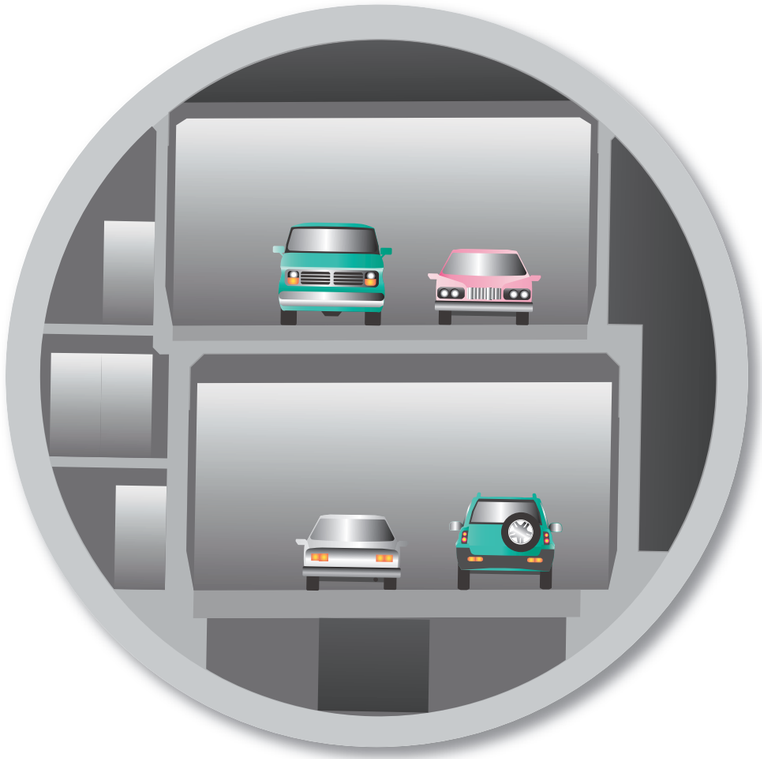
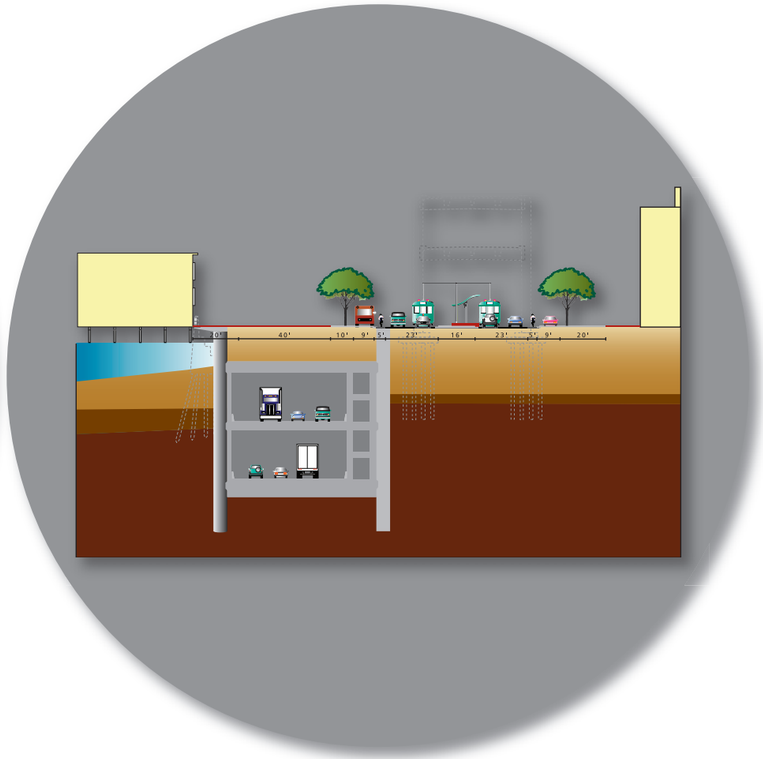
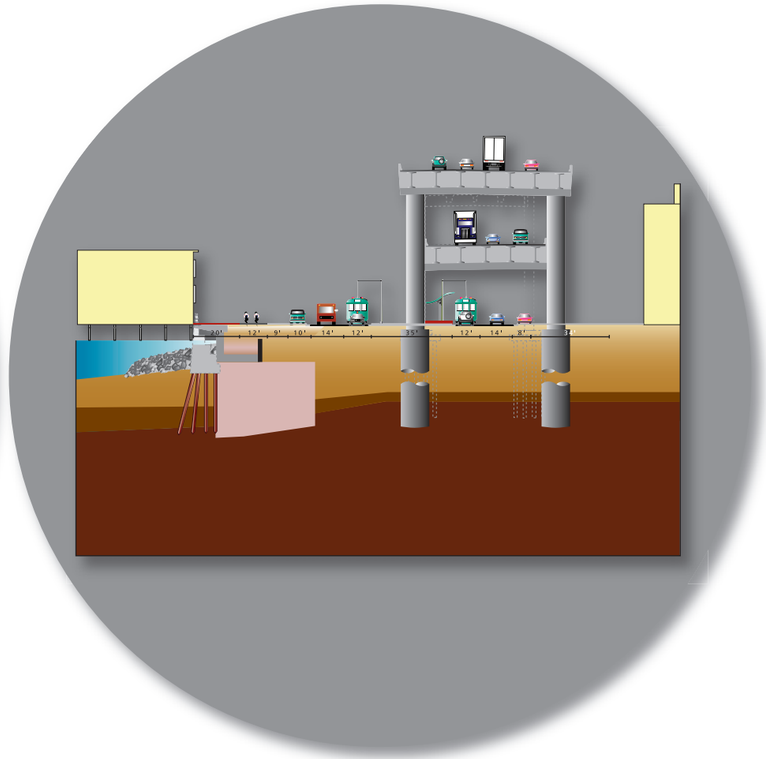


Bored Tunnel Alternative



Cut-&-Cover Tunnel Alternative



Elevated Structure Alternative

CHAPTER 8 - COMPARISON OF ALTERNATIVES

What's in Chapter 8?

This chapter compares the effects of the Bored Tunnel Alternative to the Cut-and-Cover Tunnel, Elevated Structure, and No Build Alternatives.

1 What alternatives are included in this comparison?

This Supplemental Draft Environmental Impact Statement (EIS) analyzes the Bored Tunnel Alternative and compares its effects to updated versions of the Cut-and-Cover Tunnel and Elevated Structure Alternatives previously evaluated in the 2006 Supplemental Draft EIS. Information about the Viaduct Closed (No Build Alternative) is also provided in this chapter.

Descriptions of the Bored Tunnel, Cut-and-Cover Tunnel Elevated Structure, and Viaduct Closed (No Build) Alternatives are provided in Chapter 3, Questions 9, 10, 11, and 12. Chapter 3, Question 7 discusses changes made to the Cut-and-Cover Tunnel and Elevated Structure Alternatives since the 2006 Supplemental Draft EIS. Major elements of these alternatives and their associated options are shown on Exhibit 8-1.

2 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 through routes in 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 has a critical role in the regional transportation system. From the perspective of Seattle and surrounding communities the three 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. The majority of travelers using the viaduct, 42 percent, are heading to or coming from Seattle's downtown central business district. Approximately 21 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 37 percent of travelers are making longer-distance through trips, such as trips from Ballard to Burien. 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 and I-405.

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

2010 Supplemental Draft EIS Alternatives & Options Chart

At-Grade *Aerial* *Tunnel* *Seawall* *Lowered Roadway* *Closed*

	SOUTH S. Holgate - S. Royal Brougham Way	CENTRAL S. Royal Brougham Way - Denny Way	NORTH Denny Way - Roy	BATTERY STREET TUNNEL	Seawall
Bored Tunnel	**Separate Project** Existing Viaduct replaced with a new structure by the ***S. Holgate Street to S. King Street Viaduct Replacement Project***	**Bored Tunnel** New intersection at Dearborn Street *OR* ***Bored Tunnel*** *New intersections at Dearborn & Charles Streets*	**Surface Street Improvements** Sixth Avenue curves east *OR* ***Surface Street Improvements*** *Sixth Avenue continues straight*	**Decommissioned** Tunnel filled in	**Not Part of Viaduct Replacement Project**
Options					
Cut-&-Cover Tunnel	**Separate Project** Existing Viaduct replaced with a new structure by the ***S. Holgate Street to S. King Street Viaduct Replacement Project***	**Stacked Tunnel** SR 99 under Elliott & Western Steinbrueck Park Walkway	**Partially Lowered Aurora**	**Tunnel Reconstructed** Tunnel floor lowered and walls replaced	**Tunnel Wall**
Elevated Structure	**Separate Project** Existing Viaduct replaced with a new structure by the ***S. Holgate Street to S. King Street Viaduct Replacement Project***	**Stacked Aerial** Stacked aerial along waterfront, side-by-side aerial approaching Battery St. Tunnel	**Partially Lowered Aurora**	**Tunnel Reconstructed** Tunnel floor lowered and walls replaced	**Rebuild**

Exhibit 8-1

Additional information on 2030 No Build (Viaduct Closed)

The *Transportation Discipline Report*, *Appendix C*, explains how the 2030 No Build Alternative (Viaduct Closed) was modeled and how transportation and land use could be affected. Traffic data for modeled conditions for the 2030 Viaduct Closed Alternative are provided for most of the traffic conditions that were measured, such as vehicle miles traveled, vehicle hours of delay, and traffic volumes. However, traffic conditions without the viaduct would be extremely congested. Detailed traffic models are not reliable or accurate in these circumstances so some conditions, such as travel speeds, travel times, and congested intersections cannot be meaningfully evaluated.

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 develop in 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 all of the local governments and agencies in the four-county area. The Plan'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, but through trips (i.e., trips between districts north and south of downtown in the primary travel shed) would change to a greater degree. 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.

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 triggered by the sudden closure of SR 99 redistribution of this nature would require additional expenditures by those affected and 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 South, 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 volumes on downtown streets would degrade conditions for vehicles, bicycles, and pedestrians.

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." However, behind those words are people, families, and businesses who would find their present situation so untenable that they would move away. People's lives would change. 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 considered as independent projects responding to a new set of transportation needs and evaluated under additional environmental review. 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.

3 How do access points on SR 99 compare between the alternatives?

Exhibit 8-2 compares proposed access points between the existing SR 99 roadway and the proposed alternatives.

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 to S. King Street Viaduct Replacement Project. In addition to the changes described above, the Bored Tunnel Alternative would remove the northbound Elliott Avenue off-ramp and southbound Western Avenue on-ramp. Drivers that currently use these ramps could either use Alaskan Way or the bored tunnel and Mercer Street to access SR 99.

All three build alternatives propose two through lanes in each direction for traffic between S. King Street and

Exhibit 8-2
Alternatives Comparison – SR 99 Ramp Connections

	RAMP CONNECTIONS FOR			
To/From	**Existing**	**Bored Tunnel Alternative**	**Cut-&-Cover Tunnel Alternative**	**Elevated Structure Alternative**
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 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 & 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 & 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-and-Cover Tunnel Alternative.
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 & 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 & 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-and-Cover Tunnel Alternative.

How Did We Study No Build?

In this chapter, information for the 2030 Viaduct Closed Alternative shows what would happen if the lead agencies did not replace the existing viaduct. However, the alternative represents such a substantial change to the transportation network from existing conditions that it does not serve as a useful baseline for comparing effects of the three build alternatives. Because of this, information about the 2030 Viaduct Closed is provided for informational purposes, but effects are compared among the three build alternatives to understand the tradeoffs of the build alternatives.

1 PSRC. 2010a.

2 PSRC. 2010b.

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?

To compare the effects of the three alternatives, traffic volumes were assessed throughout the transportation system. The analysis evaluated the combined traffic volumes on I-5, SR 99, and local streets at specific locations, called screenlines. The results of this analysis are shown in Exhibit 8-3.

Exhibit 8-3
Comparison of 2030 Vehicle Volumes at Screenlines

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
South Screenline – South of S. King Street				
Daily Volume	515,900	561,400	573,200	573,300
Central Screenline – North of Seneca Street				
Daily Volume	477,500	496,600	509,300	508,500
North Screenline – North of Thomas Street				
Daily Volume	535,500	582,300	579,100	574,300

Across the south and central screenlines, the Bored Tunnel Alternative is expected to carry about 2 to 2.5 percent fewer vehicles each day than the Cut-and-Cover Tunnel or Elevated Structure Alternatives. These volume reductions are likely due to access changes associated with the Bored Tunnel Alternative as compared to the Cut-and-Cover and Elevated Structure Alternatives, which would cause some travelers to change travel patterns. Across the northern screenline, the Bored Tunnel Alternative is expected to carry 0.5 to 1 percent more vehicles each day than the other two alternatives. The Bored Tunnel Alternative is expected to carry more vehicles in the north because it improves SR 99 north of Battery Street to a greater degree than the other alternatives.

Exhibit 8-4 shows the number of expected transit riders across the same three screenlines. This information reveals similar trends as those discussed above for vehicle volumes. Specifically, transit ridership is expected to be about 1 or 2 percent lower across the south and central screenlines with the Bored Tunnel Alternative than with the Cut-and-Cover Tunnel or Elevated Structure Alternatives. These reductions in the number of transit riders are likely due to access changes associated with the Bored Tunnel Alternative as compared to the Cut-and-Cover and Elevated Structure Alternatives, which would cause some travelers to change travel patterns. As shown in Exhibit 8-3, across the north screenline the number of transit riders is expected to be nearly the same for all three build alternatives.

Exhibit 8-4
Comparison of 2030 Transit Riders at Screenlines

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
South Screenline – South of S. King Street				
Daily Riders	160,800	163,700	165,500	166,300
Central Screenline – North of Seneca Street				
Daily Riders	162,400	179,200	181,200	183,100
North Screenline – North of Thomas Street				
Daily Riders	165,300	169,900	169,500	169,600

Exhibits 8-5, 8-6, and 8-7 compare vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle hours of delay (VHD) for both the nearby Seattle Center City area and the four-county region. These data indicate that VMT, VHT, and VHD are virtually the same in the four-county region. Within the Seattle Center City area, the Bored Tunnel Alternative is expected to result in about 2 percent fewer VMT than the Cut-and-Cover Tunnel and Elevated Structure Alternatives. These differences are likely due to access changes associated with the Bored Tunnel Alternative, which would cause some travelers to change travel patterns.

The Bored Tunnel Alternative is expected to result in about a 2 percent increase in VHT within the Seattle City Center area. The Bored Tunnel Alternative is also expected to result in about a 10 percent increase in delay in the transportation system (VHD) compared to the other two build alternatives. These expected changes in VHT and VHD within the transportation system in the center city area reflect the fact that the Bored Tunnel Alternative changes access. As a result, more traffic is expected to use city streets for a longer portion of their trip than they might with the other two build alternatives.

Exhibit 8-5
Comparison of 2030 Vehicle Miles Traveled

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Seatle Center City				
Daily VMT	2,371,400	2,533,900	2,575,800	2,571,100
Four-County Region				
Daily VMT	110,820,300	109,718,600	109,776,200	109,750,900

Exhibit 8-6
Comparison of 2030 Vehicle Hours Traveled

Seatle Center City				
Daily VHT	107,400	101,400	99,500	99,200
Four-County Region				
Daily VHT	4,436,100	4,428,000	4,429,300	4,427,500

Exhibit 8-7
Comparison of 2030 Vehicle Hours Delay

Seatle Center City				
Daily VHD	41,300	33,300	30,200	30,100
Four-County Region				
Daily VHD	1,385,800	1,374,900	1,374,800	1,373,800

5 How would traffic patterns and conditions on SR 99 change?

During the AM peak period, SR 99 currently experiences higher traffic volumes heading toward downtown. During the PM peak period, this pattern changes as a higher volume of traffic leaves the downtown area. This pattern is expected to remain the same, regardless of the alternative constructed.

Average SR 99 Travel Speeds

Exhibits 8-8 and 8-9 show estimated traffic speeds on SR 99 in the AM and PM peak hours for the three alternatives evaluated. Speeds vary greatly between the alternatives, with the Bored Tunnel Alternative offering the fastest SR 99 speeds of the three alternatives. The Cut-and-Cover Tunnel and Elevated Structure Alternatives are expected to have speeds similar to each other. The following factors are the primary reasons why the Bored Tunnel Alternative is expected to operate with faster speeds than the other alternatives:

- The ramp connections for the Bored Tunnel Alternative would result in fewer traffic merges, particularly in the midtown area, where ramps to and from Elliott and Western Avenues and Seneca

and Columbia Streets would not be provided. These changes would improve overall traffic flow and traffic speeds.

- The Bored Tunnel Alternative would provide wider lanes than the existing viaduct and it would have less-abrupt curves than the Battery Street Tunnel. In addition, the Bored Tunnel Alternative would include shoulders, which are not provided on the existing viaduct. These changes would improve safety conditions for drivers.

- The Bored Tunnel Alternative's southbound off-ramp near the stadiums has its ramp terminus on the east of SR 99 on S. Royal Brougham Way, which results in improved intersection performance and less delay at intersections located on S. Atlantic Street between E. Marginal Way S. and First Avenue S. compared to the Cut-and-Cover Tunnel and Elevated Structure Alternatives. Delay at these intersections for the Cut-and-Cover Tunnel and Elevated Structure Alternatives is expected to cause traffic back-ups on the southbound SR 99 mainline for both the AM and PM peak hours.

AM Peak Hour Travel Speeds

In the AM peak hour (8:00 to 9:00 a.m.), southbound travel speeds north of Denny Way are expected to be much slower with the Cut-and-Cover Tunnel and the Elevated Structure Alternatives. Slower speeds north of Denny Way are due to traffic back-ups expected due to design constraints in the Battery Street Tunnel that would constrict SR 99 traffic north of the tunnel. Through Belltown and downtown, Bored Tunnel Alternative southbound speeds are expected to be much faster than with the other two alternatives. These differences are likely due to traffic back-ups expected on the SR 99 mainline that would be caused by poor intersection performance at intersections at the ramp termini at S. Atlantic Street for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. Southbound speeds south of downtown are expected to be comparable for the three alternatives.

Comparison of SR 99 Speeds AM Peak Hour

2030 Bored Tunnel | *2030 Cut-&-Cover Tunnel* | *2030 Elevated Structure*

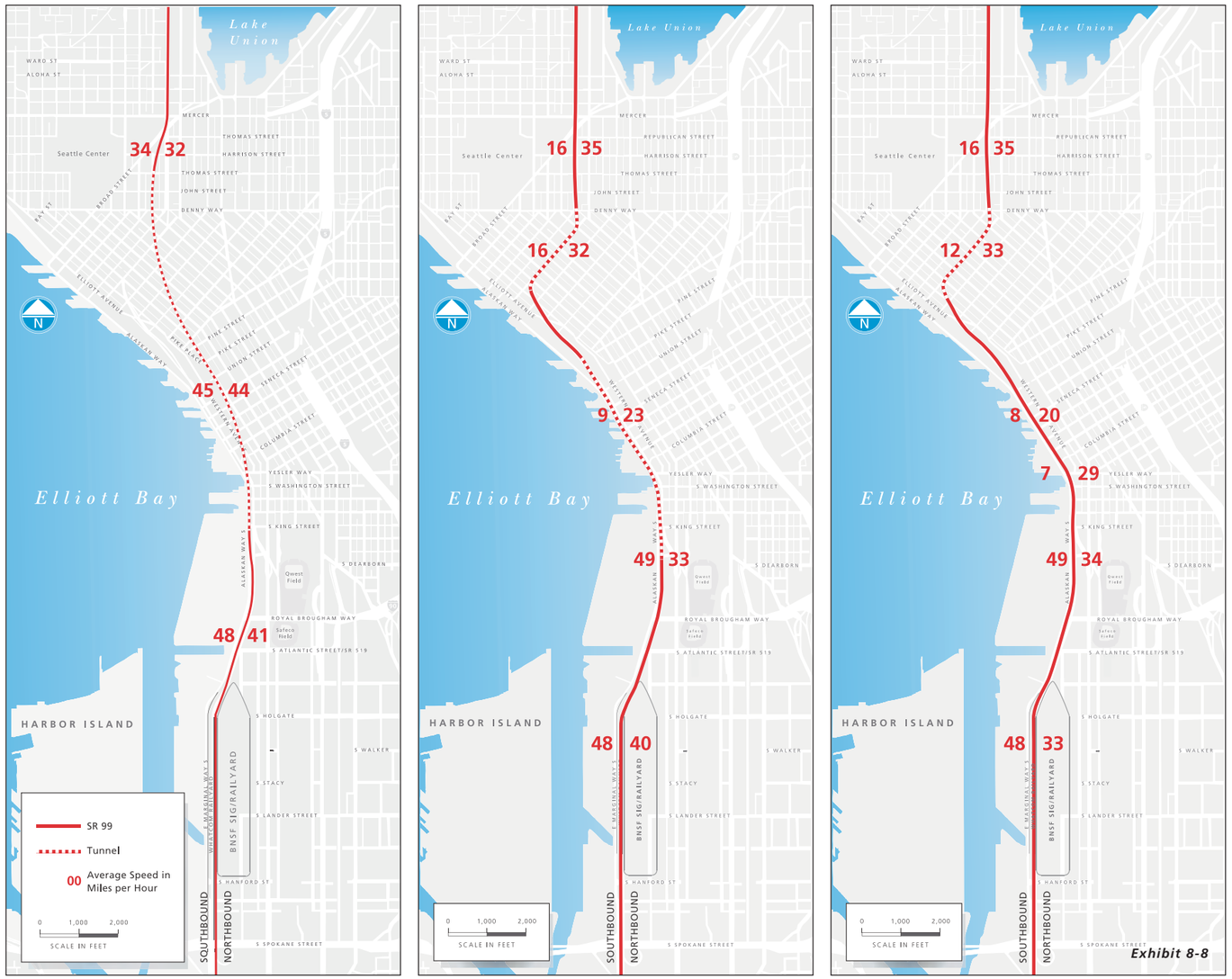


Exhibit 8-8

For northbound traffic, speeds in the Bored Tunnel Alternative are expected to be similar to the Cut-and-Cover Tunnel Alternative in the south end and somewhat faster than the Elevated Structure Alternative. Through downtown and Belltown, northbound speeds are expected to be much faster for the Bored Tunnel Alternative than the other alternatives. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would experience slower speeds in this area due to high traffic volumes using the Western Avenue northbound off-ramp, as well as design constraints in the Battery Street Tunnel that together are expected to cause traffic back-ups on the SR 99 mainline. Northbound speeds north of Denny Way are expected to be comparable for the three alternatives.

PM Peak Hour Travel Speeds

In the PM peak hour (5:00 to 6:00 p.m.), southbound speeds north of Denny Way are expected to be similar for the three alternatives. Through Belltown and downtown, speeds with the Cut-and-Cover Tunnel Alternative are expected to be slightly slower, but similar to the Bored Tunnel Alternative. Speeds for the Elevated Structure Alternative are expected to be much slower. Slower speeds for the Cut-and-Cover Tunnel and Elevated Structure Alternatives are mostly due to traffic entering SR 99 from the Columbia Street on-ramp, which would cause SR 99 mainline traffic to back-up because of friction caused by merging traffic, and to a lesser extent by SR 99 back-ups caused by the stadium area off-ramp due to poor intersection operations at the ramp's intersection with S. Atlantic Street.

For northbound traffic, speeds with the Bored Tunnel Alternative in the south and through downtown and Belltown would be faster than for the other alternatives. The slower speeds for the other alternatives are mostly due to traffic exiting SR 99 at the Western Avenue off-ramp, which would cause traffic back-ups on the SR 99 mainline. North of Denny Way, speeds are slightly lower for the Bored Tunnel Alternative than the other two alternatives because it would carry about 3 percent more vehicles in this area as compared to the other two build alternatives. The Bored Tunnel Alternative is expected to carry more

Comparison of SR 99 Speeds PM Peak Hour

2030 Bored Tunnel

2030 Cut-&-Cover Tunnel

2030 Elevated Structure

Exhibit 8-9

vehicles north of Denny Way than the other two build alternatives because it replaces the Battery Street Tunnel and improves the street grid in this area to a greater degree than the other two build alternatives.

SR 99 Travel Times
For many trips, SR 99 travel times would be faster for the Bored Tunnel Alternative than the Cut-and-Cover Tunnel or Elevated Structure Alternatives, as shown in Exhibit 8-10. Increased travel times during peak hours are expected for the Cut-and-Cover Tunnel and Elevated Structure Alternatives for reasons discussed previously related to travel speeds.

AM Peak Hour Travel Time Findings

- Travel times on I-5 between Northgate and Boeing Access Road and the southbound trip from Woodland Park to downtown are expected to be comparable for the three alternatives.

- For trips heading into downtown from West Seattle, travel times are expected to be comparable for the Bored Tunnel Alternative and the Cut-and-Cover Tunnel Alternative. The Elevated Structure Alternative is expected to be about 4 minutes faster than the Bored Tunnel Alternative because drivers would still be able to access downtown via a rebuilt ramp at Seneca Street. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives do not provide the Seneca Street ramp, which may result in slightly higher travel times for drivers destined for the central or northern portions of downtown.

- The Woodland Park to S. Spokane Street trip is expected to be about 7 minutes faster with the Bored Tunnel Alternative in the southbound direction than the Cut-and-Cover Tunnel or Elevated Structure Alternatives. Slower travel times for the Cut-and-Cover Tunnel and Elevated Structure Alternatives are due to backups expected on the SR 99 mainline that would be caused by poor intersection performance at intersections at the ramp termini at S. Atlantic Street. In the northbound direction, travel times are expected to be about 2 or 3 minutes less for the Bored Tunnel Alternative than the other alternatives. Travel times are expected to be slower for the Cut-and-Cover Tunnel and Elevated Structure Alternatives due to delays caused by high traffic volumes using the Western Avenue northbound off-ramp as well as design constraints in the Battery Street Tunnel that together are expected to cause traffic back-ups and reduced speeds on the SR 99 mainline.

- The Ballard to S. Spokane Street trip is expected to be about 4 to 7 minutes faster in the southbound direction with the Bored Tunnel Alternative than the other alternatives, depending on the route taken. Slower travel times for the Cut-and-Cover Tunnel and Elevated Structure Alternatives are due to back-ups expected on the SR 99 mainline that would be caused by poor intersection performance at intersections at the ramp termini at S. Atlantic Street. In the northbound direction, travel times with the Bored Tunnel Alternative are expected to take about 1 to 3 minutes longer than the other alternatives, because drivers would have more of their trip routed on surface streets (such as Alaskan Way or Mercer Street) than they would with the Cut-and-Cover Tunnel and Elevated Structure Alternatives where drivers would spend a greater portion of their trip on SR 99.

PM Peak Hour Travel Time Findings

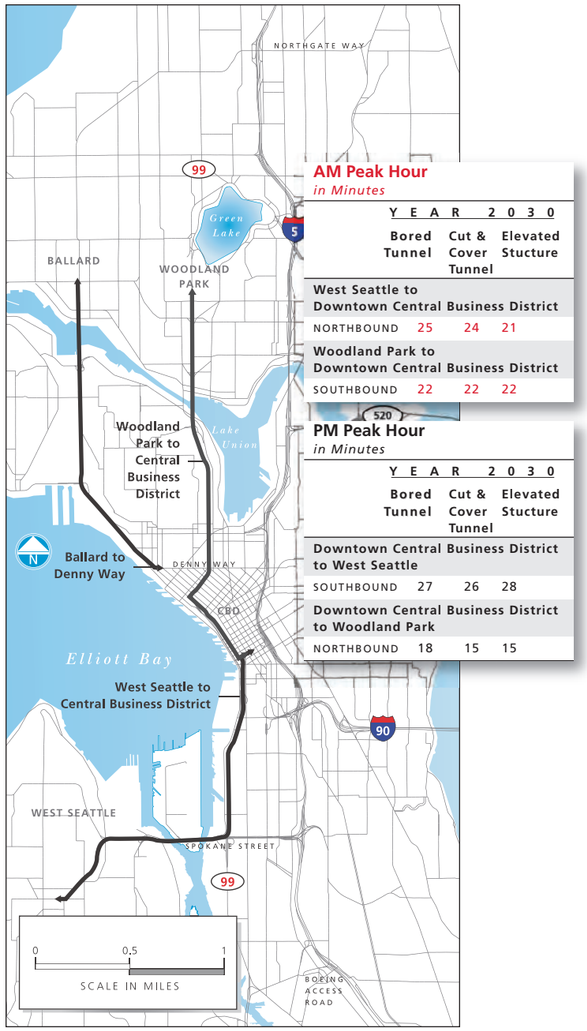
- Travel times on I-5 between Northgate and Boeing Access Road and SR 99 from downtown to West Seattle are expected to be comparable for the three alternatives.

- The northbound trip from downtown to Woodland Park is expected to take about 3 minutes longer with the Bored Tunnel Alternative than the other alternatives. The Bored Tunnel Alternative is expected to have longer travel times than the Cut-and-Cover Tunnel or Elevated Structure Alternatives, because travel times along Aurora Avenue north between Denny Way and the Aurora Bridge are expected to take longer, due in part to the addition of three traffic signals between Denny Way and Mercer Street that are not present for the other two alternatives.

- The southbound trip from Woodland Park to S. Spokane Street is expected to be comparable for the three alternatives. In the northbound direction, the Bored Tunnel Alternative is expected to be about 2 to 3 minutes faster than the Cut-and-Cover Tunnel or Elevated Structure Alternatives. The Cut-and-Cover Tunnel and Elevated Structure Alternatives are expected to have a slower trip in this direction due to delays at the Western Avenue off-ramp that causes traffic to back-up on the SR 99 mainline.

- The Ballard to S. Spokane Street trip in the southbound direction would be comparable for the three alternatives, assuming that drivers take the bored tunnel/Mercer Street route. For southbound drivers taking the Alaskan Way route with the Bored Tunnel Alternative, travel times are expected to be about 2 or 3 minutes faster than with the other alternatives. In the northbound direction, travel times would be comparable for the three alternatives, assuming that drivers take the bored tunnel/Mercer Street route. For the Alaskan Way route with the Bored Tunnel Alternative, travel times are expected to take about 4 minutes longer than with the other alternatives, because drivers would have more of their trip routed on the Alaskan Way surface street than they would with the Cut-and-Cover Tunnel and Elevated Structure Alternatives where drivers would spend a greater portion of their trip on SR 99.

2030 Travel Time Comparison

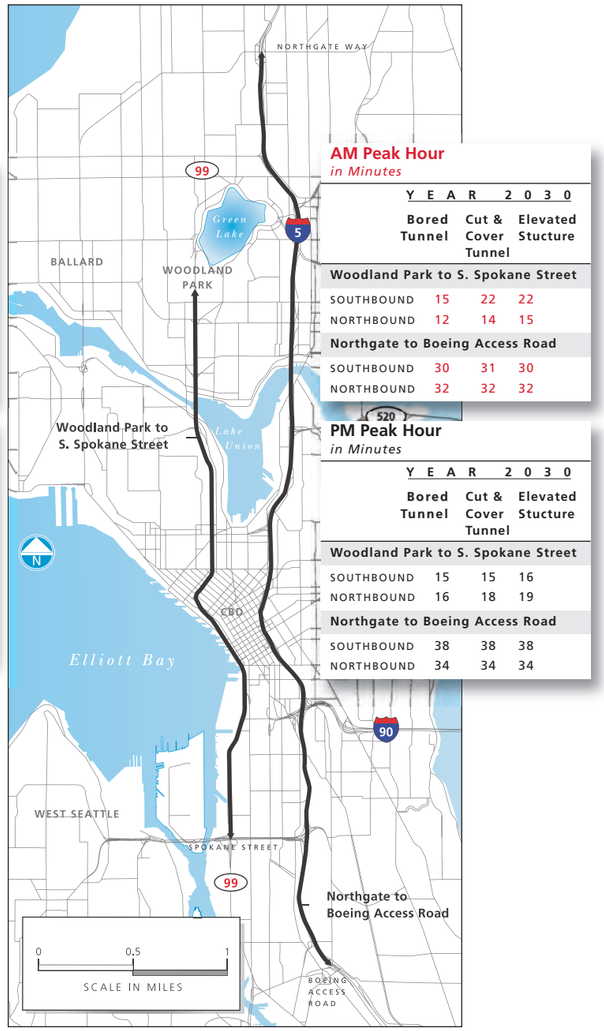


AM Peak Hour
in Minutes

	YEAR 2030		
	Bored Tunnel	Cut & Cover Tunnel	Elevated Stucture
West Seattle to Downtown Central Business District			
NORTHBOUND	25	24	21
Woodland Park to Downtown Central Business District			
SOUTHBOUND	22	22	22

PM Peak Hour
in Minutes

	YEAR 2030		
	Bored Tunnel	Cut & Cover Tunnel	Elevated Stucture
Downtown Central Business District to West Seattle			
SOUTHBOUND	27	26	28
Downtown Central Business District to Woodland Park			
NORTHBOUND	18	15	15

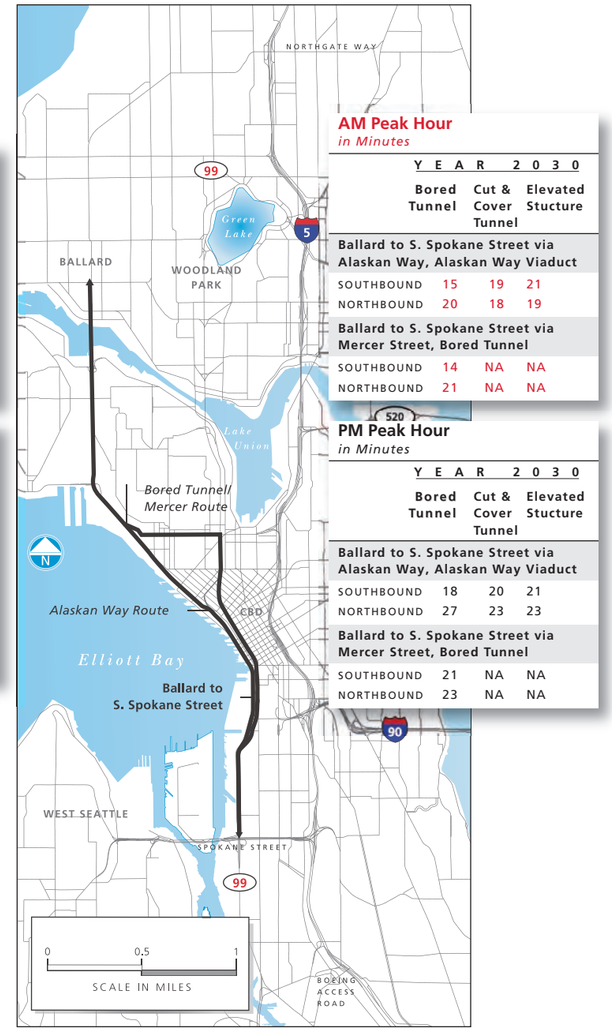


AM Peak Hour
in Minutes

	YEAR 2030		
	Bored Tunnel	Cut & Cover Tunnel	Elevated Stucture
Woodland Park to S. Spokane Street			
SOUTHBOUND	15	22	22
NORTHBOUND	12	14	15
Northgate to Boeing Access Road			
SOUTHBOUND	30	31	30
NORTHBOUND	32	32	32

PM Peak Hour
in Minutes

	YEAR 2030		
	Bored Tunnel	Cut & Cover Tunnel	Elevated Stucture
Woodland Park to S. Spokane Street			
SOUTHBOUND	15	15	16
NORTHBOUND	16	18	19
Northgate to Boeing Access Road			
SOUTHBOUND	38	38	38
NORTHBOUND	34	34	34



AM Peak Hour
in Minutes

	YEAR 2030		
	Bored Tunnel	Cut & Cover Tunnel	Elevated Stucture
Ballard to S. Spokane Street via Alaskan Way, Alaskan Way Viaduct			
SOUTHBOUND	15	19	21
NORTHBOUND	20	18	19
Ballard to S. Spokane Street via Mercer Street, Bored Tunnel			
SOUTHBOUND	14	NA	NA
NORTHBOUND	21	NA	NA

PM Peak Hour
in Minutes

	YEAR 2030		
	Bored Tunnel	Cut & Cover Tunnel	Elevated Stucture
Ballard to S. Spokane Street via Alaskan Way, Alaskan Way Viaduct			
SOUTHBOUND	18	20	21
NORTHBOUND	27	23	23
Ballard to S. Spokane Street via Mercer Street, Bored Tunnel			
SOUTHBOUND	21	NA	NA
NORTHBOUND	23	NA	NA

Exhibit 8-10

Traffic Volumes on SR 99 and Connecting Ramps
Exhibits 8-11 and 8-12 compare estimated daily traffic volumes on SR 99 for the 2030 Bored Tunnel, 2030 Cut-and-Cover Tunnel, and 2030 Elevated Structure. Daily traffic volumes on SR 99 through the south and central sections are projected to be lower for the Bored Tunnel Alternative than 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 Bored Tunnel Alternative are expected to be higher than with the other alternatives. Traffic volumes would increase near the Battery Street Tunnel, because the Battery Street Tunnel would be closed and replaced with a new bored tunnel that would have wider lanes and shoulders and less-abrupt curves. This would improve conditions for drivers, and additional traffic would be expected to use the tunnel.

Exhibit 8-12
Percentage Change in SR 99 Traffic Volumes as Compared to the 2030 Bored Tunnel

	2030 Cut-&-Cover Tunnel	2030 Elevated Structure
South of S. Spokane Street	+13%	+15%
S. Holgate Street	+10%	+15%
North of Seneca Street	+28%	+24%
Battery Street Tunnel	-15%	-19%
North of Aloha Street	-3%	-4%

Even though SR 99 volumes are expected to decrease with the Bored Tunnel Alternative, vehicle throughput across the transportation system is expected be similar among all three alternatives. As previously discussed in Question 3 and shown in Exhibit 8-3, the Bored Tunnel Alternative is expected to carry about 2 to 2.5 percent fewer vehicles each day than the Cut-and-Cover and Elevated Structure Alternatives. These small volume reductions are likely due to access changes associated with the Bored Tunnel Alternative, which would cause some travelers to change travel patterns.

SR 99 ramp volumes vary between the three alternatives as shown in Exhibit 8-13. This variation is due to proposed changes in SR 99 ramp locations and lane configurations. The most notable differences between the alternatives are that the Bored Tunnel Alternative does not include ramps at Seneca, Columbia, Elliott, or Western. Access to downtown Seattle would instead be provided via the Alaskan Way S. ramps near S. King Street. Ballard/Interbay access would be provided via the Alaskan Way S. ramps, or drivers could use the bored tunnel and exit at Republican Street and travel on Mercer and Roy Streets to reach their destination. Because of this, ramp volumes at the Alaskan Way S. ramps are expected to be highest with the Bored Tunnel Alternative. The Cut-and-Cover Tunnel Alternative also does not include ramps to Columbia and Seneca Streets, so ramp volumes are expected to be higher at the Alaskan Way S. ramps as compared for the Elevated Structure Alternative, though not as high as with the Bored Tunnel Alternative.

6 How would traffic conditions on I-5 compare?

I-5 vehicle volumes, presented in Exhibit 8-14, show little variation (less than a 1 percent difference) among the three alternatives. Given these small differences, I-5 is expected to operate similarly through the project area for any of the alternatives.

Exhibit 8-14
Comparison of I-5 Vehicle Volumes in 2030

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
I-5 South of I-90	286,600	274,300	274,600	272,600
I-5 North of Seneca	283,200	269,900	268,500	268,400
I-5 South of SR 520	324,900	324,500	325,300	325,000

7 How would traffic conditions on area streets compare?

Daily Vehicle Volumes on Alaskan Way
Daily vehicle volumes on Alaskan Way vary among the alternatives as shown below in Exhibit 8-15.

Exhibit 8-15
Comparison of Vehicle Volumes on Alaskan Way in 2030

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
South of S. King Street	47,300	32,600	39,300	27,500
North of Seneca Street	23,300	18,600	13,400	13,500
North of Pine Street	23,000	17,800	12,700	13,100

Vehicle volumes on Alaskan Way are expected to be highest south of S. King Street with the Cut-and-Cover Tunnel Alternative, followed by the Bored Tunnel and Elevated Structure Alternatives. The tunnel alternatives are expected to carry additional vehicles in this location because these alternatives remove the Columbia and Seneca ramps. For the tunnel alternatives, drivers coming from the south would use the ramps to Alaskan Way S. to access downtown destinations via Alaskan Way.

North of Seneca Street, the Bored Tunnel Alternative is expected to have the highest vehicle volumes on Alaskan Way of the three alternatives studied, and vehicle volumes for the other Cut-and-Cover Tunnel and Elevated Structure Alternatives are expected to be similar to each other. Higher vehicle volumes are expected on this section of Alaskan Way with the Bored Tunnel Alternative because it does not provide SR 99 ramps to and from Elliott and Western Avenues like the other alternatives. Because of this, drivers destined to and from northwest Seattle would travel on Alaskan Way or they would use the Bored Tunnel/Mercer Street route. Because of this change, vehicle volumes on Alaskan Way are expected to increase on this section of Alaskan Way with the Bored Tunnel Alternative as compared to the other two alternatives.

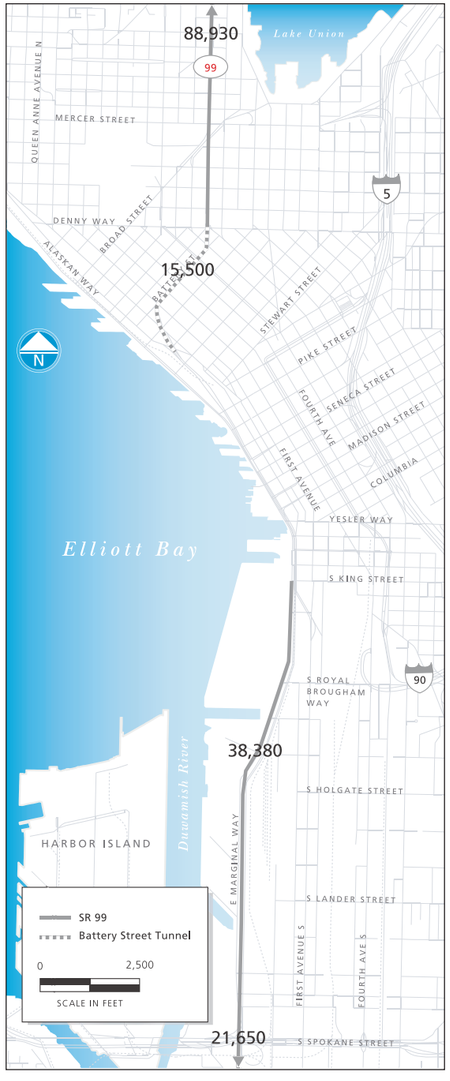
Despite variations in traffic volumes on Alaskan Way, the three alternatives are expected to operate with similar levels of delay. None of the intersections studied are expected to be congested or highly congested, as shown in Exhibits 8-16 and 8-17.

Daily Vehicle Volumes and Intersection Operations on Other City Streets
The following information was used to compare traffic conditions on area streets for the three alternatives:

- Daily vehicle volumes on city streets at screenlines. Screenlines capture combined vehicle volumes that cross locations in the transportation system shown in Exhibit 8-18.

Comparison of SR 99 Volumes

2030 No Build



2030 Bored Tunnel

2030 Cut-&-Cover Tunnel

2030 Elevated Structure

Exhibit 8-11

Comparison of SR 99 Ramp Volumes

2030 No Build

2030 Bored Tunnel

2030 Cut & Cover Tunnel

2030 Elevated Structure

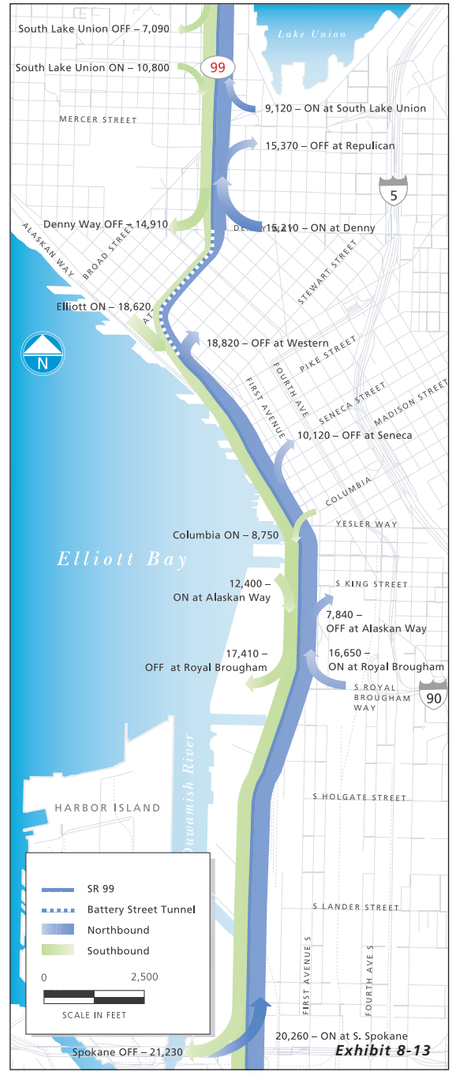


Exhibit 8-13

- Delay at intersections. The alternatives were compared based on the number of intersections where delay of a minute or more is expected. Congested and highly congested intersections for each of the alternatives during the AM and PM peak hours are shown in Exhibits 8-16 and 8-17.

South of S. King Street

Exhibit 8-19 compares vehicle volumes on city streets south of S. King Street for the three alternatives.

Exhibit 8-19
Comparison of Vehicle Volumes in 2030 for Screenlines South of S. King Street

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Streets between the Duwamish River & I-5, north of S. Spokane Street	162,600	136,400	133,300	131,400
Streets between SR 99 and I-5, south of S. King Street	124,100	110,700	93,300	90,400

Vehicle volumes on city streets south of S. King Street are highest for the Bored Tunnel Alternative. As discussed in Chapter 5, the Bored Tunnel Alternative is expected to shift some traffic from SR 99 to city streets due to access changes.

Despite increased vehicle volumes on city streets in the south, overall operations and delay on surface streets are expected to be somewhat better for the Bored Tunnel Alternative than for the Cut-and-Cover Tunnel and Elevated Structure Alternatives near S. Atlantic Street, as shown in Exhibits 8-16 and 8-17. Intersections along Atlantic Street between E. Marginal Way S. and First Avenue S. are expected to operate with less congestion and delay with the Bored Tunnel Alternative as compared to the Cut-and-Cover Tunnel and Elevated Structure Alternatives in both the AM and PM peak hours. Travelers would experience increased vehicle delay in this area with the Cut-and-Cover Tunnel or Elevated Structure Alternatives, because the southbound stadium off-ramp traffic is connected directly to S. Atlantic Street at a very congested location. During the AM and PM peak hours, the additional traffic at this location with the Cut-and-Cover Tunnel or Elevated Structure Alternatives would cause substantial congestion that is expected to cause up to an additional 2.5 minutes of delay at the following intersections:

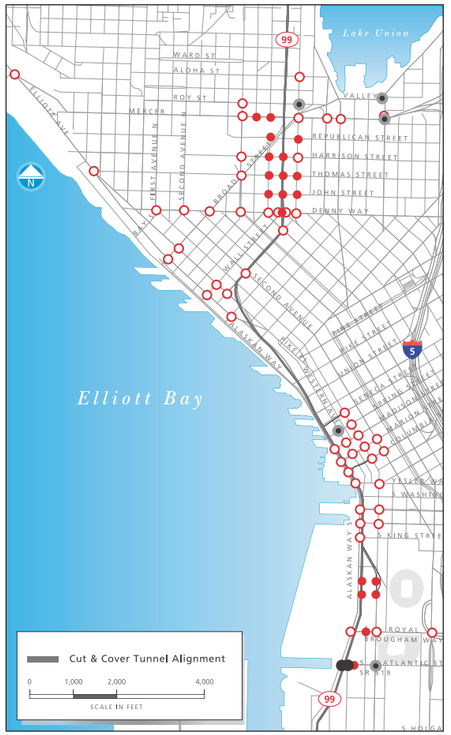
- East Marginal Way/Terminal 46 and S. Atlantic Street
- Colorado Avenue and S. Atlantic Street

Conversely, the southbound off-ramp for the Bored Tunnel Alternative would route SR 99 traffic through S. Royal Brougham Way, which would cause fewer conflicts and less delay.

Comparison of Congested Intersections AM Peak Hour

2030 Bored Tunnel

2030 Cut-&-Cover Tunnel



2030 Elevated Structure

Exhibit 8-16

Central (between S. King Street and Battery Street)

Exhibit 8-20 compares vehicle volumes on city streets north of S. King Street for the three alternatives.

Exhibit 8-20
Comparison of Vehicle Volumes in 2030 for Screenlines North of Seneca Street

	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Streets between Alaskan Way & I-5, north of Seneca Street	143,000	120,400	112,600	116,200
Streets between I-5 & Lake Washington, north of Seneca Street	167,400	152,800	150,000	150,400

Vehicle volumes on city streets north of Seneca Street are expected to be highest with the Bored Tunnel Alternative. Exhibits 8-16 and 8-17 compare delay at several intersections. Through central downtown, the following

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.

notable differences in intersection operations are expected for the three alternatives:

- In the AM peak hour, the number of congested intersections are expected to be the same for the three alternatives (one congested intersection is expected).

- In the PM peak hour, operations are expected to be similar for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. For the Elevated Structure Alternative, additional congestion and delay is expected at First Avenue and Columbia Street, because this alternative provides an SR 99 on-ramp in this location, which would increase traffic volumes at the intersection and on adjacent surface streets.

Elliott and Western Corridor North of Battery Street

All of the alternatives show similar delays at intersections located along Elliott and Western Avenues north of Battery Street. Congestion and delay in this corridor are expected to be slightly higher during peak hours with the Elevated Structure and Cut-and-Cover Tunnel Alternatives than the Bored Tunnel Alternative due to higher vehicle volumes associated with the Elliott and Western ramps.

North of Denny Way

Exhibit 8-21 compares vehicle volumes on city streets north of Thomas Street for the three alternatives.

Exhibit 8-21
Comparison of Vehicle Volumes in 2030 for Screenlines North of Thomas Street

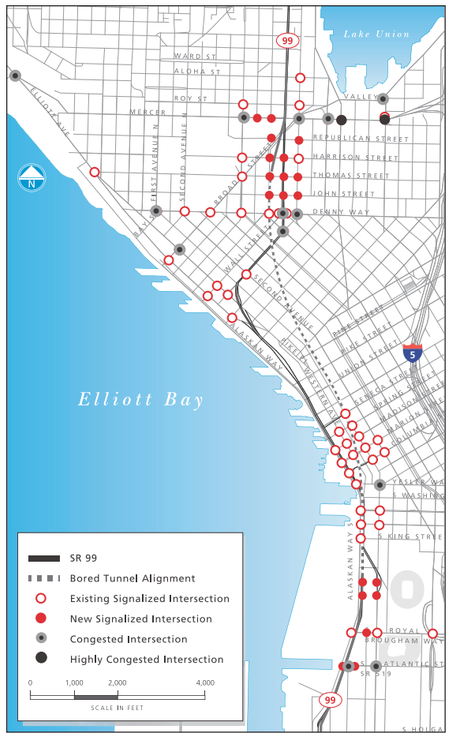
	Viaduct Closed	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Streets between Elliott & Aurora Avenue	113,700	117,800	97,600	97,400
Streets between Aurora Avenue and I-5	79,500	92,000	89,000	87,900

Vehicle volumes on city streets north of Thomas Street are expected to be highest with the Bored Tunnel Alternative. As discussed in Chapter 5, new east-west connections provided across Aurora Avenue at John, Thomas, and Harrison Streets with the Bored Tunnel Alternative provide greater mobility in the South Lake Union area and better utilize available capacity on existing streets like Dexter Avenue N. and Westlake Avenue N. than the other two build alternatives.

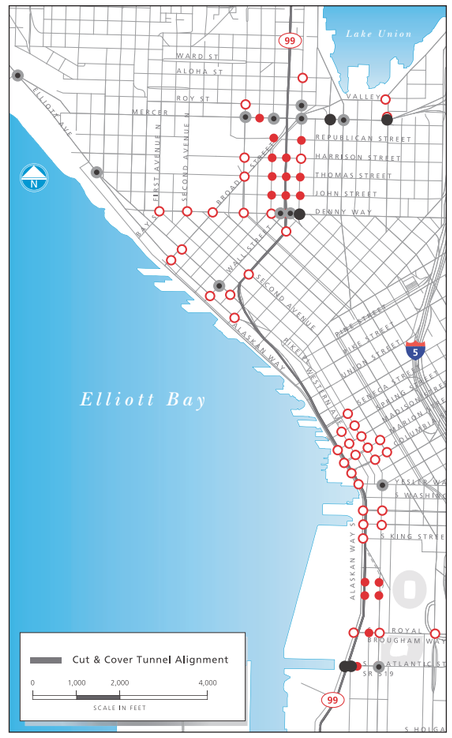
Despite increased vehicle volumes on city streets in the north, intersection operations north of Denny Way are expected to be somewhat better with the Bored Tunnel Alternative than with the Cut-and-Cover Tunnel or Elevated Structure Alternatives as shown in Exhibits 8-16 and 8-17. The Bored Tunnel Alternative is expected to have slightly less congestion and delay because it would connect three east-west streets across Aurora Avenue (compared to two for the other alternatives), which would provide an additional route for drivers to use north of Denny Way.

Comparison of Congested Intersections PM Peak Hour

2030 Bored Tunnel



2030 Cut-&-Cover Tunnel



2030 Elevated Structure

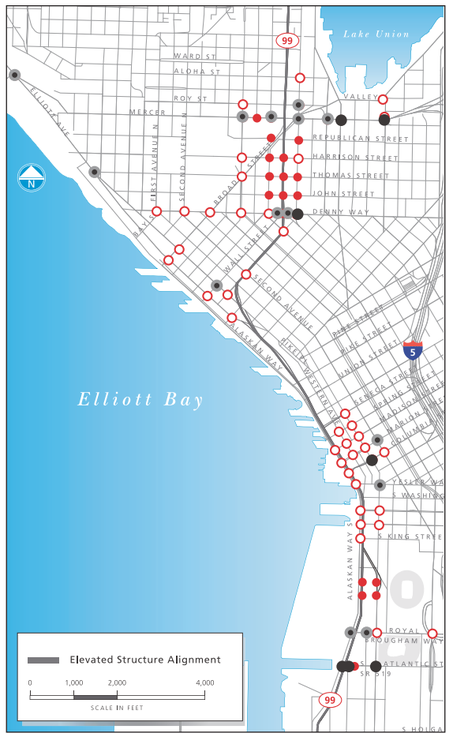


Exhibit 8-17

8 How would access change for drivers, bicyclists, and pedestrians?

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 Elevated Structure Alternative as compared to the 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 distribute from Alaskan Way to the downtown street grid using any of several cross streets, including S. Jackson Street, S. Main Street, Yesler Way, and Columbia, Marion, Madison, and Spring Streets, rather than being concentrated 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 4 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 for any of the alternatives evaluated. For any of the alternatives, similar access is provided. With the Cut-and-Cover Tunnel or Elevated Structure Alternatives, access to and from downtown would be provided via rebuilt ramps at Denny Way, which would be similar to access provided today. For the Bored Tunnel Alternative, access to Denny Way would be provided via ramps near Harrison Street. Between Harrison Street and Denny Way, drivers would 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 Cut-and-Cover Tunnel and Elevated Structure Alternatives would rebuild the existing on- and off-ramps at Elliott and Western Avenues, so access would be similar to what is provided today. The Bored Tunnel Alternative 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. Despite these access changes travel times are expected to be comparable between the three alternatives as discussed previously in the discussion of travel times found in Question 4 of this chapter.

How would access for freight compare?
Conditions for freight with the Elevated Structure and Cut-and-Cover Tunnel Alternatives would be similar to existing conditions, only the lanes and ramps on SR 99 would be wider than they are today, which would improve conditions for freight. With the 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 drivers take 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.

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 Alaskan Way or I-5. This change is expected to affect 55 to 70 tanker trucks per day.

How would access for transit compare?
Downtown transit access to and from the south would likely be similar to existing conditions for the Elevated Structure Alternative, 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 tunnel alternatives, downtown transit access to and from the

Exhibit 8-18

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 and/or S. Washington Streets 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. Bus travel times to most areas would remain comparable, depending on the rider's final destination. The travel time discussion in Question 4 of this chapter provides information about changes to travel times for trips destined to or from the central downtown area near Seneca Street and Fourth Avenues. Compared to the travel time information presented in Question 4, for the Bored Tunnel and Cut-and-Cover Alternatives, bus travel times to areas south of central downtown, near Pioneer Square could decrease, although travel times to areas north of Seneca Street might increase since the buses would enter the street grid farther south. The Bored Tunnel Alternative would provide a transit-only lane on the off-ramp that would allow transit to bypass potential queues emanating from the intersection. A transit-only lane is not provided with the other alternatives.

For transit vehicles serving downtown Seattle from the north, transit access is expected to be comparable for all three alternatives. Access for the Bored Tunnel Alternative 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 emanating from intersections; however, transit would be required to travel through three additional traffic signals on Aurora Avenue between Harrison Street and Denny Way. A discussion of how travel times may be affected by these access changes for the three alternatives is provided in Question 4 of this chapter.

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

How would access compare for ferry traffic?
Access to the Seattle Ferry Terminal would be similar for the three 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.

How would conditions compare for event traffic?
During special events at the stadiums or Seattle Center, the Bored Tunnel Alternative is expected to provide the best package of improvements to accommodate event traffic of the three alternatives examined. The Bored Tunnel Alternative provides additional surface street connections in the south and north (not provided by the other two alternatives) that offer drivers and pedestrians more travel options when large volumes of event traffic increase congestion on area streets. These additional options would likely improve circulation and reduce overall congestion levels at critical intersections during large events. The same is true in the north end, where the Bored Tunnel Alternative would connect three additional east-west streets across SR 99, compared to two with the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

How would access compare for pedestrians?
All three alternatives provide improved pedestrian conditions in the south and north areas due to proposed improvements between S. Royal Brougham Way and S. King Street and connecting the street grid north of Denny Way. In the south and north sections, the Bored Tunnel Alternative offers somewhat better pedestrian connections due to the following improvements:

- Improving the street grid by adding one or two new east-west streets west of Qwest Field
- Connecting three additional east-west streets across SR 99 rather than two north of Denny Way

In the central waterfront area, the 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 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 Bored Tunnel Alternative. The Bored Tunnel Alternative provides the most available space along the waterfront to provide pedestrian amenities, since unlike the other alternatives, it does not propose to locate a streetcar along the waterfront. In the central waterfront area, the Elevated Structure Alternative offers limited opportunities to improve pedestrian conditions.

How would access compare for bicyclists?
All three 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 Bored Tunnel Alternative would connect three east-west streets compared with two for the other alternatives. In addition, the Bored Tunnel Alternative may provide dedicated bicycle lanes on John Street.

In the central waterfront area, the Cut-and-Cover Tunnel Alternative offers the most improved conditions for bicyclists due to the combination 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 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 Bored Tunnel Alternative. In the central waterfront area, the Elevated Structure Alternative offers limited opportunities to improve conditions for bicyclists, although dedicated bicycle lanes would be provided along Alaskan Way.

Appendix F, Noise Discipline Report

The feasibility and reasonableness of noise abatement measures for the Bored Tunnel Alternative is discussed in the *2010 Appendix F*, Section 5.4. The feasibility and reasonableness of noise abatement measures for the Cut-and-Cover and Elevated Structure Alternatives is discussed in the *2004 Appendix F*, Section 8.1.

9 How would noise levels compare?

The tunnel alternatives would reduce noise levels in the central waterfront area, as compared to the Elevated Structure Alternative. Noise along the waterfront would not change much if the Elevated Structure Alternative were built. Exhibit 8-22 compares the results of the noise analysis done for the three alternatives. The Bored Tunnel Alternative would reduce noise levels along the waterfront to the greatest degree, followed by the Cut-and-Cover Tunnel Alternative. Between Lenora Street and the Battery Street Tunnel, the Bored Tunnel Alternative would reduce noise levels compared to the other alternatives, since SR 99 would no longer exist in this location. Finally, the Bored Tunnel Alternative would reduce noise levels to the greatest degree north of Denny Way, since SR 99 would be located in a tunnel up to about Harrison Street.

Exhibit 8-22
Comparison of Noise Effects

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Sites That Would Exceed FHWA Noise Criteria	40 of 68 sites modeled	29 of 52 sites modeled	42 of 52 sites modeled
Change in Noise Levels on the Central Waterfront	Up to an 18 dBA decrease	Up to a 12 dBA decrease	Similar to existing levels
Change in Noise Levels from Lenora Street to the Battery Street Tunnel	5 to 17 dBA decrease	2 to 3 dBA decrease	Similar to existing levels
Change in Noise Levels North of Denny Way	Varies from a 5 dBA decrease to a 4 dBA increase	Varies from a 2 dBA decrease to a 2 dBA increase	Same as the Cut-&-Cover Tunnel

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

- Traffic management measures
- Land acquisition for noise buffers or barriers
- Realigning the roadway
- Noise insulation of buildings
- Noise barriers

None of these measures were identified to be feasible and reasonable.

10 How would views change for the alternatives?

Views and the look and feel along Seattle's waterfront would be affected in very different ways depending on the alternative. With either of the tunnel alternatives, SR 99 would be removed, which would open up views along the central waterfront. Once drivers were inside either tunnel, both northbound and southbound vehicle occupants would no longer have the scenic views of the central waterfront and downtown as they do today. For the Elevated Structure Alternative, drivers on SR 99 would continue to have similar views from the viaduct as they do today, but the new, larger elevated structure would continue to dominate views between downtown and the waterfront as it does today. For the Elevated Structure Alternative, SR 99 would be 54 to 74 feet wider than the existing structure in the area from S. King Street to about S. Jackson Street, substantially increasing the bulk of the elevated structure in this location.

North of Denny Way, views for all three alternatives may improve slightly, since SR 99 would be located in a retained cut or tunnel, compared to the surface roadway that exists today.

11 What differences would the alternatives have on properties?

Exhibit 8-23 shows the number of properties that would be fully or partially acquired for the proposed alternatives. The Bored Tunnel Alternative would require the fewest property acquisitions.

Exhibit 8-23
Comparison of Parcels Acquired for the Alternatives

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Partial Acquisitions	6	10	11
Full Acquisitions	5	25	24
Total Properties Affected	**11**	**35**	**35**

In addition to the parcels required above, the Bored Tunnel Alternative would require permanent tieback easements for subsurface wall shoring systems on three properties in the north portal area. The Bored Tunnel Alternative would also require subsurface property acquisitions for 52 to 59 parcels. These subsurface acquisitions would not affect the use of the building or property; however, these acquisitions may constrain future development above the tunnel if substantial excavation or piles are required.

12 How would land use effects compare?

Along the central waterfront, land uses would be affected in very different ways, depending on the alternative. For the Bored Tunnel and Cut-and-Cover Tunnel Alternatives, removing the existing viaduct could provide an indirect land use benefit by making nearby buildings and land more desirable for land uses that benefit from views, proximity to public open space, and foot traffic—possibly leading to new kinds of uses on adjacent properties. For the Elevated Structure Alternative, the existing viaduct along the central waterfront would be replaced with a new elevated structure along a similar alignment. The new structure would be wider and 3 feet taller, which would increase the shaded area below SR 99.

North of Denny Way, all three build alternatives would improve connections between Seattle Center and the South Lake Union and Uptown/Queen Anne neighborhoods. Connections for areas located east and west of SR 99 would be improved to a greater degree with the Bored Tunnel Alternative, because SR 99 would be located in an underground tunnel between Denny Way and Harrison Street (compared to an open cut with the other two alternatives). In addition, the Bored Tunnel Alternative would rebuild Aurora Avenue over the top of the tunnel and would connect three east-west streets compared to two for the other alternatives, which would improve circulation to a greater degree than the other two alternatives.

All three build alternatives would backfill and close Broad Street between Ninth Avenue N. and Taylor Avenue N., allowing the street grid to be connected. Local streets that currently dead end at Broad Street could continue through at street level, just as they did before SR 99 was built. When the project is completed, portions of the former Broad Street right-of-way could provide opportunities for new development. The City would likely

What is a tieback easement?

A tieback easement allows for use of a property below the surface for a wall shoring system that would be used to build a permanent wall and may be abandoned after the permanent wall is constructed.

vacate the filled-in portion of Broad Street, and the remaining parcels could be developed in a way that would support City planning goals for the neighborhood and would be consistent with zoning regulations in the area.

13 How would local and regional economic effects compare?

Businesses and Employees

Exhibit 8-24 compares economic effects of the required property acquisitions shown in Exhibit 8-23. As the exhibit shows, the Bored Tunnel Alternative requires the least square footage of work space to be relocated and results in the fewest number of jobs to be relocated or displaced of the three alternatives evaluated.

Exhibit 8-24
Acquired Property Effects

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
No. of parcels subject to acquisition	11	35	35
No. of parcels subject to full acquisition	5	25	24
No. of buildings acquired	3	11	10
Approximate area of work space relocated or displaced – *in square feet*	121,900	344,791	332,391
Estimated no. of permanent jobs relocated or displaced	144	271	256
Approximate area of fully acquired tax-paying parcels – *in square feet*	213,630	228,852	222,051

Parking

As shown in Exhibit 8-25, the Elevated Structure and Cut-and-Cover Tunnel Alternatives would remove more parking than the Bored Tunnel Alternative. Specifically, the Elevated Structure and Cut-and-Cover Tunnel Alternatives would require removing hundreds of on-street parking spaces located under the existing viaduct along the central waterfront.

Exhibit 8-25
Parking Spaces Removed

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
On-Street	320	620	680
Off-Street	250	510	510
Total	**570**	**1,130**	**1,190**

14 How would effects to historic and archaeological resources compare?

The text below compares effects to historic resources for the three alternatives. The Federal Highway Administration (FHWA) has consulted with the Washington Department of Archaeological and Historic Preservation, which concurred on July 8, 2010 that the project will have an adverse effect on one or more properties that are on or eligible for the National Register of Historic Places (NRHP).

Alaskan Way Viaduct

All three of the alternatives would demolish the Alaskan Way Viaduct, which is eligible for listing with the Battery Street Tunnel as one resource in the NHRP. For the tunnel alternatives, removing the viaduct and replacing it with a tunnel would benefit the Pioneer Square and Pike Place Market Historic Districts, the historic waterfront piers, and many other historic properties by creating views more like those that existed before the viaduct was built. The Elevated Structure Alternative would continue to affect views to and from these buildings and historic districts, especially in the Pioneer Square area between S. Jackson and S. King Streets, where the new elevated structure would be 54 to 74 feet wider than the existing viaduct. The Elevated Structure Alternative would also continue to have noise and visual impacts to the potential waterfront piers historic district.

The tunnel alternatives would remove the Columbia and Seneca ramps, which would improve views to historic buildings adjacent to the ramps. These buildings include the Polson and Journal buildings (both in the Pioneer Square Historic District) and the Colman, Grand Pacific, and Olympic Warehouse buildings (listed in the NRHP).

Battery Street Tunnel

All three alternatives would substantially modify the Battery Street Tunnel, which is eligible for listing with the Alaskan Way Viaduct as one resource in the NRHP. The Bored Tunnel Alternative would decommission the Battery Street Tunnel, possibly by filling it with concrete rubble from viaduct demolition and injecting concrete to seal it.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would lower the tunnel floor to increase vertical clearance to 16.5 feet, replace the tunnel's outer walls, and update the tunnel's electrical and lighting systems.

Alaskan Way Seawall

The Cut-and-Cover Tunnel and Elevated Structure Alternatives require replacing the Alaskan Way Seawall, which is also eligible for listing in the NRHP.

Potential Effects to Historic Districts

The tunnel alternatives would require ventilation buildings in locations that could affect the character of neighboring historic districts, but these effects are not considered adverse. The Bored Tunnel Alternative would require one tunnel operations building with vent stacks near each tunnel portal. The tunnel operations building at the south portal would be located near the Pioneer Square Historic District. The Cut-and-Cover Tunnel Alternative would require six ventilation buildings. Three of these buildings would be located near the Pioneer Square Historic District, and one would be located near the Pike Place Market Historic District, but these effects are not considered adverse.

15 How would effects to neighborhoods, social service providers, minority, and low-income populations compare?

At this time, all three build alternatives do not appear to have a disproportionately high and adverse effect on low-income or minority populations. Effects of the Bored Tunnel are discussed in Chapter 5, Question 20, and effects of the Cut-and-Cover Tunnel and Elevated Structure are discussed in the 2006 Supplemental Draft EIS (attached). A final determination will be made in the Final EIS.

In the south, the Bored Tunnel Alternative offers more benefits to surrounding neighborhoods, social service providers, and minority and low-income populations than the other alternatives. The Bored Tunnel Alternative would construct one or two new surface streets between

What is off-street parking?

Off-street parking includes parking garages and lots where people pay to park. Most off-street parking is privately owned or operated.

What is on-street parking?

There are two types of on-street parking, short-term and long-term. On-street short-term parking includes metered spaces, time-restricted public parking spaces (such as 1-hour parking and loading zones), bus/taxi zones, and spaces reserved for police parking. On-street long-term parking includes unmetered, unrestricted on-street public parking spaces and metered spaces that allow all day parking.

Section 4(f) and Protection of Historic Resources

This project is adjacent to some of Seattle's most well-known historic buildings and neighborhoods. Section 4(f) is a provision of federal law pertaining to transportation projects that requires FHWA to carefully consider and address protection of these resources in order to receive federal funding.

The **Section 4(f) Evaluation** can be found at the end of this document on page 225. The Section 4(f) Supplemental Materials are provided in ***Appendix J*** of the ***2010 Supplemental Draft EIS***.

Additional Effects to Historic and Archaeological Resources

Effects to historic and archaeological resources during construction are discussed in **Question 22** of this chapter.

Chapter 9 Tolling

The three build alternatives evaluated in this chapter assume the SR 99 replacement would be an untolled facility. However, the state legislature has directed WSDOT to analyze the performance of a tolled facility and how it might affect traffic and effects to other resources. Tolls have the potential to be a burden on low-income individuals. Tolling and its possible effects are discussed in **Chapter 9** of this ***Supplemental Draft EIS***.

S. Royal Brougham Way and S. King Street and would replace the existing multi-use Waterfront Bicycle/Pedestrian Facility with the City Side Trail. These improvements would improve connections, particularly for pedestrians between the SODO, Pioneer Square, and waterfront areas. These pedestrian improvements would benefit people walking to and from the many organizations offering community and social services located in the Pioneer Square neighborhood.

Along the central waterfront, both tunnel alternatives would remove the viaduct from the waterfront, which would eliminate the perceived barrier between Pioneer Square, downtown, and the waterfront, substantially improving connections between these neighborhoods. The Cut-and-Cover Tunnel Alternative offers the greatest benefits to neighborhoods, social service providers, minority and low-income populations of three alternatives considered, because the Alaskan Way surface street would be replaced with a new street and improved bicycle and pedestrian facilities and a new streetcar would be built. The Elevated Structure Alternative would also replace Alaskan Way and would provide improved bicycle and pedestrian facilities. However, these improvements would provide fewer benefits than the Cut-and-Cover Tunnel Alternative, since the new elevated structure would be wider than the existing viaduct, increasing the shaded area beneath the structure and increasing the sense that the waterfront is separate from neighborhoods to the east. The Bored Tunnel Alternative would remove the viaduct, but improvements to Alaskan Way are not proposed as part of the alternative. North of Denny Way, all three alternatives would improve neighborhood and nonmotorized connections between the South Lake Union and Uptown/Queen Anne neighborhoods. However, neighborhood and nonmotorized connections for areas located east and west of SR 99 would be improved to a greater degree with the Bored Tunnel Alternative, since SR 99 would be located in an underground tunnel between Denny Way and Harrison Street compared to an open cut with the other two alternatives. The Bored Tunnel Alternative would connect three east-west streets, compared to two for the other alternatives. The Bored Tunnel Alternative would acquire and remove a building where the non-profit organization Seattle Jobs Initiative has office space. This office space is used primarily for administration purposes. Seattle Jobs Initiative works directly with low-income individuals out of other locations, so this office space would be able to be relocated in the area without a substantial disruption to low-income individuals served. Relocation assistance would be provided by the project.

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

All of the alternatives would maintain parks, recreation, and open space opportunities along the central waterfront. However, the tunnel alternatives would substantially improve and enhance these opportunities compared to the Elevated Structure Alternative, because these alternatives would remove the existing viaduct, opening up views and expanding the land available for pedestrians, bicyclists, and open space. The Cut-and-Cover Alternative would provide the greatest improvement of the three alternatives, because it includes improving the Alaskan Way surface street, adding bicycle and pedestrian amenities, and constructing a new walkway at Victor Steinbrueck Park connecting to the waterfront. The Bored Tunnel Alternative would improve opportunities for open space along the waterfront, but it does not include improvements to these areas as part of the alternative. The Elevated Structure Alternative would be wider than the existing structure, which would continue to limit open space and recreational opportunities along the waterfront, although it too proposes to improve the Alaskan Way surface street by adding bicycle and pedestrian amenities.

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

Effects to emergency and public service providers would depend on the route taken and the time of the trip. Emergency service providers typically respond to emergencies in their service areas traveling on city streets. For emergency providers, response times are expected to be similar for the three alternatives, although in some areas travel time may be slightly longer with the Bored Tunnel Alternative since vehicle volumes on city streets are expected to be higher than they would be with the Cut-and-Cover and Elevated Structure Alternatives.

For public service providers who use SR 99, the travel time findings discussed in Question 5 summarize differences among the alternatives. For many trips, particularly through trips, travel times on SR 99 are expected to be faster for the Bored Tunnel Alternative than the Cut-and-Cover Tunnel and Elevated Structure Alternatives. For public service providers who travel mostly on city streets, travel times may be slightly longer with the Bored Tunnel Alternative, since vehicle volumes on city streets are expected to be higher than they would be with the Cut-and-Cover and Elevated Structure Alternatives.

18 How would effects to air quality compare?

For all three alternatives, future pollutant concentrations for carbon monoxide were estimated to be below (within) the national ambient air quality standards (NAAQS). Additionally, future mobile source air toxic (MSAT) emissions for all three alternatives are expected to decrease compared to existing conditions, because the project would replace an existing highway without adding substantial new capacity. Regardless of the alternative chosen, emissions will be lower than present levels in the design year (2030) as a result of the U.S. Environmental Protection Agency's national control programs.

The Bored Tunnel Alternative would include two tunnel operations buildings with vent stacks. One building would be located adjacent to each of the tunnel portals. The Cut-and-Cover Tunnel Alternative would include six ventilation buildings adjacent to the waterfront. Both the Cut-and-Cover Tunnel and Elevated Structure Alternatives would add vents to each of the Battery Street Tunnel portals. Negative air quality effects are not expected at vent openings for the Battery Street Tunnel or proposed ventilation buildings.

19 How would effects to water resources compare?

For all three alternatives, once the project is built, stormwater runoff generated within the project area would

Appendix M, Air Quality

Additional information about the MSAT analysis is provided in *Appendix M*, Section 5.2.3.

Construction Activities Chart

STAGE ONE | STAGE TWO | STAGE THREE | STAGE FOUR | STAGE FIVE | STAGE SIX | STAGE SEVEN | FINAL STAGE

Begin July

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

Shorter Construction Plan

Cut & Cover Tunnel

Tunnel – 30 months | **Tunnel** – 42 mos. | **Tunnel** – 12 mos | **7 yrs**

- Relocate utilities – *occurs periodically throughout all construction stages*
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. HOLGATE TO S. KING VIADUCT REPLACEMENT PROJECT

- S. Holgate to S. King construction – *Complete early 2014*

- Remove existing viaduct
- Build tunnel along the central waterfront
- Rebuild seawall from S. Jackson to Broad
- Replace the viaduct from Pine to the Battery Street Tunnel
- Complete Battery Street Tunnel improvements
- Complete construction of north end improvements
- Connect tunnel to S. Holgate to S. King

- Restore Alaskan Way and complete landscaping & lighting
- Complete relocating utilities

Intermediate Construction Plan

Cut & Cover Tunnel

Stacked – 30 months | **Stacked** – 9 mos. | **Stacked** – 15 mos. | **Stacked** – 27 mos. | **Stacked** – 12 mos. | **Stacked** – 12 mos. | **8.75 yrs**

- Relocate utilities – *occurs periodically throughout all construction stages*
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. HOLGATE TO S. KING VIADUCT REPLACEMENT PROJECT

- S. Holgate to S. King construction – *Complete early 2014*

- Complete seawall construction from S. Jackson to Pike
- Start building the tunnel
- Construct retaining wall from Stewart to Blanchard
- Construct temporary Bell Street Overpass

- Continue tunnel construction
- Remove and replace southbound SR 99 from Pike to Battery Street Tunnel
- Begin construction of Partially Lowered Aurora

- Remove viaduct from S. King to Pike
- Complete southbound tunnel
- Continue SR 99 construction from Pike to Battery Street Tunnel
- Complete Battery Street Tunnel improvements
- Continue north end construction and construct the Mercer & Roy bridges

- Complete northbound tunnel
- Continue seawall construction from Pike to Broad
- Complete the northbound SR 99 from Pike to the Battery Street Tunnel

- Complete the seawall from Pike to Broad
- Restore Alaskan Way and complete landscaping & lighting
- Complete relocating utilities

Longer Construction Plan

Elevated Structure

Elevated Structure – 30 months | **Elevated** – 9 mos. | **Elevated Structure** – 27 mos. | 3 mos. | **Elevated Structure** – 24 mos. | **Elevated Structure** – 21 mos. | 3 mos. | 3 mos. | **10 yrs**

- Relocate utilities – *occurs periodically throughout all construction stages*
- Construct temporary over-water bridge between Pier 48 and Colman Dock
- Relocate ferry holding
- Begin seawall construction from S. Jackson to Pike
- Relocate Seattle Fire Station
- Build retaining wall from Stewart to Blanchard

S. HOLGATE TO S. KING VIADUCT REPLACEMENT PROJECT

- S. Holgate to S. King construction – *Complete early 2014*

- Construct Broad Street Detour
- Build new viaduct columns
- Construct retaining wall from Stewart to Blanchard
- Construct temporary Bell Street Overpass

- Complete seawall construction from S. Jackson to Pike. Rebuild seawall from Pike to Broad.
- Widen lower viaduct deck from S. King to Pike
- Remove and construct southbound SR 99 from Pike to the Battery Street Tunnel
- Begin constructing improvements to Battery Street Tunnel
- Begin constructing Partially Lowered Aurora

- Demolish upper viaduct from S. King to Pike
- Remove northbound SR 99 from Pike to Battery Street Tunnel
- Complete Partially Lowered Aurora

- Construct upper viaduct from S. King to Pike
- Build northbound SR 99 from Pike to the Battery Street Tunnel
- Complete Battery Steet Tunnel Improvements
- Build bridges at Thomas and Harrison

- Demolish and rebuild lower level viaduct from S. King to Pike

Connect structure to S. Holgate to S. King

- Restore Alaskan Way and complete landscaping & lighting
- Complete relocating utilities

Exhibit 8-26

Construction Activities Chart

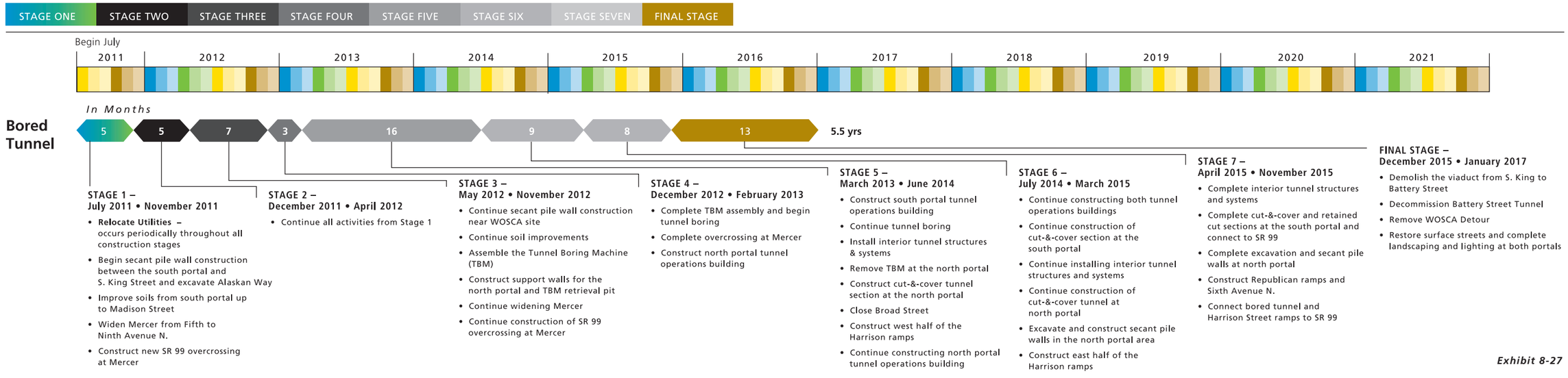


Exhibit 8-27

be collected and either directed to the combined sewer system and sent to a treatment plant, or treated using best management practices (BMPs) consistent with applicable stormwater codes. This would improve water quality compared to existing conditions, since only a portion of the stormwater runoff from the project area is treated today.

20 How would effects to fish and aquatic habitat compare?

As described above, all of the alternatives would improve water quality compared to existing conditions since stormwater runoff would be treated prior to being discharged. Improving water quality would reduce potential effects to fish and aquatic resources compared to existing conditions.

21 How do construction effects compare?

Construction Duration and Activities

Exhibits 8-26 and 8-27 show proposed construction activities and durations for each of the three alternatives. Construction durations are summarized below:

- **Bored Tunnel Alternative –** About 5.5 years
- **Cut-and-Cover Tunnel Alternative –** 7 to 8.75 years, depending on the construction approach
- **Elevated Structure Alternative –** 10 years

In addition to a shorter construction period, the Bored Tunnel Alternative would limit construction activity mostly to the portals located on the south and north ends of the project area, with virtually no impacts to the central waterfront until the existing viaduct is demolished. Conversely, construction of the Cut-and-Cover Tunnel and Elevated Structure Alternatives would be quite disruptive in a much broader area than the Bored Tunnel Alternative. In addition to effects in the south and north, the central waterfront and areas adjacent to the viaduct as it climbs to the Battery Street Tunnel would be heavily affected during the majority of the construction period.

The three build alternatives propose to use the same construction staging areas. The proposed construction staging areas are discussed in Chapter 4, Question 1 and shown in Exhibit 4-2.

Roadway Closures, Restrictions, and Detours

Exhibits 8-28 and 8-29 show proposed roadway closures, restrictions, and detours for the three alternatives. One of the primary differences between the Bored Tunnel Alternative and the other alternatives is that it does not require substantial closures or of SR 99 during construction and would have fewer lane and ramp restrictions. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would affect SR 99 and city street traffic to a much greater degree than the Bored Tunnel Alternative.

The Bored Tunnel Alternative would require a 3-week SR 99 closure, occasional night and weekend closures of SR 99, and reducing SR 99 by one lane in each direction between S. Spokane Street and the Battery Street Tunnel and from Denny Way to Roy Street for a period of about 3.5 years. The Elevated Structure Alternative would require closing SR 99 for about 6 months and reducing SR 99 to two lanes for about 6 years. The Cut-and-Cover Tunnel Alternative would require closing SR 99 for 27 to 42 months, depending on the construction approach. If the construction approach were selected that required a

Construction Roadway Closures, Restrictions, and Detours

STAGE ONE | STAGE TWO | STAGE THREE | STAGE FOUR | STAGE FIVE | STAGE SIX | STAGE SEVEN | FINAL STAGE

Begin July

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

Shorter Construction Plan

Cut & Cover Tunnel

Tunnel – 30 months

- Traffic remains on SR 99
- Alaskan Way reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track

S. HOLGATE TO S. KING VIADUCT REPLACEMENT PROJECT

- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012
- All SR 99 traffic on WOSCA Detour mid-2012

Tunnel – 42 mos.

- SR 99 closed from Royal Brougham to Denny
- SR 99 north of Denny is reduced to 3 lanes total
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Tunnel – 12 mos

- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

7 yrs

Intermediate Construction Plan

Cut & Cover Tunnel

Stacked – 30 months

- Traffic remains on SR 99
- Alaskan Way reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track

S. HOLGATE TO S. KING VIADUCT REPLACEMENT PROJECT

- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012
- All SR 99 traffic on WOSCA Detour mid-2012

Stacked – 9 mos.

- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Stacked – 15 mos.

- Southbound SR 99 open from S. Spokane to Columbia, closed from Columbia to Denny
- Northbound SR 99 open from S. Spokane to Denny, Western ramp closed
- SR 99 north of Denny is reduced to 2 northbound lanes and 1 southbound lane
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Stacked – 27 mos.

- SR 99 closed to all traffic from Royal Brougham to Denny
- SR 99 north of Denny is reduced to 1 northbound lane and 2 southbound lanes
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Stacked – 12 mos.

- Southbound SR 99 open to traffic in new tunnel
- Northbound SR 99 closed from Royal Brougham to Denny, open north of Denny
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Stacked – 12 mos.

- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

8.75 yrs

Longer Construction Plan

Elevated Structure

Elevated Structure – 30 months

- Traffic remains on SR 99
- Alaskan Way reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track

S. HOLGATE TO S. KING VIADUCT REPLACEMENT PROJECT

- SR 99 reduced to 2 lanes in each direction from S. Spokane to Battery Street Tunnel
- Close SR 99 for one week mid-2012
- All SR 99 traffic on WOSCA Detour mid-2012

Elevated – 9 mos.

- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way restricted to local access
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Elevated Structure – 27 mos.

- SR 99 reduced to 2 lanes in each direction
- Southbound traffic routed to Broad Street Detour
- Elliott & Western ramps closed
- SR 99 north of Denny reduced to 3 lanes total
- Alaskan Way reduced to 1 lane in each direction
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

3 mos.

- SR 99 closed
- SR 99 north of Denny is reduced to 1 northbound land and 2 southbound lanes
- Alaskan Way reduced to 1 lane in each direction
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Elevated Structure – 24 mos.

- SR 99 reduced to 2 lanes in each direction on lower viaduct deck
- Southbound traffic routed to Broad Street Detour
- Columbia, Seneca, Elliott, and Western ramps closed
- Alaskan Way reduced to 1 lane in each direction
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

Elevated Structure – 21 mos.

- SR 99 reduced to 2 lanes in each direction on upper viaduct deck
- Columbia & Elliott ramps closed
- Seneca & Western ramps open
- Alaskan Way reduced to 1 lane in each direction
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

3 mos.

- SR 99 closed
- Alaskan Way periodically reduced to 1 lane in each direction

3 mos.

- SR 99 completed and open to traffic
- Alaskan Way periodically reduced to 1 lane in each direction

10 yrs

Exhibit 8-28

Construction Roadway Closures, Restrictions, and Detour

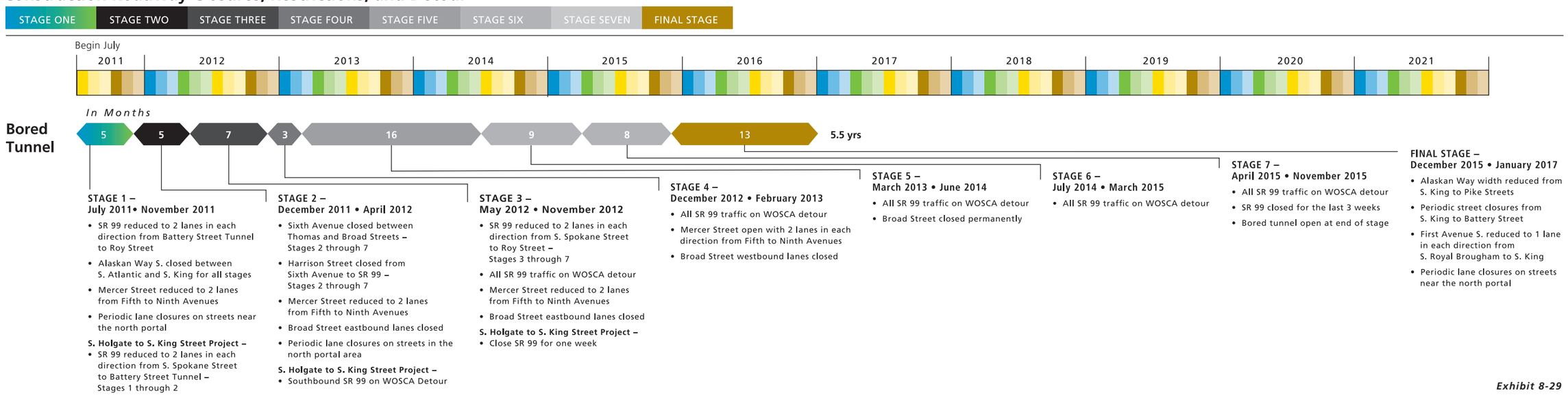


Exhibit 8-29

27-month closure of SR 99, SR 99 would require lane restrictions for an additional 27 months. In addition, both the Cut-and-Cover Tunnel and Elevated Structure Alternatives require lengthy ramp closures on SR 99.

All three alternatives would require temporary lane closures on city streets, including periodic restrictions on cross streets located near the viaduct and streets north of Denny Way. The Bored Tunnel Alternative would require closing Alaskan Way S. between S. Atlantic Street and S. King Street throughout the 5.5-year construction period. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would require substantial restrictions on Alaskan Way between S. King Street and approximately Pike Street. The Cut-and-Cover Tunnel Alternative would restrict Alaskan Way to only local traffic for a period of 3.5 to 4.5 years, and it would be reduced to one lane in each direction for an additional 3.5 years. The Elevated Structure Alternative would restrict Alaskan Way to one lane in each direction for a period of 10 years.

22 How do other construction effects compare?

Noise

During construction, the Bored Tunnel Alternative would affect existing noise levels the least of the three alternatives, since many of the construction activities would take place well below ground. With the Bored Tunnel Alternative, construction noise would be focused in the north and south portal areas throughout the 5.5-year construction period. Properties adjacent to Alaskan Way would be affected by construction noise during viaduct demolition, which would occur over a 9-month period. The intensity of noise from construction activities would be highest during viaduct demolition directly adjacent to a building. Viaduct demolition over a 2-block area is expected to take about 2 to 4 weeks within the total 9-month demolition period. The intensity and duration of construction noise would be greater for the Cut-and-Cover Tunnel and Elevated Structure Alternatives than the Bored Tunnel, because construction activities would take place at street level along the central waterfront. Construction noise would also affect a larger area for these two build alternatives since construction activities would span the entire 2-mile length of SR 99, as compared to the Bored Tunnel Alternative, where most noise effects would be limited to portal areas. The Cut-and-Cover Tunnel Alternative would have fewer noise impacts than the Elevated Structure Alternative, but would be more than what is expected for the Bored Tunnel Alternative, since it requires an open cut along the central waterfront. The duration of construction noise would be shorter for the Cut-and-Cover Tunnel than the Elevated Structure since construction would occur over 7 to 8.75 years, as compared to 10 years. For all alternatives, construction activities are planned to occur up to 24 hours a day, 7 days a week throughout construction.

Vibration

All of the alternatives require demolishing the existing viaduct, which is the construction activity expected to cause the highest levels of vibration. Impact pile driving may also be required for the three alternatives, which could also cause vibration effects. Potential vibration effects are expected to be similar among the alternatives,

and for any of the alternatives, buildings would be evaluated on a case-by-case basis to determine what mitigation measures would be needed. With the Bored Tunnel Alternative, the tunnel boring machine (TBM) would produce ground vibration, but due to the depth of the TBM, vibration levels would not be noticeable and would not pose a risk to buildings or utilities.

Views
Views in the project area would be affected by staging areas, heavy equipment, drill rigs, scaffolding, fencing, cranes, dust and dirt, noise barriers or curtains, and storage of construction materials. The Bored Tunnel Alternative would have the least effect of the three alternatives on views because construction would not take place along the central waterfront.

Economics
Construction would inconvenience or disturb businesses and business customers adjacent to the project for all of the alternatives. However, the Bored Tunnel Alternative's effects to businesses would be limited largely to the south and north portal areas, and the duration of effects would be shorter than with the other alternatives. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would also affect areas in the south and north, in addition to the central waterfront and associated impacts to SR 99 traffic.

The direct effects of construction to businesses along the central waterfront would be much more extensive with the Cut-and-Cover Tunnel and the Elevated Structure Alternatives compared to the Bored Tunnel Alternatives. The extended duration of these waterfront construction activities would be especially difficult for many waterfront businesses.

Parking Effects
Business customers and employees could also be affected by changes and a loss of parking spaces during construction. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would have more construction activities along the waterfront, as well as traffic detours that would affect parking to a greater degree than the Bored Tunnel Alternative.

Economic Benefits
Some sectors of the economy, such as contractors and construction material providers, would benefit from the dollars being invested to build any of the three alternatives. The construction dollars entering the economy to build this project would add tax revenue, wages, and new economic activity to the area for any of the alternatives constructed.

Historic Resources
Effects to historic resources during construction for the three build alternatives are provided below. FHWA has consulted with the Washington Department of Archaeological and Historic Preservation, who concurred on July 8, 2010 that the project will have an adverse effect on one or more structures that are on or eligible for the NRHP.

Bored Tunnel Alternative
The Bored Tunnel Alternative is expected to affect the following buildings during construction:

- **Western Building –** The Western Building is a contributing building in the Pioneer Square Historic District. The building may experience settlement that could damage it. FHWA and Washington State Department of Transportation (WSDOT) have concluded that effects to the Western Building would be adverse under Section 106.

- **Polson Building –** The Polson Building is a contributing building in the Pioneer Square Historic District. It may experience settlement, if unmitigated. However, the Polson Building is in good structural condition. Protective measures prior to construction and high levels of monitoring during construction would prevent major structural damage, and the remaining structural and aesthetic damage could be repaired.

In addition to the Western and Polson Buildings, 12 historic buildings eligible for listing on the NHRP may be affected by settlement during construction:

- 1 Yesler Building –1 Yesler Way
- Maritime Building – 911 Western Avenue
- Federal Building – 901 First Avenue
- National Building – 1000 Western Avenue
- Alexis Hotel/Globe Building – 1001 First Avenue
- Arlington South/Beebe Building – 1015 First Avenue
- Arlington North/Hotel Cecil – 1015 First Avenue
- Grand Pacific Hotel – 1115 First Avenue
- Colonial Hotel – 1123 First Avenue
- Two Bells Tavern – 2313 Fourth Avenue
- Fire Station No. 2 – 2334 Fourth Avenue
- Seattle Housing Authority – 120 Sixth Avenue N.

All of these buildings are also eligible for listing as Seattle landmarks, except for the Federal Building. The buildings may experience utility disruptions and cracks or other aesthetic damage from settlement that could be repaired. The repairs would not affect the eligibility of these properties.

The Watermark/Colman Building façade, which is listed as a city landmark and is not eligible for listing in the NRHP, could also be affected during construction.

Elevated Structure and Cut-and-Cover Tunnel Alternatives
The Elevated Structure and Cut-and-Cover Tunnel Alternatives are expected to affect the following historic structures during construction:

- **Washington Street Boat Landing –** Both alternatives would require removing the Washington Street Boat Landing pergola during construction and replacing it nearby once construction was completed.

- **McGraw Kittenger Case (Blu Canary/MGM) Building –** Both alternatives would require excavating under the building to improve the Battery Street Tunnel. During this excavation, protective measures would be required to support

Section 4(f) and Protection of Historic Resources

This project is adjacent to some of Seattle's most well-known historic buildings and neighborhoods. Section 4(f) is a provision of federal law pertaining to transportation projects that requires FHWA to carefully consider and address protection of these resources in order to receive federal funding.

The **Section 4(f) Evaluation** can be found at the end of this document on page 225. The Section 4(f) Supplemental Materials are provided in ***Appendix J*** of the ***2010 Supplemental Draft EIS***.

the building during construction. FHWA and WSDOT have concluded that effects to this building for either alternative would be considered adverse under Section 106.

Archaeological Resources
For all three alternatives, construction activities related to excavation and soil improvements could affect areas with the potential for yielding archaeological resources.

Bored Tunnel Alternative
Construction of the Bored Tunnel Alternative near the south portal would adversely affect an NRHP-eligible archaeological site, the Dearborn South Tideland Site (45KI924). FHWA and WSDOT have determined that the site is considered eligible under Section 106 Criterion D for its potential to yield information about early development in Seattle, but its value is in the data that may be recovered and does not depend on its being preserved in place. Section 4(f) regulations provide an exception for the use of these types of archaeological properties (23 Code of Federal Regulations, Title 23, Section 774.13(b) [23 CFR 774.13 (b)]), and the State Historic Preservation Officer has concurred with FHWA's finding.

Construction in the south portal area just south of S. King Street may adversely affect Native American and historic-period archaeological deposits that have not been discovered through previous testing. Potential soil improvements from S. King Street to S. Main Street along the bored tunnel alignment may also have the potential to adversely affect Native American archaeological sites associated with the former tidal flats in this location.

Construction in the north portal area has the potential to adversely affect Native American and historic-period archaeological sites from about Harrison Street north beyond the margins of the Denny Regrade. One historic-period archaeological site has been identified in this area, 45KI958. Although this archaeological site, which is located under the Seattle maintenance yard, has not been formally determined eligible for the NRHP, WSDOT will treat it as eligible. Given the constraints imposed by the urban environment and deep historic fill, evaluation at this archaeological site would be undertaken in concert with construction. Intact peat deposits, which date to the time of earliest human occupation of the area, also exist in this location. However, no Native American archaeological sites have been identified.

Cut-and-Cover Tunnel and Elevated Structure Alternatives
The Cut-and-Cover Tunnel Alternative would require extensive excavation along the central waterfront, which is a high-probability area for archaeological resources. The Elevated Structure Alternative would also have some excavation and extensive soil improvements in this high-probability area.

Neighborhoods, Social Service Providers, and Low-Income Populations
Social service providers and neighborhood residents, including low-income residents, would be affected by traffic detours and congestion, loss of parking, construction noise, and disruption of day-to-day activities. The Bored Tunnel Alternative would be the least disruptive of the three alternatives because SR 99 closures would be limited to one 3-week closure and periodic night and weekend closures. In addition, the Bored Tunnel Alternative would not require roadway restrictions for several years on Alaskan Way like the Cut-and-Cover Tunnel and Elevated Structure Alternatives.

Parks and Recreation
The Bored Tunnel Alternative is expected to have the fewest impacts of the three alternatives studied because much of construction would take place underground and away from parks and the central waterfront. In addition, the Cut-and-Cover Tunnel and Elevated Structure Alternatives require removing the Washington Street Boat Landing pergola during construction. After construction, the pergola would be put back at a nearby site at the foot of S. Washington Street.

Public Services
The Cut-and-Cover Tunnel and Elevated Structure Alternatives would affect public services to a greater degree than the Bored Tunnel Alternative because they would require substantial SR 99 traffic restrictions, including complete closure of SR 99 for many months. The Cut-and-Cover Tunnel Alternatives would require closing SR 99 for 27 to 42 months, and the Elevated Structure Alternative would require closing SR 99 for about 6 months. By comparison, the Bored Tunnel Alternative would require a one-time, 3-week closure and occasional night and weekend closures of SR 99, resulting in much less disruption and fewer travel delays to emergency responders. In addition, the Cut-and-Cover Tunnel and Elevated Structure Alternatives would restrict Alaskan Way traffic for 7 to 10 years, and these two alternatives would require relocating Fire Station No. 5, located next to Colman Dock, for some portion of the construction period.

Utilities
All three alternatives require relocating utilities during construction. The Bored Tunnel Alternative would require fewer relocations than the Cut-and-Cover Tunnel or Elevated Structure Alternatives, since it does not include replacing the seawall or rebuilding the Alaskan Way surface street.

Air Quality
Likely air quality effects during construction include dust from construction and demolition activities and emissions from construction equipment. The Bored Tunnel Alternative would result in fewer air quality effects, followed by the Cut-and-Cover Tunnel and Elevated Structure Alternatives. The Bored Tunnel Alternative is expected to have a lesser effect because much of the construction would take place underground, and it would take less time to construct. The Elevated Structure Alternative is expected to have the most effect to air quality since all construction would take place above ground, and it would take the most time of all the alternatives to construct.

Water Resources
Construction effects of the Bored Tunnel Alternative are expected to be less than those described for the other

alternatives since no in-water construction is required and the total construction duration would be shorter. Construction effects to water quality during construction would be similar for the Cut-and-Cover Tunnel and Elevated Structure Alternatives, though the construction period when effects could occur would be longest with the Elevated Structure Alternative. Having a shorter window of time when potential spills could occur and construction equipment is operating would reduce the number of rainy seasons when construction is taking place, which would reduce the risk of construction effects to water quality.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would require installing a temporary sheet pile wall (or equivalent protection measure) along active work areas along the waterfront to protect water quality in Elliott Bay during construction. Temporary turbidity could result from disturbing bottom sediments, which could be contaminated. In addition, these alternatives require construction of a new temporary over-water bridge for ferry access between Pier 48 and Colman Dock. Stormwater runoff from the temporary bridge would be collected and treated with temporary stormwater BMPs to minimize or prevent impacts to Elliott Bay.

Fish and Aquatic Habitat

Construction effects of the Bored Tunnel Alternative are expected to be less than those described for the other alternatives, since no in-water construction is required. In addition, the Cut-and-Cover Tunnel and Elevated Structure Alternatives require building a temporary over-water ferry access bridge between Pier 48 and Colman Dock. The bridge would temporarily shade approximately 15,000 square feet of shallow subtidal habitat. In addition, to help maintain pedestrian access along the waterfront during construction, the lead agencies may consider the feasibility of constructing temporary over-water pedestrian walkways between some piers.

Soil

All of the alternatives require improving soils located in the project area to support the structures. The Elevated Structure Alternative would require the greatest volume of soil improvements to stabilize soil as part of seawall reconstruction, followed by the Cut-and-Cover Tunnel and Bored Tunnel Alternatives. The Bored Tunnel Alternative would have soil improvements to make sure the ground is suitable for launching the TBM and preventing settlement along the bored tunnel alignment.

The Cut-and-Cover Tunnel Alternative would require excavating the most soil to construct the tunnel, followed by the Bored Tunnel and Elevated Structure Alternatives.

23 How do costs compare?

Exhibit 8-30 shows estimated costs for the proposed alternatives. These costs include an allowance for unexpected changes or events and account for inflation from now until the projects would be constructed.

Exhibit 8-30
Cost of the Alternatives
in Billions

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Cost	$1.9	$3.0 – $3.6	$1.9 – $2.4

The Bored Tunnel Alternative cost does not include replacing the seawall, improving the Alaskan Way surface street, or building a streetcar. Costs for the Cut-and-Cover Tunnel and Elevated Structure Alternatives do not include replacing the seawall between Union Street and Broad Street.

24 How do cumulative effects compare?

The list of assumed present and reasonably foreseeable future projects or actions that were considered in the cumulative effects analysis for the three alternatives are similar to each other, though there are a few important differences between the Bored Tunnel Alternative and the Cut-and-Cover Tunnel and Elevated Structure Alternatives. The Bored Tunnel Alternative does not include replacing the Alaskan Way surface street, Alaskan Way Seawall, and waterfront streetcar, whereas the Cut-and-Cover Tunnel and Elevated Structure Alternatives do include replacing these facilities. With the Bored Tunnel Alternative, these facilities would be replaced as part of the Alaskan Way Viaduct and Seawall Replacement Program, but they would be replaced as separate, independent projects. The net effects of constructing these projects separately would be fewer direct impacts to SR 99 and Alaskan Way traffic and to properties located adjacent to the central waterfront than the Cut-and-Cover Tunnel and Elevated Structure Alternatives, which would have much more intense and severe direct effects.

No adverse long-term cumulative effects are expected for the three alternatives. Most of the long-term cumulative effects for the three alternatives are expected to be beneficial, since collectively the effects from other planned projects would replace failing infrastructure, improve existing transportation facilities, provide improved public amenities, and increase transit capacity and services. Potential adverse cumulative effects for all three alternatives are limited to short-term, construction-related impacts due to the potential for construction schedules and areas of individual projects to overlap.

What are cumulative effects?

Cumulative effects result from the total effect of the project when added to other past, present, and reasonably foreseeable future projects or actions.

25 How do indirect effects compare?

Once the project is built, any of the three alternatives considered generally would result in similar indirect effects because the project is a replacement project that would maintain and not increase roadway capacity. As such, the replacement facilities would continue to support existing conditions and the mobility assumed by local land use plans. In some areas, the built project may support renovation and revitalization of existing urban land uses. 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 No Build Alternative would have substantial indirect effects on the local and regional transportation system, economy, and communities north and south of Seattle.

26 Do the alternatives vary in the irreversible decisions or irretrievable resources that would be required?

There are notable differences in the irreversible decisions or irretrievable resources required for the three alternatives evaluated. If the decision is made to build the Elevated Structure Alternative, views would irreversibly be affected since the new elevated structure would affect

views more than the existing viaduct. The second irreversible decision for any of the three alternatives would be converting existing commercial, industrial, or retail properties to roadway land uses. All three 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 about 24 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 6, Question 37, the lead agencies will develop mitigation measures, a Memorandum of Agreement, and an Unanticipated Discovery Plan to 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 landfills; 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 landfills.

Finally, 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, though 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.

27 How do tradeoffs between short-term uses of environmental resources and long-term gains (or productivity) compare?

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 three alternatives evaluated, the Bored Tunnel Alternative would have far fewer construction effects than the other two alternatives.

The Bored Tunnel Alternative would require about 5.5 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 to 42 months, and could require up to 3 additional years of substantial lane restrictions and closures. The Elevated Structure Alternative would require closing SR 99 for 6 months in addition to up to 5 years of substantial lane restrictions and closures. The Bored Tunnel Alternative would affect SR 99 traffic for about 3.5 years, but impacts to SR 99 traffic would be far less disruptive and cause less congestion than the other alternatives.

In addition to effects to SR 99 traffic, during construction, the Bored Tunnel Alternative would be much less disruptive to Alaskan Way and neighboring residents and businesses located along Alaskan Way. 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 to two areas covering about four city blocks that would move as demolition progresses. The Cut-and-Cover Tunnel Alternative would affect waterfront businesses and residents for almost all of the expected 7- to 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, 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 do the long-term benefits of the Bored Tunnel Alternative compare to the other alternatives. Our analysis and comparison of these three alternatives in this chapter shows that there are tradeoffs between the three alternatives in terms of their long-term benefits, but that for most elements of the environment, the Bored Tunnel Alternative offers long-term benefits that are as good as or better than the other two alternatives.

28 How do these alternatives meet the revised purpose and need?

While all three 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 three alternatives would provide a safe transportation facility that would meet current seismic design standards.

Improve Traffic Safety
All three alternatives would improve traffic safety on SR 99 compared to existing conditions. All three alternatives would replace SR 99 with a facility that would meet roadway design standards where feasible. For all three of the alternatives, there are specific areas where deviations from current roadway design standards would be needed, but all three of the alternatives would replace SR 99 with a facility that would come closer to meeting existing roadway design standards than the existing facility.

The 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 a 6-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 not be remedied with improvements proposed for the 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 three alternatives provide sufficient capacity to efficiently move people and goods to and through downtown Seattle. All three of the alternatives provide two through lanes in each direction on SR 99. The 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 Elliott Avenue on-ramp, which serve trips destined to and from northwest Seattle. The Bored Tunnel Alternative does not provide these ramps, but these trips could access their destinations via the Alaskan Way surface street or via the bored tunnel and Mercer Street.

As shown in the traffic analysis, the 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 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 Bored Tunnel Alternative.

SR 99 is projected to carry fewer vehicles through downtown with the Bored Tunnel Alternative. Despite this, total vehicle volumes across the transportation network are expected to be comparable for the three alternatives. Therefore, the transportation network in downtown Seattle is expected to carry nearly the same volume of traffic for each of the alternatives, but with the Bored Tunnel Alternative, SR 99 will carry fewer vehicles than with the other alternatives. Because of this, more vehicles are projected to travel on city streets with the Bored Tunnel Alternative than with the other alternatives. As shown in the discussion presented in Chapter 5, questions 6, 7, and 8, the Bored Tunnel Alternative is not expected to substantially increase congestion on I-5 or local streets compared to the other alternatives, even though more vehicles would be traveling on these routes. Taken together, these results support the fact that all three alternatives 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 three alternatives have similar connections in the south from SR 99 to Alaskan Way S. near S. King Street. The Bored Tunnel Alternative also develops one or two east-west cross streets and provides a priority lane for northbound transit service during peak hours. This provides the best linkage with south portions of downtown Seattle. The 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 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 they could travel along Alaskan Way.

North of Denny Way, the 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 three alternatives are their construction impacts and construction duration. The Bored Tunnel Alternative could be built with limited SR 99 closures (3 weeks in addition to occasional night and weekend closures). The Cut-and-Cover Tunnel Alternative would close SR 99 for 27 to 42 months, and the Elevated Structure Alternative would close it for 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 5.5-year period while the Bored Tunnel Alternative is built. Effects to the central waterfront would be limited to the 9 months when the viaduct is demolished. The Cut-and-Cover Tunnel Alternative would bring substantial construction impacts to the central waterfront for 7 to 8.75 years. During this time, heavy equipment would be operating directly in front of many businesses, and vehicles and pedestrians would be frequently rerouted. Most of the parking in the area would be removed. The 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 three alternatives vary in how they would affect activities on the central waterfront and in downtown Seattle. 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 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.