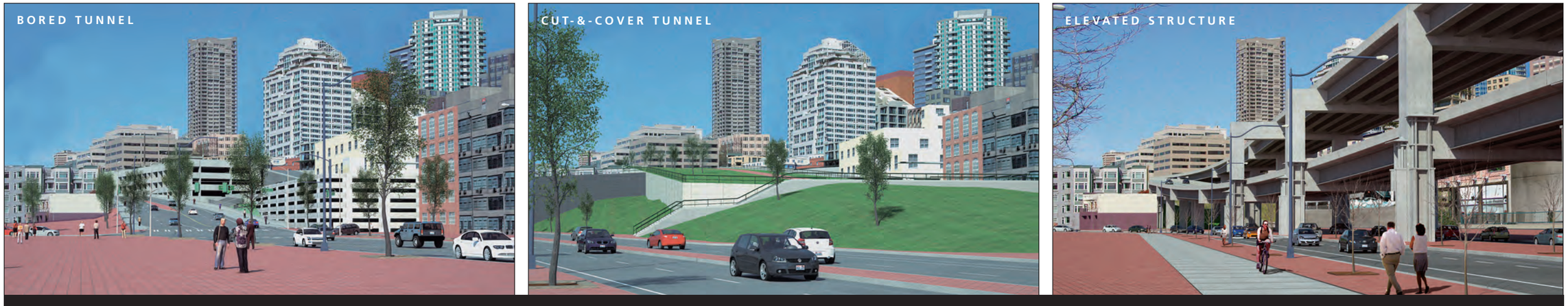
Views exiting the bored tunnel for vehicle occupants traveling northbound on SR 99 would be nearly identical to what people experience today when exiting the Battery Street Tunnel, as shown in Exhibit 5-42. Views from southbound SR 99 would also be similar to existing conditions. Vehicle occupants traveling southbound would see the downtown access off-ramp in the center lane connecting at Harrison Street. SR 99 would continue to have semi-restricted access north of the portals with a barrier in the center. Views from perpendicular streets would continue to be of a standard urban roadway with large volumes of fast-moving traffic, much like today.

Between Harrison Street and Denny Way, the rebuilt Aurora Avenue surface street would be integrated with the surrounding neighborhood. John, Thomas, and Harrison Streets would connect across Aurora Avenue. The neighborhood would no longer be divided by SR 99, and vehicle, bicycle, and pedestrian circulation would be enhanced. This would not change the visual quality of the street, which would continue to be a six-lane urban arterial. The major difference would be the slower speed of traffic and the periodic queuing of cars at intersections.

The tunnel operations building located on Sixth Avenue N. between Thomas and Harrison Streets would be similar in size to existing buildings in the vicinity. The tunnel operations building is expected to be approximately 60 feet tall with vent stacks extending up to 35 feet above the roof. This could be somewhat shorter than other buildings that may be developed in the future, since zoning in this area now allows building heights of up to 85 feet.

**Cut-and-Cover Tunnel Alternative**

The Cut-and-Cover Tunnel Alternative has visual effects almost identical to those of the Bored Tunnel Alternative at the south portal and along the central waterfront. It differs in the connection between Alaskan Way and Pike Street and the Battery Street Tunnel, and on Aurora Avenue. As with the Bored Tunnel, the major changes are beneficial and result from removal of the existing elevated structure along the waterfront with associated visual impacts, providing opportunities for a variety of visual amenities on the Alaskan Way surface street. The


**Visual Simulations Looking North on Alaskan Way at Union Street** *Exhibit 5-41*

Cut-and-Cover Tunnel includes additional visual amenities provided by the proposed lid connecting to Steinbrueck Park.

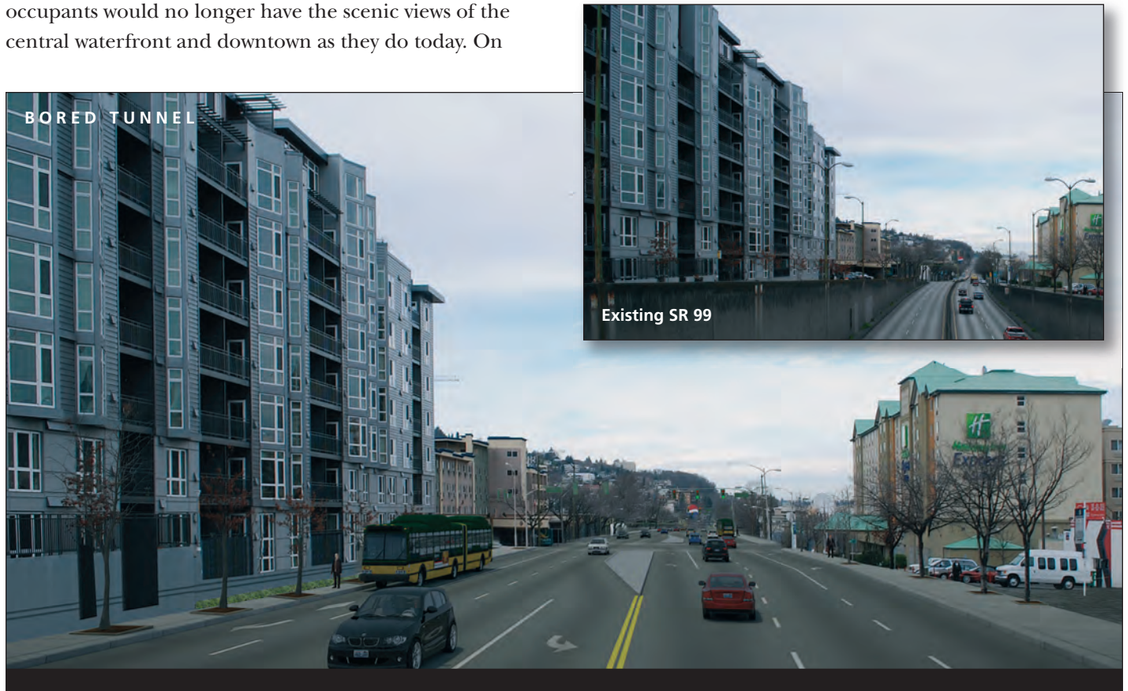
***South Area***

Visual effects with the Cut-and-Cover Tunnel are almost identical to the Bored Tunnel; the one exception is the tunnel operations and maintenance building (see Exhibit 5-39). For the Cut-and-Cover Tunnel, this building would contain an operations room, offices, equipment and vehicle storage, and facilities for minor repairs. It would not contain ventilation equipment and would be two stories tall (as compared to the Bored Tunnel Alternative operations building height of approximately 65 feet, with ventilation stacks extending up to 30 feet above the roof).

***Central Waterfront***

As with the bored tunnel, once inside the cut-and-cover tunnel, both northbound and southbound vehicle occupants would no longer have the scenic views of the central waterfront and downtown as they do today. On the surface, with the removal of the viaduct, views to and from downtown areas, as well as views to and from the improved central waterfront streetscape would improve, as with the Bored Tunnel Alternative.

Along the central waterfront, the Cut-and-Cover Tunnel includes a tunnel operations building near Pine Street and a lid above the tunnel from near Pike Street to Steinbrueck Park, as shown in Exhibit 5-41, but otherwise would appear similar to the Bored Tunnel Alternative. The lid would extend over the roof of the operations building between Pike and Pine Streets. North of Pine Street, the lid would be about 100 feet wide and extend over the northbound lanes and a portion of the southbound lanes. The pedestrian lid would provide more opportunities for observing the Olympic Mountains, Puget Sound, Elliott Bay, and the downtown skyline. South of Pine Street, the two-story high wall of the tunnel operations building would be visible along the east side of the Alaskan Way surface street. This wall would be somewhat obscured by street trees in spring, summer, and early autumn. If it is treated as a building frontage with windows and other openings, it is more likely to be perceived as part of the building frontage of a typical urban street. If it is a blank concrete wall, it would be more likely to detract from the urban streetscape. The building also would include vent stacks that would protrude above the public open space area on top of the building.




**Visual Simulation Looking North Toward Aurora Avenue at Denny Way** *Exhibit 5-42*

As SR 99 enters the Battery Street Tunnel, a new south portal and vent structure would extend to the south over the approach roadway. The building roof would be at the approximate level of First Avenue and may include a public open space or viewing area. The portal and the vent building would be about 50 feet high, including the 15-foot-high vent enclosure. It would be a relatively minor element in the continuous arterial framed by urban buildings.

***North Area***

Views for occupants of vehicles on SR 99 north of the Battery Street Tunnel would be of a lowered roadway framed by retaining walls on either side. This would be a change from the existing frontage of street trees and buildings but would not be substantially different from expectations of a high-speed corridor through an urban setting.

With the SR 99 lowered below grade, Thomas and Harrison Streets are proposed to connect over SR 99. The neighborhood would no longer be divided by the existing high-speed highway, and vehicle and pedestrian circulation would be enhanced. However, these improvements would not substantially change the visual quality of the street, either for views from the road or views toward the road.

The tunnel operations building at the north Battery Street Tunnel portal would be located over the portal on the north side of Denny Way, and it would block pedestrian views of SR 99 to the north. Loss of this view of a high-

speed highway in an urban environment is not considered adverse. The building would be one story high, with about 70 feet of street frontage.

**Elevated Structure Alternative**

With the Elevated Structure Alternative, drivers on SR 99 would experience portions of the views currently seen from the viaduct today. Because the new structure would be wider and taller than the existing viaduct, this alternative would continue to dominate near views and be a visual barrier to and from the waterfront and downtown Seattle and the Pioneer Square Historic District.

***South Area***

The Elevated Structure Alternative would remove the elevated Railroad Way S. ramps in the south area, but it would construct new elevated structures in the same vicinity, maintaining the visual barrier between Pioneer Square and the waterfront, as shown in Exhibit 5-39. Because of the additional width of the elevated structure, views would be restricted along Alaskan Way.

***Central Waterfront***

With the Elevated Structure Alternative, effects to views in the project area would be similar to existing views. For motorists traveling on the new elevated structure, scenic views of the Seattle skyline would still be a part of their driving experience. But views toward the waterfront would be different than today, because roadside barriers would be solid (like concrete jersey barriers) instead of being topped by railings, and the barriers would be taller than they are now. From an average car, Puget Sound, Bainbridge Island, and the Olympic Mountains would probably still be part of the view, but it is likely that views of much of the waterfront would be hidden by the barriers.

Like the existing viaduct, the new elevated structure would continue to obstruct views; cast shade over an extensive area; limit future development of parks, trails, and sidewalks; generate overhead traffic noise; and give the impression that the city is separated from its waterfront, as shown in Exhibit 5-41. The additional width of the elevated structure would restrict views along Alaskan Way. However, the Elevated Structure Alternative would make some improvements over existing conditions. The new structure would have fewer support columns and they would be spaced farther apart, reducing visual clutter beneath the structure. The streetscape—things like sidewalks, streetcar stops, landscaping, and lighting—would be part of an integrated design that would create continuity along the waterfront compared to today's conditions.

With the Elevated Structure Alternative, SR 99 would continue to be routed over Elliott and Western Avenues. The effects to views from the new elevated structure near Pike Place Market and Victor Steinbrueck Park would be similar to views today, and the views and overall character of the surrounding neighborhood would be about the same.

As with the Cut-and-Cover Tunnel Alternative, new tunnel operations structures (maintenance and ventilation buildings) would be constructed at the Battery Street Tunnel's south and north portals, but they would not adversely affect the urbanized visual environment.

***North Area***

As with the Cut-and-Cover Tunnel Alternative, views for motorists north of the Battery Street Tunnel would be of a depressed roadway framed by retaining walls on either side. The connections of John, Thomas, and Harrison Streets over SR 99 would not substantially change the visual quality of the street, for views either from or toward the road.

**18 What properties would need to be acquired?**

The Bored Tunnel Alternative would have fewer acquisitions on the surface than the other alternatives, as shown in Exhibit 5-43. The Bored Tunnel Alternative would also require subsurface acquisitions. The Cut-and-Cover Tunnel Alternative would acquire a few more parcels than the Elevated Structure Alternative. The specific parcels needed for the alternatives are shown in Exhibit 5-43 and the totals are listed in Exhibits 5-44 and 5-45. Tolling would not affect which parcels are needed for each of the alternatives. WSDOT is currently advancing acquisitions where there are willing parties.

***Exhibit 5-44***
**Summary of Surface Parcels Acquired for the Alternatives**

| | Bored Tunnel | Cut-&-Cover Tunnel | Elevated Structure |
|---|---|---|---|
| Partial Acquisitions | 6 | 24 | 19 |
| Full Acquisitions | 6 | 16 | 16 |
| **Total Properties Affected** | **12** | **40** | **35** |

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

When acquiring properties, Washington State Department of Transportation (WSDOT) would follow the amended provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. This act implements federal and state constitutional guarantees that private property will not be taken or damaged for public use without just compensation.

There are warehouse and office/commercial properties available for sale or lease south of downtown, in central downtown, and in the South Lake Union area that could provide comparable space for businesses located on acquired properties. The sizes of available properties vary greatly, as do prices and lease rates. The current market has slowed due to difficult economic conditions. This has resulted in higher vacancy rates than were experienced at the end of the 1990s and early 2000s when the economy was stronger. It is difficult to predict how long the current economic environment will last; however, as the economy improves, the demand for all property types downtown is expected to be relatively high, based on activity during the recent past.

**Bored Tunnel Alternative**

For the Bored Tunnel Alternative, 12 parcels (approximately 7.8 acres) would be acquired for right-of-way. In addition to the 6 partial and 6 full acquisitions, the Bored Tunnel Alternative would have approximately 55 subsurface acquisitions.[4] The subsurface property acquisitions would not affect land uses on the surface because the area acquired would be outside of the practical building requirements for typical building

***Exhibit 5-45***
**Parcel Areas Needed for the Alternatives**

| | Bored Tunnel | | Cut-&-Cover Tunnel | | Elevated Structure | |
|---|---|---|---|---|---|---|
| | PARTIAL | FULL | PARTIAL | FULL | PARTIAL | FULL |
| **SOUTH** – South of S. King Street | | | | | | |
| Parcels | 3 | 2 | 3 | 0 | 3 | 0 |
| Square Feet | 17,900 | 173,900 | 17,900 | 0 | 17,900 | 0 |
| Acres | about 0.4 | about 4.0 | about 0.4 | 0 | about 0.4 | 0 |
| **CENTRAL** – S. King Street to Denny Way | | | | | | |
| Parcels | 55 subsurface easements | 0 | 12 | 5 | 7 | 5 |
| Square Feet | | 0 | 8,300 | 30,200 | 2,500 | 62,200 |
| Acres | | 0 | about 0.2 | about 0.7 | about 0.06 | about 1.4 |
| **NORTH** – Denny Way North | | | | | | |
| Parcels | 3 | 4 | 9 | 11 | 9 | 11 |
| Square Feet | 15,850 | 15,850 | 93,050 | 248,900 | 93,050 | 248,900 |
| Acres | about 0.4 | about 3.0 | about 2.1 | about 5.7 | about 2.1 | about 5.7 |
| **Total** | | | | | | |
| Parcels | **6** | **6** | **24** | **16** | **19** | **16** |
| Square Feet | **33,750** | **304,500** | **119,250** | **279,100** | **113,450** | **311,100** |
| Acres | about **0.8** | about **7.0** | about **2.7** | about **6.4** | about **2.6** | about **7.1** |

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

**Appendix G, Land Use Discipline Report**

Additional details about acquired properties can be found in Chapter 5 of *Appendix G*.

Attachment A of *Appendix G* lists subsurface property acquisitions required for the Bored Tunnel Alternative.

4 Parsons Brinckerhoff 2009.

# Surface Parcels Acquired for the Alternatives

## BORED TUNNEL ALTERNATIVE

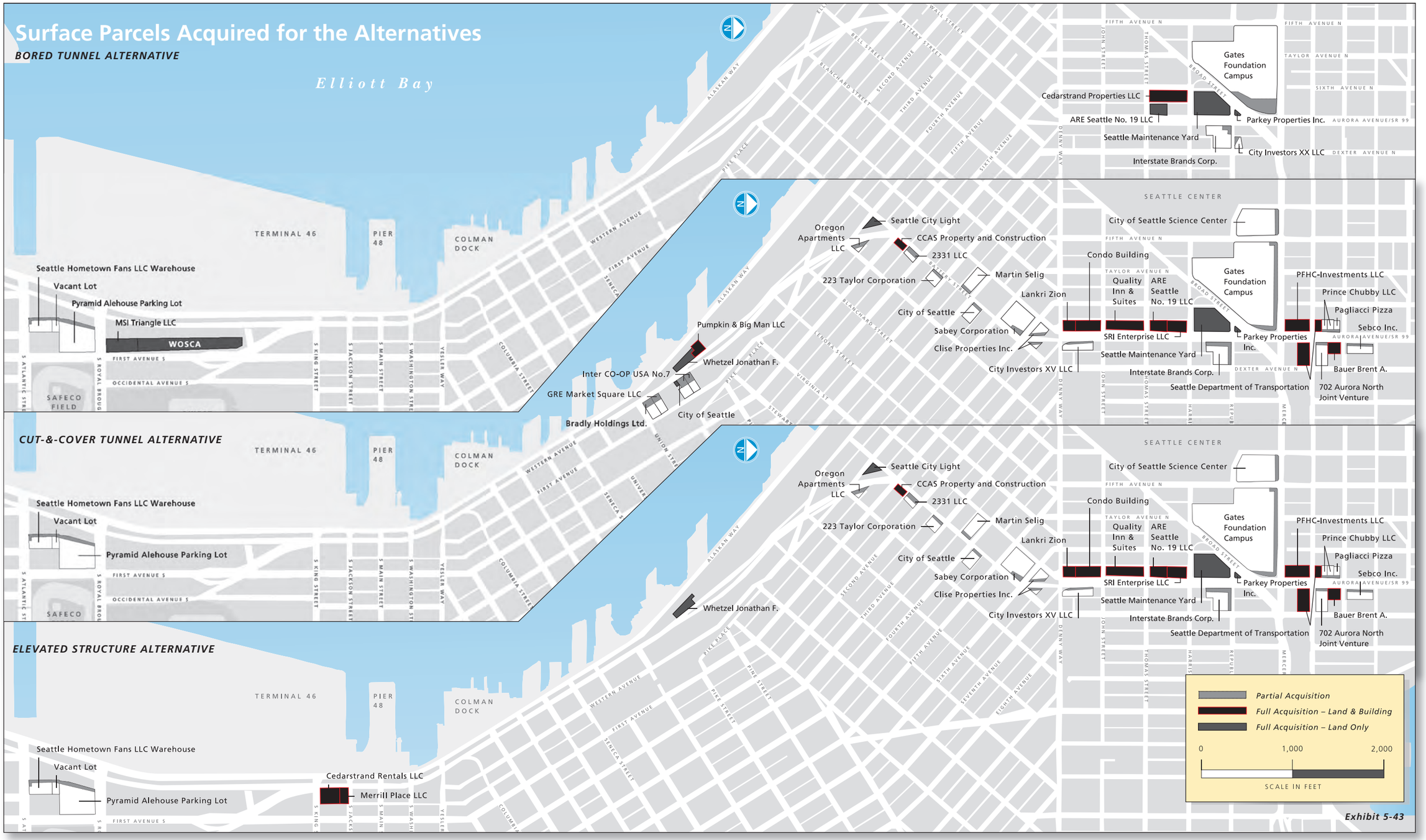



*Exhibit 5-43*

foundations and zoning requirements. Future development such as excavations for grouting, pilings, or installing heat pumps, would need to consider the boundaries of the subsurface property that would be acquired for the tunnel. These acquisitions are not anticipated to change the development potential of the affected properties under current zoning. For the GSA Federal Office Building, the subsurface acquisition is also outside potential development requirements. The distance between the building piles and the top of the bored tunnel would be approximately 64 feet.

In the south portal area, full acquisitions would include about 173,000 square feet (4.0 acres) of land zoned for Industrial Commercial and Pioneer Square Mixed use. One warehouse building near S. Atlantic Street could be displaced with an estimated 25 employees affected. The determination of the need for altering or demolishing this warehouse will be made during final design of the project. One building on Terminal 46 would also be permanently removed, which would relocate 8 employees. Partial acquisitions would include about 17,900 square feet (0.4 acre) of land zoned for Industrial Commercial use.

In the north portal area, full acquisitions would include about 131,500 square feet (approximately 3.0 acres) of property. Partial acquisitions would include about 15,850 square feet (approximately 0.4 acre). Two buildings, an office and a vacant building, would be displaced on the acquired parcels, and an estimated 119 employees could be affected. All of the property acquisition in the north portal area is zoned as Seattle Mixed.

**Cut-and-Cover Tunnel Alternative**

For the Cut-and-Cover Tunnel Alternative, up to 40 parcels (approximately 9.1 acres) would be acquired for right-of-way. This would include full acquisition of 16 parcels and partial acquisition of 24 parcels. Eleven buildings would be displaced on the acquired parcels, and an estimated 124 employees could be affected. The 11 buildings include 3 retail buildings, 2 office buildings, 1 church, 2 hotel/motel buildings, 1 condominium, and 2 vacant buildings.

Some of the acquired parcels would be used for tunnel operations buildings, which would be constructed at the south tunnel portal near Railroad Way S. and at the north portal between Pike and Pine Streets on the east side of Alaskan Way. Maintenance and ventilation buildings would also be located at each end of the Battery Street Tunnel, near where First Avenue intersects with Battery Street and near Denny Way.

In the south area, there would be no full acquisitions. Partial acquisitions would include about 17,900 square feet (approximately 0.4 acre). Along the central waterfront area, full acquisitions would include about 30,200 square feet (approximately 0.7 acre) of property. Partial acquisitions would include about 8,300 square feet (approximately 0.2 acre). In the north area, full acquisitions would include about 249,000 square feet (approximately 5.7 acres) of property. Partial acquisitions would include about 93,100 square feet (approximately 2.1 acre).

**Elevated Structure Alternative**

The Elevated Structure Alternative requires the acquisition of 35 parcels (approximately 9.7 acres), 16 full acquisitions and 19 partial acquisitions. Twelve buildings would be displaced on the acquired parcels. These buildings include 1 parking garage, 2 office buildings, 1 church, 2 hotels, 3 retail buildings, 1 condominium building, and 2 vacant buildings. Under this alternative, approximately 170 employees could be affected by potential displacements.

In the south area, there would be no full acquisitions. Partial acquisitions would include about 17,900 square feet (approximately 0.4 acre). Along the central waterfront area, full acquisitions would include about 62,200 square feet (approximately 1.4 acres) of property. Partial acquisitions would include about 2,500 square feet (approximately 0.06 acre). In the north area, property acquisitions would be the same as for the Cut-and-Cover Tunnel Alternative.

**19 How would land use effects compare?**

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

The proposed project elements are allowed and consistent with the City's land use and shoreline codes as well as the Coastal Zone Management Act (CZMA). They would not affect the ecological functions of the shoreline. The viaduct is considered "upland" in Seattle's Comprehensive Plan and Shoreline Master Program, and demolition of the viaduct and its replacement with a surface street, an elevated structure, or a tunnel would be allowed.

The build alternatives would maintain local and regional mobility by replacing the existing viaduct with a facility that would provide an alternate route to I-5 and Seattle's surface streets. Tolling may directly benefit motorists through reduced congestion on SR 99, and it may also result in a shift of traffic and congestion problems to other routes and areas. Although there would be some properties that would be permanently changed due to right-of-way acquisitions, this conversion of land use is not expected to influence development activity or trends in this densely developed urban area. None of the tolled or non-tolled build alternatives would have direct effects to land uses or land use patterns in the study area.

The project represents only one of numerous ongoing improvements occurring in the city. Because the project would replace an existing facility to meet safety and mobility needs, it is consistent with land use plans and generally maintains and supports existing land use conditions. Therefore, the potential to induce growth in Seattle would be minor. The alternatives are not expected to be a major catalyst for future growth, because large-scale redevelopment is not likely and the alternatives

**Appendix G, Land Use Discipline Report**

Additional details about acquired properties can be found in Chapter 5 of *Appendix G*.

5 City of Seattle 2006.

would support planned future growth as identified in Seattle's Comprehensive Plan.

Several properties would be permanently converted from office, retail, and commercial land uses to transportation uses due to the acquisitions discussed in Question 18. Conversion of land to transportation use would result in a slight reduction in the overall density of potential development in the project area. However, it is not expected to influence development activity or trends in affected areas. Several private developments are planned or already under construction near the project area. Planned development in the south area includes an office and residential mixed-use project on Qwest Field's north parking lot, as well as other mixed-use residential and office developments. In the Uptown and South Lake Union neighborhoods, much of the development continues to be focused on residential and office uses and includes the Gates Foundation Campus.

Removing off-street parking spaces would not result in any land use nonconformities with respect to accessory parking requirements. Parking effects are discussed in Question 20.

For all of the build alternatives, no permanent changes in land use would occur as a result of property being used as a staging area. A potential opportunity for redevelopment would occur at the various construction staging locations after the project is completed.

Current waterfront planning activities are expected to help determine future land uses in the central section. Seattle's Central Waterfront Concept Plan[6] identifies a few existing waterfront development opportunities as well as sites near the project area that have development potential but may require partnerships between private developers and public agencies.

The City's guiding principles for central waterfront development are established by Seattle Resolution 31264. With regards to transportation, these principles include "Improve Access and Mobility," which states "The future waterfront should accommodate safe, comfortable and efficient travel by pedestrians, bicyclists, vehicles and freight. The interactions among these parties must be designed carefully for safety, comfort and efficiency for all." To the extent alternatives, especially with tolling, increase vehicle volumes on Alaskan Way they could make achieving these goals more difficult.

With the Bored Tunnel or Cut-and-Cover Tunnel Alternatives, it is expected that small to moderate-scale future redevelopment along a new Alaskan Way would be an indirect effect of removing the existing viaduct. Development would be constrained by land use and building regulations and likely occur in the form of modest expansions of existing buildings on the east side of the roadway. In addition, changes would occur in the relationship between the waterfront and upland properties leading to the downtown core. To the extent that the existing viaduct has been perceived as a barrier to waterfront uses, new development on vacant or underused property or redevelopment may take place around the new Alaskan Way surface street.

**Bored Tunnel Alternative**

Only a few land uses in the south and north portal areas would be permanently changed due to right-of-way acquisitions for the Bored Tunnel Alternative. The primary changes would be from office, retail, and commercial land uses to transportation uses. This conversion of land use is not expected to influence development activity or trends in those areas. The subsurface acquisitions would not affect existing land uses and are not anticipated to change the development potential of the affected properties under current zoning, because the limits would be outside of the practical building requirements for typical building foundations and zoning requirements.

A tunnel operations building would be built at each of the portals to house ventilation equipment and maintenance and control facilities. Each building would likely be about 60 to 65 feet tall, with ventilation stacks extending 30 to 35 feet beyond the roof, which meets existing zoning and land use code requirements. The tunnel operations buildings would be designed to fit in with their surrounding neighborhoods.

The new east-west surface street at S. Dearborn Street in the south portal area would improve east-west connections between existing land uses such as the sports stadiums, Seattle Ferry Terminal, and waterfront businesses. The south portal area would also have new blocks of property that would be available for future development under the City's existing Industrial Commercial land use zone. Some of the properties that had been used for staging and other construction activities may be sold at a future date. The availability of this land for development is not expected to influence development activity or trends in the Pioneer Square or Greater Duwamish Manufacturing and Industrial Center neighborhoods.

In the north portal area, new connections across Aurora Avenue at John, Thomas, and Harrison Streets and the extension of Sixth Avenue N. to Mercer Street would improve vehicle, bicycle, and pedestrian mobility between the Uptown, Belltown, and South Lake Union neighborhoods. Broad Street would be closed between Ninth Avenue N. and Taylor Avenue N. Although the removal of Broad Street would change pedestrian, bicycle, and vehicle circulation patterns, it would not decrease accessibility to adjacent land uses, and overall mobility in the area would be improved compared to existing conditions.

**Cut-and-Cover Tunnel Alternative**

With the Cut-and-Cover Tunnel Alternative, conversion of land to transportation use would result in a reduction in the overall amount of developable industrial and commercial property. However, it is not expected to greatly influence development activity in the project area. The existing viaduct structure would be removed, and new open space would be created between S. King Street and the Battery Street Tunnel. In addition to the construction staging areas, the right-of-way above the proposed tunnel could also have some redevelopment potential for public use.

6 City of Seattle 2006.

Tunnel operations buildings would be located near each portal of the cut-and-cover tunnel. At the south portal near Railroad Way S., the approximately 40-foot-tall building does not include ventilation stacks and would meet existing zoning and land use code requirements. At the north portal near Pine Street, the building would be 15 feet above the proposed roadway, with ventilation stacks extending about 30 feet beyond the roof. The tunnel operations buildings would follow Seattle's design review process and be designed to fit in with their surrounding neighborhoods.

Maintenance and ventilation buildings would also be located at each end of Battery Street Tunnel, near where First Avenue intersects with Battery Street and near Denny Way. These buildings would likely vary in height from approximately 15 to 40 feet, with ventilation stacks 15 feet tall, and they are not expected to exceed the zoning height limitations. It is expected that if potential conflicts with zoning regulations occur, they would be addressed by conditional use permit requirements.

Most of the land to be acquired is located in the central and north sections of the project area. After the removal of the existing viaduct, a portion of the public land area that currently contains its support columns may become available for other public uses.

Where enhanced pedestrian access could be provided by this alternative from the lid structure above the cut-and-cover tunnel between Union Street and just north of Virginia Street, the connection among business, retail, and service uses downtown and waterfront land uses would improve.

**Elevated Structure Alternative**

Conversion of acquired parcels to transportation use would result in a minor reduction in the overall amount of developable industrial and commercial property, which may have some localized effect on uses. However, it is not expected to greatly influence development activity in the project area. Most of the land to be acquired is located in the central and north sections.

The Elevated Structure Alternative would not result in opportunities for redevelopment in the project area, because it would be in the same location as the existing viaduct. Because the new elevated structure would be wider than the existing structure, the "barrier effect" between the waterfront and downtown would be reinforced. This barrier has been considered a hindrance to improving the connection between the downtown core and the land uses along the waterfront. This alternative would not influence land use patterns and is less likely than the other build alternatives to result in a noticeable change in the connection between the waterfront and downtown.

### 20 How would local and regional economic effects compare?

**Effects to Businesses and Employees**

As discussed previously, 12 properties would be acquired for the Bored Tunnel Alternative, 40 for the Cut-and-Cover Tunnel Alternative, and 35 for the Elevated Structure Alternative. The number of property acquisitions would be the same for tolled and non-tolled build alternatives. The economic effects of acquiring these properties are summarized in Exhibit 5-46.

Partially acquired properties would retain their existing buildings, maintain their current function, and continue to pay property taxes at a reassessed value.

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

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

***Exhibit 5-46***
**Acquired Parcel Effects**

| | Bored Tunnel | Cut-&-Cover Tunnel | Elevated Structure |
|---|---|---|---|
| **SOUTH AREA** | | | |
| Number of Parcels Subject to Acquisition – *full and partial* | 5 | 3 | 3 |
| Number of Parcels Subject to Full Acquisition | 2 | 0 | 0 |
| Number of Buildings Acquired | 2 | 0 | 0 |
| Approximate Area of Work Space Relocated or Displaced – *in square feet* | 14,925 | 0 | 0 |
| Estimated Number of Permanent Jobs Affected by Relocation or Displacement[1] | 33 | 0 | 0 |
| Approximate Property Tax Paid by Fully Acquired Parcels[2] – *in dollars* | 0 | 0 | 0 |
| Area of Fully Acquired Parcels – *in square feet* | 173,900 | 0 | 0 |
| **CENTRAL WATERFRONT AREA** | | | |
| Number of Parcels Subject to Acquisition – *full and partial* | 0[4] | 17 | 12 |
| Number of Parcels Subject to Full Acquisition | 0 | 5 | 5 |
| Number of Buildings Acquired | 0 | 2 | 3 |
| Approximate Area of Work Space Relocated or Displaced – *in square feet* | 0 | 18,900 | 94,100 |
| Estimated Number of Permanent Jobs Affected by Relocation or Displacement[1] | 0 | 24 | 70 |
| Approximate Property Tax Paid by Fully Acquired Parcels[2] – *in dollars* | 0 | 32,000 | 91,200 |
| Area of Fully Acquired Tax-Paying Parcels[3] – *in square feet* | 0 | 30,200 | 49,850 |
| **NORTH AREA** | | | |
| Number of Parcels Subject to Acquisition – *full and partial* | 7 | 20 | 20 |
| Number of Parcels Subject to Full Acquisition | 4 | 11 | 11 |
| Number of Buildings Acquired | 2 | 9 | 9 |
| Approximate Area of Work Space Relocated or Displaced – *in square feet* | 51,500 | 291,600 | 291,600 |
| Estimated Number of Permanent Jobs Affected by Relocation or Displacement[1] | 119 | 100 | 100 |
| Approximate Property Tax Paid by Fully Acquired Parcels[2] – *in dollars* | 105,600 | 478,900 | 478,900 |
| Area of Fully Acquired Tax-Paying Parcels[3] – *in square feet* | 131,500 | 249,000 | 249,000 |

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

1 *This estimate was based on the total square footage of each individual building, the use of the building (e.g. car wash, educational, and office), and the average square feet required per worker based on the use of the building (U.S. Department of Energy 2006).*

2 *This estimate was based on actual amounts collected in 2009 by the King County Finance and Business Operations for all of the parcels to be acquired. This estimate is for 1 year and represents less than 0.01 percent of all property tax revenue collected by King County in 2009 (King County GIS Center 2010).*

3 *The area of tax-paying parcels is less than the total area of property acquired because City and State-owned property does not pay tax.*

4 *The subsurface easements are not included here because this section is discussing the economic impacts of surface properties acquired.*

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

**Appendix L, Economics Discipline Report**

Additional information on economic effects are provided in Chapter 5 of *Appendix L, Economics Discipline Report*.

**Appendix C, Transportation Discipline Report**

Additional information on parking is provided in *Appendix C*, Section 5.8.

Any of the build alternatives could result in indirect regional economic benefits. Pedestrians and vehicles would benefit from increased connectivity of the surface streets in the north project area, linking South Lake Union and the Uptown neighborhoods. Other improvements that would increase connectivity include the extension of Sixth Avenue N., closure of the existing Broad Street right-of-way, and reconstruction of the Mercer Street corridor, which would facilitate freight movement between the BINMIC and I-5. Where improved connections to the downtown core and the central waterfront may facilitate commute trips from surrounding neighborhoods, some development activity and/or increased shopping visits may be stimulated by the desirability of this connection.

Either of the tunnel alternatives would have substantially fewer effects on visual quality and noise effects along the central waterfront than the structure associated with the Elevated Structure Alternative or the existing viaduct. These improved conditions would have the indirect effect of enhancing the viability and desirability of the central waterfront, which, in turn, would increase the economic vitality of the area.

**Effects to Parking**

Exhibit 5-47 summarizes the total on- and off-street parking losses for each build alternative. All of the build alternatives are expected to reduce parking compared to existing conditions. There would be approximately twice as many parking spaces removed for the Cut-and-Cover Tunnel and Elevated Structure Alternatives as for the Bored Tunnel Alternative. The number of parking spaces affected by each of the alternative would be the same under both tolled and non-tolled conditions. If any ADA parking spaces are affected, they would be accommodated in accordance with City guidelines and Federal requirements.

***Exhibit 5-47***
**Public Parking Spaces Removed**

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

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

In the stadium area, the parking effects are the same for all of the build alternatives, as shown in Exhibit 5-48. About 110 on-street spaces and 250 off-street spaces would be removed near the stadiums.

Along the central waterfront, the Cut-and-Cover Tunnel and Elevated Structure Alternatives would remove about half of the on-street parking spaces under the viaduct and along Alaskan Way. The affected parking spaces are shown in Exhibit 5-49. There would be no long-term effects to existing parking under the viaduct from the Bored Tunnel Alternative; however, future planned projects along the central waterfront may reduce available parking. The Bored Tunnel Alternative would not change the parking supply in the Pioneer Square, central, or Belltown areas.

The parking effects north of the Battery Street Tunnel are the same for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. The Bored Tunnel Alternative would remove about 40 more on-street parking spaces in the north area than the other two alternatives. Affected parking spaces in the north area are shown in Exhibit 5-50.

The parking removals are consistent with Seattle's Comprehensive Plan.[7] Goal TG18 indicates that in making decisions about on-street parking, transportation is the primary purpose of the street system. In addition, it is the City's general policy, as described in policy T-42, to replace short-term parking only when the project results in a concentrated and substantial amount of on-street parking loss. The Seattle Department of Transportation will ultimately determine how on-street parking spaces are managed and will likely encourage short-term instead of long-term parking.

## Stadium Area Affected Parking Spaces

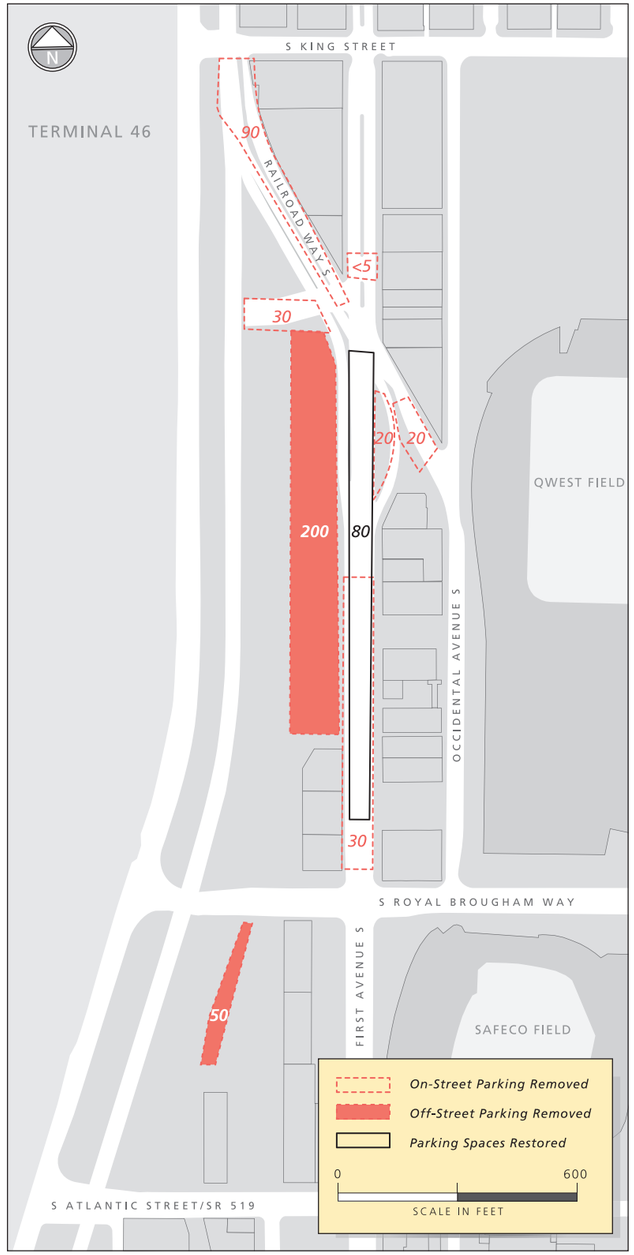



***Exhibit 5-48***

7 City of Seattle 2005.

### *Bored Tunnel Alternative*

The Bored Tunnel Alternative would remove approximately 640 parking spaces, as shown in Exhibit 5-51.

***Exhibit 5-51***
**Parking Effects of the Bored Tunnel Alternative**

| | SPACES REMOVED | | |
|---|---|---|---|
| **Area** | **On-Street** | **Off-Street** | **Total** |
| Stadium | 110 | 250 | **360** |
| North | 280 | 0 | **280** |
| **Total** | **390** | **250** | **640** |

*Note: Effects for the Non-Tolled and Tolled Bored Tunnel Alternative are the same.*

In the stadium area, there are approximately 440 existing parking spaces. Any of the build alternatives would remove about 360 of these spaces. Approximately 80 on-street spaces would be replaced and about 110 on-street spaces would be removed. If 110 on-street spaces were removed, approximately $278,000 would be lost each year from the City's General Fund. On-street parking is available within several blocks of the spaces that would be removed. Most of the on-street spaces that would be permanently removed are 2-hour metered parking spaces along Railroad Way S. Drivers who would have otherwise used these spaces may have to travel several blocks farther to find available on-street spaces on surrounding streets, or they could use a pay lot.

Approximately 250 off-street parking spaces would be permanently affected by the Bored Tunnel Alternative. Of these spaces, about 200 are on the Washington-Oregon Shippers Cooperative Association (WOSCA) property and are currently unavailable due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project. However, the S. Holgate Street to S. King Street Viaduct Replacement Project assumed that these 200 spaces could be replaced. With this project, there may be space on the WOSCA site to replace some of the off-street parking; however, the conservative assumption is that these spaces would not be replaced. As a result, the 200 spaces on the WOSCA site are included as an effect of the Bored Tunnel Alternative. Future use of the space will be determined by WSDOT or potential future property owners. Off street parking lots generally are underutilized

## Central Waterfront Area Affected Parking Spaces

*Cut-&-Cover Tunnel*


***Exhibit 5-49***

during an average non-event weekday within walking distance of the stadium area, so parking spaces are not expected to be difficult to find.

During events at the stadiums, finding available parking may be more challenging or more expensive than it is today. However, a number of major parking facilities are located within walking distance of the stadiums, including the Safeco Field Garage, Qwest Event Center Garage, Union Station Garage, North Lot (Qwest Field), Impark Parking, and Home Plate Parking. These six parking facilities provide about 6,900 parking spaces. Many smaller parking lots and garages are also within walking distance of the stadiums. Event-goers will continue to be encouraged to use bus and rail service and to carpool to the stadiums. The Safeco Field Transportation Management Plan and the Qwest Field Transportation Management Program both include parking reduction and transit-related goals and mitigation measures that aim to reduce the number of event attendees who require parking near the stadiums.

In the north area, there are approximately 90 on-street, short term parking spaces and approximately 230 on-street, long-term spaces within the north portal area, for a total of 320 on street spaces. The on-street, long-term spaces mainly consist of metered spaces with a 10-hour limit. For the Bored Tunnel Alternative, approximately 40 spaces would be replaced, resulting in a loss of 280 on street spaces, compared with existing conditions. Most of these spaces would be removed to accommodate bicycle lanes or vehicle lanes. The Seattle Department of Transportation will manage the on-street parking spaces, so no assumptions are made about whether the new and replaced on street parking spaces would be long- or short-term. However, if 280 on-street spaces are removed in the north area, approximately $244,000 would be lost each year from the City's General Fund.

***Cut-and-Cover Tunnel Alternative***

The Cut-and-Cover Tunnel Alternative would remove approximately 1,190 spaces, as shown in Exhibit 5-52.

## North Area Affected Parking Spaces

*Bored Tunnel*


***Exhibit 5-50***

***Exhibit 5-52***
**Parking Effects of the Cut-&-Cover Tunnel Alternative**

| | SPACES REMOVED | | |
|---|---|---|---|
| **Area** | **On-Street** | **Off-Street** | **Total** |
| Stadium | 110 | 250 | **360** |
| Pioneer Square | 110 | 0 | **110** |
| Central | 240 | 70 | **310** |
| Belltown | +10 | 150 | **140** |
| North | 240 | 30 | **270** |
| **Total** | **690** | **500** | **1,190** |

*Note: Effects for the Non-Tolled and Tolled Cut-&-Cover Tunnel Alternative are the same.*

In the stadium area, the Cut-and-Cover Tunnel Alternative would have the same effects as described for the Bored Tunnel Alternative.

In the Pioneer Square area, about 110 on-street parking spaces would be removed. Almost all of the affected spaces are short-term spaces, with the exception of about 10 unrestricted unmetered spaces along Alaskan Way. The loss of 110 on-street spaces could make it more difficult for shoppers and restaurant patrons to find parking in this area, and would result in approximately $278,000 lost each year from the City's General Fund.

In the central waterfront area along Alaskan Way and under the viaduct, approximately 240 of the existing 510 on-street spaces would be removed by the Cut-and-Cover Tunnel Alternative. These 240 spaces represent about half of the on-street spaces under the viaduct and along Alaskan Way. On-street parking along the waterfront is highly utilized under existing conditions, so removing many of the spaces would make it even more difficult to find parking. Many drivers would likely need to seek short-term parking in surrounding parking garages, which could be more expensive and farther away from their destinations on the waterfront. The loss of these 240 paid on-street spaces would reduce the City's General Fund by approximately $1.6 million each year.

In addition to the on-street parking effects along the central waterfront, there also would be an off-street public parking lot located across from the Seattle Aquarium that would be removed. This lot holds approximately 70 pay spaces.

In Belltown, which includes parking along Alaskan Way north of Wall Street, Battery Street, and Elliott and Western Avenues, about 10 on-street spaces would be gained. These spaces would generate approximately $9,000 annually, which would be added to the City's General Fund each year. Two private public pay lots under the viaduct in the Elliott/Western vicinity and one on Battery Street would be removed by the Cut-and-Cover Tunnel Alternative. These lots total about 150 off-street spaces.

In the north area, about 240 on-street spaces would be removed, as shown on Exhibit 5-52. This includes about 70 short-term spaces and 170 long-term spaces. The number of on-street parking spaces removed is similar to the 280 on-street spaces removed by the Bored Tunnel Alternative, but the spaces are in different locations. The loss of these 240 paid on street spaces would reduce the City's General Fund by approximately $209,000 each year.

***Elevated Structure Alternative***

The Elevated Structure Alternative would remove approximately 1,380 spaces, as shown in Exhibit 5-53.

***Exhibit 5-53***
**Parking Effects of the Elevated Structure Alternative**

| | SPACES REMOVED | | |
|---|---|---|---|
| **Area** | **On-Street** | **Off-Street** | **Total** |
| Stadium | 110 | 250 | **360** |
| Pioneer Square | 130 | 130 | **260** |
| Central | 250 | 70 | **320** |
| Belltown | 20 | 150 | **170** |
| North | 240 | 30 | **270** |
| **Total** | **750** | **630** | **1,380** |

*Note: Effects for the Non-Tolled and Tolled Elevated Structure Alternative are the same.*

In the stadium area, the Elevated Structure Alternative would have the same affects as described for the Bored Tunnel Alternative.

In the Pioneer Square area, about 130 on-street parking spaces would be removed. Almost all of the affected spaces are short term spaces, with the exception of about 10 unrestricted unmetered spaces along Alaskan Way. The loss of 130 on-street spaces could make it slightly more difficult for shoppers and restaurant patrons to find parking in this area, and would result in approximately $329,000 lost each year from the City's General Fund.

The Elevated Structure Alternative would also remove a parking garage on S. King Street that has approximately 130 off-street spaces. The other two alternatives do not require demolition of this parking garage. The net effect would be a loss of about 260 parking spaces in the Pioneer Square area.

In the central waterfront area along Alaskan Way and under the viaduct, approximately 250 of the existing 510 on-street spaces would be removed by the Elevated Structure Alternative. These 250 spaces represent about half of the on-street spaces under the viaduct and along Alaskan Way. On-street parking along the waterfront is highly utilized under existing conditions, so removing many of the spaces would make it even more difficult to find parking. Many drivers would likely need to seek short-term parking in surrounding parking garages, which could be more expensive and farther away from their destinations on the waterfront. The loss of these 250 paid on street spaces would reduce the City's General Fund by approximately $1.65 million each year.

In addition to the on-street parking effects along the central waterfront, about 70 off-street spaces located in a surface parking lot on the east side of Alaskan Way near the Seattle Aquarium would be removed to accommodate the realigned Alaskan Way surface street.

In Belltown, which includes parking along Alaskan Way north of Wall Street, Battery Street, and Elliott and Western Avenues, about 20 on-street spaces would be removed. If these spaces are removed, approximately $17,000 would be lost each year from the City's General Fund. In addition, two pay lots under the viaduct in the Elliott/Western vicinity and one on Battery Street would be removed by the Elevated Structure Alternative. These lots total about 150 off-street spaces.

In the north area, the Elevated Structure Alternative would have the same affects as described for the Cut-and-Cover Tunnel Alternative.

**How would local and regional economic effects change if the build alternatives were not tolled?**
Most of the effects to the local and regional economy are the same for the tolled and non-tolled build alternatives. However, if the SR 99 facility is not tolled, the state would not be able to recoup a portion of the capital cost from the direct users of the facility. The non-tolled alternatives would place a higher burden on the state to use gas tax and other state funds on the Alaskan Way Viaduct Replacement Project, rather than using these funds for other projects in the state.

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

## 21 How would effects to historic resources compare?

### Bored Tunnel Alternative

The Bored Tunnel Alternative would demolish the Alaskan Way Viaduct and decommission the Battery Street Tunnel, both of which are eligible for the National Register of Historic Places (NRHP). These structures have been documented with photos and a narrative history in accordance with Historic American Engineering Record (HAER) standards. The consultation process required by Section 106 of the National Historic Preservation Act (see Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report, for more information) determined the project will have an adverse effect on one or more structures that are listed in or eligible for the NRHP, as shown in Exhibit 5-54. These properties are the Alaskan Way Viaduct and Battery Street Tunnel, and the Lake Union Sewer Tunnel. The Western Building and Polson Building are contributing elements of the NRHP-listed Pioneer Square Historic District. Therefore, effects to these buildings during construction of the Bored Tunnel Alternative would affect the district itself; see Chapter 6, Question 19. Adverse effects to these resources are addressed in a Memorandum of Agreement developed in consultation with the State Historic Preservation Office, tribes, and the consulting parties and will meet the requirements of Section 106 and other applicable laws, regulations, and policies.

At the south portal, an approximately 65-foot-high tunnel operations building that would contain ventilation fans, exhaust stacks, emergency generators, and electrical and fire support utilities would be constructed on the block bordered by Alaskan Way S., Railroad Way S., and S. Dearborn Street. This site is across the street from the Pioneer Square Historic District and the Triangle Building, which are listed in the NRHP. It would be a noticeable new feature, but less obtrusive than the ramp adjacent to First Avenue S. along Railroad Way S. that would be demolished as part of the Bored Tunnel Alternative, and therefore would not adversely affect the adjacent NRHP-listed historic resources.

At the north portal, an approximately 60-foot-high tunnel operations building would be constructed on the east side of Sixth Avenue N. between Thomas and Harrison Streets. The NRHP-eligible Seattle City Light Broad Street Substation is located across Sixth Avenue N. from the proposed tunnel operations building, but since both are concrete industrial buildings of similar appearance, the substation would not be adversely affected by the tunnel operations building. Also near the north portal at Republican Street, a shaft connecting to the NRHP-eligible Lake Union sewer tunnel would be modified by the project, resulting in an adverse effect to the resource.

Removing the existing viaduct structure would result in beneficial effects to the Pioneer Square Historic District and Piers 54 through 62/63 on the central waterfront due to reduced noise, vibration, and air pollution and improved views to and from the historic buildings. Removing the adjacent Columbia and Seneca Street ramps would provide similar benefits to nearby historic structures. The Tolled Bored Tunnel Alternative would increase traffic in Pioneer Square compared to the Non-Tolled Bored Tunnel Alternative; however, the additional traffic would not adversely affect the contributing features of Pioneer Square that make it eligible for the NRHP.

***Exhibit 5-54***
**Permanent Effects to Historic Properties**

| Property | National Register Status | ALTERNATIVES | | |
|---|---|---|---|---|
| | | Bored Tunnel | Cut-&-Cover Tunnel | Elevated Structure |
| Alaskan Way Viaduct[1] | NRHP eligible | Demolition – *Adverse effect* | Demolition – *Adverse effect* | Demolition – *Adverse effect* |
| Battery Street Tunnel[1] | NRHP eligible | Decommisioning – *Adverse effect* | Alteration | Alteration |
| Elliot Bay Seawall | NRHP eligible | *No operational effect* | Demolition – *Adverse effect* | Demolition – *Adverse effect* |
| Washington Street Boat Landing – *Foot of Washington Street* | NRHP listed | *No operational effect* | Removal[2] – *Adverse effect* | Removal[2] – *Adverse effect* |
| Lake Union Sewer Tunnel – *Republican Street east of Aurora Avenue* | NRHP eligible | Alter manhole shaft – *Adverse effect* | Alter manhole shaft – *Adverse effect* | Alter manhole shaft – *Adverse effect* |

*Note: Effects for the non-tolled and tolled build alternatives would be the same*

*1 The Alaskan Way Viaduct and the Battery Street Tunnel are recorded as a single historic property.*

*2 After construction, the Washington Street Boat Landing would be replaced in approximately the same location.*

### Cut-and-Cover Tunnel Alternative

As with the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would demolish the NRHP-eligible Alaskan Way Viaduct and modify the NRHP-eligible Battery Street Tunnel (adverse effect), construct a tunnel operations building adjacent to Pioneer Square (no adverse effect), modify the historic sewer tunnel shaft near Republican Street (adverse effect) and benefit historic piers and buildings along the central waterfront by removing the viaduct and the Columbia and Seneca ramps (beneficial effect). Unlike the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would not affect the Polson or Western Buildings. It would replace the NRHP-eligible Elliott Bay Seawall (adverse effect) as well as remove the NRHP-listed Washington Street Boat Landing (adverse effect) during construction. The boat landing would be replaced in approximately the same location after construction. The Cut-and-Cover Tunnel Alternative would also excavate beneath the NRHP-eligible Buckley's (MGM-Loew's) building, formerly known as the McGraw Kittenger Case Building (adverse effect during construction, discussed in Chapter 6). It would construct tunnel operations and maintenance buildings near historic resources at Pine Street and both ends of the Battery Street Tunnel. The

**Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report**

Methods used to assess existing conditions, environmental effects, and mitigation are described in ***Appendix I***, Chapter 2. Chapter 5 of ***Appendix I*** provides additional information on effects to historic, cultural, and archaeological resources.

The Memorandum of Agreement can be found in Attachment C of ***Appendix I***.

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

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic and archaeological sites. The project is adjacent to some of Seattle's best-known historic buildings and neighborhoods. The Alaskan Way Viaduct/Battery Street Tunnel and the Lake Union sewer tunnel manhole shaft would be permanently affected by all alternatives.

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

**Appendix U, Final EIS Correspondence**

For more information about historic and archaeological resources, please see the DAHP concurrence letter in ***Appendix U***.

tunnel operations building at Pine Street would be located below the landscaped pedestrian lid and would therefore not adversely affect the historic resources in its vicinity, which are located above the lid. The tunnel operations building at the south end of the Battery Street Tunnel would be incorporated into the tunnel portal and would not protrude into the historic context of nor adversely affect the nearby resources, located above the portal on First Avenue. The tunnel operations building at the north end of the Battery Street Tunnel would be an unassuming one-story structure that would not block views of, nor interfere with the historic context of, nor adversely affect resources in its vicinity. The Tolled Cut-and-Cover Tunnel Alternative would increase traffic in Pioneer Square compared to the Non-Tolled Cut-and-Cover Tunnel Alternative; however, the additional traffic would not adversely affect the contributing features of Pioneer Square that make it eligible for the NRHP.

**Elevated Structure Alternative**
As with the tunnel alternatives, the Elevated Structure Alternative would demolish the NRHP-eligible Alaskan Way Viaduct and modify the Battery Street Tunnel (adverse effect), and modify the historic sewer tunnel shaft near Republican Street (adverse effect). Unlike the tunnel alternatives, the Elevated Structure Alternative would not include a tunnel operations building near Pioneer Square. The Elevated Structure Alternative would be larger than the existing structure and therefore would have greater impacts to the Pioneer Square Historic District than the existing viaduct. It would not result in benefits to historic piers and buildings along the central waterfront, due to the continued presence of an elevated highway. As with the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would not affect the Polson or Western Buildings or historic resources near the new Battery Street Tunnel ventilation and maintenance buildings (no adverse effect). Unlike the Cut-and-Cover Tunnel Alternative, the Elevated Structure Alternative would not affect the NRHP-eligible Buckley's (MGM-Loew's) Building (formerly known as the McGraw Kittenger Case Building). The Tolled Elevated Structure Alternative would increase traffic in Pioneer Square compared to the Non-Tolled Elevated Structure Alternative; however, the additional traffic would not adversely affect the contributing features of Pioneer Square that make it eligible for the NRHP.

**How would effects to historic properties change if the build alternatives were not tolled?**
If the build alternatives were not tolled, less traffic would divert into historic districts. However, the effects discussed above would occur as a result of the proposed facility designs, not as a result of vehicle volumes on surface streets. Therefore, the absence of tolls would not result in substantial changes to the expected effects of the build alternatives to historic resources.

### 22 How would effects to archaeological resources compare?

No effects to archaeological properties would result from the operation of any of the alternatives, because no ground disturbance is anticipated to result during operation.

All of the build alternatives would result in ground disturbance in archaeologically sensitive areas during construction, which is discussed in Chapter 6, Question 20.

### 23 How would effects to parks, recreation, and open space compare?

Effects to parks, recreation, and open spaces would be the same for the build alternatives with or without tolls.

**Bored Tunnel Alternative**
The Bored Tunnel Alternative would benefit parks and recreational resources by removing the existing viaduct, which would improve connections between elements of Seattle's park and recreation system into Seattle's downtown neighborhoods.

Near the south portal, the Bored Tunnel Alternative would change the configuration of SR 99 and nearby streets. The on- and off-ramps near the stadiums would provide more direct connections to recreational facilities such as Qwest and Safeco Fields.

In the Pioneer Square area, conditions for people visiting the Washington Street Boat Landing would be improved due to viaduct removal. Viaduct removal may encourage more pedestrian movement between the waterfront and Pioneer Square. The additional open space provided by removing the viaduct would be consistent with the Pioneer Square and Downtown Urban Center Neighborhood Plans.[8,9]

In the central waterfront area, viaduct removal would improve the integration of existing park and recreation uses between the waterfront piers and downtown Seattle and reduce noise levels. With the viaduct gone, the Seattle Aquarium is likely to benefit from more pedestrian-friendly connections between the aquarium and downtown along east-west streets such as University Street and the Pike Street Hillclimb. The relationship between the waterfront and the Pike Place Market, which is a major tourist destination, would be strengthened. Piers 55 to 62/63 also attract many tourists and would be enhanced by reduced noise levels, improved views, and a more pedestrian-friendly environment. The boat service providing access across Puget Sound to Tillicum Village and Blake Island State Park is located at Pier 55 and also would potentially benefit from these changes.

Near the north portal, the Bored Tunnel Alternative would change the configuration of SR 99 and connect three surface streets across Aurora Avenue. Providing new connections at John, Thomas, and Harrison Streets would improve circulation near Denny Park and provide increased opportunities for park access. Along with new street connections, closing the Broad Street underpass and widening Mercer Street to accommodate two-way traffic would change the circulation of local traffic accessing Seattle Center. This would change travel routes for people destined for area park and recreational facilities but would not affect the physical configuration of these facilities.

**Cut-and-Cover Tunnel Alternative**
By removing the viaduct, the Cut-and-Cover Tunnel Alternative would improve connections between open spaces along the central waterfront, throughout downtown,

**Section 4(f) and Protection of Public Park and Recreation Resources**

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic and archaeological sites. The project is adjacent to some of Seattle's best-known historic buildings and neighborhoods. The Alaskan Way Viaduct/Battery Street Tunnel and the Lake Union sewer tunnel manhole shaft would be permanently affected by all alternatives.

Additional construction-related effects to park and recreational resources are discussed in **Chapter 6**, **Question 24** and in the **Section 4(f) Evaluation** found at the end of this document on page 239. Section 4(f) Supplemental Materials are provided in *Appendix J* of this *Final EIS*.

**Appendix H, Social Discipline Report**

Methods used for assessing social resources are described in *Appendix H*, **Chapter 2**. **Chapter 5** provides additional information on effects to neighborhoods, community, social services, and park and recreational resources.

Effects on low-income and minority populations (environmental justice) are also discussed in *Appendix H*.

8 City of Seattle 1998.

9 City of Seattle 1999.

and in Pioneer Square. Access to the stadiums and connections to Denny Park and Seattle Center also would improve. In contrast to the Bored Tunnel Alternative, which would require a separate project to create new recreational spaces along the central waterfront, the Cut-and-Cover Tunnel Alternative would create these spaces, along with new pedestrian and bicycle facilities and an improved Alaskan Way surface street. The Cut-and-Cover Tunnel Alternative includes the additional benefit of a new 130-foot-wide public open space between Stewart and Virginia Streets, creating a continuous park setting and pedestrian connection between Pike Place Market and the waterfront. It is envisioned as a lively urban landscape that could have features like seating, landscaping, fountains, viewpoints, public art, restaurants, and shopping.

**Elevated Structure Alternative**

Unlike the tunnel alternatives, the Elevated Structure Alternative would limit opportunities for open space and recreational activities on the central waterfront. However, some recreational amenities would be constructed along Alaskan Way as part of the Elevated Structure Alternative, in contrast with the Bored Tunnel Alternative, under which recreational facilities would be separate projects. The Elevated Structure Alternative would, as with the tunnel alternatives, improve connections to Denny Park and Seattle Center.

### 24 How would effects to neighborhoods compare?

The build alternatives would generally benefit neighborhoods by providing improved access and surface street connections near the stadiums and the Seattle Center area. The Elevated Structure Alternative would provide access to central downtown and northwest Seattle similar to the existing viaduct because it would include ramps at Columbia and Seneca Streets and Elliott and Western Avenues. The Cut-and-Cover Tunnel Alternative would include the Elliott and Western Avenue ramps, and the Bored Tunnel Alternative would not provide any of these ramps. Therefore, the tunnel alternatives would change how some drivers access downtown. Some travel routes to businesses and residences in the downtown Central Business District and Belltown may take more time, since drivers would need to exit SR 99 at the north or south portal and then travel via local streets.

All of the build alternatives would enhance roadway safety north of Denny Way, since arterial connections to and from SR 99 between John and Roy Streets would be consolidated to a fewer set of access points. Circulation for all modes of travel to, from, and within neighborhoods and community resources would improve north of Denny Way, since east-west streets would be connected across Aurora Avenue. The Bored Tunnel Alternative would connect three east-west streets across Aurora Avenue compared to the other build alternatives, which would connect two east-west streets.

As an indirect result of the new east-west street connections, some areas within the Belltown, Uptown, and South Lake Union neighborhoods may become more cohesive and connected. For the Bored Tunnel Alternative, the elimination of the Western Avenue and Battery Street SR 99 ramps, and the decommissioning of the Battery Street Tunnel would likely increase the perceived quality and desirability of surrounding Belltown properties. With the Bored Tunnel or Cut-and-Cover Tunnel Alternative, removing the viaduct along the central waterfront would also likely have an indirect effect on the adjacent neighborhoods, increasing the desirability of existing properties immediately adjacent to the existing elevated structure.

### 25 How would effects to community and social services compare?

For people who work or seek services at downtown area community and social service facilities, access would change only slightly. Access would not change for residents who seek services in neighborhoods directly adjacent to this section of SR 99. However, for residents traveling on SR 99 to access services from outside of the project area, access would change, as discussed previously in Exhibit 5-1. Some routes might be slightly more circuitous, and travel times may be somewhat longer, while other routes (such as those to the Pioneer Square area) may become more direct and travel times may decrease.

Of the parcels that would be acquired to build the Bored Tunnel Alternative, one non-profit employment service (the Seattle Jobs Initiative) would be displaced and relocated. This organization is a policy and research agency and has no direct contact with job seekers or members of any environmental justice population; it coordinates with other community-based organizations, such as community colleges and other training programs. The relocation would not affect the environmental justice population.

Although there would be many more full and partial acquisitions necessary for the Cut-and-Cover Tunnel and Elevated Structure Alternatives, no social resources would be acquired.

### 26 How would effects to low-income and minority populations compare?

**Access**

A primary concern for minority and low-income populations (environmental justice populations) with this project is changes in SR 99 access, pedestrian routes, and transit services. These effects are likely to be short-term as people and service providers adjust to changes. Some minority and low-income populations, including those with physical and mental disabilities, economic disadvantages, and language and cultural barriers, may have more difficulty adapting to such transitions. Continued community outreach and communication will be a crucial part of minimizing any potential effects.

For social service organization workers and patrons living outside of downtown Seattle, travel routes may be altered because of changes to SR 99 access. Travel times could increase or decrease depending on the travel route and the time of the trip, but this would not substantially affect the service providers continued operations or the ability of patrons to visit these providers.

Homeless people who currently seek shelter under the viaduct would be affected by its removal with either of the tunnel alternatives, although seeking shelter underneath

**What is environmental justice?**

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

the viaduct is illegal. Regardless, the lead agencies have considered ways to coordinate with social service providers to notify homeless individuals who may be using areas under the viaduct for shelter.

**Acquisitions and Displacements**
None of the properties acquired for any of the build alternatives would be resources specifically important to minority or low-income populations. As discussed previously in Question 18, residents and employees would be displaced by the build alternatives. However, it is unknown what proportion of these residents and employees would be low-income and minority. No comprehensive survey of downtown Seattle employees and residents was conducted for this purpose.

***Bored Tunnel Alternative***
None of the resources displaced by the operation of the Bored Tunnel Alternative would be resources that are specifically important to minority or low-income populations. The property acquisitions required for the Bored Tunnel Alternative would result in the displacement of the nonprofit Seattle Jobs Initiative, a policy and research agency. However, this organization has no direct contact with job seekers or members of any environmental justice population; it coordinates with other community-based organizations, such as community colleges and other training programs.

***Cut-and-Cover Tunnel Alternative***
Most of the alignment of the Cut-and-Cover Tunnel Alternative would be within existing right-of-way. The acquisition effects of the Cut-and-Cover Tunnel Alternative would be more substantial than those of the Bored Tunnel Alternative, because the tunnel would be cut and covered along Alaskan Way and the waterfront, rather than bored under downtown. Although there would be many more full and partial acquisitions necessary for the Cut-and-Cover Tunnel Alternative, no properties social resources are located would be acquired.

***Elevated Structure Alternative***
Most of the alignment for the Elevated Structure Alternative would be within existing right-of-way (similar to the Cut-and-Cover Tunnel Alternative) and the effects of property acquisition would be more substantial than for the Bored Tunnel Alternative. The acquisitions would be the same as those described for the Cut-and-Cover Tunnel Alternative in the south and north segments. However, there would be differences in the central segment due to the significant differences between the Cut-and-Cover Tunnel Alternative and the Elevated Structure Alternative. With the Elevated Structure Alternative, the acquired properties do not currently house social resources; many of them are office buildings or are already publicly owned.

**Noise**
As discussed previously in Question 16, traffic noise levels were modeled at 70 sites for both existing conditions and the year 2030 for each of the build alternatives, with and without tolls. The modeling results indicate that 10 to 13 fewer sites would approach or exceed FHWA noise abatement criteria with the tolled and non-tolled Bored Tunnel and Cut-and-Cover Tunnel Alternatives, compared to projected 2015 Existing Viaduct conditions. This reduction in noise levels would benefit all people near these sites, regardless of income level or minority status. Modeling results indicate that throughout most of the study area, sites with the Elevated Structure Alternative would experience similar noise levels compared to the projected 2015 Existing Viaduct. However, four additional sites would approach or exceed FHWA noise abatement criteria.

**Transit**
None of the build alternatives are expected to substantially alter the ability for low-income and minority persons to access transit. The location transit vehicles access downtown to and from the south would change with the new ramps near the stadiums. Buses would likely access downtown near S. King Street, which is a few blocks further south than the existing ramps at Columbia and Seneca Streets. Expected changes to transit travel times are discussed in Question 14.

**Tolling**
As the Puget Sound region considers implementing tolls on its facilities, the potential effects on low-income populations are important to take into account. While toll payment, by definition, would account for a higher proportion of a low income individual's monthly income, this alone does not constitute a high and adverse disproportionate impact. The analyses of the equity of tolling concluded that the effects would not be disproportionately high and adverse because there would be viable options for avoiding the toll either through alternate routes or by switching to transit. In addition, WSDOT will employ measures to improve the accessibility of transponders to low-income and minority populations. These measures are discussed in Chapter 8.

**Determination**
For reasons discussed above, effects due to access changes, acquisitions and displacements, noise, transit, and tolling are not expected to result in disproportionately high, and adverse effects to low-income or minority populations.

As discussed in Chapter 6, Question 24, project construction would require many years to complete and would have effects to many elements in the project area. The most widespread effects would include increased traffic congestion, noise, dust, and light and glare in and around the construction zone. These effects would be adverse, but would not disproportionately affect low-income and minority populations. Chapter 8 discusses how these effects would be mitigated.

Therefore, the build alternatives are not expected to result in disproportionately high and adverse effects on low-income or minority populations.

**How would effects to low-income populations change if the build alternatives were not tolled?**
Effects due to displacement from the tolled and non-tolled build alternatives on low-income populations would not change, since the same displacements would occur under tolled and non-tolled conditions. Noise effects would not change substantially between tolled and non-tolled

**Chapter 6, Question 24**

Discusses expected effects to low-income and minority populations during construction.

**Appendix K, Public Services and Utilities Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix K***, **Chapter 2**. **Chapter 5** provides additional information on effects to public services and utilities.

conditions. Transit access for low-income and minority persons are not expected to be substantially altered; however, the access to and from the south would change somewhat with the new ramps in the stadium area, as discussed in Question 14. The most notable difference between the tolled and non-tolled build alternatives would be the absence of tolls. If the build alternatives were not tolled, low-income populations would not need to decide whether to pay the toll or to use an alternate non-tolled route. However, the tolled build alternatives would not result in a disproportionate high and adverse effect upon low-income populations, so the absence of tolls would not affect the environmental justice determination.

### 27 How would effects to public services (such as police, fire, and delivery services) and utilities compare?

**Public Services**

***Effects Common to All Build Alternatives***

All of the build alternatives would modify the transportation network in and around downtown, but they are not expected to result in significant adverse effects to public services. Since public service providers make hundreds of trips through downtown every day, some using fixed routes and others using demand-responsive routes, determining the potential effect on each provider is not possible. Depending on the route used, some public service providers would experience increased traffic-related delay while others would experience decreased traffic-related delay. Some public service providers, such as emergency medical service providers, demand right-of-way and therefore would be less affected by increased surface street traffic volume. Many public service providers operate 24 hours a day, and would therefore be unaffected during much of the day by the increased surface street traffic volumes, which are expected to cause increased congestion primarily during peak travel periods.

***Safety and Security for the Bored Tunnel and Cut-and-Cover Tunnel***

A variety of measures would be employed to minimize potential risks associated with emergencies such as a tunnel fire or an accident where hazardous materials, such as oil or gasoline, are spilled. One of the measures includes prohibiting trucks that carry flammable and hazardous materials from using the tunnels. Other measures include designing the tunnels to provide emergency access, evacuation routes, ventilation, and fire suppression systems in accordance with National Fire Protection Association standards and other codes and regulations. Access to the tunnels would be maintained at all times to ensure prompt emergency response times and the safety of people traveling in the tunnels. Depending on the location and extent of an emergency, a spill incident could require a response from a number of emergency management agencies, including the Seattle Office of Emergency Management, Port of Seattle, Washington State Department of Ecology, and the City of Seattle.

**Utilities**

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

**How would effects to public services change if the alternatives were not tolled?**

If the alternatives were not tolled, less traffic would divert from SR 99. Some routes used by public service providers would experience less traffic-related delay if the alternatives were not tolled. However, since the provision of public services is not expected to be adversely impacted under tolled conditions, non-tolled conditions would not represent a major change from the effects discussed above.

### 28 How would effects to air quality compare?

EPA has identified several air pollutants as pollutants of concern nationwide. These pollutants, known as criteria pollutants, are CO, particulate matter with a diameter of 10 micrometers or less ($PM_{10}$), particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$), ozone ($O_3$), sulfur dioxide ($SO_2$), lead (Pb), and nitrogen dioxide ($NO_2$). The sources of these pollutants, their effects on human health and the nation's welfare, and their concentration in the atmosphere vary considerably. Under the Clean Air Act, U.S. Environmental Protection Agency's (EPA) has established National Ambient Air Quality Standards (NAAQS), which specify maximum allowable concentrations for these criteria pollutants (EPA 2010).

Analysis of highway projects focus primarily on emissions from automobiles, like CO. The Washington State Intersection Screening Tool (WASIST) was used to estimate CO concentrations at sensitive receptor sites near heavily congested intersections that are expected to be affected by the Viaduct Closed (No Build Alternative) and the build alternatives. The analysis showed that the non-tolled and tolled Bored Tunnel Alternative, the non-tolled and tolled Cut-and-Cover Tunnel Alternative, and the non-tolled and tolled Elevated Structure Alternative would not cause or contribute to any new localized violations of the NAAQS for CO, increase the frequency or severity of any existing violations of the NAAQS, or delay the timely attainment of the NAAQS in the 2030 design year. The results of the WASIST model indicated that more detailed EPA modeling was not necessary.

The project is included in PSRC's long-range transportation plan, approved May 20, 2010, and referred to as *Transportation 2040*,[10] and the Statewide Transportation Improvement Program.[11] The inclusion of this project is required to show that the project conforms with the Puget Sound region's Air Quality Maintenance Plans and would not cause or contribute to exceedances of the NAAQS at the regional level. The project meets all the requirements of 40 CFR 93.123 and WAC 173-420 and demonstrates regional conformity.

**How would the tunnels be evacuated in an emergency?**

Evacuation procedures for the bored and cut-and-cover tunnels (including ADA considerations) are discussed in **Chapter 3**.

**Appendix M, Air Quality Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix M***, **Chapter 2**. For the Final EIS, the year 2015 was chosen to represent the affected environment to account for projects recently completed or currently underway. To assess the operational impacts of each alternative, the project's design year 2030 was modeled.

***Appendix M***, **Chapter 5** discusses the results of the Mobile Source CO Analysis and MSAT Analysis for the non-tolled alternatives and **Chapter 7** discusses the results for the tolled alternatives. This appendix also provides additional information on compliance.

10 PSRC 2010.

11 WSDOT 2010.

Estimated CO concentrations at intersections for all of the build alternatives are all projected to be below the 1 hour and 8 hour NAAQS of 35 and 9 parts per million, respectively. Even at areas of higher pollutant concentration, such as the tunnel portals and tunnel operations buildings analysis showed that all estimated concentrations of CO and would be below the NAAQS for the tolled and non-tolled build alternatives.

In addition to the criteria pollutants for which there are NAAQS, EPA also regulates air toxics, which are pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human sources, including on road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Based on FHWA's Interim Guidance Update on Air Toxic Analysis in NEPA Documents (FHWA 2009), the project belongs in Tier 3 (i.e., projects with a high potential for MSAT effects). This category is appropriate because the project has the potential to add capacity to urban roadways and the affected roadways are located near populated areas.

In accordance with FHWA guidelines, the Easy Mobile Inventory Tool was used to calculate annual mobile source air toxics (MSAT) pollutant burdens. To assess potential project-related effects, existing MSAT pollutant emission burdens were compared to future burdens under each build alternative.

Even though the VMT in the Seattle Center City area is predicted to increase by 2030, MSATs are predicted to decrease dramatically as a result of the EPA's national control programs. These programs are projected to reduce MSATs by 72 percent nationwide by 2050, even with an estimated 145 percent growth in VMT.

The air quality analysis did not indicate a notable difference in emission levels among the alternatives, either for criteria pollutants or MSATs.

**How would effects to air quality change if the alternatives were not tolled?**
If the alternatives were not tolled, VMT would be expected to decrease slightly within downtown Seattle. This VMT decrease would correspondingly indicate a decrease in CO emissions. However, the total change in emissions would be minor and would not alter the discussion of air quality effects provided above.

### 29 How would effects to greenhouse gas emissions compare?

Regional greenhouse gas emissions from all of the build alternatives are predicted to be higher in 2030 than for the 2015 Existing Viaduct, but lower than for the Viaduct Closed (No Build Alternative). Projected increases in greenhouse gases would be due primarily to the increases in future vehicle traffic and fuel use in the region. The bulk of greenhouse gas emissions from the build alternatives would come from vehicle exhaust. Emissions from energy sources that would power SR 99 ventilation and lighting systems and provide maintenance (for example, patching, crack sealing, and landscape maintenance) would produce a tiny fraction of greenhouse gas emissions, as shown in Exhibit 5-55.

Typical greenhouse gases that are in the atmosphere include carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), and fluorinated gases. For this project, the greenhouse gas analysis used $CO_2$ as the standard and emissions are expressed in terms of $CO_2$ equivalents to compare different greenhouse gases. The potential direct emissions of greenhouse gases under the build alternatives were estimated using the MOVES2010a model. Emissions of greenhouse gasses from construction are discussed in Chapter 6.

The estimates are conservative because they do not take into account the expected future shift in vehicle mix (i.e., fewer light-duty trucks and more fuel-efficient vehicles, including hybrids) or the new Corporate Average Fuel Economy (CAFE) standards, which would lead to better fleet-wide fuel efficiency and result in lower $CO_2$ equivalent emissions generated. The new CAFE standards, which were issued in April 2010, are expected to improve vehicle emissions by approximately 21 percent by 2030, as compared to the level that would occur without the regulations.[12]

***Exhibit 5-55***
**Daily Greenhouse Gas** ($CO_2$ equivalent)
**Roadway Emissions Estimates**
*in metric tons per day*

| | | | TOLLED ALTERNATIVES | | |
|---|---|---|---|---|---|
| Study Area | 2015 Existing Viaduct | 2030 Viaduct Closed | Bored Tunnel | Cut-&-Cover Tunnel | Elevated Structure |
| SR 99 Ventilation and Lighting | 0 | 0 | 19 | 14 | 5 |
| SR 99 Roadway Maintenance | 1 | 1 | 1 | 1 | 1 |
| Vehicles on Roadways | 46,996 | 47,488 | 47,249 | 47,215 | 47,357 |

*Note: The regional study area includes King, Pierce, Snohomish and Kitsap counties.*
*For all of the build alternatives, the energy consumption for non-tolled conditions would be within 1 percent of the tolled conditions.*

**How would effects to greenhouse gas emissions change if the build alternatives were not tolled?**
If the alternatives were not tolled, VMT would be expected to decrease slightly within downtown Seattle. This VMT decrease would correspondingly indicate a decrease in greenhouse gas emissions. However, the total change in greenhouse gas emissions would be less than 1 percent and would not alter the discussion of effects provided above.

### 30 How would effects to energy consumption compare?

As shown in Exhibit 5-56, regional energy consumption would be higher from all of the build alternatives in 2030 than the 2015 Existing Viaduct, but lower than the Viaduct Closed. Energy consumption for SR 99 ventilation and lighting systems and maintenance activities (for example, patching, crack sealing, and landscape maintenance) would consume a tiny fraction of overall energy.

**What are $CO_2$ equivalents?**

Greenhouse gases trap different levels of heat. To compare different greenhouse gases, scientists use a weighting factor. $CO_2$ is used as the standard. Other gases are converted into $CO_2$ equivalents using the weighting factor.

**Appendix R, Energy Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix R***, **Chapter 2**. This appendix also provides additional information on $CO_2$ equivalents, greenhouse gases, and energy consumption.

**What is the EPA MOVES2010a model?**

The EPA Motor Vehicle Emission Simulator (MOVES) 2010a model estimates overall fuel usage based on characteristics such as vehicle mix, vehicle age, speed, and area-specific meteorological data.

**Appendix O, Surface Water Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix O***, **Chapter 2**. **Chapter 5** provides additional information on effects to water resources. **Attachment A** of ***Appendix O*** provides the detailed pollutant-loading analysis.

*Exhibit 5-56*
**Daily Energy Consumption**
*in million BTUs*

| Study Area | 2015 Existing Viaduct | 2030 Viaduct Closed | TOLLED ALTERNATIVES Bored Tunnel | Cut-&-Cover Tunnel | Elevated Structure |
|---|---|---|---|---|---|
| SR 99 Ventilation and Lighting | 0 | 0 | 156 | 118 | 41 |
| SR 99 Roadway Maintenance | 9 | 9 | 9 | 9 | 9 |
| Vehicles on Roadways | 615,398 | 621,777 | 618,634 | 618,192 | 620,057 |

*Note: The regional study area includes King, Pierce, Snohomish and Kitsap counties.*
*For all of the build alternatives, the energy consumption for non-tolled conditions would be within 1 percent of the tolled conditions.*

The EPA MOVES2010a model was used to calculate the amount of energy consumed by vehicles. The future energy consumption estimate is conservative because it does not take into account the expected future shift in vehicle mix (fewer light-duty trucks and more fuel-efficient vehicles) or the new CAFE standards, which would lead to better fleet-wide fuel efficiency and result in lower energy consumption. CAFE regulations are expected to improve vehicle emissions by approximately 21 percent by 2030, as compared to the level that would occur without the regulations.[12]

**How would energy consumption change if the alternatives were not tolled?**
If the alternatives were not tolled, VMT would be expected to decrease slightly within downtown Seattle. This VMT decrease would correspondingly indicate a decrease in energy consumption. However, the total change in energy consumption would be less than 1 percent and would not alter the discussion of energy effects provided above.

**31 How would effects to water resources compare?**
The tolled build alternatives would have the same effects to water quality as the non-tolled build alternatives. Runoff from impervious surfaces such as streets and highways, particularly in urban environments, contains pollutants that affect the water quality of receiving waters like Lake Union, Elliott Bay, and Puget Sound. Compared to existing conditions, all build alternatives would reduce the overall amount of pollutant-generating impervious surface within the area that drains to these receiving waters. This is expected to improve water quality. Also, some portions of the project area currently discharge to Elliott Bay and Lake Union without treatment. All of the build alternatives would provide water quality treatment for pollutant-generating impervious surfaces in these areas.

The project area studied for water resources included approximately 100 acres of pervious and impervious surface area. Although all build alternatives would reduce the total pollutant-generating impervious surfaces, the non-pollutant-generating impervious surfaces would increase for all of the alternatives. Most of the increase would occur because of the wider pedestrian and bicycle facility in the south portal area, new sidewalks, and the tunnel operations building at each portal. Stormwater detention would be provided in certain areas to mitigate the potential for increases in overflows from the combined sewer system that might occur because of these increases in impervious surfaces. Basic water quality treatment would be provided using best management practices (BMPs) selected from the Seattle Stormwater Manual[13] and/or the WSDOT Highway Runoff Manual.[14] Treating stormwater prior to discharge would reduce the volume of pollutants entering receiving water bodies.

**32 How would effects to fish and aquatic habitat compare?**
The tolled build alternatives would have the same effects to fish and aquatic habitat as the non-tolled build alternatives. All build alternatives would improve water quality compared to the Viaduct Closed (No Build Alternative) because stormwater runoff would be treated prior to being discharged. Treating stormwater runoff prior to discharge would reduce potential effects to fish and aquatic resources compared to existing conditions. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would result in additional beneficial effects to aquatic life by moving the seawall landward and creating additional nearshore habitat.

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies to consult with NMFS and the U.S. Fish and Wildlife Service (USFWS), as appropriate, to ensure that their actions are not likely to jeopardize the

*Exhibit 5-57*
**Species and Critical Habitat Effect Determinations in the Biological Opinion**

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

**What is an impervious surface?**

A surface is considered impervious if water cannot pass through it easily. Common impervious surfaces in the project area are pavement and concrete.

**What is a pollutant-generating impervious surface?**

A pollutant-generating impervious surface is an area such as a street where pollution from vehicles can build up and when it rains may runoff in the stormwater.

**What is a BMP?**

A best management practice (BMP) is an action or structure that reduces or prevents pollutants from entering stormwater or treats stormwater to reduce possible degradation of water quality.

**Appendix N, Wildlife, Fish, and Vegetation Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix N***, Chapter 2. Chapter 5 provides additional information on potential effects from the Bored Tunnel Alternative.

**Appendix U, Final EIS Correspondence**

Information about the Endangered Species Act consultations including the Biological Opinion and the USFWS concurrence letter are included in ***Appendix U***.

**Appendix P, Earth Discipline Report**

Methods used for assessing existing conditions, environmental effects, and mitigation are described in ***Appendix P***, Chapter 2. This appendix also includes information on the geologic setting and hazards in the project corridor.

12 NHTSA 2010.

13 City of Seattle 2009.

14 WSDOT 2008.

continued existence of endangered or threatened species or to adversely modify or destroy their critical habitat. In addition, Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation is defined as the use of all methods and procedures that are necessary to bring any endangered or threatened species to the point at which the measures provided pursuant to the ESA are no longer necessary.

Species listed under the ESA by NMFS and USFWS were obtained from the NMFS and USFWS websites (NMFS 2011a; USFWS 2011a). These sources also identify habitat requirements of these species and specifically designated critical habitat. This information was used to assess the potential occurrence of ESA-listed or proposed species in the study area and the potential effects of project-related activities on the species or their critical habitat. The determinations made by NMFS in the January 27, 2010 Biological Opinion and USFWS in the December 7, 2010 concurrence letter and are shown in Exhibit 5-57.

Potential beneficial indirect effects of the project may include changes to invertebrate and algal resources along the waterfront due to long-term alterations of stormwater management, which could slightly alter sediment and water quality conditions in the nearshore environment.

### 33 How would soil conditions and groundwater be affected?

The tolled build alternatives would have the same effects to soil conditions and groundwater as the non-tolled build alternatives. Locally contaminated groundwater may be encountered in the project area. All of the build alternatives include building retaining walls, tunnels, foundations, excavations, and fills. Groundwater flow may be altered by the presence of the walls supporting the retained cuts, cut-and-cover tunnel sections, and soil improvement areas, particularly in the south project area. Areaways and basements adjacent to the new facilities could also experience leakage or partial flooding if groundwater mounding occurs. With mitigation, no indirect effects to soils or groundwater are anticipated for any of the alternatives.

**Bored Tunnel Alternative**

Soil improvements would be installed beneath some of the buildings along the bored tunnel alignment to mitigate potential settlement caused by tunneling. In addition, soil improvement may be performed in several locations along the tunnel alignment between S. King Street and Seneca Street to strengthen recent soil deposits along the crown of the tunnel. No soil improvements would occur between S. Main and S. Washington Streets to avoid potential archaeological deposits. Near the north portal, soil improvement may be performed near John and Thomas Streets to stabilize areas of soft and loose soils, reduce perched groundwater flow, and mitigate potential future liquefaction.

Once construction is completed, no effects to soils are expected. Soils along the bored tunnel alignment generally consist of very dense, hard soils that have been compacted by the weight of glaciers. Since the net weight of the tunnel would likely be less than the soil that is removed, additional loads would not be placed on the soil by the tunnel structure.

Groundwater flow may be altered by the presence of the bored tunnel and potential soil improvements. The combination of these improvements could obstruct groundwater flow and cause it to mound up against the east side of the tunnel alignment, raising the groundwater table in this area. A higher water table would not cause soil settlement; however, utilities and other subsurface structures that were previously above the water table could become partially submerged if groundwater mounding occurs. Areaways and basements adjacent to the south end of the alignment could also experience leakage or partial flooding if groundwater mounding occurs. The extent of effects to areaways due to groundwater mounding cannot be accurately predicted. The potential for groundwater mounding will be addressed during final design. Design elements, such as providing a path for groundwater through the retaining walls or ground improvement zones, will be incorporated into the project to avoid this effect, if determined to be necessary during final design.
If groundwater mounding occurs, it is not expected to affect contaminant concentrations or the amount of contaminants that ultimately reach Elliott Bay.

North of Yesler Way, groundwater mounding along the bored tunnel is not anticipated. The lower aquifers that the 56-foot-diameter tunnel would intersect are widespread, interconnected, and highly pervious, allowing water to flow around the tunnel.

**Cut-and-Cover Tunnel Alternative**

The Cut-and-Cover Tunnel Alternative could result in ground movement adjacent to retaining walls and potential mounding of groundwater adjacent to walls and the rebuilt seawall. Buildings, pavements, utilities, and other structures could be affected by the presence of new fills, walls, and foundations.

**Elevated Structure Alternative**

The Elevated Structure Alternative could result in ground movement adjacent to retaining walls and potential mounding of groundwater adjacent to walls and the rebuilt seawall. Although the Elevated Structure Alternative does not include a cut-and-cover structure along the waterfront, the seawall in this area would be rebuilt, which could result in groundwater mounding. Buildings, pavements, utilities, and other structures could be affected by the presence of new fills, walls, and foundations.

**Earth and Groundwater Benefits**

The Cut-and-Cover Tunnel and Elevated Structure Alternatives include replacement of the existing seawall along Alaskan Way from S. Jackson Street to Broad Street. The replacement of the seawall would mitigate potential lateral spreading of soil toward Elliott Bay during a seismic event. This would be a benefit to structures and facilities located east of the waterfront.

**What is liquefaction?**

Liquefaction is what can happen to loose soils when shaking motions from an earthquake causes the soil to turn into a quicksand-like condition. This can cause foundations to fail.

**What is groundwater mounding?**

Groundwater mounding occurs when water is blocked and builds up behind a barrier. A barrier could be something natural such as a dense soil layer, or something constructed such as a building foundation or subsurface retaining wall.

**34 What are indirect effects, and would the build alternatives have any?**

An indirect effect is a reasonably foreseeable effect caused by a project but that would occur in the future or outside of the project area. Changes inside the project area are considered direct effects and are described earlier in this chapter, and specific indirect effects are also described earlier in this chapter for each environmental resource. Indirect effects are only discussed in instances where they are anticipated (meaning that if indirect effects are not discussed for a resource, effects are not expected). Once this project is completed, any of the alternatives considered generally would result in similar indirect effects, because the project is a replacement project that would mostly maintain and not increase roadway capacity. As such, the replacement facilities would continue to support existing activities and the mobility and accessibility assumed by local and regional land use plans. North of Denny Way, the built project may support renovation and revitalization of existing urban land uses by connecting the street grid and improving local circulation. The tunnel alternatives could offer greater potential for revitalization in areas adjacent to where the viaduct is removed compared to the Elevated Structure Alternative.

The Bored Tunnel or Cut-and-Cover Tunnel Alternatives would change routes and travel times for some of those who use the existing viaduct. These types of changes can affect businesses and residents, and hence potentially have an indirect effect on future land use and development patterns. However, these patterns are largely determined by land use regulations and economic conditions. The land use changes due to either of the tunnel alternatives are so small they would be insignificant.

A risk associated with an indirect effect would be the potential for catastrophic spills of hazardous materials or wastes resulting from vehicle accidents once the roadway is operational. The environmental impacts may be less for either the Bored Tunnel or Cut-and-Cover Tunnel Alternatives compared to the Elevated Structure Alternative because the spill would be contained within the tunnel. However, the potential threat to the health and safety of responders and vehicle occupants would be greater with a tunnel alternative because the space is enclosed with limited access and egress.

The Viaduct Closed (No Build Alternative) would have substantial indirect effects on the local and regional transportation system, economy, and communities north and south of Seattle. Without the connection provided by SR 99 congestion would increase and travel through the area would become more difficult. Eventually, this would lead some people to move and businesses to relocate. They would likely be replaced by others who do not need the connection to and through Seattle, so at a regional level land use patterns are not likely to change.

**35 What irreversible decisions or irretrievable resources would be committed to building the alternatives?**

There are notable differences in the irreversible decisions or irretrievable resources required for the alternatives being evaluated. If the decision is made to build the Elevated Structure Alternative, views would irreversibly be affected and the opportunity to restore views would be lost, since the new elevated structure would affect views more than the existing viaduct. Another irreversible decision for any of the alternatives would be converting existing commercial, industrial, or retail properties to roadway land uses. All of the alternatives require partial and full property acquisitions, and some of the needed properties have buildings on them that would be demolished. The Bored Tunnel Alternative requires fewer full and partial property acquisitions than the Cut-and-Cover Tunnel and Elevated Structure Alternatives; therefore, that alternative would convert fewer existing properties to transportation uses.

There are a few effects to resources that would also be irretrievable regardless of the alternative constructed. If archaeological resources are located in areas where soil improvements are made, they would no longer be retrievable. However, as discussed in Chapter 8, Question 18, mitigation measures, a Memorandum of Agreement, and an Unanticipated Discovery Plan will help avoid, minimize, and mitigate these potential effects.

Other resources that would not be retrievable include the physical materials used to build the project. These include resources such as aggregate used to make concrete and asphalt, steel needed to make rebar and steel structures, oil to make asphalt, and fill material. These are finite resources, but they are not currently in short supply. Contaminated soil, spoil material, and excavated soil would be transported to appropriate facilities; thus, the space used for this project would not be available for other future disposal uses. However, there is adequate space available for this type of disposal at appropriate facilities.

The energy used to build the project or keep it operating would not be retrievable. Energy currently used to operate the viaduct includes the electricity needed to keep lights and electrical systems running. These resources will continue to be used as long as the viaduct is operational. During construction, gasoline, oil, and electricity would be used, though construction would hardly affect available energy supplies. Once the project is built, energy consumption levels would not substantially increase and are expected to be comparable among the alternatives, as shown in Exhibit 5-56. The tunnel alternatives would use more energy in the long-term to operate the tunnel's lighting and ventilation systems than the Elevated Structure Alternative; however, the vehicle energy consumption is expected to be highest for Elevated Structure Alternative, because it is expected to carry more vehicles each day than the tunnel alternatives.

**36 What are the tradeoffs between short-term uses of environmental resources and long-term gains (or productivity)?**

This question really is asking how the alternatives compare in terms of their long-term benefits and short-term effects. Because the project involves replacing failing infrastructure that people have depended on for several generations, it's clear that the long-term benefits of replacing the roadway with any of the proposed alternatives do outweigh the short-term effects. However, of the alternatives evaluated, the Bored Tunnel Alternative would have far fewer construction effects than the Cut-and-Cover Tunnel or the Elevated Structure Alternative.

The Bored Tunnel Alternative would require about 5.4 years of construction. SR 99 closures during construction of the Bored Tunnel Alternative would be limited to about 3 weeks, in addition to occasional night and weekend closures. The Cut-and-Cover Tunnel Alternative would require closing SR 99 for 27 months, and could require up to 2 additional years of substantial lane restrictions and closures. The Elevated Structure Alternative would require closing SR 99 for approximately 6 months, in addition to up to 6 years of substantial lane restrictions and closures. The Bored Tunnel Alternative would affect SR 99 traffic for about 4.5 years, but impacts to SR 99 traffic would be far less disruptive and cause less congestion than with the other alternatives.

In addition to effects to SR 99 traffic, the Bored Tunnel Alternative would be much less disruptive to Alaskan Way and neighboring residents and businesses during construction. The Bored Tunnel Alternative would affect Alaskan Way and adjacent areas during the 9-month period when SR 99 would be removed from S. King Street up to the Battery Street Tunnel. While viaduct removal would be noisy and disruptive, these effects would be localized in two areas covering about four city blocks that would move as demolition progresses. During the demolition, Alaskan Way would continue to be open to traffic, though cross-streets between S. King Street and Battery Street would be closed for a period of up to 4 weeks.

The Cut-and-Cover Tunnel Alternative would affect waterfront businesses and residents for almost all of the expected 8.75-year construction period. The Elevated Structure Alternative would affect waterfront businesses and residents for almost all of the expected 10-year construction period. As part of improvements proposed with the broader Alaskan Way Viaduct and Seawall Replacement Program, the seawall will be replaced, and waterfront businesses and residents will be affected; however, based on initial planning for the separate seawall replacement project, they would be affected to a much lesser degree with the Bored Tunnel Alternative and a separate seawall replacement project than they would be if seawall and viaduct replacement were to occur in the same location on the waterfront.

Clearly, the Bored Tunnel Alternative has fewer short-term effects than the Cut-and-Cover Tunnel and Elevated Structure Alternatives, so the next question is how the long-term benefits of the Bored Tunnel Alternative compare to the other alternatives. Our analysis and comparison of the build alternatives in this chapter show that there are tradeoffs between them in terms of their long-term benefits. However, for most elements of the environment, the Bored Tunnel Alternative offers long-term benefits that are as good as or better than the other build alternatives.

### 37 How do the build alternatives meet the project's purpose and need?

While all build alternatives would replace the existing viaduct, there are some important differences in how they meet some elements of the project's purpose and need. This section discusses how well the alternatives meet each element of the project's purpose statement.

**Reduce the Risk of Catastrophic Failure in an Earthquake by Providing a Facility That Meets Current Seismic Safety Standards**

All build alternatives would provide a safe transportation facility that meets current seismic design standards.

**Improve Traffic Safety**

All build alternatives would improve traffic safety on SR 99 compared to existing conditions. All build alternatives would replace SR 99 with a facility that would improve upon existing geometrics and meet roadway design standards where feasible. For all build alternatives, there are specific areas where deviations from current roadway design standards would be needed, but all would replace SR 99 with a facility that is far closer to meeting full current roadway design standards than the existing facility.

The Tolled or Non-Tolled Bored Tunnel Alternative is the only alternative that would replace the existing Battery Street Tunnel. The Battery Street Tunnel has narrow lanes, no shoulders, and abrupt curves. The Battery Street Tunnel would be replaced by the new bored tunnel, which would have two 11-foot lanes in each direction, a 2-foot-wide shoulder on one side and an 8-foot-wide shoulder on the other side, and the abrupt curves would be eliminated. These improvements would improve safety for drivers compared to existing conditions. These Battery Street Tunnel deficiencies would be only partially remedied with improvements proposed for the Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives.

**Provide Capacity for Automobiles, Freight, and Transit to Efficiently Move People and Goods to and Through Downtown Seattle**

All of the build alternatives provide sufficient capacity to efficiently move people and goods to and through downtown Seattle. They provide two through lanes in each direction on SR 99. The Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives provide an additional lane in each direction on SR 99 between S. King Street and approximately Virginia Street. The Cut-and-Cover Tunnel and Elevated Structure Alternatives provide a Western Avenue off-ramp and an Elliott Avenue on ramp, which serve trips destined to and from northwest Seattle. The Tolled or Non-Tolled Bored Tunnel Alternative does not provide these ramps, but these trips could reach their destinations via the Alaskan Way surface street or via the bored tunnel and Mercer Street.

If the build alternatives are tolled, traffic would divert from SR 99 to city streets to avoid paying the toll. This will slow traffic on SR 99 near the stadiums and north of Denny, increase congestion at intersections near the off-ramps, and increase traffic volumes on city streets. Even with this traffic diversion and related local congestion, all of the tolled alternatives provide reliable capacity to and through downtown by providing additional capacity beyond the local street system. Also, the ramps from SR 99 have queue bypass lanes that will allow transit to avoid some of the congestion.

As shown in the traffic analysis, the Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives

are expected to carry higher traffic volumes through downtown on SR 99 because of the Elliott and Western Avenue ramps. However, during peak travel times, this added traffic volume would result in lower travel speeds on SR 99 between S. King Street and Denny Way than are estimated for the Tolled or Non-Tolled Bored Tunnel Alternative.

SR 99 is projected to carry fewer vehicles through the south area and downtown with the Tolled or Non-Tolled Bored Tunnel Alternative. Despite this, total vehicle volumes across the transportation network are expected to be comparable for the build alternatives. Therefore, the transportation network in downtown Seattle is expected to carry nearly the same volume of traffic for each of the alternatives, but more vehicles are projected to travel on city streets with the Bored Tunnel Alternative. As shown in the discussion presented in Questions 7 through 11, the Non-Tolled Bored Tunnel Alternative is not expected to substantially increase congestion on I-5 or local streets compared to the other non-tolled build alternatives, even though more vehicles would be traveling on these routes.

If the build alternatives are tolled, effects to I-5 are expected to be minimal, because it is already at capacity and may change travel times during peak commute times by up to 2 minutes. Effects to city streets associated with tolling would be more pronounced and are discussed in Questions 8 through 11. Effects to city streets from the tolled build alternatives are expected to be comparable.

Taken together, these results support the fact that all alternatives with or without tolls provide sufficient capacity to move people and goods, but there are tradeoffs in the way traffic is accommodated.

**Provide Linkages to the Regional Transportation System and to and From Downtown Seattle and the Local Street System**
All build alternatives have similar connections in the south from SR 99 to Alaskan Way S. near S. King Street. All of the build alternatives develop a new east-west cross street and provide a priority lane for northbound transit service during peak hours. The Tolled or Non-Tolled Elevated Structure Alternative rebuilds the ramps at Columbia and Seneca Streets, which are not included with either tunnel alternative. These provide good linkages to the central portion of downtown.

The Tolled or Non-Tolled Cut-and-Cover Tunnel and Elevated Structure Alternatives would replace the Elliott and Western Avenue ramps near their existing location. The Bored Tunnel Alternative would not replace these ramps. Instead, traffic coming south from the Ballard, Interbay, and Magnolia neighborhoods could reach SR 99 by following Mercer Street, or it could travel along Alaskan Way.

North of Denny Way, the Tolled or Non-Tolled Bored Tunnel Alternative would rebuild Aurora Avenue to grade and would connect three east west streets, compared to two for the other alternatives. This would improve circulation and linkages north of downtown to a greater degree than the other two alternatives.

**Avoid Major Disruption of Traffic Patterns due to Loss of Capacity on SR 99**
The greatest differences among the build alternatives are their construction impacts and construction duration. The Tolled or Non-Tolled Bored Tunnel Alternative could be built with limited SR 99 closures (3 weeks in addition to occasional night and weekend closures). The Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative would close SR 99 for 27 months, and the Tolled or Non-Tolled Elevated Structure Alternative would close it for approximately 6 months. While SR 99 is closed, traffic would be directed onto adjacent surface streets and I-5. This would increase congestion for travelers through downtown Seattle.

The central waterfront would be largely unaffected during the 5.4-year period while the Tolled or Non-Tolled Bored Tunnel Alternative is built. Effects to the central waterfront would be limited to about 9 months when the viaduct is being demolished. The Tolled or Non-Tolled Cut-and-Cover Tunnel Alternative would bring substantial construction impacts to the central waterfront for 8.75 years. During this time, heavy equipment would be operating directly in front of many businesses, and vehicles and pedestrians would be rerouted frequently. Most of the parking in the area would be removed. The Tolled or Non-Tolled Elevated Structure Alternative would have similar impacts but would take about 10 years to construct. The length and severity of construction of either of these alternatives would create severe hardships on adjacent activities on the central waterfront and in downtown.

**Protect the Integrity and Viability of Adjacent Activities on the Central Waterfront and in Downtown Seattle**
The build alternatives vary in how they would affect activities on the central waterfront and in downtown Seattle, with or without tolls. Both tunnel alternatives would remove the noise and visual impacts caused by the existing viaduct, making the central waterfront a much more pleasant place and supporting Seattle's vision for the area. The Tolled or Non-Tolled Elevated Structure Alternative would have more visual impacts than the existing viaduct and similar noise impacts. Seattle's vision for the central waterfront does not include an elevated highway.