Construction Roadway Closures, Restrictions, and Detours

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

Begin August

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

Bored Tunnel

In Months

4 | 5 | 7 | 3 | 16 | 9 | 9 | 12 — **5 years 5 months**

STAGE 1 –
- SR 99 reduced to 2 lanes in each direction from Battery Street Tunnel to Roy Street, Stages 1 and 2
- Alaskan Way S. closed between S. Atlantic and S. King for all stages
- Periodic lane closures on streets near the north portal

S. Holgate to S. King Street Project –
- SR 99 reduced to 2 lanes in each direction from S. Spokane Street to Battery Street Tunnel, Stages 1 & 2

STAGE 2 –
- Sixth Avenue closed between Thomas and Broad Streets – Stages 2 through 7
- Harrison Street closed from Sixth Avenue to SR 99 – Stages 2 through 7
- Broad Street eastbound lanes closed
- Periodic lane closures on streets in the north portal area

S. Holgate to S. King Street Project –
- Southbound SR 99 on WOSCA Detour

STAGE 3 –
- SR 99 reduced to 2 lanes in each direction from S. Spokane Street to Roy Street – Stages 3 through 7
- All SR 99 traffic on WOSCA detour
- Broad Street eastbound lanes closed

S. Holgate to S. King Street Project –
- Close SR 99 for one week

STAGE 4 –
- All SR 99 traffic on WOSCA detour
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues
- Broad Street 2 lanes open in each direction

STAGE 5 –
- All SR 99 traffic on WOSCA detour
- Broad Street 1 eastbound, 2 westbound landes open
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues for most of stage

STAGE 6 –
- All SR 99 traffic on WOSCA detour
- Shift southbound SR 99 traffic to revised WOSCA Detour
- Broad Street closed permanently
- Mercer Street open with 2 or 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 7 –
- All SR 99 traffic on WOSCA detour
- SR 99 closed for several weeks at end of Stage
- Bored tunnel open at end of stage

FINAL STAGE –
- Alaskan Way width reduced from S. King to Pike Streets
- Periodic street closures from S. King to Battery Street
- First Avenue S. reduced to 1 lane in each direction from S. Royal Brougham to S. King
- Periodic lane closures on streets near the north portal

Cut-&-Cover Tunnel

30 | 9 | 15 | 27 | 12 | 12 — **8 years 9 months**

STAGE 1 –
- Traffic remains on SR 99
- Alaskan Way periodically reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track
- All SR 99 traffic on WOSCA Detour mid-2012
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues end of 2012

S. Holgate to S. King Street 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

STAGE 2 –
- 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
- Mercer Street opens with 2 lanes in each direction from Fifth to Ninth Avenues

STAGE 3 –
- 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
- Mercer Street opens with 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 4 –
- 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

STAGE 5 –
- 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

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

Elevated Structure

30 | 9 | 27 | 3 | 24 | 21 | 3 | 3 — **10 years**

STAGE 1 –
- Traffic remains on SR 99
- Alaskan Way periodically reduced to 1 lane in each direction
- Remove parking under viaduct
- Remove Waterfront Streetcar and track
- All SR 99 traffic on WOSCA Detour mid-2012
- Mercer Street reduced to 2 eastbound lanes from Fifth to Ninth Avenues end of 2012

S. Holgate to S. King Street 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

STAGE 2 –
- Traffic remains on SR 99
- Close Western off-ramp
- Alaskan Way reduced to 1 lane in each direction, Stages 2 through 6
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 2 lanes in each direction from Fifth to Ninth Avenues

STAGE 3 –
- 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
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham
- Mercer Street opens with 3 lanes in each direction from Fifth to Ninth Avenues

STAGE 4 –
- SR 99 closed
- SR 99 north of Denny is reduced to 1 northbound land and 2 southbound lanes
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 5 –
- SR 99 reduced to 2 lanes in each direction on lower viaduct deck
- Southbound traffic routed to Broad Street Detour
- Seneca, Elliott, and Western ramps closed
- Columbia ramp converted to temporary northbound off-ramp
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 6 –
- SR 99 reduced to 2 lanes in each direction on upper viaduct deck
- Columbia & Elliott southbound on-ramps closed
- Seneca & Western northbound off-ramps open
- SR 99 reduced to 2 lanes in each direction from S. Spokane to Royal Brougham

STAGE 7 –
- SR 99 closed
- Alaskan Way periodically reduced to 1 lane in each direction

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

Exhibit 6-1

CHAPTER 6 - CONSTRUCTION EFFECTS

What is in Chapter 6?

This chapter describes the roadway closures, restrictions, and detours needed and the construction effects for the preferred Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative. Construction effects would be the same for the tolled and non-tolled build alternatives, so this chapter only discusses effects of three build alternatives. The Viaduct Closed (No Build Alternative) is not discussed in this chapter, because it would not involve any construction and would not have construction effects. The Bored Tunnel Alternative, Cut-and-Cover Tunnel Alternative, and Elevated Structure Alternative are compared to the extent that their construction methods, timing, and/or effects differ from one another. To understand transportation effects during construction, traffic is compared to the 2015 existing viaduct, which represents existing conditions as discussed in Chapter 4 of this Final EIS.

Specific construction activities would affect portions of SR 99 for varying amounts of time. Areas outside the SR 99 right-of-way would be restored to their original condition as soon as possible after construction.

ROADWAY CLOSURES, RESTRICTIONS, AND DETOURS

1 How would restrictions to SR 99 compare?

SR 99 Closures and Restrictions

Construction activities, detours, and roadway restrictions are described in Exhibit 6-1 in eight stages for both the Bored Tunnel and Elevated Structure Alternatives and in six stages for the Cut-and-Cover Tunnel Alternative. In addition, periodic night or weekend closures of SR 99 would be required for all of the alternatives.

The total construction duration and length of time SR 99 would be closed completely to traffic varies between the alternatives, as shown in Exhibit 6-2. Construction of the Bored Tunnel Alternative would keep SR 99 open for all but about 3 weeks of the nearly 5.4-year construction period. The 3-week closure period would be required about 4.5 years into construction to connect SR 99 to the new bored tunnel. The Elevated Structure Alternative would close SR 99 to all traffic for a total of 5 to 7 months. SR 99 would be closed for 2 to 4 months to demolish the upper level of the existing viaduct. Near the end of the construction period, the roadway would be closed for 3 months to construct and connect the new lower level of the viaduct to existing SR 99 near S. Royal Brougham Way. The Cut-and-Cover Tunnel Alternative would close SR 99 for the longest period of time. The alternative would first close southbound SR 99 to traffic for 15 months before closing SR 99 in both directions for a period of 27 months. Then northbound SR 99 would be closed to traffic for an additional 12 months.

Exhibit 6-2
SR 99 Closures and Restrictions

	SR 99 Closed	SR 99 Restricted[1]	Total Construction Time	
Bored Tunnel	3 weeks	52 months	65 months	5.4 years
Cut-&-Cover Tunnel	**Southbound –** 42 months **Northbound –** 39 months	54 months[2]	105 months	8.75 years
Elevated Structure	5 to 7 months	120 months	120 months	10.0 years

1 *Amount of time when SR 99 would be subject to lane and ramp closures. This duration does not include time when SR 99 would be closed to all traffic.*

2 *Includes Stages 3 and 5 when SR 99 is closed in one direction and restricted in the other direction.*

SR 99 Detours

When SR 99 is open, construction would restrict traffic to two lanes in each direction in many locations for all of the build alternatives. SR 99 would be reduced to two lanes because there is only enough space for two lanes in each direction through the proposed detour in the south as well as through the area north of Denny Way. Because of these lane restrictions, the speed limit on the existing viaduct would be reduced from 50 to 40 miles per hour (mph) during construction.

When construction of this project begins in 2011, SR 99 restrictions in the south area would mostly be due to construction of the S. Holgate Street to S. King Street Viaduct Replacement Project, which will have already constructed the south end detour (Washington-Oregon Shippers Cooperative Association [WOSCA] detour). The S. Holgate Street to S. King Street Viaduct Replacement Project will reconfigure the existing SR 99 ramps to First Avenue S. and use them to route SR 99 traffic to and from the WOSCA detour. A temporary southbound off-ramp will be located near S. Atlantic Street, and a temporary northbound on-ramp will be located at S. Royal Brougham Way. The S. Holgate Street to S. King Street Viaduct Replacement Project will move mainline SR 99 traffic to the WOSCA detour in two phases: southbound traffic will be detoured beginning in December 2010, and both directions of traffic will be detoured in about May 2012, as shown on Exhibit 6-3.

Around May 2012, the traffic effects of the WOSCA detour would be considered part of the effects of this project because the detour would be needed to construct the Alaskan Way Viaduct Replacement Project between

S. Royal Brougham Way and Roy Street. The WOSCA detour would have a posted speed limit of 25 mph. The Bored Tunnel Alternative would modify the WOSCA detour for southbound traffic in Stage 6, as shown in Exhibit 6-3. The WOSCA detour would be in place for the Bored Tunnel and Cut-and-Cover Tunnel Alternatives for a period of about 4.5 years. With the Elevated Structure Alternative, the WOSCA detour would be in place for about 5.75 years.

The Elevated Structure Alternative would construct the Broad Street detour to route southbound traffic around the Battery Street Tunnel and connect back to SR 99 near Union Street, as shown in Exhibit 6-4. Southbound SR 99 traffic would be routed onto the Broad Street detour for a period of about 4.25 years to allow improvements to be constructed from Virginia Street through the Battery Street Tunnel.

2 How would traffic be restricted on other roadways during construction?

All of the alternatives would restrict surface streets in the project area during construction. When construction for this project begins, Alaskan Way S. will be closed between S. Atlantic Street and S. King Street because of the S. Holgate Street to S. King Street Viaduct Replacement Project. This section of Alaskan Way S. would remain closed between S. King and S. Atlantic Streets to accommodate construction activities for each of the alternatives. For all of the build alternatives, surface street traffic on Alaskan Way S. through the south area would be routed as shown on Exhibit 6-5. For the Bored Tunnel Alternative, this route would stay in effect for 4.5 years until the tunnel opens. For the Cut-and-Cover Tunnel Alternative, this route would be in place during the first 30 months of construction until Alaskan Way is closed north of S. King Street. For the Elevated Structure Alternative, this route would be in place for about 9.75 years.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would require closure or lane closures on Alaskan Way north of S. King Street for a period of several

WOSCA Detour

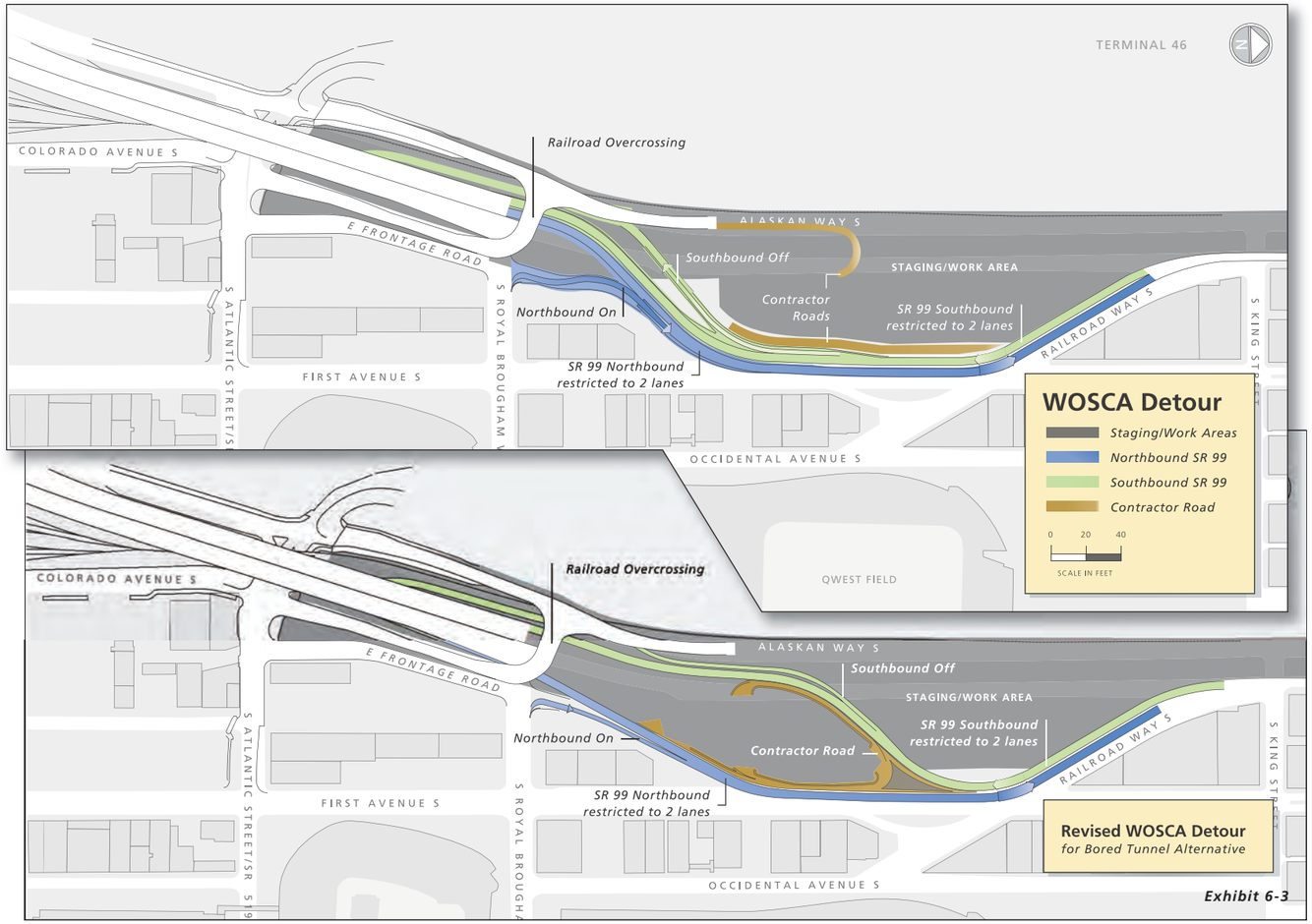


Exhibit 6-3

Broad Street Detour
Southbound Only

Viaduct
Battery Street Tunnel
Surface
Aerial
0 500 1,000
SCALE IN FEET

Elliott Bay
Pier 70
Pier 69
Pier 68
Temporary Trestle
Old Spaghetti Factory
Broad Street Detour
Bell Harbor Conference Center
Broad Street Detour
Piers 62 - 63
Waterfront Park
Temporary Trestle
Broad Street Detour End
VIADUCT
BATTERY STREET TUNNEL
Broad Street Detour
Thomas Street Bridge
Broad Street Detour Start
Exhibit 6-4

Visual Simulation of Broad Street Detour
Temporary Trestle at Broad Street

years, as indicated in Exhibit 6-6. The Bored Tunnel Alternative does not require closing or restricting Alaskan Way north of Yesler Way during construction. However, southbound traffic would be reduced to one lane between S. King Street and Yesler Way for about 4.5 years, which would have a temporary effect on ferry queuing. To alleviate potential queuing backups on Colman Dock during peak ferry travel periods, a second northbound lane of traffic between Yesler Way and Spring Street will be added, and the signal at the intersection of Yesler Way and Alaskan Way will be modified to allow left turns out of the ferry terminal.

Exhibit 6-6
Alaskan Way Surface Street Closures and Restrictions

	Alaskan Way Closed[1]	Alaskan Way Restricted	Total Construction Time	
Bored Tunnel	0	0 month[2] – cross streets periodically closed	65 months	5.4 years
Cut-&-Cover Tunnel	63 months	42 months	105 months	8.75 years
Elevated Structure	0	120 months	120 months	10.0 years

1 *Amount of time Alaskan Way would be restricted or closed north of S. King Street.*

2 *Between S. King Street and Yesler Way, Alaskan Way would be restricted to one southbound lane for about 4.5 years. There would continue to be two northbound lanes. Alaskan Way would not be restricted north of Yesler Way.*

Alaskan Way S. Traffic Routing

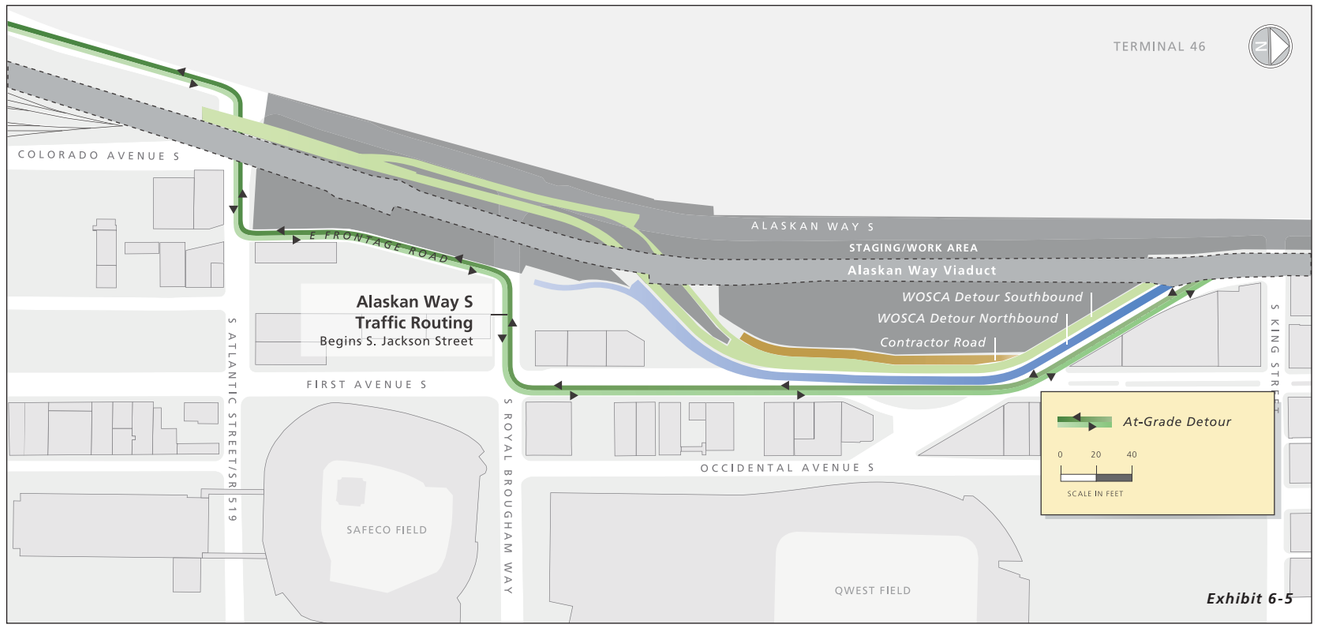


Exhibit 6-5

Throughout construction, a number of short-term traffic detours would also be needed on surface streets when activities such as relocating utilities are taking place. The text below describes likely roadway restrictions on adjacent roadways during construction for each of the alternatives. Roadway restrictions would cause some on-street parking spaces to be removed during the construction period, which are described in Question 18 of this chapter.

Bored Tunnel Alternative

South Portal Roadway Restrictions

In addition to the detour of Alaskan Way S. in this area, surface street parking on First Avenue S. would be removed between S. Royal Brougham Way and S. King Street. First Avenue S. would continue to operate with two travel lanes in each direction throughout most of the construction period; however, during the final year of construction, First Avenue S. would be closed periodically or restricted to one lane in each direction between S. Royal Brougham Way and Railroad Way S. to remove the WOSCA detour.

Central Waterfront Roadway Restrictions

Throughout most of the construction period, few long-term lane closures are expected for local streets located between the south and north portals. However, periodic lane closures would be required during viaduct demolition and to fill and close the Battery Street Tunnel. During the 9-month period when viaduct demolition occurs, Alaskan Way would be narrowed. Cross-streets that pass under the viaduct would be temporarily closed between S. King Street and the Battery Street Tunnel. It is expected that these cross-streets would be closed in two-block sections for a period of up to 4 weeks. These closures will require detours for local traffic and would cause some delays, especially during peak hours. Periodic lane closures would also be needed in specific areas along the bored tunnel alignment where soil improvements are needed.

Traffic on Battery Street and on cross streets above the Battery Street Tunnel would be maintained while it is decommissioned, although occasional short-term lane and parking restrictions may be needed.

North Portal Roadway Restrictions

There would be periodic closures on Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations. All lanes on Sixth Avenue N. from Thomas Street to Broad Street and all lanes on Harrison Street from Sixth Avenue N. to SR 99 would be closed beginning in February 2012 until about January 2016. Thomas Street would be also closed between Sixth Avenue and SR 99 for approximately 3 months when the tunnel boring machine (TBM) is removed around March 2015 to May 2015.

Near the end of 2012, Mercer Street would be reduced to two eastbound lanes between Fifth and Ninth Avenues. This restriction would last for about 1.5 years. Mercer Street would open as a two-way street, initially with two

lanes in each direction around April 2014, and three lanes in each direction around September 2014.

Broad Street would be restricted to two eastbound lanes for about a year beginning in 2012. In the beginning of 2013, Broad Street would operate with two westbound lanes and one eastbound lane. In April 2014, Broad Street would operate with only one eastbound lane. Connections would be provided from Broad Street to eastbound Mercer Street and northbound Dexter Avenue only. Broad Street would be permanently closed between Taylor and Dexter Avenues around July 2014.

Cut-and-Cover Tunnel Alternative

South Area Roadway Restrictions

In addition to the detour of Alaskan Way S. in this area, surface street parking on First Avenue S. would be removed between S. Royal Brougham Way and S. King Street. First Avenue S. would continue to operate with two travel lanes in each direction throughout the construction period.

Central Waterfront Roadway Restrictions

The Alaskan Way surface street would periodically be reduced to one lane in each direction for utility relocations during the first 2.5 years (30 months) of construction. Alaskan Way would then be closed to north-south traffic for just over 5 years (63 months). During this closure, traffic would need to use Interstate 5 (I-5) or other north-south surface streets through downtown. East-west access to waterfront businesses and Colman Dock would be provided. About May 2018, Alaskan Way would reopen with one lane of traffic in each direction. Alaskan Way would then be placed in its permanent configuration with periodic lane restrictions during the last year of construction.

North Area Roadway Restrictions

There would be periodic closures on Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations.

Near the end of 2012, Mercer Street would be reduced to two eastbound lanes between Fifth and Ninth Avenues. This restriction would last for about 1.5 years. Mercer Street would open as a two-way street, initially with two lanes in each direction around April 2014, and three lanes in each direction around September 2014.

Broad Street would be closed permanently between Taylor and Dexter Avenues in May 2018. Traffic would then travel on the improved surface street grid and Mercer Street, which would be open to two-way traffic. Thomas and Harrison Streets would be connected across SR 99 and open in August 2018.

Elevated Structure Alternative

South Area Roadway Restrictions

In addition to the detour of Alaskan Way S. in this area, surface street parking on First Avenue S. would be removed between S. Royal Brougham Way and S. King Street. First Avenue S. would continue to operate with two travel lanes in each direction throughout the construction period.

Central Waterfront Roadway Restrictions

The Alaskan Way surface street would periodically be reduced to one lane in each direction for utility relocations during the first 2.5 years (30 months) of construction. After the first 2.5 years, Alaskan Way would operate with one lane in each direction until the final stage of construction when Alaskan Way would be periodically restricted to build the street in its permanent configuration.

North Area Roadway Restrictions

There would be periodic closures on Sixth Avenue N., Taylor Avenue N., and Broad Street due to utility relocations. When SR 99 is closed, SR 99 traffic would be diverted to streets north of Denny Way. The Elevated Structure Alternative would route traffic around the Battery Street Tunnel and connect back to SR 99 near Union Street using the Broad Street Detour, as shown in Exhibit 6-4. Southbound SR 99 traffic would use the Broad Street detour for about 4.25 years.

Near the end of 2012, Mercer Street would be reduced to two eastbound lanes between Fifth and Ninth Avenues. This restriction would last for about 1.5 years. Mercer Street would open as a two-way street, initially with two lanes in each direction around April 2014, and three lanes in each direction around September 2014.

Traffic on the Broad Street detour would operate with three southbound lanes and one northbound lane from about November 2014 to May 2019. Broad Street would be permanently closed between Taylor and Dexter Avenues when the detour is removed around May 2019. Traffic would then travel on the improved surface street grid, which would connect Thomas and Harrison Streets across SR 99 and open Mercer Street to two-way traffic.

TRAFFIC EFFECTS DURING CONSTRUCTION

3 How would travel patterns on SR 99, I-5, and city streets be affected during construction?

During construction of the Bored Tunnel Alternative, daily vehicle volumes through the central waterfront section of SR 99 are expected to decrease by about one-third. Vehicles are expected to shift to city streets and, to a lesser degree I-5, and use different access points on SR 99.

Construction of the Cut-and-Cover Tunnel Alternative would have a considerable effect on vehicle traffic patterns in and near the project area, particularly when SR 99 is closed to one or both directions of traffic between the stadium area and Denny Way. While SR 99 is closed, vehicles traveling through downtown will shift to city streets and, to a lesser degree, I-5. Daily volumes on the segments of SR 99 adjacent to downtown are expected to decrease by approximately half south of downtown and by a third north of downtown.

Construction of the Elevated Structure Alternative is expected to reduce daily vehicle volumes through the central waterfront section of SR 99 by about 40 percent. The Broad Street detour would affect the majority of southbound trips, because all SR 99 traffic between

Assumptions for the Construction Traffic Analysis

The transportation analysis for construction modeled conditions during Stage 5 for the Bored Tunnel and Elevated Structure Alternatives and Stage 4 for the Cut-and Cover Tunnel Alternative, which are considered to be the most disruptive to traffic.

Denny Way and Pike Street would have to use surface streets, with a portion of those vehicles connecting back to the SR 99 mainline at Pike Street. Many northbound vehicles on SR 99 are also expected to shift to city streets and, to a lesser degree, I-5 due to increases in congestion and changes in access during construction.

4 How would SR 99 traffic be affected by lane restrictions?

Temporary lane closures and restrictions on SR 99 would increase congestion, reduce travel speeds, and increase average travel times, particularly during peak commute hours. During construction, traffic on SR 99 would be close to capacity and would be more likely to experience increased delay and congestion when there is a disruption in traffic flow, such as an accident. Where increases in travel times are minimal, it is due in large part to rerouting and reduced demand on SR 99. Demand would be reduced because of expected traffic bottlenecks near the south and north areas of the viaduct that would likely cause many drivers to divert to other city streets, such as Second or Fourth Avenues and I-5, resulting in less overall traffic on SR 99.

SR 99 closures will affect congestion and delay on city streets in the area. Effects to city streets are discussed in Question 6 of this chapter. Noticeable effects to congestion and travel times on I-5 are not expected for reasons discussed in Question 5 of this chapter. The Cut-and-Cover Tunnel Alternative would close SR 99 for the longest amount of time, which would affect drivers to a greater degree than the other build alternatives. The Bored Tunnel Alternative would affect drivers the least of the build alternatives because it would keep traffic on the viaduct through the majority of the construction period. The Elevated Structure Alternative would have more effects to SR 99 drivers than the Bored Tunnel Alternative because of the 5- to 7-month closure and lane and ramp restrictions when both directions of traffic are sharing the lower or upper deck of the viaduct.

Average travel times during construction were evaluated for the most disruptive stage of construction. Generally, the most disruptive effects would occur in Stage 5 for the Bored Tunnel and Elevated Structure Alternatives, and Stage 4 for the Cut-and-Cover Alternative. During the most disruptive construction stage for each alternative, average travel times were assessed for two typical SR 99 trips: Woodland Park to S. Spokane Street and Ballard to S. Spokane Street via the Alaskan Way Viaduct in the AM peak hour (8:00 a.m. to 9:00 a.m.) and PM peak hour (5:00 p.m. to 6:00 p.m.). In addition to discussing these specific trips, the text below qualitatively describes how specific SR 99 trips might be affected by lane restrictions during construction.

How would construction affect drivers heading through downtown on SR 99?

During construction, drivers using SR 99 to travel through downtown would be affected by lane restrictions in the south and north areas. SR 99 would be restricted in the south, because there is only enough space for two lanes in each direction through the WOSCA detour. In the north area, SR 99 would also be restricted to two lanes in each direction to allow for construction activities. Finally, all of the build alternatives require closing SR 99 for a period of time during construction, which would affect drivers traveling on SR 99 for through trips.

Exhibit 6-7 shows estimated travel times during construction between Woodland Park and S. Spokane Street. During the morning commute, construction travel times in both the southbound and northbound directions are faster for the Bored Tunnel Alternative (16 to 19 minutes) and are substantially slower for the Cut-and-Cover Tunnel Alternative (approximately 50 minutes). Travel times for the Elevated Structure Alternative are slightly slower than those for the Bored Tunnel Alternative. Large differences in travel times between the Bored Tunnel and Cut-and-Cover Tunnel Alternatives are mainly due to closing SR 99 and Alaskan Way during construction of the Cut-and-Cover Tunnel Alternative. During construction of the Bored Tunnel Alternative, a minimum of two lanes would be provided on SR 99 in both directions and Alaskan Way would be fully functional.

Exhibit 6-7
Construction-Related Travel Times from Woodland Park to S. Spokane Street
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
AM Peak Hour				
Southbound	16	19	49	25
Northbound	16	16	51	19
PM PEAK Hour				
Southbound	15	18	43	28
Northbound	18	21	49	20

During the evening commute, a similar trend in construction travel times would be expected, with the fastest travel times for the Bored Tunnel Alternative and the slowest travel times for the Cut-and-Cover Tunnel Alternative.

How would construction affect conditions for drivers heading to or from northwest Seattle (Ballard, Interbay, and Magnolia)?

Other than the times when SR 99 is completely closed, drivers heading to and from northwest Seattle would likely be most affected by changes and closures of the Elliott and Western Avenue ramps. The Bored Tunnel Alternative would keep these ramps open until the last year of construction, when traffic routed in the newly constructed tunnel and the existing viaduct is demolished. Drivers would then need to use Mercer Street to access the new on-ramp at Sixth Avenue N. or travel south on Alaskan Way and access SR 99 near S. King Street.

The Cut-and-Cover Tunnel and Elevated Structure Alternatives would both close the Western and Elliott Avenue ramps for several years. These two alternatives would also restrict traffic on Alaskan Way, which would limit possible travel routes for drivers traveling to and from northwest Seattle. The Elevated Structure Alternative would restrict Alaskan Way to one lane in each direction through most of the construction period and the Cut-and-Cover Tunnel Alternative would close Alaskan Way for most of construction. In addition, when SR 99 is completely closed, drivers headed to or from northwest Seattle would encounter increased congestion and delays as they travel through or around the construction area.

Appendix C, Transportation Discipline Report

Expected travel times during construction are discussed in *Appendix C*, Section 6.6.

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

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

Exhibit 6-8 shows the approximate travel times during construction between Ballard and S. Spokane Street. During the morning commute, both north- and southbound travel times for the Bored Tunnel Alternative during construction are expected to be faster than the other build alternatives. The Cut-and-Cover Tunnel Alternative's travel times are expected to be the slowest, because the alternative would close SR 99 and Alaskan Way along the central waterfront. Travel times for the Cut-and-Cover Tunnel Alternative would range from 45 to 53 minutes compared to a range of 16 to 22 minutes for the Bored Tunnel and Elevated Structure Alternatives.

Exhibit 6-8
Construction-Related Travel Times from Ballard to S. Spokane Street
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
AM Peak Hour				
Southbound	16	16	45	18
Northbound	19	21	53	22
PM PEAK Hour				
Southbound	16	21	42	18
Northbound	21	23	53	22

During the evening commute, a similar although not identical pattern is expected, with the slowest construction-stage travel times for the Cut-and-Cover Tunnel Alternative and much faster travel times for the Bored Tunnel and Elevated Structure Alternatives. Travel times for the Cut-and-Cover Tunnel Alternative are expected to be within a range of 42 to 53 minutes, and travel times for the other two build alternatives would likely be between 18 and 23 minutes.

How would construction in the south area affect drivers heading to or from downtown?
All of the alternatives would use the WOSCA detour and temporary on- and off-ramps for at least 4 years of the construction period. The reduced speed limit of 25 mph on the WOSCA detour would cause delays for drivers on SR 99 heading to or from downtown and locations south of the project. Intersections near the temporary southbound off-ramp at S. Atlantic and northbound on-ramp S. Royal Brougham Way would be more congested and cause congestion on nearby streets and intersections, especially during peak commute hours. When SR 99 is closed to all traffic, drivers will have to use surface streets such as First, Second, or Fourth Avenues, or I-5 to travel north-south to or from downtown.

How would construction in the north area affect drivers heading to or from downtown?
For all of the build alternatives, construction will reduce SR 99 capacity, modify access to/from and around SR 99, and increase traffic volumes on north-south surface streets between downtown and areas to the north. Mercer Street will be restricted while it is being widened and converted to a two-way street. This may cause an increase in congestion on local streets such as Sixth Avenue N., Dexter Avenue N., Denny Way, and John, Thomas, Harrison, and Republican Streets. These streets currently operate under capacity and could handle some additional volumes. Some of these streets will have periodic closures, such as Thomas and Harrison Street, which will be reconnected across Aurora Avenue.

When SR 99 is closed, southbound traffic coming into downtown Seattle from the north would be routed off of SR 99 at Broad Street or streets farther north and drivers would use surface streets to reach their destinations. Drivers wishing to travel northbound on SR 99 would be able to use the Denny Way on-ramp for much of construction, but they would have to connect with SR 99 farther north when Aurora Avenue is lowered for the Cut-and-Cover Tunnel and Elevated Structure Alternatives. When SR 99 is closed, there will be substantial congestion and delays for drivers heading to and from downtown and neighborhoods to the north.

5 How would construction affect I-5 traffic?
Noticeable effects to I-5 are not expected because the additional trips that divert to I-5 because of construction are expected to divert during off-peak travel times when I-5 has available capacity. This diversion during off-peak periods could increase the number of hours that I-5 is congested each day. During peak travel times, I-5 is already congested and operating at capacity, so most drivers would not choose to take this route. Exhibit 6-9 shows the approximate percentage of increase for vehicle volumes on I-5 during construction.

Exhibit 6-9
Increase in Vehicle Volumes on I-5 during Construction
in percentages

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Near I-90	3%	5%	4%
Near Seneca Street	2%	6%	5%
Near SR 520	0.5%	2%	1%

6 How would construction effects compare to traffic on local streets?
This section discusses anticipated congestion levels at intersections during the most disruptive construction stage for each alternative. During construction, vehicle delays at intersections in the project area are expected to increase for any of the build alternatives. For the Bored Tunnel Alternative, increased delays would be influenced by SR 99 restrictions and detours that would reduce speeds, modify access, and lead to the redistribution of SR 99 traffic to local arterials and other parallel roadways such as I-5. Modeling results indicate that this diverted traffic would have little effect on I-5 trips, but it would have a larger effect on local streets. Some drivers may choose to use other routes such as First, Second, and Fourth Avenues, which may add congestion and increase delay at intersections along these routes.

For the Elevated Structure Alternative, increased delays would also be influenced by SR 99 restrictions and detours. During Stage 5, the Broad Street detour would be in place and there would be no southbound on-ramps to SR 99 between Pike Street and S. Spokane Street. The Broad Street detour would have substantial impacts on traffic north of downtown. These changes are expected to reduce SR 99 capacity, modify access at critical points along the corridor, and increase traffic volumes on I-5 and north-south surface streets through downtown more than the Bored Tunnel Alternative.

For the Cut-and-Cover Tunnel Alternative, SR 99 and Alaskan Way along the central waterfront would be closed during Stage 4, which would result in the greatest

Appendix C, Transportation Discipline Report

Construction effects to local streets are discussed in *Appendix C*, Section 6.5.

magnitude of traffic disruption and congestion on local streets of all build alternatives. Traffic volumes on city surface streets and I-5 would increase. Congestion would occur more frequently, with greater severity, and for longer durations during the construction of the Cut-and-Cover Tunnel Alternative than with the other build alternatives.

Bored Tunnel Alternative

South Portal Area

During construction of the Bored Tunnel Alternative, traffic delays at intersections in the south portal area are expected to increase as some traffic diverts from SR 99 to local arterials. Drivers that choose to use local arterials would potentially cause additional congestion on major north-south routes such as Second and Fourth Avenues.

Congestion during construction would increase delay at the following intersections:

- First Avenue S. at S. King Street – Delay would increase by more than 2 minutes during the AM peak hour and more than 1 minute during the PM peak hour.
- Alaskan Way at Yesler Way – Delay would increase by more than 1 minute during the AM and PM peak hours.
- Alaskan Way at S. King Street – Delay would increase by more than 2 minutes during both the AM and PM peak hours.
- Second Avenue at S. Jackson Street – Delay would increase by more than 2 minutes during the PM peak hour.

The temporary northbound on-ramp for the WOSCA detour may experience long queues during the PM peak hour. These queues could back up into adjacent intersection, increasing delay at the following locations by 15 to 25 seconds:

- East Frontage Road at S. Royal Brougham Way
- First Avenue S. at S. Royal Brougham Way
- First Avenue S. at S. Atlantic Street

Central Downtown and Waterfront Area

Traffic congestion at intersections in the central area is expected to increase, although most of the increases are not expected to substantially increase delay. Along north-south arterials such as First, Second, and Fourth Avenues, increases in traffic volumes during the AM and PM peak hour would not result in high levels of congestion.

North Portal Area

Delays on local streets during construction in the north area would be affected by widening and converting Mercer Street to a two-way street and restricting access to and from SR 99 and the local street grid south of Mercer Street. Access at Roy, Republican, Harrison, and Broad Streets would be restricted, and southbound SR 99 traffic would need to shift to access local streets to the north or south. Northbound traffic would not be able to exit SR 99 to Republican Street, but the other northbound exits (Harrison, Mercer, Roy, and Aloha Streets) would be open during the majority of construction. Drivers would likely shift to Harrison Street south of Republican Street or Roy Street to the north.

Congestion levels at intersections near affected on- and off-ramp connections or along affected streets would potentially increase due to higher concentrations of peak hour traffic during construction at the following locations:

- **Denny Way at Dexter Avenue N. –** Delay would increase by more than 1 minute during the AM peak hour.
- **Mercer Street at Dexter Avenue N./SR 99 northbound off-ramp –** Delay would increase by more than 5 minutes during the morning and evening commute.
- **Mercer Street at Fairview Avenue N./I-5 ramps –** Delay would increase by more than 1 minute during the PM peak hour.

In addition, construction of the Bored Tunnel Alternative would close SR 99 once to all traffic for several weeks. During this closure, congestion on local arterials in the project area are expected to increase noticeably compared to congestion during other stages of construction, because all SR 99 traffic would be diverted to city streets and other major freeways such as I-5. Travel times during the 3-week closure would increase substantially. For example, a trip between Woodland Park and S. Spokane Street that typically takes about 15 minutes could take about 45 minutes.

Cut-and-Cover Tunnel Alternative

South Area

When SR 99 is closed, traffic operations at intersections in the south area are likely to be extremely congested. All SR 99 traffic to and from the south would exit via temporary ramps at the intersection just west of S. Royal Brougham Way at First Avenue S. The volume of traffic entering and exiting via these ramps would cause the surrounding intersections to experience very long delays (approximately 10 minutes during the AM peak hour and 6 minutes during the PM peak hour). In addition, Alaskan Way would be closed from S. Atlantic Street to University Street. Traffic from SR 99 and Alaskan Way would redistribute to other local arterials, which would cause severe congestion on major north-south routes such as First and Fourth Avenues.

For the Cut-and-Cover Tunnel Alternative, congestion and delay would be higher than is expected for the Bored Tunnel Alternative. In addition to delay described for the Bored Tunnel Alternative, delay would be experienced at the following intersections:

- **First Avenue S. at Yesler Way –** Delay would increase by more than 1 minute during the PM peak hour.

- **First Avenue S. at S. King Street –** Delay would increase by almost 2 minutes more than the Bored Tunnel Alternative during the AM and PM peak hours.

- **First Avenue S. at S. Royal Brougham Way –** Delay would increase by more than 8 minutes during the AM peak hour and more than 6 minutes during the PM peak hour.

Central Downtown and Waterfront Area
When SR 99 is closed, traffic congestion could occur throughout the day, with the potential to last as long as 10 to 13 hours per day. In addition, the Alaskan Way surface street would be closed. East-west connections across Alaskan Way would be established to provide pedestrian, delivery, and emergency access to waterfront businesses. Access to Colman Dock would be maintained throughout the construction period, but vehicles would experience delays traveling to the ferry terminal.

Intersections in the central area would operate with a substantially longer delay (1 minute or more) during construction of the Cut-and-Cover Tunnel Alternative, as compared to the Bored Tunnel Alternative. Delay is expected to increase at the following locations:

- **Western Avenue at Broad Street –** Delay would increase by more than 1 minute during the AM and PM peak hours.

- **Western Avenue at Spring Street and First Avenue at Spring Street –** Delay would increase by more than 2 minutes during the AM peak hour and by approximately 1 minute during the PM peak hour.

- **Second Avenue at Marion Street –** Delay would increase by more than 1 minute during the AM peak hour.

North Area
Delays on local streets during construction in the north area would increase due to closing SR 99 south of Denny Way, widening and converting Mercer Street to a two-way corridor, and restricting access to and from SR 99 and the local street grid south of Mercer Street.

All traffic traveling southbound on SR 99 (Aurora Avenue) would have to exit onto the street grid north of or at Broad Street. Northbound traffic would not be able to exit SR 99 at Dexter Street, but all the other northbound exits at Denny, Harrison, Republican, Roy, and Aloha Streets would be open.

Congestion levels at intersections near these affected connections to or from SR 99 or along affected arterials would potentially increase due to higher concentrations of peak hour traffic, similar to the Bored Tunnel Alternative. In addition to increases in delay described for the Bored Tunnel Alternative, the following intersections are expected to have increased delay with the Cut-and-Cover Tunnel Alternative:

- **Denny Way at Fifth Avenue –** Delay would increase by more than 1 minute during the AM and PM peak hours.

- **Fifth Avenue N. at Roy Street –** Delay would increase by approximately 1 minute during the AM peak hour.

- **Denny Way at Sixth Avenue and Mercer Street at Westlake Avenue N. –** Delay would increase by more than 1 minute during the AM and PM peak hours.

- **Mercer Street at Fifth Avenue N., Denny Way at Wall Street, and Dexter Avenue N. at Harrison Street –** Delay would increase by approximately 2 minutes during the PM peak hour.

Elevated Structure Alternative
South Area
Most of the intersections evaluated in the south area for the Elevated Structure Alternative would operate with congestion similar to that for the Bored Tunnel Alternative. One exception during the AM peak hour is the intersection of Alaskan Way at Yesler Way. For the Elevated Structure Alternative, this intersection is expected to experience even more congestion due to reduced capacity along Alaskan Way, compared to the Bored Tunnel Alternative.

Three intersections during the PM peak hour would also experience additional congestion compared to the Bored Tunnel Alternative. The intersection of Alaskan Way at Yesler Way is expected to experience delays of more than 8 minutes, and the intersections of First Avenue S. at Atlantic Street and Second Avenue S. at S. Jackson Street are both expected to experience increases in delay of more than 1 minute.

Central Downtown and Waterfront Area
During Stage 5 of the Elevated Structure Alternative, Alaskan Way would be restricted to one lane in each direction and the Broad Street detour would be in place. In addition, there would be no access to southbound SR 99 between Pike Street and S. Spokane Street.

As a result of all of the access changes along SR 99, traffic congestion at intersections in the central area is expected to increase. Most of the intersections evaluated in the central area for the Elevated Structure Alternative would operate with congestion during the AM and PM peak hours, similar to that for the Bored Tunnel Alternative. However, at the intersection of Alaskan Way at Marion Street, delay is expected to increase by more than 2 minutes during the AM peak hour compared to the Bored Tunnel Alternative due to reduced capacity along Alaskan Way.

North Area
Delays on local streets during construction in the north area would be affected by widening and converting Mercer Street to a two-way roadway and restricting access to and from SR 99 and the local street grid south of Mercer Street.

Two lanes of southbound traffic would be routed onto the Broad Street detour and one lane would continue to Denny Way. Access at Roy, Republican, and Harrison

Streets would be restricted, and southbound SR 99 traffic would need to shift to access local streets to the north or south. Northbound traffic would not be able to exit SR 99 between Denny Way and Roy Street.

Congestion levels at intersections near affected on- and off-ramp connections or along affected streets would potentially increase due to higher concentrations of peak hour traffic during construction. Expected congestion levels at intersections are generally similar to the Bored Tunnel Alternative; however, delay at the following intersections would increase substantially compared to the Bored Tunnel Alternative:

- **Denny Way at southbound Aurora Avenue –** Delay would increase by approximately 1 minute during the AM and PM peak hours.

- **Mercer Street at Fifth Avenue N. –** Delay would increase by more than 2 minutes during the PM peak hour.

In addition, construction of the Elevated Structure Alternative would close SR 99 to all traffic for 2 to 4 weeks in Stage 4 and 3 weeks in Stage 7. During these closures, congestion on local arterials in the project area are expected to increase noticeably compared to congestion during other stages of construction, because all SR 99 traffic would be diverted to city streets and other major freeways such as I-5 and I-90. Travel times during the closures would increase substantially. For example, a trip between Woodland Park and S. Spokane Street that typically takes about 15 minutes could take about 45 minutes.

Exhibit 6-10
AM Peak Hour Travel Times during Construction Along Major Transit Corridors
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Elliott Avenue – South of Ballard Bridge to Denny Way				
SOUTHBOUND	8	8	8	7
NORTHBOUND	8	8	8	7
Aurora Avenue – South of Aurora Bridge to Denny Way				
SOUTHBOUND	7	9	14	11
NORTHBOUND	7	6	8	6
Woodland Park to Spokane Street				
SOUTHBOUND	16	19	49	25
NORTHBOUND	16	17	51	19

Exhibit 6-11
PM Peak Hour Travel Times during Construction Along Major Transit Corridors
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Elliott Avenue – South of Ballard Bridge to Denny Way				
SOUTHBOUND	8	8	8	8
NORTHBOUND	8	8	8	7
Aurora Avenue – South of Aurora Bridge to Denny Way				
SOUTHBOUND	6	6	5	11
NORTHBOUND	6	8	5	6
Woodland Park to Spokane Street				
SOUTHBOUND	15	18	43	28
NORTHBOUND	18	21	49	20

7 How would effects to transit compare?

Transit Effects Overview
Transit travel times were assessed for key transit trips during the most disruptive construction stage for each alternative. The results of this analysis are shown in Exhibits 6-10 and 6-11.

For many trips, King County Metro bus services that use SR 99 would be affected by lane and speed restrictions on SR 99 during construction. However, the outside lane of northbound SR 99 north of the S. Spokane Street interchange would be a transit-only bypass lane until SR 99 merges to two lanes near the WOSCA detour. This transit-only lane would help mitigate construction effects on transit travel times. Increased congestion on First Avenue S. or Fourth Avenue S. during construction could affect transit operations. In addition, during times when SR 99 is completely closed or during any other night or weekend closures, buses that currently use SR 99 would need to use alternate routes.

Bored Tunnel Alternative
Bus access would be maintained on SR 99 during construction of the Bored Tunnel Alternative in areas where current access exists; these locations include the Seneca Street off-ramp and the Columbia Street on-ramp in downtown Seattle and the Denny Way ramps near Seattle Center. King County Metro bus services using SR 99 would be affected by the reduced speed limit on SR 99 (40 mph during construction instead of 50 mph), the 25 mph WOSCA detour, and lane restrictions north of Denny Way.

Buses using SR 99 (primarily those that travel between West Seattle/South King County and downtown) and those using the Denny Way ramps north of downtown would experience slightly longer travel times. For buses coming to and from West Seattle, SR 99 would be reduced by one lane and speeds would decrease through the WOSCA detour. Buses that use the Denny Way ramps would also encounter increased congestion. Although transit access routes would be maintained, King County Metro may decide to make routing changes to alleviate effects.

Additional congestion is expected on major north-south transit corridors in the south area, such as Second and Fourth Avenues. The availability of bus-only lanes on these arterials would help to lessen the overall delays to transit service during construction. Delay at the intersection of Second Avenue S. and S. Jackson Street is expected to increase by more than 2 minutes during the PM peak hour.

In the north area, construction on Mercer Street would likely increase congestion and delays at the following locations that are served by transit:

- **Denny Way at Dexter Avenue N. –** Delay of more than 1 minute would be expected during the AM peak hour.

- **Mercer Street at Dexter Avenue N./SR 99 northbound off-ramp –** Delays of more than 5 minutes would be expected during the AM and PM peak hours.

Appendix C, Transportation Discipline Report

Traffic congestion on SR 99 and traffic congestion on surface streets during construction are discussed in ***Appendix C, Transportation Discipline Report***, Sections 6.4 and 6.5, respectively.

Additional information on transit and freight traffic during construction is also provided in Sections 6.7 and 6.8, respectively.

Construction effects to transit are discussed in ***Appendix C***, Section 6.7.

Cut-and-Cover Tunnel Alternative
Compared to the Bored Tunnel Alternative, the extent of construction-related disruptions from the Cut-and-Cover Tunnel Alternative would be substantially greater for buses traveling through downtown Seattle.

Closing SR 99 for more than 2 years (27 months) would directly affect buses that currently use the Columbia and Seneca ramps to access downtown. Buses that use these ramps come from west and south. In addition, other bus routes operating in the project area, such as those that use the Denny Way ramps to access downtown, would be affected by additional traffic diverting from SR 99 to surface streets, while SR 99 is closed.

When SR 99 is closed, all SR 99 traffic, including buses to and from the south, would exit via temporary ramps at the intersection just west of S. Royal Brougham Way at First Avenue S. The volume of traffic entering/exiting these ramps would cause surrounding intersections to experience long delays (approximately 10 minutes during the morning commute and 6 minutes during the evening commute). Substantial congestion is also expected on major north-south routes that carry high volumes of buses, such as First and Fourth Avenues.

Bus operations will be affected to a greater degree with the Cut-and-Cover Tunnel as compared to the Bored Tunnel. Transit services would experience increased delays at the following intersections with the Cut-and-Cover Tunnel Alternative as compared to the Bored Tunnel Alternative:

- **First Avenue at S. King Street –** Delay would increase by almost 2 minutes during the AM peak hour.
- **First Avenue S. at Yesler Way –** Delay would increase by more than 2 minutes during the PM peak hour.
- **First Avenue S. at Main Street –** Delay would increase by more than 3 minutes during the PM peak hour.
- **First Avenue S. at S. Jackson Street, and First Avenue S. at S. King Street –** Delay would increase by more than 5 minutes during the PM peak hour.
- **First Avenue S. at S. Royal Brougham Way –** Delay would increase by more than 8 minutes during the AM peak hour and more than 7 minutes during the PM peak hour.

When SR 99 is closed, congestion levels through downtown could be similar to peak hour conditions for as much as 10 to 13 hours per day, which would increase travel times for buses.

North of Denny Way, peak hour congestion levels at intersections near on- or off-ramp connections or along affected arterials would potentially increase due to higher concentrations of traffic, similar to the Bored Tunnel Alternative. Transit services would experience increased delays at the following intersections with the Cut-and-Cover Tunnel Alternative as compared to the Bored Tunnel Alternative:

- **Denny Way at Fifth Avenue –** Delay would increase by more than 1 minute during the AM and PM peak hours.
- **Fifth Avenue N. at Roy Street –** Delay would increase by approximately 1 minute during the AM peak hour.
- **Denny Way at Sixth Avenue and Mercer Street at Westlake Avenue –** Delay would increase by more than 1 minute during the AM and PM peak hours.
- **Mercer Street at Fifth Avenue N., Denny Way at Wall Street, and Dexter Avenue N. at Harrison Street –** Delay would increase by approximately 2 minutes during the PM peak hour.
- **Fifth Avenue N. at Broad Street –** Delay would increase by more than 4 minutes during the PM peak hour.

Elevated Structure Alternative
Transit services would be affected by lane restrictions and changes in access on SR 99 and Alaskan Way during construction of the Elevated Structure Alternative. Bus routes on north-south transit corridors such as Second, and Fourth Avenues could experience increased delay. In addition, routes that leave downtown using the Alaskan Way Viaduct would be rerouted. When compared to the Bored Tunnel Alternative, which would maintain transit access along major transit corridors, construction-related disruptions resulting from the Elevated Structure Alternative would be more severe.

In the south area, congestion at most intersections during the evening commute with the Elevated Structure Alternative would be similar to the Bored Tunnel Alternative. However, when compared to the Bored Tunnel Alternative, delay is expected to increase at the following intersections:

- **Alaskan Way at Yesler Way –** Delay would increase by more than 8 minutes during the PM peak hour.
- **First Avenue S. at Atlantic Street –** Delay would increase by more than 1 minute during the PM peak hour.
- **Second Avenue S. at S. Jackson Street –** Delay would increase by more than 1 minute during the PM peak hour.

King County Metro routes serving West Seattle and south King County would be affected more with construction of the Elevated Structure Alternative than the Bored Tunnel Alternative, because the Seneca ramp to downtown Seattle would be closed and the Columbia Street ramp would be used as a northbound off-ramp to downtown Seattle. Buses travelling south to West Seattle would have to use the ramps on First Avenue S. at S. Spokane Street, while those destined to south King County would need to use the access locations south of S. Spokane Street.

As a result of access changes along SR 99, traffic congestion at intersections in the central area is expected to increase due to greater peak hour volumes, similar to the Bored Tunnel Alternative. The one exception is Alaskan Way at Marion Street. Increased delay is expected at this intersection with the Elevated Structure Alternative as compared to the Bored Tunnel Alternative.

In the north area, construction would affect conditions at intersections near SR 99 and Denny Way. Several bus routes pass through this area. Congestion levels at intersections near the on- or off-ramp connections to SR 99 and along the adjacent streets would potentially increase because of higher concentrations of peak hour traffic. Most of the intersections would experience delays similar to the Bored Tunnel Alternative. However, compared to the Bored Tunnel Alternative additional delay is expected at the following intersections that are served by buses:

- **Denny Way at southbound Aurora Avenue –** Delay would increase by about 1 minute during the AM and PM peak hours.

- **Mercer Street at Fifth Avenue N. –** Delay would increase by more than 2 minutes during the PM peak hours.

8 How would construction affect freight?

Freight mobility and access would be affected by lane closures and traffic congestion during construction for all of the build alternatives. Lane reductions on SR 99 and nearby surface roadways would affect many drivers, including freight operators, and cause increased congestion on alternative routes. Construction vehicles on routes used for hauling construction materials and spoils to and from the south area may also cause delays for some freight traffic. In the south area, the primary route for hauling construction materials would likely include the temporary SR 99 off-ramp to S. Atlantic Street to SR 519 (Edgar Martinez Drive S.) to First Avenue S.

Over-legal loads being transported to the WOSCA construction staging site would likely travel via SR 599 near Boeing Field to West Marginal Way S. to First Avenue S. to the construction site. Over-legal loads traveling within the city are required to obtain a special permit, and appropriate routes are selected by means of the permit approval process. Over-legal loads would likely be allowed to travel on state highways during off-peak hours, from 9:00 p.m. to 5:00 a.m., Monday through Friday, and during all hours on the weekends.

Northbound trucks on East Marginal Way S. would be required to use S. Atlantic Street and the East Frontage Road or First Avenue S., because Alaskan Way S. would be closed from S. Atlantic Street to S. King Street. Many longer-distance freight trips that previously used SR 99 may be diverted to I-5 or shifted to off peak periods because of the expected congestion and reduced speeds on the WOSCA detour.

Freight access to and from Terminal 46 and the Seattle Ferry Terminal at Colman Dock would be maintained during all construction stages. Freight trips from I-5 to the central waterfront would likely use Mercer Street to Fifth Avenue N. and then continue to Broad Street and Alaskan Way.

Preliminary routes designated for hauling construction materials and spoils in the north area include I-5 to Fairview Avenue N. to Denny Way to Sixth Avenue N. to the construction zones, or I-5 to Mercer Street to the construction zones. SR 99 to and from the north would also be available as a potential haul route.

Exhibits 6-12 and 6-13 identify travel time variations between the build alternatives and the 2015 Existing Viaduct for freight vehicles traveling on a major freight corridor, Ballard to S. Spokane Street. Travel times were evaluated during the most disruptive construction stages: Stage 5 for both the Bored Tunnel and Elevated Structure Alternatives, and Stage 4 for the Cut-and-Cover Tunnel Alternative.

Exhibit 6-12
AM Peak Hour Construction-Related Travel Times Along a Major Freight Corridor
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Ballard to S. Spokane Street				
SOUTHBOUND	16	17	45	18
NORTHBOUND	19	21	53	22

Exhibit 6-13
PM Peak Hour Construction-Related Travel Times Along a Major Freight Corridor
in minutes

	2015 Existing Viaduct	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Ballard to S. Spokane Street				
SOUTHBOUND	16	21	42	18
NORTHBOUND	21	23	53	22

Bored Tunnel Alternative

Travel times along the freight corridor between S. Spokane Street and Ballard for the Bored Tunnel Alternative are generally comparable during the morning commute (both directions) to those of the 2015 Existing Viaduct. During construction, it would take about 1 to 2 minutes longer to travel using this route.

During the evening commute, the Bored Tunnel Alternative would increase travel times somewhat relative to the travel times during the morning commute, due to higher demand during the evening commute. In the southbound direction, corridor travel times for the Bored Tunnel Alternative would be about 5 minutes longer than those for the 2015 Existing Viaduct. In the northbound direction, corridor travel times would be 2 minutes longer than those for the 2015 Existing Viaduct.

Cut-and-Cover Tunnel Alternative

When the Cut-and-Cover Tunnel Alternative closes SR 99 and Alaskan Way along the central waterfront, travel times for freight are expected to be much longer than those for the Bored Tunnel Alternative. In both directions during the morning commute, travel times for the Cut-and-Cover Tunnel Alternative would be about 30 minutes longer than those for Bored Tunnel Alternative.

Appendix C, Transportation Discipline Report

Construction effects to freight are discussed in *Appendix C*, Section 6.8.

What is an over-legal truck?

An over-legal truck is one that is oversized or overweight. These trucks are limited to the designated over-legal route along Alaskan Way and Broad Street, or I-5.

Evening commute travel times for the Cut-and-Cover Tunnel Alternative are estimated to take about 20 minutes longer to travel the length of the corridor in the southbound direction, and about 30 minutes longer in the northbound direction compared to the Bored Tunnel Alternative.

Elevated Structure Alternative
Travel times along the freight corridor between S. Spokane Street and Ballard would generally be comparable between the Elevated Structure Alternative and the Bored Tunnel Alternative during the morning and evening commutes. During the morning commute, travel times for the Elevated Structure Alternative would be about 1 minute longer. Travel times during the evening commute would be about 1 to 3 minutes shorter than the Bored Tunnel Alternative.

9 Would ferry traffic be affected?

The Seattle Ferry Terminal at Colman Dock (Pier 52) serves the most customers of any ferry terminal in the State's ferry system. In addition, the adjacent terminal at Pier 50 is home to passenger-only ferry service provided by King County. For all of the build alternatives, access to Colman Dock will be maintained throughout construction.

As planning and design of the project and construction staging progresses, coordination with Washington State Ferries staff will continue to take place to ensure that disruptions or degradations to access to and from the Seattle Ferry Terminal are minimized or avoided. All temporary street-level crossings to the terminal would meet Americans With Disabilities Act (ADA) requirements.

Bored Tunnel Alternative
The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Bored Tunnel Alternative are described below:

- Alaskan Way S. would be closed between S. Atlantic Street and S. King Street in Stages 1 through 7 (approximately 53 months). The permanent alignment would include a new connection for East Marginal Way S. between S. Dearborn Street and S. Atlantic Street.
- Alaskan Way would be reduced to one lane southbound between Yesler Way and S. King Street. To alleviate potential queuing backups on Colman Dock during peak ferry travel periods, a second northbound lane of traffic between Yesler Way and Spring Street would be added, and the signal at Yesler Way/Alaskan Way would be modified to allow left turns out of the ferry terminal.
- Alaskan Way Viaduct demolition would require closing Alaskan Way cross streets two blocks at a time for a period of up to 4 weeks. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.
- Alaskan Way Viaduct demolition would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level. An ADA-compliant alternate route would be provided during construction.

Cut-and-Cover Tunnel Alternative
The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Cut-and-Cover Tunnel Alternative are as follows:

- Alaskan Way would be periodically reduced to one lane for a period of 42 months (3.5 years).
- Alaskan Way would be closed to north-south traffic between S. Atlantic Street and University Street for just over 5 years (63 months).
- Alaskan Way Viaduct demolition would require closing Alaskan Way cross streets two blocks at a time for a period up to 4 weeks. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.
- Alaskan Way Viaduct demolition would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another structure is constructed (as part of the project), pedestrians would need to cross at the street level.

The 5-year closure of Alaskan Way to north-south traffic from S. Atlantic to University Streets with the Cut-and-Cover Tunnel Alternative would likely affect ferry operations much more than the Bored Tunnel Alternative. Ferry traffic coming from the south would need to use Yesler Way via First Avenue S. to access Colman Dock. Traffic volumes on First Avenue S. during Stage 4 of the Cut-and-Cover Tunnel Alternative are expected to be approximately 30 percent higher than those during Stage 5 of the Bored Tunnel Alternative. This added volume is expected to result in more congestion, longer delays, and longer travel times for traffic, including traffic traveling to Colman Dock.

Elevated Structure Alternative
The primary construction activities that would affect access to and from the Seattle Ferry Terminal under the Elevated Structure Alternative are as follows:

- Alaskan Way would be periodically reduced to one lane in each direction for a period of about 3 years and completely reduced to one lane in each direction for a period of about 7 years.
- Alaskan Way Viaduct demolition would require closing Alaskan Way cross streets two blocks at a time for a period of up to 4 weeks. Ferry passengers would need to be informed of street closures and short-term detours that may affect their routes to and from the Seattle Ferry Terminal.
- Alaskan Way Viaduct demolition would eliminate the pedestrian overpass that currently connects Colman Dock to First Avenue. Until another

Appendix C, Transportation Discipline Report

Construction effects to ferries are discussed in *Appendix C*, Section 6.12.

structure is constructed (as part of the project), pedestrians would need to cross at the street level.

Construction of the Elevated Structure Alternative would require reducing Alaskan Way to one lane in each direction for nearly 7 years. This would affect ferry operations more than the Bored Tunnel Alternative. The reduced capacity of Alaskan Way would most likely increase congestion and delay for traffic along the corridor, including traffic traveling to and from Colman Dock.

10 How would event traffic be affected during construction?

Construction activities, roadway restrictions, and periodic lane closures would cause higher levels of congestion in the immediate vicinity of the stadiums and Seattle Center during large events. Travel times into and out of parking facilities during construction are likely to increase for all of the build alternatives. Mitigation measures for traffic are discussed in Chapter 8, Question 9.

Stadium Area

Safeco Field can host up to 47,000 people at a Mariners baseball game, which may translate to roughly 14,000 additional vehicles on local surface streets and highways (based on game-day surveys and traffic counts). Seahawks football games at Qwest Field, although typically held on Sundays, draw even larger crowds and result in greater levels of traffic demand. While a portion of patrons for both types of events travel via ferry or public transit (5,000 to 7,000 persons), the majority of these event-goers are likely to continue to travel via private vehicle and/or carpool.

Event-related detour routes, lane closures, and general traffic management for all transportation modes before and after events would be needed during the construction period for all of the alternatives. Traffic management would be required at entry points to the stadiums, such as the intersection of S. Atlantic Street and First Avenue S. because of substantial vehicle and pedestrian traffic.

Bored Tunnel Alternative

During construction of the Bored Tunnel Alternative, the WOSCA detour would reduce capacity on SR 99 for approximately 4.5 years. The temporary southbound off-ramp at S. Atlantic Street and northbound on-ramp at S. Royal Brougham Way would allow connections similar to existing conditions. Vehicles exiting on the southbound off-ramp at S. Atlantic Street would have to merge with heavy event traffic activity on First Avenue S. or with S. Atlantic Street/SR 519 west of First Avenue S.

The effects of construction activity and changes to ramp access points would potentially result in higher levels of congestion in the immediate vicinity of the stadiums. Therefore, travel times into and out of parking facilities would increase, particularly during large events. SR 99 traffic congestion is not expected to be substantially affected based on the results of preliminary analyses of construction effects because some traffic will divert to alternative routes. Specific pedestrian paths and dedicated barriers through construction areas may be needed to separate non-motorized routes near the stadiums.

Cut-and-Cover Tunnel Alternative

Construction activities for the Cut-and-Cover Tunnel Alternative would have substantial effects on traffic access and circulation to and from the stadiums when SR 99 and Alaskan Way are closed during Stage 4 of construction. Event traffic coming to and from the north would be the most affected and would have to use alternate downtown arterials such as First, Second, and Fourth Avenues or I-5. For event traffic to and from the south, added delays and congestion would occur because of the higher congestion levels on surface streets such as East Marginal Way, First Avenue S., and Fourth Avenue S. Travel times into and out of parking facilities, particularly during large events would increase. Specific pedestrian paths and dedicated barriers through construction may be needed to separate non-motorized routes near the stadiums.

Elevated Structure Alternative

Construction activities for the Elevated Structure Alternative would be the most disruptive to traffic capacity, circulation, and event traffic during Stage 5. Similar to the Bored Tunnel Alternative, the temporary southbound off-ramp to the stadium area would create a high concentration of traffic and congestion at S. Atlantic Street. The northbound on-ramp at S. Royal Brougham Way would potentially lead to backups on the East Frontage Road. In addition, reducing Alaskan Way to a single lane in each direction would shift many event-related trips to First or Second Avenues. The combination of these changes would result in longer delays before and after large events at Safeco Field and Qwest Field. Specific pedestrian paths and dedicated barriers through construction may be needed to separate non-motorized routes near the stadiums.

Seattle Center

Based on data collected in 2007 and 2008, more than 5,000 events are documented annually at Seattle Center, with the largest concentrations of people and traffic occurring during major Key Arena events such as high-profile concerts, Seattle Storm playoff basketball games, and large-scale weekend festivals. Attendance at regional events such as Bumbershoot, the Northwest Folklife Festival, and the Bite of Seattle has been shown to reach up to 60,000 persons per day. Peak loads may approach 17,000 person-trips for a Key Arena event and as high as 200,000 person-trips during a festival weekend such as the Northwest Folklife Festival or Bumbershoot. Construction activities in the north area for all of the alternatives could cause disruptions to these large events at Seattle Center due to temporary lane closures, detours, and access modifications to SR 99 ramps, especially during early stages of the Mercer Street construction.

A wide range of measures related to signage, signal timing and operations, road closures, and detours would be critical for maintaining reasonable levels of traffic flow and circulation near Seattle Center during major events, particularly onto and off of SR 99. Flaggers or police details at key intersections may also be needed during major events at Seattle Center to establish clear event way-finding routes and detours, including turn restrictions. In addition, Seattle Center's 50th Anniversary celebration will

Appendix C, Transportation Discipline Report

Construction effects to event traffic are discussed in *Appendix C*, Section 6.14.

be held from April to October 2012 and may require additional mitigation measures due to potentially higher-than-average patronage. Ongoing coordination with Seattle Center would help identify issues and target specific potential mitigation measures as needed.

Bored Tunnel Alternative
Construction activity in the north area for the Bored Tunnel Alternative could cause major disruptions to these large events at Seattle Center. These disruptions should be reasonably well managed because the access ramps and mainline SR 99 will be open. During the most disruptive stage (Stage 5), the primary effects to event traffic would likely be related to lane restrictions on SR 99 and, to a lesser degree, the temporary absence of east-west connections across SR 99 on arterials between Denny Way and Mercer Street. Travel times to and from Seattle Center during construction are expected to increase.

Cut-and-Cover Tunnel Alternative
Construction effects on local circulation and traffic access to and from Seattle Center during the most disruptive stage (Stage 4) of the Cut-and-Cover Tunnel Alternative would be substantial, because SR 99 and Alaskan Way would be closed. Seattle Center traffic coming from or traveling to the south would be the most affected and would have to use downtown surface streets or I-5. Event traffic to and from the north would also be affected due to added congestion on surface streets such as Mercer Street, Roy Street, and Fifth Avenue.

With SR 99 closed, greater coordination between Seattle Center, the Seattle Department of Transportation, and the Seattle Police Department would be needed to identify issues and target specific potential mitigation measures for event traffic than for the other alternatives.

Elevated Structure Alternative
The effects on event traffic to Seattle Center for the Elevated Structure Alternative would be most noticeable during Stage 5. Impacts to access and circulation in the north area would be substantial because of the closure of southbound SR 99 into the Battery Street Tunnel and the temporary Broad Street detour. Alaskan Way would also be reduced to a single lane in each direction, forcing some event goers to other surface streets such as First and Fourth Avenues. The northbound Western Avenue off-ramp from SR 99 is expected to be open during this stage of construction providing Seattle Center traffic with more than one route. Post-event traffic to the south on SR 99 would be required to travel on the Broad Street detour. Event traffic to and from the north would be adversely affected because of the Broad Street detour and added congestion levels on surface streets such as Mercer Street, Roy Street, and Fifth Avenue N.

11 How would bicyclists and pedestrians be affected during construction?

The effects to bicycles and pedestrians during construction would be similar for all alternatives and are discussed below. However, these effects would last for a longer period of time with the Cut-and-Cover Tunnel and Elevated Structure Alternatives than they would for the Bored Tunnel Alternative.

For safety, bicyclists and pedestrians would be routed around construction zones. During construction, sidewalks and trail facilities would be closed for short periods of time due to utility relocations, construction activities, demolition, and street restoration. To maintain bicycle and pedestrian mobility and accessibility, the duration of the temporary closures would be minimized to the extent practical. As part of the traffic management plan, construction mitigation discussed in Chapter 8, Question 9 will include identifying accessible routes to accommodate persons with disabilities. The location and duration of temporary closures will be determined during final design.

Bicyclists riding in the street may face increased potential for conflicts with vehicles, due to increased traffic volumes, lane restrictions, and reduced space to maneuver on some streets. In particular, First Avenue S., Fourth Avenue S., Denny Way, and Dexter Avenue N. are expected to carry increased volumes of traffic during construction.

South Area
Bicycle and pedestrians access would be maintained on the Port Side Pedestrian/Bike Trail on the western edge of the project area, which runs adjacent to the Port of Seattle facilities. The City Side Trail, which will be constructed as part of the S. Holgate Street to S. King Street Viaduct Replacement Project, may be detoured slightly during construction of this project before being constructed in its final location.

For all of the alternatives in the south area, bicyclists would have the option of continuing to use First Avenue S., using the Port Side Pedestrian/Bike Trail on the western edge of the project area, or diverting to Occidental Avenue S. Depending on their origin or destination, bicyclists may choose to travel on Fourth Avenue S., sharing the roadway with other vehicles but avoiding construction activities in the south portal area. The existing in-street bicycle lanes on Second and Fourth Avenues through downtown would be maintained throughout the construction period.

East-west bicycle travel between S. King Street and S. Atlantic Street would be restricted during nearly all traffic stages, but the bicycle lanes along S. Royal Brougham Way would remain accessible.

Pedestrians would encounter intermittent sidewalk closures on First Avenue S. from S. Royal Brougham Way to S. Jackson Street, as well as additional traffic due to the closures on Alaskan Way. When these sidewalks are closed, pedestrians may be routed to sidewalks on the opposite side of the roadway or they may be required to detour to parallel roadways.

Central Area
Bicycle and pedestrian access would be maintained to the central waterfront during all stages of construction for all of the build alternatives, regardless of whether Alaskan Way is closed or restricted. Bicyclists would experience increased congestion and delays along with vehicle traffic when Alaskan Way is restricted. For the Cut-and-Cover Tunnel Alternative, bicycles would not be able to travel north-south on this surface street when Alaskan Way is

Appendix C, Transportation Discipline Report

Construction effects to pedestrians and bicyclists are discussed in *Appendix C*, Section 6.10 and 6.11, respectively.

closed. East-west crossings would be provided for bicycles and pedestrians but would periodically change due to construction needs and work locations. When viaduct demolition activities are taking place, access to the waterfront could become slightly more circuitous as areas under the viaduct are temporarily closed due to demolition.

From Second Avenue to Sixth Avenue along both sides of Battery Street, bicycle and pedestrian facilities would experience intermittent detours and sidewalk closures due to construction activities proposed for the Battery Street Tunnel. The Bored Tunnel Alternative would have fewer effects to these streets that the Cut-and-Cover Tunnel or Elevated Structure Alternative, since proposed construction activities are more extensive with these alternatives.

North Area

Bicycle and pedestrian facilities and access in the north area would experience intermittent detours and sidewalk closures during construction, particularly on the east side of SR 99 around construction staging areas. Bicycles and pedestrians would be detoured when Sixth Avenue N. between Thomas and Broad Streets and Harrison Street between SR 99 and Sixth Avenue N. are closed or restricted by construction activities.

Bicyclists would generally face the same lane reductions and closures as other traffic in the north area. The in-street bicycle lanes on Dexter Avenue N. would be maintained during construction; however, increased traffic volumes on Dexter Avenue N. and other parallel facilities may increase the potential for automobile and bicycle conflicts.

East-west bicycle and pedestrian travel on Mercer and Broad Streets would be restricted at times during construction activities. East-west pedestrian mobility in this area is already challenging due to limited crossings of SR 99. Particular attention would be focused on minimizing the duration of closures and out-of-direction travel by maintaining sidewalk facilities on the opposite side of the roadway. Sidewalks on SR 99 may be closed during construction of the Mercer Street overcrossing of SR 99.

OTHER TEMPORARY CONSTRUCTION EFFECTS

12 How would soil and contaminated materials be handled and removed during construction?

All of the alternatives would excavate soil and material to relocate utilities and construct foundations. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would also excavate soil to build retained cuts and tunnel sections. Excavated materials may be contaminated, which would require special handling and disposal. Exhibit 6-14 shows the estimated volume of excavated material and the amount of that material that may be potentially contaminated. All of the build alternatives have been designed to avoid contamination where possible.

Exhibit 6-14
Excavated and Contaminated Soil Volumes
cubic yards

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Excavated Material	1,573,500	2,007,000	806,000
Potentially Contaminated Material	1,451,000	1,437,000	660,920

Excavated material would be hauled away by trucks or railcars, or at the south area may be conveyed to a barge at Pier 46, the northern edge of Terminal 46. The conveyer would be located within the construction staging areas and would, therefore, not affect traffic patterns or business access in the area. Materials would be removed to a predetermined site. Excavated materials that are barged would likely be disposed of at the Mats Mats Quarry, near Port Ludlow in Jefferson County, Washington. Trucks will be required to follow City-designated truck routes and could cause increased congestion and delay on these routes. In the south area, the primary route for trucks to haul excavated materials would be the temporary SR 99 off-ramp to S. Atlantic Street to First Avenue S. to SR 519 (Edgar Martinez Drive S.). Routes being considered for hauling excavated material in the north portal area include I-5 to Fairview Avenue N. to Denny Way to Sixth Avenue N. to the construction zone. SR 99 to and from the north is also available as a potential haul route.

There are six general types of contamination found in the project area:

- **Oil –** mid- to heavy-range petroleum hydrocarbons
- **Gasoline**
- **Metals –** such as arsenic, chromium, lead, and mercury
- **Solvents –** such as trichloroethylene and tetrachloroethylene
- **Polychlorinated biphenyls (PCBs)**
- **Polycyclic aromatic hydrocarbon (PAHs) –** associated with oil and creosote-treated timbers

In the south area from S. Royal Brougham Way to S. King Street, wood debris could be encountered, including creosote-treated timbers that are a source of PAHs. Fill in the south area may also contain petroleum and metals. The contaminants most commonly found in the area north of Denny Way are gasoline, petroleum (diesel), and solvents associated with past site uses.

Construction activities would likely result in several types of potential effects related to hazardous materials:

- Spoils containing contaminated soil and debris would be removed.
- Contaminated groundwater would be extracted during dewatering activities.
- Air quality near the project area could be affected by the release of contaminants and dust during construction.

In addition, for all alternatives groundwater pathways could be modified due to subsurface construction activities, which could spread groundwater contaminants. The potential for groundwater pathways to be modified is higher for the tunnel alternatives than for the Elevated Structure Alternative, since the tunnel alternatives require more subsurface construction.

Appendix P, Earth Discipline Report and Appendix Q, Hazardous Materials Discipline Report

Additional information on the geologic setting, soils, and hazards in the project area is provided in ***Appendix P***. Information about contamination that could be encountered during construction is provided in ***Appendix Q***.

Properties with Contaminated Sites

The number of sites where contamination has a moderate or high potential to impact the project are shown in Exhibit 6-15. A majority of the sites are associated with former railroad operations, metal works, a junkyard, gas stations, and dry-cleaning operations. In addition to these parcels, temporary construction easements and temporary tieback easements would also be acquired for each of the alternatives.

Exhibit 6-15
Sites with Moderate or High Potential of Contamination

	Bored Tunnel	Cut-&-Cover Tunnel	Elevated Structure
Number of partially and fully acquired parcels[1] with contaminated sites	13	40	35
Number of validated sites[2] with a **moderate** potential impact	18	26	39
Number of validated sites[2] with a **high** potential impact	4	6	6

1 More than one contaminated site may be located on a parcel

2 Validated sites are categorized as having a "high," "moderate," or "low" potential to adversely affect the project, as defined by WSDOT.

With the Cut-and-Cover Tunnel and the Elevated Structure Alternatives, one site in the central area and five sites in the north area would pose a high potential impact on the project because of potential contamination. With the Bored Tunnel Alternative, four sites located in the north area could have a high potential impact on the project. Two of these sites are owned by the City. The site investigations that have been conducted before construction begins reduce the risk of adverse effects for these sites.

Bored Tunnel Alternative

The quantity of excavated material is estimated to be 1,573,500 cubic yards, which includes material generated during viaduct demolition as shown in Exhibit 6-16. For the south and north areas, the material to be excavated or generated would come from the retained cut section as the roadway transitions from the surface to below grade, cut-and-cover sections, soil improvements, the tunnel operations building, and tunnel boring machine (TBM) launch or retrieval pit. Tunnel boring would excavate about 900,000 cubic yards of material and generate approximately 49,000 cubic yards of spoils from jet grouting above the tunnel to strengthen soils.

Exhibit 6-16
Excavated Material for the Bored Tunnel Alternative
in cubic yards

	Excavated Material	Amount Potentially Contaminated
South Area	284,500	208,500
Bored Tunnel	949,000	949,000
Viaduct Removal	107,000	107,000
North Area	233,000	160,500
Total	**1,573,500**	**1,451,000**

The maximum daily volume of soil that could be excavated in north and south areas is estimated to be approximately 2,800 cubic yards. This is the equivalent of approximately 4,000 to 5,000 tons of soil. The volume of spoils from the bored tunnel would likely range between 3,900 and 6,600 tons per day, assuming that the TBM advances 30 to 50 feet per day. As shown in Exhibit 6-16, much of the excavated material is potentially contaminated. Waste handlers for problem waste estimate that they can accept approximately 5,000 tons of soil per day for disposal at a RCRA Subtitle D landfill that has no restrictions on levels of contamination, organic content, and pH level, as long as it is not considered dangerous waste. Although the estimates indicate substantial spoils disposal volumes, coordination and budgeting for disposal in advance would help to manage the spoils disposal issue. For temporary storage, soil could be stockpiled at proposed staging areas in the south end of the project area shown previously in Exhibit 3-8. More than one waste disposal company may be used to address the volume of soil requiring disposal. Potential effects from construction activities to remove, stockpile, and transport spoils would be minimized or prevented through proper selection and implementation of best management practices (BMPs).

Dewatering would likely be required for the cut-and-cover tunnel sections of the Bored Tunnel Alternative, retained cuts, and deep excavations for the tunnel operations buildings. Water from dewatering would be discharged to the sewer system or it would be reinjected to mitigate the potential effects of dewatering, including settlement of structures and changes to groundwater flow. No dewatering water would be discharged directly to Elliott Bay. Water that is discharged to the combined sewer could require treatment before discharge to comply with the conditions of the King County Wastewater Discharge Permit or Authorization. Water that does not comply would be disposed of off-site. Off-site disposal may also be necessary if the volume of water exceeds the permitted discharge limits or if King County specifically requests discharges to cease. Dewatering water that is directly reinjected could not degrade groundwater quality. The dewatering systems would be designed to minimize drawdown of the water table. This would reduce the volume of groundwater requiring treatment and disposal. It would also reduce the potential for mobilization and spreading of groundwater contaminants in the project area.

Battery Street Tunnel Decommissioning

The Battery Street Tunnel would be decommissioned as part of the Bored Tunnel Alternative. As part of the decommissioning process, proper management and disposal of debris would be required. Any hazardous materials present in the tunnel would need to be removed before decommissioning.

One possible decommissioning option includes partially filling the tunnel with the concrete debris recycled from the viaduct demolition. The remainder of the empty space in the tunnel would then be filled with controlled-density fill. The demolition debris would be appropriately managed and handled to address the specific environmental hazards associated with concrete rubble, including an elevated pH. In addition, necessary regulatory permits and approvals would be procured if they are determined to be necessary to perform this type of construction activity.

Cut-and-Cover Tunnel Alternative

The quantity of excavated material is estimated to be 2,007,000 cubic yards, as shown in Exhibit 6-17. For the south and north areas, the material excavated or generated would come from the retained cut section as the roadway transitions from the surface to below grade, cut-and-cover sections, soil improvements, and the tunnel

Appendix Q, Hazardous Materials Discipline Report

Methods used for assessing existing conditions, environmental effects, and mitigation are described in *Appendix Q*, Chapter 2. The discipline report includes additional information on the subsurface explorations conducted in the project area in Chapter 3.

Appendix Q, Chapter 4 contains exhibits for each of the alternatives displaying sites with documented and potential contaminant releases.

operations building. The materials excavated or generated along the central waterfront include viaduct demolition, and in the north waterfront include jet grouting for the seawall. Because the outer wall of the cut-and-cover tunnel would replace the seawall, only the south area and area north of Union Street to Broad Street would require soil improvement. Improvements in the Battery Street Tunnel include lowering the floor, extending the tunnel walls below their current base, and constructing emergency egress facilities.

Exhibit 6-17
Excavated Material for the Cut-&-Cover Tunnel Alternative
in cubic yards

	Excavated Material	Amount Potentially Contaminated
South Area	197,000	151,000
Central Area[1]	1,235,000	863,000
Battery Street Tunnel	80,000	33,000
North Area	272,000	170,000
North Waterfront[2]	223,000	220,000
Total	**2,007,000**	**1,437,000**

1 The Central Area includes the material generated from viaduct demolition.

2 The North Waterfront includes the area on Alaskan Way between Pike Street and Broad Street.

Construction of the cut-and-cover tunnel and seawall along the central waterfront would occur in an area that has already been filled. An elevated railroad trestle and/or elevated wood-plank road were constructed along the former waterfront; consequently, the former ground surface may have been contaminated with low concentrations of petroleum due to small releases from the rail cars and/or vehicles. In addition, creosote-treated timbers may have been used to support the former trestles and piers, and contamination from these timbers likely leached into the adjacent soil.

The way contaminated materials are stored and removed and the volumes waste handlers can accept are the same as described for the Bored Tunnel Alternative.

Dewatering along the waterfront tunnel would be accomplished using a series of dewatering wells installed both within the area to be excavated and below the bottom elevation of the excavation. The presence of hydrogen sulfide is documented at the intersection of University Street and Alaskan Way. Groundwater removed from this area may contain high levels of hydrogen sulfide that would necessitate treatment before discharge.

Elevated Structure Alternative
The quantity of excavated material is estimated to be 806,000 cubic yards, as shown in Exhibit 6-18. The Elevated Structure Alternative would generate the same 107,000 cubic yards of material for viaduct demolition as the other build alternatives. In the south end, some of the materials excavated or generated would be from soil improvements. Soil improvement for the Elevated Structure Alternative would occur along the southern and central portions of the alignment near the waterfront and continue north to Broad Street as part of the seawall replacement. Improvements to the Battery Street Tunnel include excavation to extend the tunnel walls below their current base and to build egress facilities. In north areas, the material to be excavated or generated would be the same as for the Cut-and-Cover Tunnel Alternative.

Exhibit 6-18
Excavated Material for the Elevated Structure Alternative
in cubic yards

	Excavated Material	Amount Potentially Contaminated
South Area	84,000	66,000
Central Area[1]	95,000	77,000
Battery Street Tunnel	34,000	27,000
North Area	272,000	170,000
North Waterfront[2]	321,000	320,000
Total	**806,000**	**660,000**

1 The Central Area includes the material generated from viaduct demolition.

2 The North Waterfront includes the area on Alaskan Way between Pike Street and Broad Street.

13 Would settlement during construction affect surrounding areas?

Settlement could occur for all alternatives during construction. Activities such as pile driving, sheet pile installation, or stone column installation could cause vibration resulting in soil or utilities settling. Relocating utilities would require trenching and dewatering. Improper trenching and dewatering techniques could lead to settlement and lateral movement of adjacent facilities.

Settlement would be a greater concern for the tunnel alternatives. The Cut-and-Cover Tunnel Alternative could cause lateral movement of settlement where cuts and excavation occur. The Bored Tunnel Alternative could cause ground loss and settlement above the TBM if adequate measures have not been taken in advance to control groundwater and soil inflow.

Any settlement from construction of the build alternatives is expected to be minor. Some uneven settlement may cause minor cracks in the pavement and sidewalks adjacent to the construction area. Pavement damage would be repaired by temporary overlay of asphalt pavement for use by traffic until the final pavement surface can be placed. Damage to items on the surface streets, such as trees, manholes, drains, and signals are expected to be minor and would be repaired. The streets and sidewalks would be permanently repaired where needed once construction is completed and no further settlement is occurring.

Bored Tunnel Alternative
Settlement from tunnel boring could affect nearby surface streets, various utilities (including traffic signals), and buildings over the proposed bored tunnel alignment. Effects would vary depending on soil conditions, tunnel depth, and other variables. Settlement at the surface is anticipated to be less than an inch over the tunnel for most of the alignment. The area where settlement is of the most concern is located between the south portal and Yesler Way where the TBM would begin boring in relatively shallow fill material. The excavation at the face of the TBM would be performed with positive pressure acting at the face to prevent soil from moving. From about S. Main Street to about S. Washington Street, drilled shafts would be installed only along the east side of the tunnel to mitigate potential viaduct settlement.

Any surface settlement would generally occur incrementally as the TBM advances, with some final settlement occurring over several weeks.

Potentially affected historic buildings would be monitored for settlement effects as listed in the Memorandum of Agreement, which is included as Attachment C of Appendix I, Historic, Cultural, and Archaeological

Settlement Effects to Historic Buildings

Settlement effects to historic buildings are discussed in **Question 20** of this chapter.

Discipline Report. Where needed, protective measures such as compensation grouting or compaction grouting would be used during tunnel boring to prevent or limit damage to buildings and utilities from settlement. Experience in Europe indicates that these measures control settlement to within 22 millimeters (less than 1 inch).[1] The use of these measures is expected to prevent damage to most buildings.

Cut-and-Cover Tunnel Alternative

The Cut-and-Cover Tunnel Alternative would construct retained cut sections at the tunnel portals on the waterfront and at the south end of the Battery Street Tunnel, as well as the cut-and-cover section along the waterfront. A large amount of material would be excavated from these areas. Where the cuts are near existing roadways, railways, structures, or utilities, lateral movement or settlement of these structures or utilities could occur if the retaining wall is not constructed properly. Excavation in the Battery Street Tunnel would require adequate shoring to avoid lateral ground movement. Jet grouting would be performed below and behind the existing seawall to rebuild the seawall and mitigate liquefaction between Union and Broad Streets. If not controlled properly, lateral movement and settlement could occur.

Elevated Structure Alternative

For the Elevated Structure, settlement could occur during soil improvements, retrofit of the section between Virginia Street and the Battery Street Tunnel, and excavation in the Battery Street Tunnel.

Soil improvement may be performed beneath or around foundations to stabilize soft soils and mitigate potential liquefaction. Jet grouting would be performed below and behind the existing seawall to rebuild the seawall and mitigate liquefaction. If not controlled properly, lateral movement and settlement could occur.

Depending on the retrofit method used between Virginia Street and the Battery Street Tunnel, installation adjacent to or underneath the existing viaduct footings could cause loosening of the soil, which could contribute to settlement and lateral movement of the existing footings. Excavation in the Battery Street Tunnel would require adequate shoring to avoid lateral ground movement.

14 How would construction affect noise levels?

Noise during construction would be disruptive to nearby residents and businesses, because it would make it unpleasant to be outside and hard to hold conversations. Construction could occur up to 24 hours a day, 7 days a week depending on the construction activity and will be determined during final design. A Noise Management and Mitigation Plan that establishes specific noise levels that must not be exceeded for various activities is described in Chapter 8, Mitigation. WSDOT will implement measures to minimize nighttime and weekend construction noise if it exceeds the local ordinance noise levels (except in the case of emergency) during the hours between 10:00 p.m. and 7:00 a.m. on weekdays, or between 10:00 p.m. and 9:00 a.m. on weekends and legal holidays.

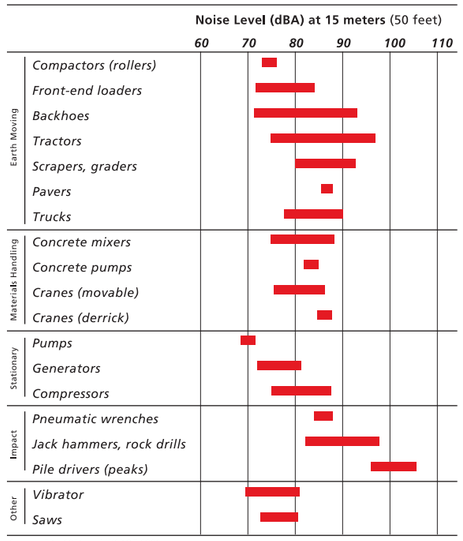
The Bored Tunnel Alternative would have fewer noise effects than the Cut-and-Cover Tunnel or Elevated Structure Alternatives because more of the major construction activities would occur underground and the duration of construction is shorter.

Construction noise levels for all of the alternatives may exceed City noise level limits at 50 feet or the nearest property line (whichever is farther) and require a variance from the City. Nighttime noise level limits would be the same or less than the daytime noise level limits. A construction noise control program, described in Chapter 8, Question 11, would be implemented to reduce construction noise effects.

Noise levels would depend on the type, intensity, and location of construction activities. For all alternatives, the most common noise sources during all stages of construction would be machine engines such as bulldozers, cranes, generators, and other earth- and material-moving equipment. Temporary large-scale stationary equipment or structures could be located at the WOSCA staging area.

Typical noise levels from construction equipment for all build alternatives would range from 69 to 106 A weighted decibels (dBA) at 50 feet as shown in Exhibit 6-19. By comparison, the project area is currently noisy, with peak hour average daytime sound levels that range from 61 to 80 dBA.

Exhibit 6-19
Typical Construction Equipment Noise Levels



Source: EPA 1971 and WSDOT 1991

Because various pieces of equipment would be turned off, idling, or operating at less than full power at any given time and because construction machinery is typically used to complete a short-term task at any given location, average daytime noise levels would be less than the maximum noise levels shown in Exhibit 6-19. The majority of construction activities would fall within the range of about 75 to 95 dBA at 50 feet. Noise at the upper end of this range would be annoying and could interfere with nearby residents and businesses. Some construction activities like impact pile driving could reach levels just over 100 dBA at 50 feet. Pile driving is not currently proposed and would be used only in instances where less disruptive techniques are not available. The only locations where pile driving may be used are for the cut-and-cover sections near the portals for the Bored Tunnel and Cut-

Appendix F, Noise Discipline Report

Additional information about the effects of noise and vibration during construction is provided in *Appendix F*, Chapter 6.

What is dBA?

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

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

1 Littlejohn 2009.

and-Cover Tunnel Alternatives. In contrast, the operation of stationary equipment (such as pumps, generators, and compressors) would have sound levels that are fairly constant over time.

Bored Tunnel Alternative
Construction noise would mostly affect areas adjacent to the south and north portals during the 5.4-year (65-month) construction period. The most common source of construction noise would be machine engines, such as bulldozers. In both the north and south portal areas, there would be noise from constructing retaining walls, cut-and-cover sections, and new surface streets. Construction noise levels would change and occur at different times over the 5.4-year construction period throughout the project area.

Noise from tunnel boring operations would occur at the staging areas where the muck generated by boring would be treated, stored, and removed. Noise at the staging areas could also potentially include effects from a temporary concrete batch plant and hopper cars or conveyers to move spoils and muck. The noise may be disruptive to nearby residents and businesses ranging from 69 to 106 dBA at 50 feet, as shown previously in Exhibit 6-19. The TBM would also produce some ground-borne noise, but due to the depth of the machine and the ambient noise levels in the area, the noise would not be noticeable at building level except near the tunnel portals.

Removing the viaduct between S. King Street and the Battery Street Tunnel would take about 9 months and would be the loudest construction activity. Demolition would occur in two-block segments at two locations at a time and is expected to last no more than 4 weeks per segment. The noise would be disruptive to nearby residents and businesses.

Noise associated with construction activities to fill and decommission the Battery Street Tunnel could also be disruptive to nearby residents and businesses. This activity would occur during the same 9-month time period as the viaduct removal.

Cut-and-Cover Tunnel Alternative
Construction noise levels in the south and north areas, and for viaduct demolition, would be similar to the Bored Tunnel Alternative, but the Cut-and-Cover Tunnel Alternative's construction duration would last for 8.75 years.

Along the central waterfront, construction noise effects with the Cut-and-Cover Tunnel Alternative would be more severe than for the Bored Tunnel Alternative. This is because construction activities for the cut-and-cover tunnel and seawall would occur at or near the surface along Alaskan Way. As a result, construction equipment noise for nearby residents and businesses would be higher and more prolonged.

Improvements to the Battery Street Tunnel, including constructing new emergency egress structures near Second, Third, Fourth, and Sixth Avenues would cause construction noise levels that may exceed City noise level limits and disturb the people nearby.

Elevated Structure Alternative
Although the construction activities would differ, the construction noise levels in the south and north areas for the Elevated Structure Alternative would be similar to both the Bored Tunnel and Cut-and-Cover Tunnel Alternatives. However, construction of the Elevated Structure Alternative would last the longest, approximately 10 years. Noise associated with the majority of construction activities for the Elevated Structure Alternative would be disruptive to nearby residents and businesses for a longer period of time than the other build alternatives.

Along the central waterfront, construction of the Elevated Structure Alternative would take place mostly at the surface or above ground. Because of this, the noise effects would be more severe.

Noise levels during viaduct demolition would be similar to the other alternatives, although the Elevated Structure Alternative would demolish the upper and lower levels of the viaduct at different times rather than at once.

Construction of the Battery Street Tunnel improvements would have similar effects on noise levels as the Cut-and-Cover Tunnel Alternative.

15 Would vibration during construction affect surrounding areas?

Construction activities that would cause the highest levels of vibration are viaduct demolition and the use of impact equipment, such as jackhammers and pile drivers. Buildings along the alignment for each alternative would be evaluated on a case-by-case basis during final project design to determine what specific mitigation measures are needed to minimize vibration and potential damage to older, fragile buildings.

Viaduct demolition and removal in locations adjacent to existing buildings would use concrete munchers to control the size and dispersion of concrete debris. In other areas, the viaduct could be demolished using various methods of concrete removal. The use of jackhammers and hoe rams would cause the highest levels of vibration during demolition.

Vibration from other construction activities can be reduced by either restricting their operation to predetermined distances from historic structures or other sensitive receivers (such as sensitive utilities), or using alternative equipment or construction methods. Vibration monitoring will be required at the nearest historic structure or sensitive receiver within 300 feet of construction activities. The monitoring data will be compared to the project's vibration criteria to ensure that ground vibration levels do not exceed the damage risk criteria for historic and non-historic buildings and sensitive utilities. The total number of buildings requiring monitoring will be determined during final design.

The only proposed construction activity that would generate vibration levels that could damage utilities is impact pile driving. Pile driving would be performed only when other methods will not work. Utilities less than 25 feet and older cast-iron water mains less than 100 feet from impact pile driving locations would be evaluated

Vibration Effects to Historic Buildings

Vibration effects to historic buildings are discussed in **Question 19** of this chapter.

during final design to determine whether mitigation is needed.

For the Bored Tunnel Alternative, the TBM would also produce some ground vibration. Between S. Royal Brougham Way and S. Main Street, a perimeter of secant piles would be constructed to isolate the TBM as it begins boring. Once the TBM is north of S. Main Street, the vibration levels would not be noticeable at building level and would not pose a damage risk to buildings due to the depth of the machine and the noise levels along the surface streets. The risk of construction vibration damaging underground and buried utilities would generally be less than the risk of damaging buildings.

16 How would views be affected during construction?
The temporary affects to views during construction would be similar in many ways for the build alternative but would occur for different lengths of time. Views would be affected for about 5.4 years with Bored Tunnel Alternative, 8.75 years with Cut-and-Cover Tunnel Alternative, and 10 years with Elevated Structure Alternative.

Views for drivers and pedestrians during construction would include elements common to construction activities, including staging areas, heavy equipment, scaffolding, cranes, trucks, temporary materials storage and temporary noise barriers. The south area is expected to have extensive staging on the WOSCA property for equipment and materials for all of the alternatives. For all alternatives, the WOSCA site would also be used for a traffic detour and construction offices and possibly a concrete batch plant. These elements would be visible from nearby streets that do not have temporary noise barriers. Temporary noise barriers are planned on the eastern side of the WOSCA property extending from S. Royal Brougham Way to Railroad Way S. and on the south side of S. King Street. The barriers would be 16 feet high and would block views from adjacent streets.

For all of the build alternatives, views will change as construction progresses. Some heavy equipment and elements such as scaffolding would be needed only during a portion of the construction period. Many pieces of equipment would also move as the construction stages and activities progress.

During viaduct demolition, construction equipment and materials would be prominent in street views and could look similar to the photograph shown in Exhibit 6-20. Normal streetscapes would be disrupted with fencing, cranes and other equipment, vehicles, and general construction activity. Views under the viaduct would be interrupted by fencing, construction equipment, and materials.

Bored Tunnel Alternative
Construction of the bored tunnel section would not have visual effects because the tunneling activities would occur below grade or at the portals. At both the WOSCA property in the south end and the north end construction staging areas, views would include construction pits and equipment needed to launch and extract the TBM. For the Bored Tunnel Alternative, views of the WOSCA staging area could also include activities related to assembling and launching the TBM and interior tunnel structures, materials stockpiles and materials transfer to trucks or barges, and a temporary electrical substation to support the TBM. At the north portal, a temporary noise barrier 16 feet high on the north side of Thomas Street and Sixth Avenue N. would block views into the construction site.

Cut-and-Cover Tunnel Alternative
The construction of the Cut-and-Cover Tunnel Alternative would involve a large open cut along the central waterfront that would be open in stages. Temporary east-west pedestrian bridges would maintain access to waterfront piers during construction. Views from the piers on the west side of the corridor would include a variety of equipment, vehicles, and construction activity.

Elevated Structure Alternative
Construction of the Elevated Structure Alternative would be built in sections with traffic maintained on portions of the old and new structures. Normal streetscapes near the viaduct would be disrupted with fencing, cranes and other equipment, construction vehicles, and general construction activity. Seawall construction would also add construction equipment along Alaskan Way.

The Broad Street detour would construct a temporary aerial structure in the Broad Street right-of-way starting at Western Avenue that would continue to the west over Elliott Avenue, the BNSF Railway tracks, and Alaskan Way S. This structure would have temporary visual impacts on the Olympic Sculpture Park and other adjacent properties, as shown in Exhibit 6-4. This aerial structure would be approximately 30 to 35 feet high. Views to the south of the waterfront and Mount Rainier may be somewhat obscured for pedestrians and others using the Olympic Sculpture Park.

17 Would temporary construction easements or relocations be needed during construction?
To facilitate the construction, each of the alternatives would need temporary tieback and construction easements. Temporary tieback easements would be needed for shoring that would be used to construct the permanent walls below the surface.

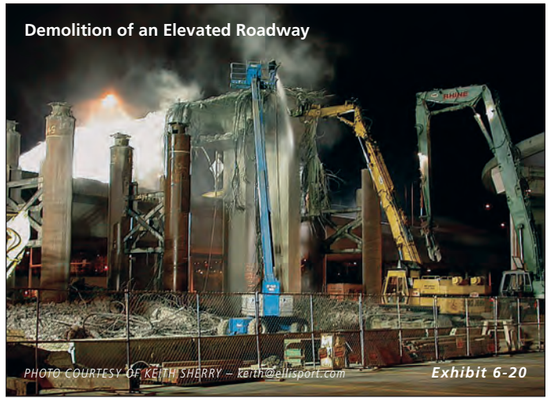
Construction easements allow the temporary use of a property to facilitate construction and may include the purchase of existing improvements. Temporary construction easements may also be used for implementing the settlement mitigation measures in or under the buildings (e.g., building modifications and grouting).

If any occupants are displaced, they would be compensated and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and the Washington Relocation Assistance – Real Property Acquisition Policy Act of 1970, as amended.

Bored Tunnel Alternative
Temporary tieback easements would be needed on the Port of Seattle's Terminal 46 property in the south portal

Appendix D, Visual Quality Discipline Report

Additional information about construction effects on visual quality is provided in Chapter 6 of *Appendix D*.



Demolition during the first phase of SR 519 project. Photo courtesy of WSDOT.

What is a tieback easement?

A temporary tieback easement allows for temporary 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. The tiebacks in the temporary easement areas would be removed or the tension released after construction is completed.

Appendix G, Land Use Discipline Report

All of the properties where temporary tieback easements or construction easements would be needed are indicated in *Appendix G*, Chapter 6. *Appendix G* also provides additional information about construction effects on land uses.

area and three properties in the north portal area along Sixth Avenue N. near Thomas Street.

Temporary construction easements would be needed on 31 properties for the Bored Tunnel Alternative. Twenty-one of these properties are in the approximate area between Western Avenue and First Avenue, and Yesler Way and Union Street. The other 10 properties are in the north portal area. Six affected properties are parking lots that are privately owned pay parking lots between Yesler Way and Marion Street, with one other parking lot between Spring Street and Seneca Street. Some or all of the parking would be removed during the 9 month viaduct demolition period. As a result, businesses and residents that rely on these parking areas may be temporarily inconvenienced. This could result in drivers looking for parking spaces several blocks farther from their destinations, or using pay lots.

In addition, in the central section, about 84 tenants of the Western Building would be relocated. The building would be unavailable for 12 to 20 months during the construction period. Most of the tenants of this building are artists that use the building for studio or workspace. WSDOT is actively working and supporting the efforts of the artists to find replacement accommodations, either nearby in the Pioneer Square neighborhood, if feasible, or other locations in the greater Seattle area where the individual artists may choose to relocate. Relocation assistance would be provided in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, and the Washington Relocation Assistance – Real Property Acquisition Policy Act of 1970, as amended.

Cut-and-Cover Tunnel Alternative
Twenty-seven temporary tieback easements for the Battery Street Tunnel improvements would be needed with the Cut-and-Cover Tunnel Alternative.

Temporary construction easements would be needed on three properties in the north area. Two of the affected properties are currently used for parking and one is a commercial property.

Elevated Structure Alternative
Twenty-four temporary tieback easements for the Battery Street Tunnel improvements would be needed with the Elevated Structure Alternative.

Temporary construction easements would be needed on six properties. Three of these properties (two used for parking and Pier 62/63) are located near the existing viaduct and Pine Street. The other three properties (two used for parking and one commercial property) are located in the north area.

18 How would the local and regional economy be affected during construction?

Construction would inconvenience or disturb businesses and customers of businesses adjacent to the project area. Construction-related effects would vary considerably over time and area. Effects can also vary according to the methods used to stage and construct the alternatives. Mitigation measures would be in place to minimize or avoid economic impacts, as described in Chapter 8, Question 15. These measures would provide local connections and access to buildings and businesses for pedestrians, bicyclists, motorists, and movers of freight.

The inventory of existing businesses identified approximately 1,400 businesses (including multi-family residential buildings) adjacent to or within one block of the existing SR 99 alignment that could experience disruption as a result of the Bored Tunnel or Cut-and-Cover Tunnel Alternatives construction. The Elevated Structure Alternative could affect 1,540 businesses that are located along the Broad Street detour.

These temporary construction effects to businesses would be similar for each alternative in both the north and south areas. The effects would last for a longer period of time with the Cut-and-Cover Tunnel Alternative (8.75 years) and Elevated Structure Alternative (10 years) compared to the Bored Tunnel Alternative (5.4 years). For example, First Avenue S. would be more congested along the WOSCA construction staging area. Businesses whose primary access points are on the east side of First Avenue S. may choose to access their business from the other side of the building on Occidental Avenue S. during construction.

Throughout the project area, trucks servicing businesses would be subject to the same traffic delays that general-purpose vehicles would experience. On-street parking may not be available near the construction areas, which could prevent the use of curbside lanes for truck parking and loading or unloading. Trucks would have to park nearby on side streets. This may inconvenience or disrupt the flow of materials and supplies to and from adjacent businesses.

Along the central waterfront, about 160 active commercial and industrial buildings that would not be acquired for any of the build alternatives are located within 50 feet of the existing viaduct. Many of these buildings are occupied by multiple businesses. The period of active disruption in front of any one building depends on the build alternative. The Bored Tunnel Alternative would have the shortest and the Elevated Structure would have the longest duration of active disruption along the central waterfront. Disruptions could be caused by utility relocations before viaduct demolition, loss of use of loading areas beneath the viaduct, and loss of private parking areas beneath the viaduct. Some of these businesses may suffer little or no adverse effect, whereas others may experience a noticeable decline in sales, increase in costs, and/or decrease in efficiency.

These construction-related effects could adversely affect the comfort and daily life of residents and inconvenience or disrupt the flow of customers, employees, and materials and supplies to and from these businesses.

Bored Tunnel Alternative
In addition to the effects described above, removing spoils generated during tunnel boring from the south portal area to disposal sites could result in up to several hundred truck trips per day if the material is not removed by barge. These truck trips in and out of the WOSCA staging area

Appendix L, Economics Discipline Report

Appendix L, **Chapter 6** provides additional information about construction effects on the local and regional economy.

could be disruptive to nearby businesses. Businesses adjacent to the project construction would experience increased noise, dust, and vibrations associated with the tunnel excavation and street improvements.

Along the central waterfront, the 9-month period when the viaduct is being demolished would be the most disruptive to the waterfront businesses.

Cut-and-Cover Tunnel Alternative
Existing businesses within one block of the existing SR 99 alignment along the central waterfront would experience more severe construction effects than the Bored Tunnel Alternative, and the effects would take place over a much longer period of time.

Pedestrian and vehicle access to the waterfront businesses would be provided, but the Alaskan Way surface street would be closed to north-south traffic for just over 5 years. In addition, the presence of construction materials, equipment, and activities, would make access to businesses along the waterfront difficult and would inhibit pedestrian use of Alaskan Way. These effects could result in indirect economic effects to businesses by decreasing the number of customers willing to patronize them.

Elevated Structure Alternative
Existing businesses within one block of the existing SR 99 alignment along the central waterfront would experience more severe construction effects than the Bored Tunnel Alternative and these effects would take place over a longer period of time, because it would take longer to build the Elevated Structure Alternative than the other build alternatives.

The decreased capacity on SR 99 and Alaskan Way for a number of years together with the presence of construction materials, equipment, and activities, would make access to businesses difficult. However, Alaskan Way would remain open with one lane in each direction throughout most of the construction period. Effects to waterfront businesses and pedestrians are expected to be greater than the Bored Tunnel Alternative, but would not be as severe as the Cut-and-Cover Tunnel Alternative.

The Elevated Structure Alternative would also construct the Broad Street detour. Construction of the detour would last about 9 months and cause businesses along Broad Street to experience construction noise, dust, and possibly vibrations. Once the detour is in place, the businesses along Broad Street would experience increased traffic as southbound vehicles from SR 99 are routed onto this detour for approximately 4.25 years.

Economic Benefits
Construction expenditures would occur over a number of years, directly resulting in new demand for construction materials and labor. These direct effects would lead to indirect or secondary effects, as the production of output by firms in other industries increases to supply the demand for inputs to the construction industry. Both the direct and indirect effects of construction expenditures typically cause businesses to employ more workers to meet the increased demand. The increase in employment leads to induced effects because the additional wages and salaries paid to workers foster greater consumer spending.

For all of the build alternatives, the average number of jobs directly related to construction would be 450 per year, although up to 480 workers per day could be required during the most intense period of construction. The direct jobs needed to construct the alternatives would generate approximately $60.8 million in direct wages per year.

Bored Tunnel Alternative
The capital costs associated with construction of the Bored Tunnel Alternative would result in additional activity throughout all economic sectors within the Puget Sound region and the State of Washington. With the Bored Tunnel Alternative, new demand for construction would generate an estimated $1,788 million in construction dollars. Approximately $3,688 million in economic activity would be generated for other industries in the Puget Sound region beyond those directly involved in the project. Of this amount, $1,089 million would be paid to the 6,598 workers as wage and salary earnings for the jobs generated. The amount of new indirect and induced earnings (wages) as a result of money entering the Puget Sound economy would be $79 million.

Approximately 7 percent of the total capital cost for the Bored Tunnel Alternative would come from federal funds, which represents new money coming from outside the Puget Sound region to support the local economy.

Cut-and-Cover Tunnel Alternative
With the Cut-and-Cover Tunnel Alternative, new demand for construction would generate an estimated $3,372 million in construction dollars. Approximately $6,955 million in economic activity would be generated for other industries in the Puget Sound region beyond those directly involved in the project. Of this amount, $2,055 million would be paid to the 10,557 workers as wage and salary earnings for the jobs generated. The amount of new indirect and induced earnings (wages) as a result of money entering the Puget Sound economy would be $82 million.

Approximately 4 percent of the total capital cost for the Cut-and-Cover Tunnel Alternative would come from federal funds, which represents new money coming from outside the Puget Sound region to support the local economy.

Elevated Structure Alternative
With the Elevated Structure Alternative, new demand for construction would generate an estimated $1,831 million in construction dollars. Approximately $3,777 million in economic activity would be generated for other industries in the Puget Sound region beyond those directly involved in the replacement of the viaduct. Of this amount, $1,116 million would be paid to the 11,876 workers as wage and salary earnings for the jobs generated. The amount of new indirect and induced earnings (wages) as a result of money entering the Puget Sound economy would be $78 million.

Approximately 7 percent of the total capital cost for the Elevated Structure Alternative would come from federal funds, which represents new money coming from outside the Puget Sound region to support the local economy.

Effects to Parking

The parking spaces that would be removed during construction generally include the spaces that would be permanently affected (as described in Chapter 5), plus those spaces that are needed for construction, staging, or demolition activities. If any ADA parking spaces are affected, they would be accommodated nearby in accordance with City guidelines and federal requirements.

The Bored Tunnel Alternative would affect fewer parking spaces than the Cut-and-Cover Tunnel and Elevated Structure Alternatives, particularly during Stages 1 through 7, as shown in Exhibit 6-21. Stage 8 of the Bored Tunnel Alternative is reported separately, because demolition of the viaduct would cause the number of affected parking spaces to increase, compared to Stages 1 through 7. The location of these parking spaces is shown in Exhibit 6-22.

Exhibit 6-21
Parking Effects during Construction

	PARKING SPACES				
	On-Street			Off-Street	Total
Alternatives	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Bored Tunnel Stages 1-7	350 to 470	280 to 290	**630 to 760**	50 to 90	**680 to 850**
Bored Tunnel Stage 8	Up to 910	Up to 290	**Up to 1,200**	Up to 310	**Up to 1,510**
Cut-&-Cover Tunnel	1,090	230	**1,320**	480	**1,800**
Elevated Structure	1,090	230	**1,320**	610	**1,930**

Note: The maximum number of spaces in each subarea would not be affected at the same time, so the total is not a sum of all of the high ranges.

All of the build alternatives would affect the same amount of parking spaces in the stadium area south of S. King Street. About 230 on-street and 50 off-street spaces would be removed in this area during construction. Most of the 230 on-street spaces are short-term parking, but about 50 are long-term spaces. The 50 off-street spaces that would be affected are located in a public pay lot south of S. Royal Brougham Way, behind the Pyramid Alehouse.

The 200 off-street parking spaces on the WOSCA property have been removed due to the construction associated with the S. Holgate Street to S. King Street Viaduct Replacement Project. Because this effect was accounted for by the S. Holgate Street to S. King Street Viaduct Replacement Project, they are not included as a construction removal for the build alternatives.

The removal of about 280 parking spaces in the stadium area is not expected to substantially affect parking availability in the area, although some drivers may be slightly inconvenienced. The on-street parking removals along First Avenue S. between S. King Street and Railroad Way S. may affect customer parking for adjacent businesses. However, on-street parking would continue to be available a block to the north and along S. King Street.

Although parking would be reduced compared to existing conditions, ample parking is expected to be available in pay lots near the stadiums. Pay lots in the stadium area are abundant and underutilized on non-event days. The off-street parking utilization rate for the stadium area is about 31.1 percent on an average non-event weekday,[2] suggesting that it is relatively easy to find a pay parking space in the stadium area. In addition, most surface streets in the area allow on-street parking, and some of it is long-term, particularly farther south.

During events such as Seahawks, Mariners, and Sounders games, parking is currently highly utilized and private lots charge a premium for event parking. Removing about 50 off street parking spaces is not expected to noticeably affect the overall parking supply. Approximately 6,900 off-street parking spaces are available in the major parking facilities near the stadiums.

In all areas, parking removals during construction would make it more difficult to find parking in the project area. This could result in drivers looking for parking spaces several blocks farther from their destinations, or using pay lots instead of on street parking.

Parking effects during construction for the areas north of S. King Street are discussed by alternative below.

Bored Tunnel Alternative

During Stages 1 through 7, a total of 680 to 850 spaces would be affected in the project area by the Bored Tunnel Alternative, as shown in Exhibit 6-23. During Stage 8 (the last year of construction, shown in Exhibit 6-24), demolition of the viaduct would cause the number of affected parking spaces to increase, compared to Stages 1 through 7. The 680 to 850 on-street spaces would result in the annual loss of approximately $1.5 million to $1.80 million in parking revenue for the City of Seattle. The loss of 350 to 560 short-term spaces represents about 7.5 percent of the short-term parking in the Seattle Central Business District.

In addition to the spaces identified in Exhibits 6-23 and 6-24, there may be short-term (such as during peak periods of traffic) parking restrictions on some streets near the WOSCA and north end construction staging areas to help accommodate transit or general-purpose traffic during construction. Relatively short-term parking restrictions would likely be needed on Battery Street and on cross-streets above the Battery Street Tunnel during decommissioning. Restrictions would be determined by the contractor when the plans for the decommissioning are finalized. Utility relocations also could affect some parking spaces in the project area for a few days.

Exhibit 6-23
Bored Tunnel Alternative Parking Effects during Construction Stages 1 Through 7

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	70 to 150	10	**80 to 160**	0 to 40	**80 to 200**
Central	0 to 90	0	**0 to 90**	0	**0 to 90**
Belltown	0	0	**0**	0	**0**
North	90 to 140	230 to 240	**320 to 370**	0	**320 to 370**
Total	**350 to 470**	**280 to 290**	**630 to 760**	**50 to 90**	**680 to 850**

Note: The maximum number of spaces in each subarea would not be affected at the same time, so the total is not a sum of all of the high ranges.

Appendix C, Transportation Discipline Report

Construction effects to parking are discussed in *Appendix C*, Section 6.9.

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.

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.

2 PSRC 2007.

Parking Affected During Construction

BORED TUNNEL ALTERNATIVE
Stages 1-7

BORED TUNNEL ALTERNATIVE
Stage 8

CUT-&-COVER TUNNEL AND ELEVATED STRUCTURE ALTERNATIVES

Stage 5
Off-Street Parking Removed

Stages 4-5
On-Street Parking Removed

Stages 1-3
On-Street Parking Removed

Stage 7
On-Street Parking Removed

Stage 1-3
On-Street Parking Removed

Elevated Structure Alternative Only

On-Street Parking Removed
Off-Street Parking Removed

0 1,000 2,000
SCALE IN FEET

Elliott Bay
Lake Union
TERMINAL 46
PIER 48
COLMAN DOCK
SAFECO
SEATTLE CENTER
ALASKAN WAY
PIKE STREET
PIKE
BATTERY STREET
BROAD STREET
FIFTH AVENUE N
TAYLOR AVENUE N
SIXTH AVENUE N
DEXTER AVENUE N
AURORA AVENUE/SR 99
DENNY WAY
JOHN STREET
THOMAS STREET
HARRISON STREET
REPUBLICAN STREET
MERCER STREET
ELLIOTT AVENUE
WESTERN AVENUE
FIRST AVENUE
SECOND AVENUE
THIRD AVENUE
FOURTH AVENUE
FIFTH AVENUE
SIXTH AVENUE
SENECA STREET
MADISON STREET
COLUMBIA STREET
STEWART STREET

Exhibit 6-22

Exhibit 6-24
Bored Tunnel Alternative Parking Effects during Construction Stage 8

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	170	10	**180**	0	**180**
Central	390	0	**390**	40	**430**
Belltown	80	0	**80**	220	**300**
North	90	230	**320**	0	**320**
Total	**Up to 920**	**Up to 290**	**Up to 1,210**	**Up to 310**	**Up to 1,510**

Note: The totals presented in Exhibit 6-24 represent all spaces affected during Stage 8 and are not in addition to the totals in Exhibit 6-23.

In the Pioneer Square area, the on-street spaces removed are under the viaduct and along Alaskan Way S., south of Yesler Way. During Stage 5, about 40 off-street parking spaces adjacent to the Western Building would be unavailable for 12 to 20 months while the building is being reinforced. In Stage 8, about 180 on-street spaces would be inaccessible due to construction and viaduct demolition. Directly after viaduct demolition and removal, the City of Seattle expects to begin work on the waterfront promenade and the new Alaskan Way surface street. Construction of these projects will likely affect parking availability until they are completed in 2018.

The parking on Alaskan Way between S. King Street and Pine Street is also expected to be affected at some point during viaduct demolition, but all of these spaces would not be removed at the same time. It is expected that two demolition crews would each work on two blocks at a time, so four blocks of parking would be affected for approximately 4 weeks at a time during demolition in Stage 8.

In the central area, there would be up to 90 short-term spaces in the central subarea affected during the majority of the construction period. These spaces are under the viaduct and along Alaskan Way S. south of Yesler Way. In Stage 8, approximately 390 on-street parking spaces under the viaduct and ramps and along Alaskan Way would be affected during viaduct demolition. In addition, approximately 40 off-street spaces just east of the viaduct would be affected for about a month during demolition.

In the Belltown area, no substantial parking effects are expected until Stage 8. Up to 220 off-street spaces in the Belltown subarea would be affected when the viaduct is demolished and the Battery Street Tunnel is decommissioned. These spaces are parking lots under the viaduct near Elliott and Western Avenues or adjacent to the Battery Street Tunnel. Additionally about 80 on-street spaces would be affected, of which about 70 spaces would be temporarily restricted for only about 3 months during Battery Street Tunnel decommissioning.

In the north area, about 320 to 370 on-street spaces would be removed during construction. The removals would be needed to accommodate new travel lanes, construction traffic, utility relocations, and other construction activities. No public pay lots would be affected in this area. Of the affected on-street parking spaces, the majority are long-term spaces. On-street parking would still be available within several blocks of the removed spaces. There are numerous off-street lots within several blocks of the removed parking spaces. More than 3,100 pay spaces are available between Denny Way and Roy Street, and Fifth Avenue N. and Dexter Avenue N.[3] The 3,100 spaces take into account the spaces removed by the Gates Foundation construction and the new Fifth Avenue Parking Garage. There are no expected direct effects on access to these garages during project construction, although there may be construction activities in the vicinity that affect traffic congestion. It may become slightly more difficult to find parking on event days, and parking in some lots would potentially become more expensive in response to the reduction in the adjacent parking inventory. Puget Sound Regional Council (PSRC) found that the total number of off-street parking stalls in the Uptown area totaled 18,564 in 2006, with an occupancy rate of 47.4 percent.[3]

Cut-and-Cover Tunnel Alternative

The approximately 1,800 on-street and off-street parking spaces expected to be removed or restricted during construction of the Cut-and-Cover Tunnel Alternative are summarized in Exhibit 6-25 and shown in Exhibit 6-22. The loss of 1,320 on street spaces would result in the annual loss of approximately $4.5 million in parking revenue for the City of Seattle. The loss of 1,090 short-term parking spaces during construction represents about 15 percent of the short-term parking in the Seattle Central Business District.

Exhibit 6-25
Cut-&-Cover Tunnel Alternative Parking Effects during Construction

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	170	10	**180**	0	**180**
Central	510	0	**510**	110	**620**
Belltown	150	0	**150**	240	**390**
North	80	170	**250**	80	**330**
Total	**1,090**	**230**	**1,320**	**480**	**1,800**

In the Pioneer Square area, the number of parking spaces affected is the same as the Bored Tunnel Alternative in Stage 8. However, the parking spaces would be removed for a substantially longer time with the Cut-and-Cover Tunnel Alternative.

Along the central waterfront, approximately 510 on-street parking spaces under the viaduct and ramps from Columbia Street to Elliott Avenue and Lenora Street, and along Alaskan Way to Wall Street would be affected during construction. An additional 110 off-street spaces would be removed for at least part of the construction duration. Removing these public parking spaces in the central area for up to 8.75 years is expected to make parking substantially more difficult to find. Several parking garages are located in the Central Business District, which is within walking distance of the central waterfront.

In the Belltown area, 390 spaces would be affected during construction of the Cut-and-Cover Tunnel Alternative. About 70 spaces along and adjacent to Battery Street would be restricted for about 1 year during the Battery Street Tunnel upgrades. The parking removals along Battery Street would continue for about 9 months longer than the duration for the Bored Tunnel Alternative.

In the north area, the Cut-and-Cover would remove fewer on-street spaces during construction compared to the

3 PSRC 2007.

Bored Tunnel Alternative. Of the affected on-street parking spaces, the majority are long-term spaces. On-street parking would still be available within several blocks of the removed spaces. The Cut-and-Cover Tunnel Alternative would also remove an off-street parking lot near Denny Way and Aurora. There are numerous off-street lots within several blocks of the removed parking spaces.

Elevated Structure Alternative

The approximately 1,930 on-street and off-street parking spaces expected to be removed or restricted during construction of the Elevated Structure Alternative are summarized in Exhibit 6-26 and shown in Exhibit 6-22. The loss of 1,320 on-street spaces would result in the annual loss of approximately $4.5 million in parking revenue for the City of Seattle. The loss of 1,090 short-term parking spaces during construction represents about 15 percent of the short-term parking in the Seattle Central Business District. The Elevated Structure Alternative construction period is the longest (10 years), which would extend the period during which parking may be difficult to find.

Exhibit 6-26
Elevated Structure Alternative Parking Effects during Construction

	PARKING SPACES				
	On-Street			Off-Street	Total
Area	SHORT-TERM	LONG-TERM	SUB-TOTAL		
Stadium	180	50	**230**	50	**280**
Pioneer Square	170	10	**180**	130	**310**
Central	510	0	**510**	110	**620**
Belltown	150	0	**150**	240	**390**
North	80	170	**250**	80	**330**
Total	**1,090**	**230**	**1,320**	**610**	**1,930**

In the Pioneer Square subarea, the Elevated Structure Alternative would also remove 180 on-street spaces during construction. However, the parking spaces would be removed for a substantially longer time with the Elevated Structure Alternative compared the Bored Tunnel Alternative Stage 8, and slightly longer than the Cut-and-Cover Tunnel Alternative. The Elevated Structure Alternative also would remove a parking garage containing about 130 parking spaces, contributing to a further negative effect on the parking supply in Pioneer Square.

Along the central waterfront, Belltown, and north areas, the Elevated Structure Alternative would affect the same number of parking spaces as the Cut-and-Cover Tunnel Alternative. However, the Elevated Structure Alternative has a longer construction period that is expected to make parking substantially more difficult to find along the waterfront for up to 10 years. There are numerous off-street lots within several blocks of the removed parking spaces.

Construction Worker Parking

For all of the build alternatives, WSDOT would have the contractor identify appropriate parking options for construction workers, as necessary, and would discourage their use of short-term visitor/customer parking in the project vicinity. There would be up to 480 construction workers per day for all of the alternatives during the most intense periods of construction. For the preferred Bored Tunnel Alternative, construction worker parking is expected to be accommodated at Terminal 106 and Pier 48, with contractor shuttles transporting construction workers to job sites. It is likely that these areas would also be used for construction worker parking if the Cut-and-Cover Tunnel or Elevated Structure Alternative is selected.

19 How would historic properties be affected during construction?

For all of the build alternatives, vibration associated with demolition and removal of the existing viaduct is not expected to be substantial, and it would not result in an adverse effect on the adjacent historic properties. The viaduct structure is expected to be taken apart piece by piece. Businesses and residents between S. Jackson and Columbia Streets and near the ramps on Columbia and Seneca Streets would experience noise, reduced access and parking, and traffic congestion during this construction period. The economic effect of viaduct demolition would not be long enough to threaten the maintenance and preservation of the historic buildings or historic neighborhoods. Through the consultation process required by Section 106 of the National Historic Preservation Act (see Appendix I, Historic, Cultural, and Archaeological Resources Discipline Report, for more information) WSDOT, on behalf of FHWA, determined the adverse effects from the Bored Tunnel Alternative. WSDOT, on behalf of FHWA, also determined adverse effects to historic properties for the Cut-and-Cover Tunnel and Elevated Structure Alternatives, listed below in Exhibit 6-27. Adverse affects for the Bored Tunnel Alternative have been resolved by a Memorandum of Agreement developed in consultation with the State Historic Preservation Officer (SHPO), tribes, and the consulting parties. Mitigation measures for historic resources are discussed in Chapter 8, Question 17.

Exhibit 6-27
Construction Effects to Historic Properties

		ALTERNATIVE		
Property	**National Register Status**	**Bored Tunnel**	**Cut-&-Cover Tunnel**	**Elevated Structure**
Pioneer Square Historic District	NRHP historic district	Settlement damage to two buildings – *Adverse effect* Increased traffic congeston	Increased traffic and potential damage to areaways	Increased traffic and potential damage to areaways
Western Building *619 Western Avenue*	Contributing property in PSHD	Damage due to settlement – *Adverse effect on PSHD*	Temporary utility easement	Temporary utility easement
Polson Building *83 Columbia Street*	Contributing property in PSHD	Damage due to settlement – *Adverse effect on PSHD*	Temporary utility easement	Temporary utility easement
Pike Place Market Historic District	NRHP historic district	*No construction effect*	Long-term reduction in parking and waterfront connections – *Adverse effect*	Long-term reduction in parking and waterfront connections – *Adverse effect*
Piers 54, 55, 56, and 57	NRHP eligible	*No construction effect*	Long-term severe traffic disruption, reduced access, and reduced parking – *Adverse effect* Temporary pedestrian bridges	Long-term severe traffic disruption, reduced access, and reduced parking – *Adverse effect* Temporary pedestrian bridges
Buckley's – *MGM-Loew's 2331 Second Avenue*	NRHP eligible	*No construction effect*	6-month vacation for underpinning – *Adverse effect*	Temporary tieback easement
Old Spaghetti Factory *2800 Elliott Avenue*	NRHP eligible	*No construction effect*	*No construction effect*	Economic, visual, and vibration effects due to Broad Street detour structure – *Adverse effect*
Dearborn South Tideland Site *45KI924*	NRHP eligible	South portal excavation and utilites work – *Adverse effect*	South portal excavation and utilites work – *Adverse effect*	Pilings supports and utilites work – *Adverse effect*

NRHP: *National Register of Historic Places*

Bored Tunnel Alternative

Effects Due to Settlement

The primary construction effects on historic resources would occur from settlement due to soil subsidence as the TBM moves beneath buildings in the northwest corner of the Pioneer Square Historic District.

Vulnerable buildings along the bored tunnel alignment may be damaged by settlement as the TBM bores beneath or close to them. The Bored Tunnel Alternative is being designed to avoid or minimize settlement near historic resources. Where needed, improvements such as compensation grouting or compaction grouting would be

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

Additional information about construction effects on historic, cultural, and archaeological resources is provided in ***Appendix I***, Chapter 6.

Historic and Archaeological Memorandum of Agreement

For more information about effects to historic and archaeological resources, see the Memorandum of Agreement in Attachment C of *Appendix I, Historic, Cultural and Archaeological Resources Discipline Report*.

used to prevent damage to vulnerable buildings due to ground settlement. Damage that is unavoidable would be repaired in accordance with the Secretary of the Interior's Standards for Rehabilitation of Historic Buildings (36 CFR 67.7). An assessment of buildings in the study area was conducted to determine the risk of building damage due to settlement.[4] To avoid and minimize these effects, structural engineers have inspected every building within the anticipated settlement zone (approximately one block on each side of the proposed alignment).

The anticipated amount of settlement along most of the alignment is small because of the depth of the tunnel boring. However, near the portals where the tunnel is shallower, there is greater potential for settlement. Of particular concern is settlement-related damage to two contributing properties in the Pioneer Square Historic District:

- Western Building (619 Western Avenue)
- Polson Building (61 Columbia Street)

WSDOT, on behalf of FHWA, determined that settlement damage to the Western and Polson Buildings would result in an adverse effect upon the Pioneer Square Historic District. The Section 4(f) use is of the District, but the area of use is confined to the Western Building. WSDOT has identified a high potential for settlement damage to the Western Building, since the TBM would excavate soils directly beneath the building. Engineering evaluations of the building found it to be in very poor structural condition due to prior settlement, deterioration of its wooden pile foundation, the effects of the Nisqually earthquake in 2001, and general deterioration over time. The building today has many large cracks in columns and large visible cracks on external walls, in most other structural and interior walls, and on the ground floor slab.

WSDOT's engineering assessment rates the potential settlement damage to the Western Building as "very severe" if the project does not provide protective measures. Without protective measures, settlement would damage major structural and architectural elements of the building, perhaps enough to make the building collapse. In response, WSDOT has defined a program of protective measures that would protect the building by constructing structural reinforcements and bracing for the interior and exterior of the building. The tenants would be relocated. The building would be unavailable for approximately 12 to 20 months during the construction period.

The Polson Building may also experience settlement, if unmitigated. However, this building is in good structural condition and would be protected by compensation grouting to stabilize the surrounding soil before construction. Along with high levels of monitoring during construction, stabilizing the soil underneath the building would prevent major structural damage, and the remaining structural and aesthetic damage could be repaired. The Polson and Western buildings are assessed in more detail in the Section 4(f) Evaluation.

For all historic structures, in the event that minor damage occurs, such as minor cracks or aesthetic damage that require interior painting or repointing of brick walls, or slightly sticking doors and windows, it would be mitigated as required and in accordance with the Secretary of the Interior's Standards for Rehabilitation of Historic Buildings (36 CFR 67.7). Any such minor damage and repairs would not adversely affect the properties under the NRHP.

No damage to areaways (spaces beneath the sidewalks adjacent to some buildings) is expected. Areaways in Pioneer Square are located one block or more away from the tunnel alignment and are typically in fair condition but are vulnerable because of their age and materials. Other areaways near Pike Place Market are also some distance away and the bored tunnel would be at depth when it reaches the area.

Effects Due to Construction Activities Other Than Settlement
The Alaskan Way Viaduct and the Battery Street Tunnel are collectively a NRHP-eligible structure and would be demolished and decommissioned, respectively, as part of the Bored Tunnel Alternative. The viaduct structure is expected to be taken apart piece by piece. With this approach, vibration associated with demolition and removal is not expected to be substantial, and it would not result in an adverse effect on the adjacent historic properties.

Cut-and-Cover Tunnel Alternative
Construction of the Cut-and-Cover Tunnel Alternative would cause access and traffic disruptions for many years, especially along the central waterfront, affecting nearby historic resources. Alaskan Way along the central waterfront would be limited to local traffic only for a period of just over 5 years, and it would be periodically reduced to one lane for an additional 3.75 years, limiting vehicle access. The impacts to specific historic resources would vary over that time, depending on the work being done and its location. However, construction and traffic disruption would continue throughout the entire period. Potential effects of cut-and-cover tunnel construction include exposure of building occupants and customers to high levels of noise and dust, prolonged limited access, reduced parking, and possible utility disruptions. WSDOT, on behalf of FHWA, determined that the Cut-and-Cover Tunnel Alternative would have adverse effects to the Pike Place Market Historic District and NRHP-eligible Piers 54, 55, 56, and 57 during construction because of the long-term traffic and parking effects.

The Washington Street Boat Landing pergola would also be adversely affected during construction. The pergola and historical markers on the waterfront guardrail would be removed during construction and replaced appropriately upon project completion. Along the central waterfront, temporary pedestrian bridges would be constructed between Piers 54 and 55 and Piers 56 and 57 to help maintain access for customers.

The Buckley's (MGM-Loew's) building at Second Avenue and Battery Street would be adversely affected because it would have to be vacated for safety reasons for approximately 6 months to complete the underpinning work inside the building for construction of the Battery Street Tunnel.

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

Section 4(f) refers to a federal law that protects public park and recreation lands, wildlife and waterfowl refuges, and historic and archaeological sites. The project is adjacent to some of Seattle's best-known historic buildings and neighborhoods. Historic and cultural resources that would be subject to use under Section 4(f) are discussed in the Section 4(f) Evaluation:

- Alaskan Way Viaduct and Battery Street Tunnel
- Western Building – located within the NRHP-listed Pioneer Square Historic District
- Lake Union Sewer Tunnel – manhole shaft
- Seattle Maintenance Yard – Archaeological Site 45KI958

The **Section 4(f) Evaluation** can be found at the end of this ***Final EIS*** on page 239. The **Section 4(f) Supplemental Materials** are provided in ***Appendix J***.

Construction Effects to Utilities

Question 25 of this Chapter discusses the construction effects on utilities.

4 Coughlin Porter Lundeen et al. 2010.

Temporary easements for utility relocation may be required for five historic buildings: Western Building (619 Western Avenue), Maritime Building (911 Western Avenue), Polson Building (61 Columbia Street), Olympic Warehouse (1203-1207 Western Avenue) and the Pacific Net and Twine Building (51 University Street). The easement would not affect the structures.

The Alaskan Way Viaduct and Battery Street Tunnel are collectively a NRHP-eligible structure and would be demolished and altered, respectively, as part of the Cut-and-Cover Tunnel Alternative.

Elevated Structure Alternative

With the Elevated Structure Alternative, Alaskan Way would be restricted to one lane in each direction for 7 years and periodically restricted to one lane in each direction for 3 years, limiting vehicle access. The impacts to specific historic resources would vary over that time period, depending on the work being done and its location. However, construction and traffic disruption would continue throughout the entire construction period, especially on the central waterfront. The potential traffic impacts and adverse effects would be generally the same as those described above for the Cut-and-Cover Tunnel Alternative.

Temporary easements for utility relocation may be required for six historic buildings: Western Building (619 Western Avenue), Maritime Building (911 Western Avenue), Polson Building (61 Columbia Street), Olympic Warehouse (1203-1207 Western Avenue), Pacific Net and Twine Building (51 University Street), and Fix Building (1507 Western Avenue). An aerial easement may also be needed at the Polson Building for construction of the new ramp. Temporary easements for construction tiebacks for the Battery Street Tunnel may be needed for three historic buildings: Austin Bell Building (2326 First Avenue), Buckley's (MGM-Loew's) Building (2331 Second Avenue), and Lexington-Concord Apartments (2402 Second Avenue). These temporary easements would not adversely affect the structures.

Construction of the Broad Street detour with a temporary trestle over the BNSF railroad tracks would potentially result in adverse effects to the Old Spaghetti Factory, a building that is eligible for listing in the NRHP and for Seattle landmark designation. Vibration associated with the construction of the detour would potentially result in direct impacts on the brick building, as well as visual impacts and economic impacts due to noise, dust, and altered traffic patterns.

The Alaskan Way Viaduct and the Battery Street Tunnel are collectively a NRHP-eligible structure and would be demolished and altered, respectively, as part of the Elevated Structure Alternative.

20 Would construction affect archaeological resources?

Two archaeological sites would be affected by all of the build alternatives during construction. Near the south area, construction would adversely affect the NRHP-eligible Dearborn South Tideland Site (45KI924). It is not feasible to avoid the Dearborn South Tideland Site, because it occupies most of the area west of First Avenue between S. Royal Brougham Way and S. Dearborn Street. Avoiding the site would require that the SR 99 corridor to be moved east, which could cause additional impacts on the Pioneer Square Historic District and several historic buildings. 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 CFR 774.13(b)), and the SHPO has concurred with FHWA's finding.

The other historic-period archaeological site is located in the north area, the Seattle maintenance yard (45KI958). Although this archaeological site has not been formally determined to be eligible for the NRHP, WSDOT will treat it as eligible under Section 106 Criterion D for planning purposes. Given the constraints imposed by the urban environment and deep historic fill, evaluation and, if necessary, data recovery 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.

For all of the alternatives, construction would also affect the following archaeologically sensitive areas:

- The area between the southern project extent and S. King Street, where historic resources are likely to be present beneath regrade fill. The Bored Tunnel and Cut-and-Cover Tunnel Alternatives would include a cut-and-cover trench in this location, and the Elevated Structure Alternative would include piling supports.

- Former tidal flat areas between the southern project extent and S. King Street, and in the Alaskan Way alignment from just south of S. Jackson Street to just south of Columbia Street, where Native American resources may be present. These areas were probably used as resource gathering locations and travel corridors, and some artifacts or features may be present. All of the build alternatives would disturb the ground for trenching, piling supports, or ground improvements through the entire depth of potential resources in these areas.

- Holocene sediments near the modern ground surface in the Alaskan Way Viaduct alignment between Pike and Bell Streets. Disturbance during the historic era has reduced the potential for the presence of Native American Pre-Contact archaeological resources, but such resources may still be present. The Cut-and-Cover Tunnel and Elevated Structure Alternatives would disturb the ground through the entire depth of potential deposits, and the Bored Tunnel Alternative would disturb of the upper 5 feet of the deposits.

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

Additional information about construction effects on historic, cultural, and archaeological resources is provided in *Appendix I*, Chapter 6.

- The area from the Battery Street Tunnel to the northern extent of the project area. Historic surfaces are known to exist beneath fill, and all of the build alternatives would excavate a cut-and-cover trench and relocate utilities in this area.

- A peat deposit in the northern part of the study area (between John Street and Valley Street, along Aurora Avenue N.) dating to the Pre-Contact period that may contain Native American deposits. No archaeological materials have been found in the peat layer, but such materials may be present and as yet undiscovered. All of the build alternatives would excavate a cut-and-cover trench and relocate utilities in this area.

An archaeological treatment plan will be developed and implemented before the initiation of construction. The plan will detail measures to evaluate archaeological sites for NRHP eligibility and recover information that qualifies a site for the NRHP. An Unanticipated Discovery Plan will be prepared for the project that provides for notification and consultation among SHPO, the tribes, and the consulting parties related to discoveries of unknown archaeological material or human remains. All of the measures were developed in consultation with SHPO, the tribes, and the consulting parties and are included as commitments of the Memorandum of Agreement to avoid, minimize and mitigate adverse effects on historic resources.

Bored Tunnel Alternative
The primary construction effects on cultural and archaeological resources would likely occur during excavation of the tunnel portal areas, which would disrupt fill and potentially cultural deposits in the Dearborn South Tideland Site and Seattle Maintenance Yard.

Cut-and-Cover Tunnel Alternative
In addition to the archaeological resources and sensitive areas listed above, the Cut-and-Cover Tunnel Alternative would probably adversely affect two more archaeological sites and two more archaeologically sensitive areas. The two archaeological sites are below the bluff north of the Pike Place Market and would likely be affected by the seawall replacement. The area where the Cut-and-Cover Tunnel Alternative would disturb the ground is west of the known extent of both sites. However, the sites may well extend farther west than their mapped boundaries. Therefore, the Cut-and-Cover Tunnel Alternative may adversely affect one or both sites.

The Cut-and-Cover Tunnel Alternative would also affect two archaeologically sensitive areas:

- The Ballast Island area, where Native Americans camped during the historic period. The Cut-and-Cover Tunnel Alternative would involve trenching in this area through the entire depth of the deposit.

- The area between Alaskan Way and Elliott Avenue, from Blanchard Street to the northern project extent. Historic resources are known to occur in the area. The Cut-and-Cover Tunnel Alternative includes seawall replacement in this area, which would disturb the entire depth of the deposit.

Elevated Structure Alternative
The effects and potential effects to archaeological resources for the Elevated Structure Alternative are very similar to the Cut-and-Cover Tunnel Alternative. However, in the Alaskan Way alignment between S. Dearborn Street and Pike Street, the area disturbed by building the piles for the Elevated Structure Alternative would be smaller than the area disturbed by trenching for the Cut-and-Cover Tunnel Alternative. Therefore, impacts to the former tidal flats areas in the Alaskan Way alignment would be less for the Elevated Structure Alternative than the Cut-and-Cover Tunnel Alternative.

21 How would parks, recreation, and open space be affected during construction?

In general, for all build alternatives, construction could disrupt access to approximately 40 park and recreation facilities, including shoreline access points, in the project area. During construction, use of local streets and sidewalks would be periodically restricted, disrupting access to specific sites. Parking would also be reduced during construction, potentially reducing visits by those who normally drive to the area and use park and recreation facilities.

The following resources could experience indirect effects of increased traffic congestion during construction:

- Occidental Park
- Pioneer Square Park
- Boat access to Blake Island
- Waterfront Park
- Victor Steinbrueck Park
- Pier 62/63 Park
- Pier 66 Shoreline Access
- Belltown Cottage Park
- Olympic Sculpture Park
- Myrtle Edwards Park
- Elliott Bay Park
- Denny Park
- Seattle Center
- Tilikum Place
- Lake Union Park

However, the build alternatives would not impair the activities and features of these resources.

Bored Tunnel Alternative
In the south area, traffic congestion may cause some people attending events at Safeco or Qwest Fields to use different routes or different modes of transportation. During construction, the trail connection from the Mountains to Sound Greenway Trail to the waterfront would likely be rerouted. The existing Waterfront Bicycle/Pedestrian Facility would be maintained but rerouted to nearby areas during construction.

When the viaduct is demolished in the central waterfront area, it would occur in two-block segments at two locations at a time, and is expected to last no more than 4 weeks per segment. During this time, access to the existing waterfront promenade and other waterfront facilities

would be disrupted near the sections being removed, but access would still be available elsewhere along the central waterfront. Visitors to the Seattle Aquarium would experience these short-term changes in access. Resources adjacent to the viaduct would experience noise and temporary changes in access while it is being demolished. During viaduct demolition, pedestrian and bicycle access would be maintained on the Port Side Pedestrian/Bike Trail adjacent to the Port of Seattle facilities. The short segments of the Waterfront Bicycle/Pedestrian Facility adjacent to active viaduct removal would be temporarily closed, but elsewhere the facility would remain open. Bicyclists would have the option of continuing to use First Avenue S. or using in-street bicycle lanes (sharing the road with vehicles) on Second Avenue or Fourth Avenue.

The pedestrian bridge at Marion Street would be replaced after the viaduct has been demolished. Pedestrian access would need to occur at street level while the replacement bridge is being constructed and would be ADA-compliant. The Lenora Street pedestrian bridge would not be altered but would likely be closed for a short time while demolition activities are occurring adjacent to the bridge.

In the north area, traffic congestion, restrictions, changes in access, and loss of parking could affect people attending events at Seattle Center during construction. Construction noise may disturb users at Denny Park, although the park itself would not be affected.

Cut-and-Cover Tunnel Alternative
Construction effects to parks and recreation facilities in the south area would be the same as those described for the Bored Tunnel Alternative.

In the central waterfront area, access along the waterfront would be disrupted throughout the duration of construction. Pedestrian access to the waterfront piers and parks would be maintained throughout construction. However, the appeal of the waterfront would likely be diminished on account of the actual lack or perceived lack of access. Noise from construction may affect portions of parks and recreation resources, and park attendance would likely be influenced by overall levels of construction activity on the waterfront. Furthermore, the asphalt trail for the Waterfront Bicycle/Pedestrian Facility would be displaced early in the construction process and functions would not be available again until Alaskan Way is rebuilt near the end of the construction period. Bicycle and pedestrian traffic would likely divert to Western Avenue south of Pine Street and continue to use the surface street north of Pine Street. Pedestrians using east-west streets to connect to the waterfront, such as the Marion Street Green Street, would likely be reduced as some people avoid the construction area.

Access to the Colman Dock public access facilities in the main terminal will be maintained as part of pedestrian access to ferries. However, the shoreline public access areas on Pier 50 and the plaza area at Yesler Way are not likely to be maintained during construction. Boat access by Argosy Cruise Lines from Pier 55 to Blake Island State Park could be temporarily relocated to portions of the waterfront less affected by the cut-and-cover tunnel and seawall construction.

Attendance at the Seattle Aquarium could be reduced during construction, even with pedestrian access maintained in the construction area. With major waterfront construction activities expected to last more than 5 years, and potential public perceptions of difficulty in travel and parking in the area, the appeal of the waterfront as a recreational destination could be diminished. These perceptions could persist and could affect attendance and revenue.

In the north area, the parks and recreation resources would be predominantly affected by increased traffic congestion during construction caused by lane restrictions and detours. In addition, resources along the northern portion of the waterfront would experience minor effects, such as noise, vibration, and dust during the seawall reconstruction.

Elevated Structure Alternative
The construction effects of the Elevated Structure Alternative on parks and recreation facilities would be similar to those described for the Cut-and-Cover Tunnel Alternative but for a longer duration.

22 How would neighborhoods be affected during construction?

For all build alternatives, businesses, government offices, services, and residents would be inconvenienced by the construction traffic detours, congestion, noise and vibration, light and glare, and dust. Construction would likely be perceived as a barrier to reaching or traveling through a neighborhood. People living or working within approximately two blocks of the construction zone would be able to hear construction noises; construction could occur up to 24 hours a day and 7 days per week during some construction activities at specific locations. During nighttime hours, light and glare would especially affect residents who have direct line-of-sight views to construction zones and staging areas.

Neighborhood linkages, such as pedestrian walkways, bicycle paths, and sidewalks, would be altered intermittently due to temporary road closures. Short-term road closures may cause temporary hardships and stress for some residents. However, the detours and road closures would not adversely affect a neighborhood's sense of community or its ability to function cohesively because they would be temporary and would not entirely eliminate access to a certain part of a neighborhood. Finding parking would be difficult in some locations during construction and could discourage visitors to adjacent neighborhoods.

Bored Tunnel Alternative
Construction of the Bored Tunnel Alternative is not expected to prevent neighborhoods from maintaining their social identity. Because most of the construction effects would occur underground, the adjacent neighborhoods along the bored tunnel alignment would not likely experience substantial adverse construction effects. Construction activities at the north and south

portals and during viaduct demolition would be above ground. Therefore, neighborhoods adjacent to those areas would experience construction effects, but they are not expected to be severe enough to reduce the sense of community or the ability of a neighborhood to function and be recognized as a unit.

Cut-and-Cover Tunnel Alternative
Unlike the Bored Tunnel Alternative, construction activities would be aboveground throughout the duration of project construction for the Cut-and-Cover Tunnel Alternative. The noise, light and glare, and dust of construction activities would affect the neighborhoods along the entire alternative alignment.

The Cut-and-Cover Tunnel Alternative would close the viaduct for the longest time (27 months) of all the build alternatives. Adjacent neighborhoods including SODO, the International District, Pioneer Square, Central Business District, and Belltown would experience the effects of detoured traffic traveling through them to avoid the construction along the waterfront for the longest period of time with this alternative. This additional traffic could be perceived as a barrier to reaching or traveling through these neighborhoods.

Elevated Structure Alternative
The long duration of construction associated with this alternative (10 years) would contribute more than the other build alternatives to a diminished ability of people to communicate and interact with each other in ways that lead to a sense of community. The construction effects experienced by the adjacent neighborhoods would not be notably different than for the Cut-and-Cover Tunnel Alternative, but the severity of the effects would be exacerbated by the length of the time they would occur.

23 How would community and social services be affected during construction?

In general, community and social services would be affected by construction noise, vibration, light and glare, dust and exhaust, and truck traffic. Pedestrian detours around construction areas will be ADA-compliant. These effects would be common for all build alternatives.

Bored Tunnel Alternative
Near the south portal, the area is primarily industrial and commercial, but also contains 13 community or social service providers are located within two blocks of planned construction activities and would be affected. These include social and employment services, cultural institutions (e.g., museums and performance venues), and government services. These social resources are not expected to experience substantial construction effects.

Vehicle and transit access to these social resources could be more difficult during the 5.4-year construction period but would be maintained in coordination with the social service providers. Access to buildings may also change for short periods as construction activities shift but would be maintained throughout the construction period. The social resources in this area are primarily active during daytime hours when people generally have higher thresholds for loud noises, vibration, light, and glare, so substantial effects to social resources in the south portal area are not expected. In the central section, the Western Building's 118 tenants would be permanently relocated. The building would not be available for 12 to 20 months. The tenants include a community of artists using the space for a studio or workspace. The artists benefit from their close spaces and opportunities to share ideas and inspiration. WSDOT is actively working and supporting the efforts of the artists to find replacement accommodations, either nearby in the Pioneer Square neighborhood, if feasible, or wherever the individual artists may choose to relocate. The building also includes a community art education program for at-risk youth called Youth Art Space, which is run by the City of Seattle Parks and Recreation Department.

Near the north portal, 12 social resources are located within approximately two blocks of the construction area. These include 4 educational institutions, 3 churches, 3 social services, a cultural institution, and City of Seattle Parks and Recreation Department offices. All of these resources are generally used during daytime hours. Construction noise could be disruptive to services held by religious organizations and classes at the educational institutions in nearby buildings.

Similarly, operators of the two childcare facilities in the north portal area could be concerned about potential disruptions from construction activities. Depending on the hours of operation and the age of the children at the facilities, construction noise could disrupt nap time, or other activities, and construction noise, dust, or emissions from construction vehicles could disrupt play time for the children.

Removing the existing viaduct, which extends over 20 city blocks, would occur in two 2-block segments at a time. An estimated 22 social resources would be affected by noise, vibration, light, glare, dust, and truck traffic during demolition activities. These include seven childcare or educational facilities, one religious institution, three social services, eight cultural institutions, and three government offices or other facilities. Most of these social resources are visited during daytime or early evening hours, when people have higher thresholds for construction-related disturbances. However, depending on the hours of operation and the age of the children, viaduct demolition could disrupt nap time, or other activities, at the childcare facilities. Viaduct demolition also could also be disruptive to services held by the religious organization and classes at the educational institutions nearby. Vehicle and transit access and access to the buildings are anticipated to be the major concerns of the operators of these social resources.

Eleven social services providers, plus dorms for Cornish College of the Arts are located within about two city blocks of the Battery Street Tunnel. Most of the work to decommission (fill) the Battery Street Tunnel would occur underground during the same 9-month period that viaduct demolition is occurring. Vehicle and transit access to and from these community resources, as well as access in and out of the buildings, is not expected to change. As a result, effects would not be expected for most providers.

Appendix H, Social Discipline Report

Additional information about construction effects on neighborhoods, community, social services, environmental justice, and park and recreational resources is provided in ***Appendix H***.

Attachment E of ***Appendix H*** contains a detailed inventory and maps of the social resources in the project area.

However, three social service providers could be sensitive to increased noise levels during the decommissioning.

Cut-and-Cover Tunnel Alternative
For the south area, viaduct demolition along the waterfront, and north area, effects to community and social services would be the same as described for the Bored Tunnel Alternative.

Construction of the cut-and-cover tunnel along the waterfront would have a substantial effect on the neighborhood social resources adjacent to the construction activities, including social and employment services, cultural institutions, and government services. These resources would be affected by construction noise, vibration, light and glare, dust, and truck traffic during the 8.75-year construction period.

Modifications to the Battery Street Tunnel would occur underground. Light, glare, and dust from the construction activities that occur inside the Battery Street Tunnel would not affect nearby social resources. Access to community and social resources could be affected by roadway closures and detours near the Battery Street Tunnel, as shown in Exhibit 6-1.

Elevated Structure Alternative
For the south area, central waterfront, and north area, effects to community and social services would be the same as described for the Cut-and-Cover Tunnel Alternative. However, the Elevated Structure Alternative's construction period is 10 years, so effects would be experienced for a longer period with this alternative. Modifications to the Battery Street Tunnel would result in the same effects as described for the Cut-and-Cover Tunnel Alternative above.

In addition, viaduct demolition effects may be experienced differently, because with this alternative the viaduct would be demolished and rebuilt one deck at a time, rather than being demolished during one period of time as with the other build alternatives.

24 How would low-income and minority populations be affected during construction?
Like the effects on downtown commuters and residents, the construction effects to minority and low-income populations would include increased traffic congestion, travel delays, increased response time for emergency services, changes to transit services, equipment noise, and decreased parking. If not mitigated, these changes could have an adverse effect on the minority and low-income populations in the project area and the organizations that strive to serve them. With the mitigation discussed in Chapter 8, the project would not have a disproportionately high and adverse effect on low-income or minority populations.

An estimated 9,500 housing units and more than 15,500 residents are located within about two blocks of planned construction areas. Almost 2,050 (21 percent) of the housing units in the project area and 3,650 people (24 percent of the population) may be low-income. The concentration of residents and proportion of low-income individuals differ in the project area. Exhibit 6-28 shows the approximate number of dwelling units and population near SR 99 for each area along the corridor.

Exhibit 6-28
Housing and Population Within Two Blocks of SR 99 Construction Activities

	Total Housing Units[1]	Total Population[2]
South Area	550	1,300
Central Area	5,750	9,500
Battery Sreet Tunnel	5,300	8,400
North Area	1,700	2,700
Entire Project Area[3]	9,500	15,500

Note: Additional housing units and people would be affected by the Broad Street Detour when it is in use for the Elevated Structure Alternative.

1 *Housing units are those that would be located within approximately two blocks of the construction area. The term "housing" does not include stays in hotels, motels, or shelters. Buildings that house homeless shelters are counted as one housing unit, no matter how many beds are provided at the facility.*

2 *Population is calculated using the Seattle average household size 1.58 persons per household (2000 census) plus the total capacity of the shelters.*

3 *The entire project area is the total for the two-block area on each side of the project corridor; it is not the sum of the component parts, due to an overlap of project corridor sections.*

In the south area, there is a large number of subsidized, emergency, and transitional housing units; a disproportionate share, more than 40 percent, of these residents are low-income. The St. Martin de Porres emergency shelter, The Compass Housing Alliance (formerly the Compass Center), and the Bread of Life facilities are key emergency housing resources near the south area. As part of the effort to determine possible construction effects on low-income and minority populations in the project area, members of the project team have held individual meetings with social service providers. Concerns expressed at these meetings included maintaining access for clients and employees, service deliveries, and emergency services; wayfinding through constructions sites; and preventing access by homeless persons or others to potentially dangerous construction locations.

Construction activities also may adversely affect persons with disabilities. Traffic and sidewalk detours, barricades, and other temporary construction measures could present substantial hurdles for these persons.

Construction activities would affect homeless persons living on downtown streets. As reported by area social service providers, the homeless population is concerned with the loss of parking areas used for car camping and the displacement of campsites under the viaduct. Although the concerns raised are valid, because these encampments are illegal they are ineligible for mitigation.

In addition, the general area around the project has a substantial number of small businesses, some of which could be minority-owned. During project meetings, several non-minority business owners expressed concern that during construction, actual or perceived traffic congestion could discourage customers from driving to patronize businesses in the project area.

The lead agencies will continue to look for ways to avoid or reduce construction-related effects on these populations through careful planning and design, and by providing solutions to construction-related problems when they do occur.

25 How would public services and utilities be affected during construction?

Public Services

Public services could be affected by lane closures and increased traffic congestion and delays on roadways in and around the construction area for all of the alternatives during construction. As previously discussed in the transportation effects text, traffic effects for all drivers, including public and emergency service providers, would be least with the Bored Tunnel Alternative followed by the Elevated Structure and Cut-and-Cover Tunnel Alternatives, since traffic effects would be the least intense and would occur over a shorter duration with the Bored Tunnel Alternative. Response times for police, fire, and emergency medical aid to locations within and near the construction area would likely increase. The increase in response time may be a few seconds or a couple minutes depending on the time of day and route. Fire and emergency medical services outside the project area also could be affected due to changes in traffic patterns on local roads. Increased travel times and reduced efficiency could be experienced by other public services, such as solid waste and recycling collection and disposal services, postal services, and school bus routes.

Construction in some high-volume traffic and pedestrian areas could require additional police support services to direct and control traffic and pedestrian movements.

During construction, fire hydrants would need to be relocated. Most of these relocations would occur along surface streets throughout the project area, requiring sidewalk and street curb relocations. Water line relocations during construction could temporarily affect water supplies used for fire suppression.

Utilities

All of the build alternatives are being designed to accommodate the utilities currently located in the project area, where feasible. Relocations would be performed according to agency regulations and permits, utility provider requirements, and appropriate BMPs.

Coordination with utility providers is ongoing to prepare for emergency repair situations and address potential mitigation. The project area contains numerous utilities that would be relocated or protected in place during construction:

- Wet vaults or regulators
- Water distribution mains, large water feeder mains, water services, and hydrants
- Sanitary sewer mains, large conveyances, and manholes
- Storm drainage and combined sewer facilities
- Natural gas facilities including low-pressure, intermediate-pressure, and high-pressure mains, metering equipment, and valves
- Low-pressure and high-pressure steam lines, valves, and vaults
- Telephone service and fiber-optic cable lines
- Electrical distribution and transmission lines
- Electrical systems (underground and overhead wire) serving transit systems

Underground utility relocations typically involve pavement demolition, excavation, repaving, ground support systems, groundwater control, relocation effects on other localized utilities, dust and noise control requirements, traffic disruptions, and lane or sidewalk closures. Aboveground utility relocations typically include placement of new or temporary poles. Direct effects for all utilities include disruptions of utility service during the cutover from existing to temporary service feeds, and again when the permanent utilities are completed.

Bored Tunnel Alternative

Utilities along the bored tunnel alignment could also be affected by settlement induced by tunnel boring. The length of time a utility is affected and specific construction methods used will be determined by the contractor during final design and would influence whether a utility requires replacement or support. These utilities include Seattle City Light clay tile duct banks, brick vaults, Orangeburg duct banks, lead-jointed cast-iron water mains, water main thrust blocks, gravity utilities, side sewers, water services, steam lines, and natural gas mains. Coordination with Seattle Public Utilities, King County, Seattle City Light, Seattle Department of Information Technology, private communications providers, Puget Sound Energy, and Seattle Steam would occur to verify that they are aware of potential settlement and vibration caused by tunnel boring and to seek their guidance regarding mitigation.

Several major construction activities could cause temporary interruptions for utility service customers within the project area. Removing concrete pavement and installing foundations or other structures are anticipated construction activities that may adversely affect vibration- and settlement-sensitive underground utilities, such as water lines. Cast-iron lead-joint water lines, sewers, and drains could require replacement or joint reinforcement before these construction activities begin.

Utilities may be temporarily taken out of service in order to remove them from the excavation area and to connect to the new facilities, or periodically as part of a major construction activity. These interruptions would be planned in advance.

Inadvertent damage to underground utilities could also occur during construction. Although such incidents do not occur frequently, they could temporarily affect services to customers of the affected utility while emergency repairs are being made.

Cut-and-Cover Tunnel Alternative

The general effects to utilities for this alternative would be similar to those described above for the Bored Tunnel

Appendix K, Public Services and Utilities Discipline Report

Additional information about construction effects on public services and utilities is provided in *Appendix K*.

Alternative. One different effect for this alternative as compared to the Bored Tunnel Alternative is that it would result in more disruptive effects to underground utilities located on the central waterfront along its alignment. Another difference is that the Cut-and-Cover Tunnel Alternative is not expected to result in settlement effects to utilities.

Elevated Structure Alternative
The general effects to utilities for this alternative would be similar to those described above for the Bored Tunnel Alternative. However, because the Elevated Structure Alternative requires less underground work, there would be fewer effects to utilities than for the other build alternatives.

26 How would air quality be affected during construction?

Air quality effects during construction would occur primarily as a result of dust and emissions from construction equipment (such as bulldozers, backhoes, and cranes), diesel-fueled trucks, diesel- and gasoline-fueled generators, and other project-related vehicles such as service trucks. The general construction-related effects to air quality would be similar for all the build alternatives, even though some of the specific construction activities may vary by alternative. For the Bored Tunnel Alternative, the TBM would be electrically powered and have negligible emissions.

Dust from construction is associated with demolition, land clearing, ground excavation, grading, cut-and-fill operations, and building structures. The amount of dust in the air due to construction would vary from day to day, depending on the level of activity, specific operations, and soil and weather conditions. Larger dust particles would settle near the source, and fine particles would be dispersed over greater distances from the construction site.

In addition, heavy trucks and construction equipment powered by gasoline and diesel engines would generate particulate matter less than 2.5 micrometers in size (also known as $PM_{2.5}$.), carbon monoxide, and nitrogen oxides in exhaust emissions. Traffic restrictions during construction are expected to increase congestion in the area, which would temporarily increase emissions from traffic while vehicles are delayed. These emissions would be temporary and limited to the immediate area where congestion is occurring.

Some construction phases (particularly those involving paving operations using asphalt) would result in short-term odors. These odors might be detectable to some people near the site and would be diluted as distance from the site increases.

Because the total construction period for all of the alternatives would be longer than 60 months, the potential impacts on carbon monoxide concentrations are also subject to the EPA's Transportation Conformity Rule (40 CFR 93). For the preferred Bored Tunnel Alternative, the results indicate that carbon monoxide concentrations during construction would conform to the National Ambient Air Quality Standards.

27 How would greenhouse gas emissions be affected during construction?

Bored Tunnel Alternative
Energy consumption related to construction activities, including the use of construction equipment, such as diesel- and gasoline-powered equipment and trucks, contributes to greenhouse gas emissions.

Of all the build alternatives, the Bored Tunnel Alternative would produce the second highest estimated total amount of greenhouse gas emissions (reported as carbon dioxide equivalents, or CO_2e) during construction, as shown in Exhibit 6-29. However, these emissions would occur over the shortest build alternative construction period of 65 months.

Exhibit 6-29
Total Construction CO_2e Emissions Estimates

Alternative	Months of Construction	Total Metric Tons
Bored Tunnel	65	69,947
Cut-&-Cover Tunnel	105	63,485
Elevated Structure	120	72,853

Annual CO_2e emissions during construction were estimated to be 12,913 metric tons with the Bored Tunnel Alternative, and the daily emissions were estimated to be 35 metric tons. The daily CO_2e emissions would be the highest for the Bored Tunnel Alternative because of the short construction period as compared to the construction periods of the other build alternatives. However, the 35 metric tons that would be produced by the Bored Tunnel Alternative construction each day is a negligible portion of the total regional emissions of CO_2e projected for the 2015 Existing Viaduct, as shown in Exhibit 6-30.

Exhibit 6-30
Daily CO_2e Emissions Estimates

	Metric Tons per Day
Bored Tunnel Alternative Construction	35
Cut-&-Cover Tunnel Alternative Construction	20
Elevated Structure Alternative Construction	20
2015 Existing Viaduct – Regional	46,997

Cut-and-Cover Tunnel Alternative
The estimated total greenhouse gas emissions for this alternative are 63,485 metric tons, as shown in Exhibit 6-29. This alternative would have the lowest total of greenhouse gas emissions over the course of construction. Annual CO_2e emissions during construction were estimated to be 7,255 metric tons, and the daily emissions were estimated to be 20 metric tons. Similar to the Bored Tunnel Alternative, the estimated 20 metric tons of daily CO_2e emissions produced for this alternative would be a negligible portion of the regional daily emissions of CO_2e, as shown in Exhibit 6-30.

Elevated Structure Alternative
The estimated total greenhouse gas emissions for this alternative are 72,853 metric tons, as shown in Exhibit 6-29. This alternative would have the highest total of greenhouse gas emissions. Annual CO_2e emissions during construction were estimated to be 7,285 metric tons, and the daily emissions were estimated to be 20 metric tons. The estimated 20 metric tons of daily CO_2e emissions produced for this alternative would be a negligible portion of the regional daily emissions of CO_2e, as shown in Exhibit 6-30.

Appendix M, Air Discipline Report

Additional information on air quality during construction is provided in *Appendix M*.

The air quality conformity compliance determination is discussed in Section 3.7 of *Appendix M*.

Appendix R, Energy Discipline Report

Additional information on energy consumption and greenhouse gases during construction is provided in *Appendix R*.

What are CO_2 equivalents?

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

28 How much energy would be needed to construct the project?

For all of the alternatives, energy would be consumed by the following construction activities:

- Excavation and grading
- Material and debris handling and transport (e.g., trucks, barges, and conveyors)
- Operation of diesel- and gasoline-powered construction equipment
- Operation of diesel trucks involved in the transport of excavated material and delivery of construction material, both within construction areas and on local streets
- Operation of barges, which would likely transport construction material and excavated materials, particularly for spoils excavated from the bored tunnel
- Viaduct demolition
- Operation of the TBM (electric-powered – only for the Bored Tunnel Alternative)

The energy required for each construction area was estimated based on horsepower requirements, equipment usage, equipment load factors, and construction schedule.

Bored Tunnel Alternative

The estimated total construction energy requirements of the Bored Tunnel Alternative are provided in Exhibit 6-31. This alternative has the highest energy consumption of all the build alternatives. Construction activities specific to this alternative, such as interior tunnel construction are included in the estimate. The annual energy consumption is estimated to be 70,401 million British thermal units (BTUs) and the daily energy consumed during construction for this alternative would be about 193 million BTUs. The current daily energy consumption by vehicles in the city center is 13,221 million BTUs, so the daily energy consumed by this project would be just a small percentage of the overall energy consumption in the region.

Exhibit 6-31
Construction Energy Consumption
in million BTUs

	ALTERNATIVE		
Construction Area	**Bored Tunnel**	**Cut-&-Cover Tunnel**	**Elevated Structure**
South	109,513	54,845	118,844
Central – tunnel or elevated structure	155,503	155,926	158,578
North	88,519	112,469	43,134
Viaduct Demolition	27,806	27,806	27,806
Total	**381,341**	**351,046**	**348,362**

The TBM would be powered by electricity. A substation would be built in the WOSCA staging area to supply power for the TBM, interior tunnel construction activities, and Intelligent Transportation Systems signage. Existing electrical service would not be affected by activities powered by the substation.

Cut-and-Cover Tunnel Alternative

The estimated construction energy consumption for this alternative is 351,046 million BTUs, as presented in Exhibit 6 31. This alternative would consume about 9 percent less energy than the Bored Tunnel Alternative. The annual energy consumption is estimated to be 40,120 million BTUs and the daily energy consumed during construction would be about 120 million BTUs. As with the Bored Tunnel Alternative, the daily energy consumption for this alternative would be a small percentage of the overall energy consumed in the region.

Elevated Structure Alternative

The estimated construction energy consumption for this alternative is 348,362 million BTUs. The Elevated Structure Alternative would use the least amount of energy compared to the other alternatives; however, the differences in energy consumption between the alternatives is small, as shown in Exhibit 6-31. The annual energy consumption is estimated to be 34,836 million BTUs and the daily energy consumed during construction for this alternative would be about 95 million BTUs. The daily energy consumption for this alternative would be a small percentage of the overall energy consumed in the region.

29 How would water resources be affected during construction?

For all the build alternatives, construction effects related to water resources and water quality would be minimized or prevented through proper selection and implementation of BMPs. Construction staging, material transport, earthwork, stockpiling, and dewatering are all construction activities that could affect water resources in the project area. Construction-related pollutants such as sediment, oil, and grease can increase turbidity and affect other water quality parameters, such as the amount of available oxygen in the water. In addition, pH can be altered if runoff comes in contact with curing concrete, for example, which could have serious effects on aquatic species.

Much of the construction-related water quality effects would come from erosion of disturbed soil areas or soil stockpiles, which could result in stormwater runoff carrying silt, sediment, or other contaminants to receiving waters. Staging areas that are close to Elliott Bay and the East Duwamish Waterway have a greater potential of affecting water quality as a result of sediment transport and spills due to their close proximity to receiving waters.

Runoff water and dewatering water would likely be discharged to the combined sewer system for treatment at the West Point wastewater treatment plant. Before discharge to the combined sewer, stormwater runoff from active construction areas would need to be treated as necessary to comply with applicable permit requirements and project specifications.

Sediment and other contaminants also could fall onto roadways and be captured in stormwater runoff along haul routes. In addition, because construction materials and excavation spoils may be transported over water by barge, there is a risk of water quality effects on Elliott Bay during material transfer from the staging areas.

What is a British thermal unit?

A British thermal unit (BTU) is the approximate amount of energy needed to heat 1 pound of water 1 degree Fahrenheit.

Appendix O, Surface Water Discipline Report

Additional information about construction effects on water resources is provided in ***Appendix O***.

Demolition of the viaduct is expected to generate fugitive dust, which also could temporarily affect water quality in the project area. The effects could include slight changes in water quality along the nearshore area, either from the dust settling on the water surface or from stormwater runoff that reaches Elliott Bay.

Bored Tunnel Alternative
Dewatering would be required during construction of the south portal and most of the retained cut sections, and it would likely continue until construction of the south portal retaining walls is completed. Dewatering during construction could result in groundwater flow from adjacent areas being drawn toward excavated areas. If this adjacent water contains contaminants, these contaminants could migrate and increase pollutant concentrations in dewatering water.

Given the rates of pumping for dewatering water in some areas, detention may be needed to avoid overwhelming existing conveyance systems. Depending on the volumes and timing, off-site disposal may be required. Large amounts of dewatering can also increase the risk for settlement. This would be mitigated by reinjecting water from the dewatering operation back into the ground. Any water that is not used for reinjection would need to be treated and disposed of in the sanitary sewer or at an off-site location. Construction dewatering systems would be designed to minimize reductions in the water table.

Cut-and-Cover Tunnel Alternative
In addition to the effects common to all build alternatives discussed above, the Cut-and-Cover Tunnel Alternative would require substantial earthwork, especially along the central waterfront, because a large part of the project would require excavation. This could result in a greater quantity of spoils stockpiles in the project area subject to erosion, which could mean more stormwater runoff carrying sediment and contaminants to receiving waters.

Soil improvements, which would likely consist of jet grouting, are proposed behind the Elliott Bay Seawall. Potential water quality impacts from soil improvement include grout seepage into Elliott Bay through cracks in the existing seawall.

After the new seawall is completed, the old seawall would be removed, which would require in-water work. This work would be performed primarily at low tide and with the use of appropriate BMPs (e.g., silt curtains) to minimize or eliminate effects to water quality.

The Cut-and-Cover Tunnel Alternative would require continuous dewatering throughout the construction process. As mentioned for the Bored Tunnel Alternative, dewatering could lower the groundwater table, and the reinjection of dewatering water could mitigate for this effect. Any water not reinjected would need to be treated and disposed of in the sanitary sewer or at an off-site location.

Elevated Structure Alternative
This alternative would have similar effects as described for the Cut-and-Cover Tunnel Alternative, except that large amounts of dewatering are not expected during construction. There are no major excavations planned; however, localized dewatering may be required for utility excavations. As a result, effects relating to dewatering activities would be minor with this alternative.

30 How would fish, aquatic, and wildlife species and habitat be affected during construction?

Bored Tunnel Alternative
Unlike the other build alternatives, the Bored Tunnel Alternative would not include replacing the Elliott Bay Seawall. Effects to fish and wildlife, in the project area would most likely be associated with construction noise and potential temporary and localized sedimentation and turbidity in Elliott Bay. Increased turbidity could occur due to erosion; spoils handling, stockpiling, and dewatering; and potential spills.

Some of the construction activities are likely to require the use of a nearshore loading and unloading facility to transport construction materials to the construction site and to remove excavation spoils. This operation would use existing facilities, and no in-water construction would be required. The associated vessel movement would be similar to existing navigation movements along the shoreline and would not represent a new or different effect.

Viaduct demolition would result in a temporary substantial change in the noise levels along the central waterfront. In addition, the viaduct demolition is expected to generate fugitive dust, which could temporarily affect habitat conditions in the area. The effects could include slight changes in water quality along the nearshore area, either from the dust settling on the water surface or from stormwater runoff that reaches Elliott Bay, which could have some minor effects on fish and wildlife species in the area. However, these effects are expected to be temporary and minor and are not expected to affect the long-term conditions of the species or their habitat. Consultation under the Endangered Species Act has been completed for construction of the Bored Tunnel Alternative and is summarized in Chapter 5, Question 32.

Cut-and-Cover Tunnel Alternative
In addition to the effects discussed for the Bored Tunnel Alternative, the Cut-and-Cover Tunnel Alternative would excavate and transport an amount of soil that greatly exceeds the amount of soil generated by the tunneling process for the Bored Tunnel Alternative (see Exhibit 6-14). This large quantity of excavated soil would increase the potential to release dust and sediment to the environment.

Construction of a new seawall is a component of this alternative and would require the construction of a temporary access bridge over open-water habitat between Pier 48 (near S. Jackson Street) and the Seattle Ferry Terminal to provide ferry access during construction. This temporary bridge could be in place for more than 7 years. Pile driving, removal, and shading of about 15,000 square feet of shallow subtidal habitat would be associated with the construction of this structure. Also, to help maintain pedestrian access along the waterfront, it is possible that

Appendix N, Wildlife, Fish, and Vegetation Discipline Report

Additional information about construction effects on wildlife, fish, and vegetation is provided in ***Appendix N***.

temporary overwater pedestrian walkways between some piers would be constructed.

Any pile-driving activities needed to install these temporary over-water structures could potentially harm fish and aquatic species due to the underwater sound impulses generated by the pile driver, and/or disturb other wildlife species due to airborne sound levels.

After the new seawall is completed, the old seawall would be removed, which would require in-water work. This work would be performed primarily at low tide and with the use of appropriate BMPs (e.g., silt curtains) to minimize or eliminate effects on the nearshore habitat. Marine organisms affected by the removal of the existing seawall would eventually be replaced by means of recolonization from adjacent habitat areas.

Elevated Structure Alternative
The Elevated Structure Alternative would also replace the Elliott Bay Seawall in the central waterfront. The potential effects to fish, aquatic habitat, and wildlife that would occur as the result of seawall replacement, as described above for the Cut-and-Cover Tunnel Alternative, would apply for this alternative as well.

Other potential effects to fish, aquatic habitat, and wildlife would be the same as described above for the Bored Tunnel Alternative.

31 Would construction have any indirect effects?
An indirect effect is a reasonably foreseeable effect caused by a project but that would occur in the future or outside of the project area. Construction of a viaduct replacement would primarily have direct effects on areas next to the construction sites and to local traffic. Specific indirect effects during construction are described earlier in this chapter for each environmental resource. Indirect effects are only discussed in instances where they are anticipated (meaning that if indirect effects are not discussed for a resource, effects are not expected). Indirect effects of construction would occur as people change their travel patterns and where they shop or go out to eat to avoid construction activity or congestion caused by closures or restrictions on SR 99. This means that the indirect effects are primarily related to the extent and duration of direct construction effects. The indirect effects would be dispersed throughout the greater Seattle area outside of downtown. Businesses away from the project area could see a small benefit, but the overall indirect effects are not expected to be significant. Parks could experience indirect effects of increased traffic congestion during construction; however, the activities and features of these resources would not be impaired.

Bored Tunnel Alternative
The Bored Tunnel Alternative would have the least indirect effects during construction. Except for the 9 months when the viaduct is being demolished, construction activity is limited to the two portal areas. Traffic on SR 99 is interrupted for just 3 weeks and otherwise is restricted only by the WOSCA detour.

Cut-and-Cover Tunnel Alternative
The Cut-and-Cover Tunnel Alternative would have the greatest indirect effects during construction. Construction activity along the central waterfront and the extended closure of SR 99 (more than 3 years) would lead some people to change how they travel and where they shop and go out to eat. Because SR 99 would be closed for a period of years, it is possible that some of these changes in travel and shopping patterns would be permanent.

Elevated Structure Alternative
The indirect effects of construction of the Elevated Structure Alternative would be greater than for the Bored Tunnel but less than the Cut-and-Cover Tunnel. Like the Cut-and-Cover Tunnel, there is extensive construction activity along the central waterfront, but SR 99 is closed for a much shorter time (5 to 7 months instead of 3 years). It is unlikely these changes would be permanent.

32 Would construction have any cumulative effects?
Cumulative effects are the combined effects of past, present, and reasonably foreseeable future projects. When we consider cumulative effects we look at long-term trends and large-scale effects, so the relatively short-term effects of construction usually do not make much difference. However, if multiple projects are under construction in the same general area at the same time, they can have combined effects that need to be considered. Construction of the following projects may overlap with construction of any of the alternatives:

- **Gull Industries on First Avenue S. –** This project is located west of First Avenue between S. Massachusetts Street and S. Atlantic Street. The project would develop the entire site with a mixture of office, retail, and restaurant uses. If construction of this project coincides with construction on the WOSCA site north of S. Atlantic Street, excavation and dewatering could draw down the local water table. This could cause settling that could affect nearby structures, roadways, and utilities. These effects could be minimized by coordinated planning appropriate mitigation (such as recharge) to maintain the water table.

- **North Parking Lot Development at Qwest Field –** The construction timeline for this planned development is unknown, but it is possible that part of it could overlap with construction activity on the WOSCA site. The development would include the construction of a 20-story office tower and three residential towers of 10, 20, and 25 stories. Likely effects could be the temporary loss of parking adjacent to the stadiums and the Pioneer Square Historic District and effects from noise and dust for those located next to the site.

- **Washington State Ferries Seattle Terminal Improvements –** To maintain service at this busy transportation hub, one of the slips needs to be rebuilt and the terminal building needs to be replaced to meet current seismic standards. Additional improvements are planned to help pedestrian and vehicle traffic flow more smoothly. Construction of these improvements would overlap with viaduct replacement construction along the

central waterfront. The primary effects would be temporary traffic restrictions on Alaskan Way and construction noise.

- **Bill and Melinda Gates Foundation Campus Master Plan –** Major construction related to the $500 million headquarters for the Bill and Melinda Gates Foundation was completed in spring 2011. A third building is expected to be built on the site between 2014 and 2017. Possible effects could be noise, dust, and truck traffic for those next to the site.

- **Mercer Street West Corridor Improvements –** These improvements will convert Mercer Street to two-way operation, with two lanes in each direction and turn pockets between Fifth Avenue N. and Queen Anne Avenue N.; and convert Roy Street to a two-way street with bicycle lanes between Fifth Avenue N. and Queen Anne Avenue N. With the improvements now under construction on Mercer Street between I-5 and Dexter Avenue and those included with the viaduct replacement project, there will be a direct, two-way connection between I-5 and Elliott Avenue West. Likely construction effects would be temporary traffic restrictions and parking reduction.

- **South Lake Union Redevelopment –** Several large-scale commercial, retail, and residential construction projects are planned in the South Lake Union area. Specific projects that may have timelines coinciding with the north portal construction are unknown. Possible effects could be noise, dust, and truck traffic.

With the Bored Tunnel Alternative, the Elliott Bay Seawall would be replaced at the same time as the tunnel is under construction, from 2013 to 2015. Because the existing viaduct would still be in use, the concurrent construction would not cause any additional effects. The seawall work would be completed before the viaduct is demolished in 2016. Directly after viaduct demolition and removal, the City of Seattle expects to begin work on the waterfront promenade and the new Alaskan Way surface street. With the Cut-and-Cover Tunnel and Elevated Structure Alternatives, the seawall would be replaced at the same time as construction of the viaduct replacement.