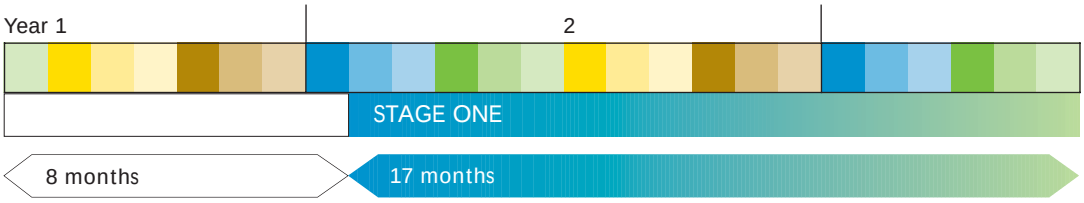
Views of the viaduct at S. Massachussetts Street, S. Atlantic Street, and S. Royal Brougham Way from First Avenue S.

Exhibit 4-1

Construction Activities



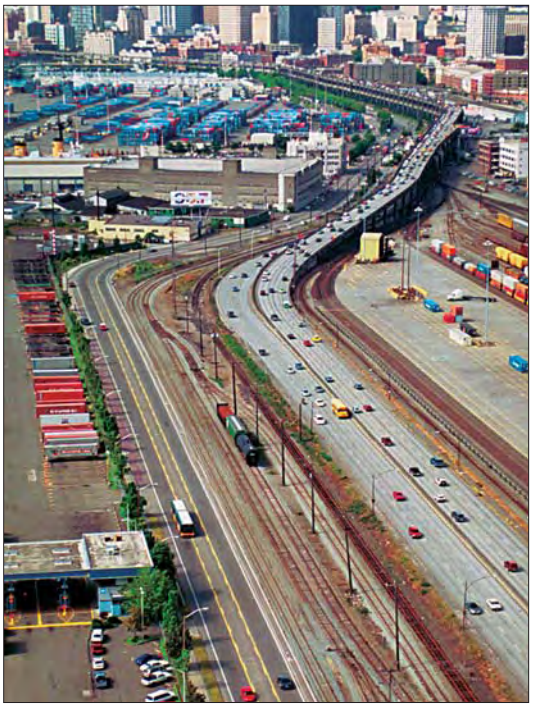
- Relocate utilities

- Construct temporary lead and tail track
- Construct temporary ferry holding west of viaduct
- Improve soil for southbound SR 99
- Construct southbound SR 99
- Construct west half of the undercrossing
- Build southbound WOSCA detour

CHAPTER 4 - CONSTRUCTION EFFECTS & MITIGATION

What's in Chapter 4?

Chapter 4 explains how the project would be built and how traffic would be affected during construction. It also identifies other construction effects (such as noise) and describes proposed mitigation measures. Only elements of the environment that would be affected are discussed. Energy, fisheries, wildlife, and habitat resources are not affected by the project and are therefore not discussed in this chapter.

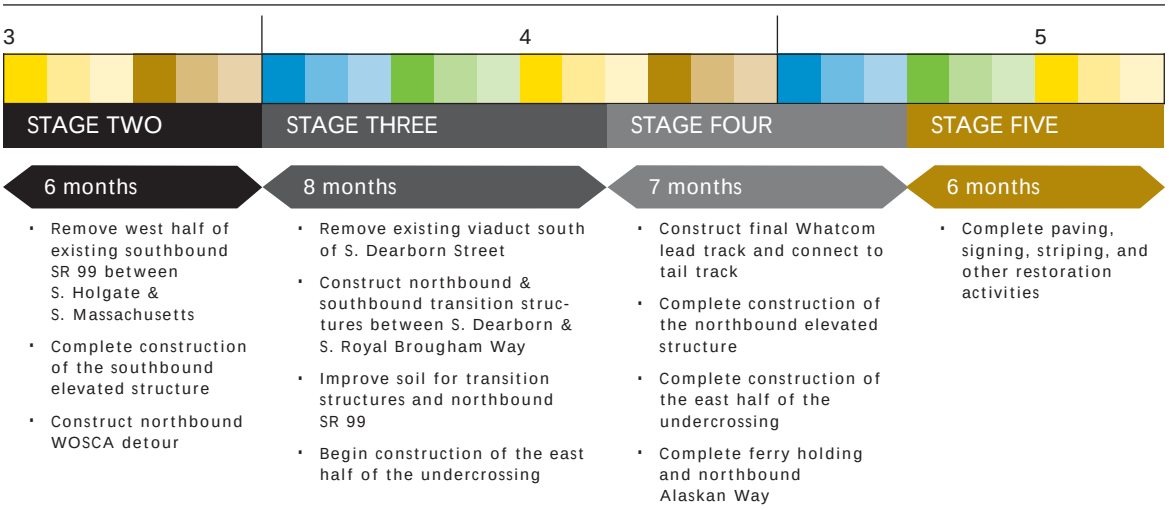


View of the Whatcom Railyard next to SR 99

1 How would construction activities be sequenced?

The construction activities chart in Exhibit 4-1 shows how construction activities could be sequenced for the project. We expect construction to take about 4 years and 4 months beginning in mid-2009. The first 8 months of construction would consist of utility relocations. After the early utility relocations, construction activities have been organized into five stages that include distinct traffic restrictions or detours, which are described in Question 3 of this chapter. Construction activities are expected to affect traffic on SR 99 for about 2 years and 3 months.

Construction would typically take place 5 days per week, 10 hours per day, but may occur up to 24 hours per day,



Construction Staging & Work Zones

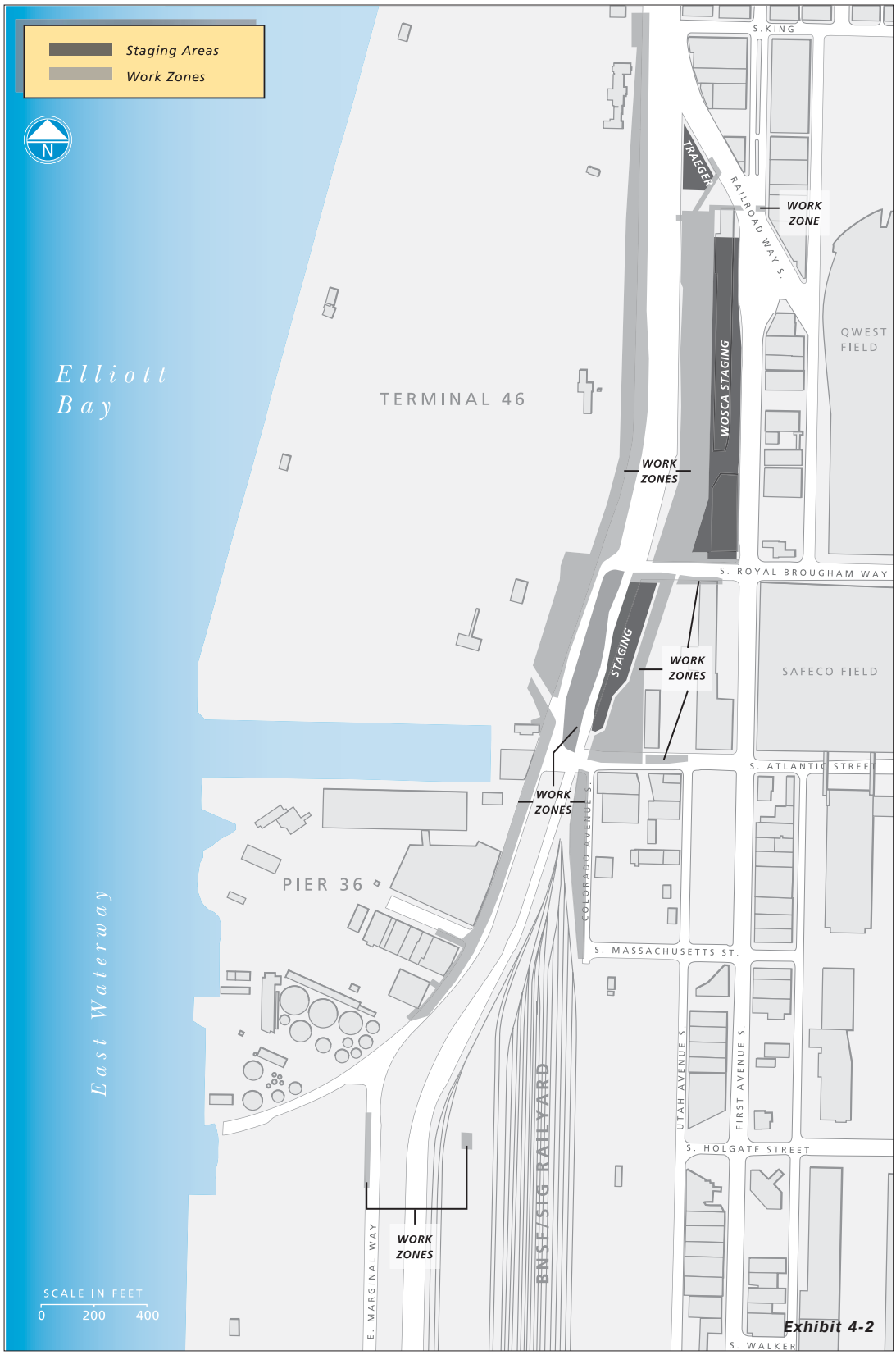


Exhibit 4-2

7 days per week at times. Construction over and above the typical 50-hour work week would only occur when needed to keep the project on schedule. Some night or weekend work may also be required for roadway crossings, tail track relocation, or other critical construction phases.

Construction would occur simultaneously at several locations throughout the project area, and the intensity of construction at each location would vary. Construction activities would progress throughout the project area so that a specific location would not experience intense activities outside their front door for the entire construction duration. Construction is likely to pass by properties located in the construction zone more than once. The duration of each construction activity would vary greatly, ranging from a few days to several months depending on the type of activity. Proposed construction methods and sequencing may change as the project design progresses.

2 How would the project be built?

Construction activities would be staged within the existing right-of-way for SR 99 and affected local streets, where possible. Exhibit 4-2 shows proposed construction staging areas and work zones. Staging areas are where construction equipment, supply lay-down areas, parking, and other miscellaneous resources are located. Work zones are those areas where the construction is occurring. Work zones change as construction moves through different locations in the project area.

Construction crews would need a wide variety of equipment such as trucks, cranes, backhoes, excavators, loaders, forklifts, jackhammers, compactors, pumps, grading and paving equipment, compressors, generators, and welding equipment. Construction crews may also require additional equipment such as pile drivers, dewatering pumps and tanks, and conveyor belts. Materials and equipment would be stored within the project area and existing right-of-way outside of the shoreline area.

Once utilities are relocated, construction of the bridge structure, street-level facilities, and retained cuts that would compose the new SR 99 roadway and ramps would require the following construction activities:

- Demolishing and removing the existing viaduct and support structures
- Soil improvements
- Building bridge foundations

- Retained cut-and-fill construction
- At-grade roadway construction

Removing the Viaduct and Other Structures

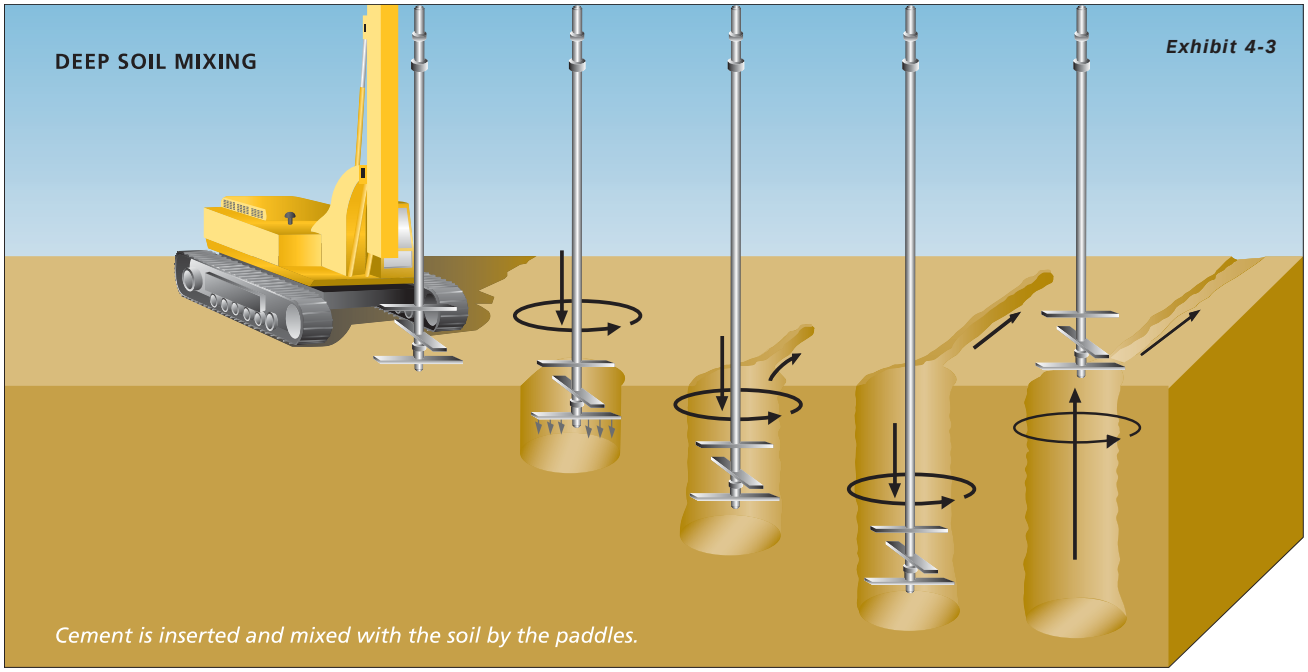
The viaduct and associated structures south of the intersection of Railroad Way S. and Alaskan Way S. would be demolished and removed. Demolishing and removing these structures is expected to take about 3 months during Stage 3. In total, approximately 40,000 cubic yards of reinforced concrete would be removed. These materials would primarily be hauled away by truck.

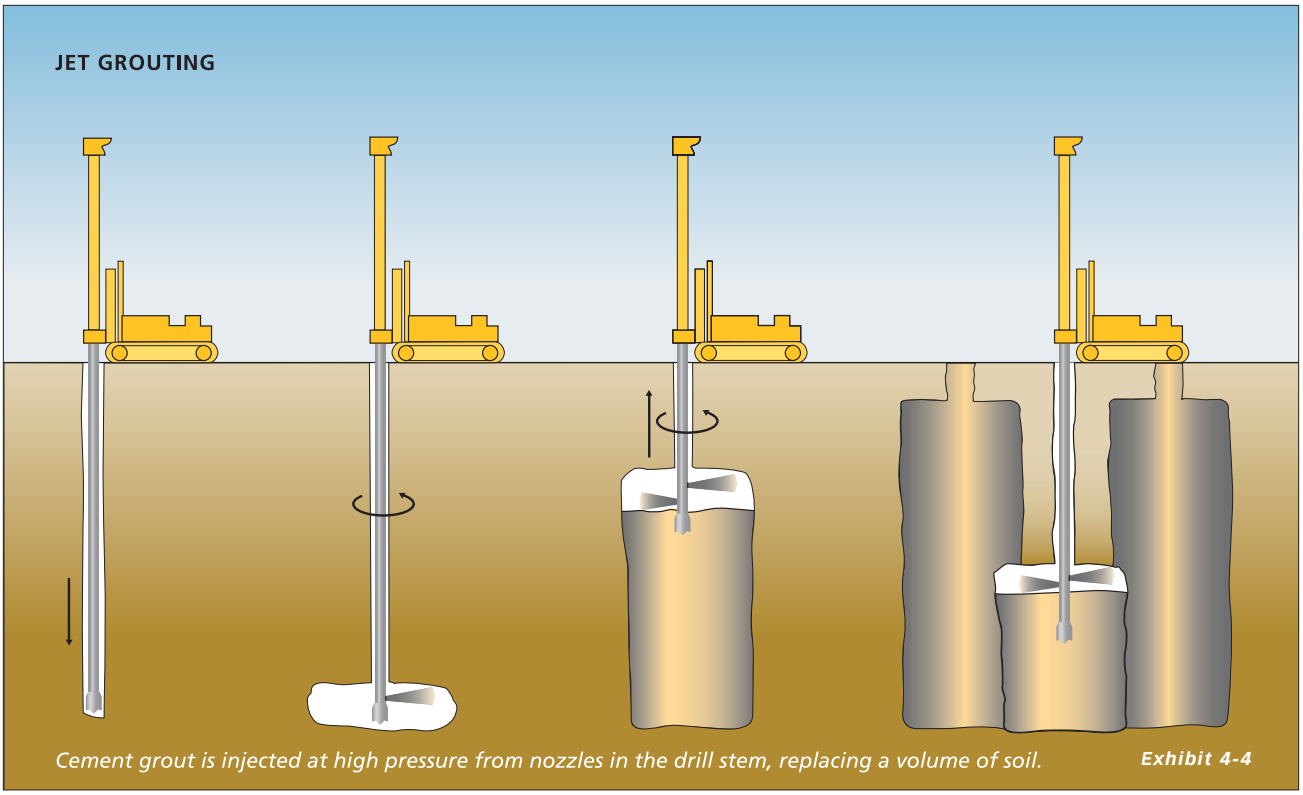
Soil Improvements

Soil improvements would be required throughout the footprint of the proposed alignment to strengthen soils to offset the risk of soil liquefaction and lateral spreading in the event of an earthquake. Soils can be strengthened many different ways, and a combination of soil improvement techniques would be used. Though a variety of soil improvement techniques may be used, for this project soil improvement methods would likely include deep soil mixing, jet grouting, and stone columns.

Deep soil mixing involves strengthening soil by mixing it with cement grout injected under pressure. As the soil is mixed, it creates columns of strengthened soil, as shown in Exhibit 4-3.

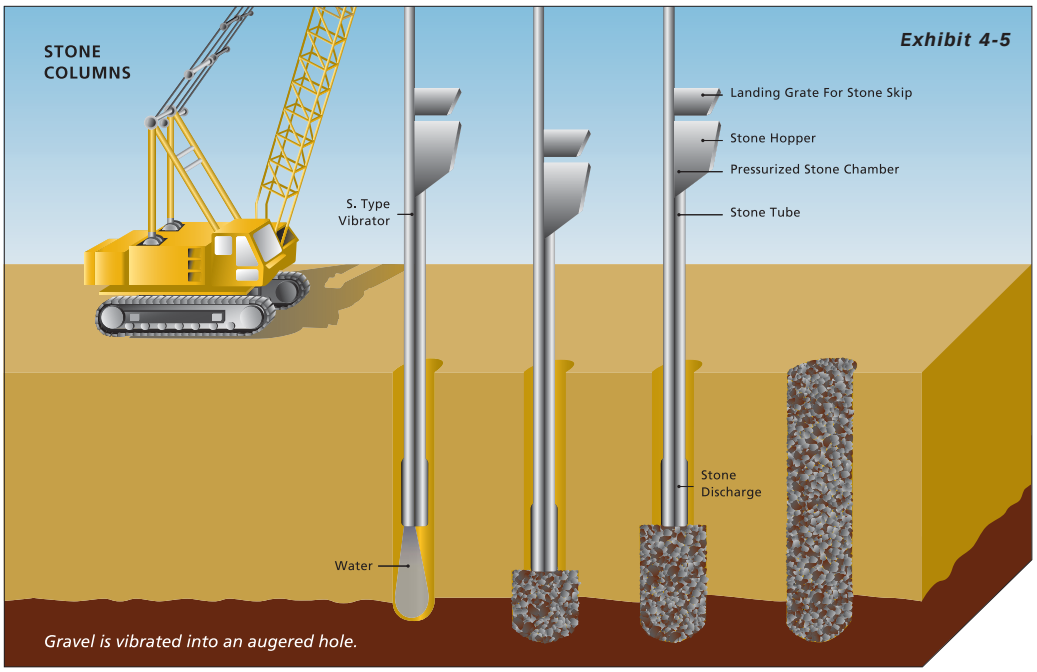
Soil Improvement Methods





Cement grout is injected at high pressure from nozzles in the drill stem, replacing a volume of soil. **Exhibit 4-4**

Jet grouting is similar to deep soil mixing, but can be done using smaller equipment, as shown in Exhibit 4-4. Stone columns are created by backfilling drilled holes with gravel and vibrating it into place to strengthen soil, as shown in Exhibit 4-5.



Gravel is vibrated into an augered hole.

Deep soil mixing would most likely be used throughout the footprint of the proposed alignment. Jet grouting would be used in place of deep soil mixing where existing utilities preclude access for deep soil mixing equipment. Stone columns may be used beneath proposed fill areas and in the vicinity of bridge abutments and piers.

Deep soil mixing and jet grouting would produce spoils. The volume of spoils created would range from 30 to 50 percent of treated ground volume for deep soil mixing and from 50 to 100 percent of treated ground volume for jet grouting. Stone columns would produce minimal spoils.

What are spoils?

Spoils are composed of soil, rock, and other materials that come to the surface when soil is mixed with cement grout.

What is a bent?

A bent is a structural support consisting of two columns (like the columns on the east and west sides of the existing viaduct) with an interconnecting beam.

Building Bridge Foundations

Foundations for proposed elevated structures would be built using drilled concrete shafts or cast-in-place concrete piles. The foundations would support steel-reinforced concrete columns and bents.

Cast-in-place concrete piles would be used for the portion of the structure carrying SR 99 over S. Atlantic Street. The area for the pile cap would be excavated and shored up as needed. Next, piles would be driven into the ground in the area of the excavation to an average depth of 150 feet. If hammering methods are used, pile driving activities would be disruptive, increasing noise in areas where this activity occurs. However, methods such as pushing or vibrating piles into the ground would be much less disruptive and not as loud. Piles could be constructed in various sizes using several different materials. At this time, it is expected that 2-foot-diameter piles constructed of steel casings filled with reinforced concrete would be used.

Once a cluster of several piles is driven, the pile cap would be finished to connect the cluster of piles together to form a new foundation. The pile cap would be constructed by placing concrete forms in the excavated area, installing rebar (reinforcing bars of steel), and placing concrete within the concrete form. A typical pile cap is expected to be approximately 30 feet by 50 feet with a depth of 5 to 7 feet. Approximately 600 cubic yards of soil would be excavated for each pile cap.

The remainder of the bridge structures would be supported by drilled concrete shafts. Drilled shafts in the south section would range from 8 to 12 feet in diameter and would extend between 60 and 125 feet into the soil. In general, drilled shafts would be built by drilling soil out to the desired circumference

and depth, installing rebar, and filling the hole with concrete. The stability of the excavated hole could be maintained either by keeping the hole continuously filled with a sealing mixture or by advancing a steel casing while drilling. Each drilled shaft would require the excavation of approximately 100 to 500 cubic yards of soil.

Temporary bridges proposed during construction to connect the existing First Avenue S. ramps to the WOSCA detour would be built on drilled concrete shafts or micropiles. These pile types would not produce heavy ground vibrations and would protect the existing utilities from damage.

Retained Fill Construction

Proposed retained fills are expected to be retained by constructing structural earth walls. Structural earth walls are built by placing and compacting progressive lifts of soil. Retaining straps made from plastic or steel are placed with the lifts. The successive layers of soil and retaining straps create a block of soil that acts as a solid wall. The wall's exterior face is typically wrapped with a metal or plastic mesh to retain the reinforced soils; a system of reinforced concrete face panels may also be connected to the retaining straps. The concrete face panels also help to retain the soils and could be cast with architectural finishes.

Retained Cut Construction

Roadway sections constructed in retained cuts (such as the U-shaped undercrossing) would be built using a combination of soil improvements, excavation, concrete bottom slabs, secant piles, and interior concrete.

The area would be excavated, once soil improvement activities are completed. Excavation depth is expected to vary between 0 and 40 feet. Excavation in retained cuts would be supported using an internally braced excavation support wall. The support wall would be constructed of secant piles. Secant pile walls are constructed of overlapping drilled concrete piles. First, two shafts would be drilled apart from each other, rebar would be installed, and the hole would be filled with concrete to form the pile. Then another shaft would be placed and filled between the first two. This process would be used to form a continuous wall of interlocking piles.

A concrete bottom slab up to 15 feet thick would be placed at the base of the retained cut. This would provide support for the roadway and would provide a water barrier to allow the

interior of the cut to be dewatered. Water in the cut would then be pumped out, and the remaining roadway construction and finishes would be built in dry conditions.

At-Grade Roadway Construction

At-grade roadway sections include portions of SR 99 and Alaskan Way S. The at-grade roadways would be built by removing existing roadways, clearing and grading the area, laying the aggregate roadway foundation, and placing an asphalt or concrete roadway surface. In addition, portions of Colorado Avenue S. and S. Atlantic Street west of Utah Avenue S. would be reconstructed and paved. Sidewalks, landscaping, and lighting would also be constructed on the surface streets.

3 How would SR 99 traffic be restricted and detoured during construction?

During construction, WSDOT would make it a priority to maintain traffic capacity on SR 99 as much as practical, minimize effects to First Avenue S., and maintain access to and from area businesses and the stadiums. These priorities would be accomplished by:

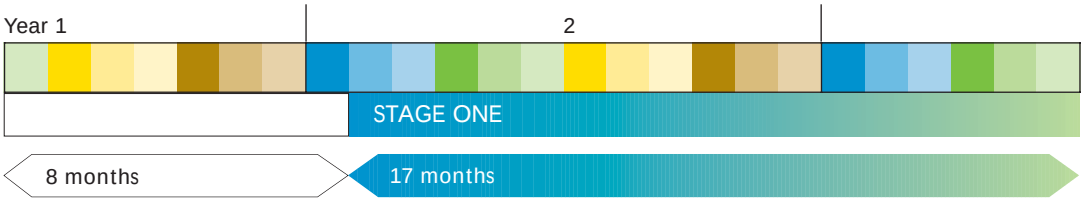
- Maintaining a minimum of two lanes of SR 99 traffic in each direction during peak traffic hours or providing a comparable detour.
- Allowing full closures of SR 99 only during nights and weekends.

Appendix F Transportation Discipline Report

Appendix F contains supporting traffic information that explains how the construction traffic analysis was conducted and documents the conclusions contained within the text of this EA.

Exhibit 4-6

Construction Roadway Closures, Restrictions, and Detours



- Lane closures on various streets to relocate utilities

- Northbound & southbound SR 99 unchanged for the first 11 months, then southbound SR 99 reduced to 2 lanes for last 6 months
- Lane closures on various streets to relocate utilities
- For 3 to 6 months during undercrossing construction, northbound & southbound traffic on Alaskan Way will be detoured on S. Royal Brougham Way, First Avenue S., and S. Atlantic Street
- One or more lanes maintained in each direction on S. Atlantic Street
- Ferry queueing maintained under the Alaskan Way Viaduct

- Maintaining access to and from the North SIG Railyard and the Port of Seattle's Terminal 46 at all times.
- Keeping the railroad tracks and the Whatcom Railyard in service, except for short periodic closures of 8 hours or less to facilitate construction activities. Any closures would be coordinated with BNSF and Union Pacific Railroad.

The project is expected to take approximately 4 years and 4 months to build starting in mid-2009. We have divided the total construction period into five stages that have distinct traffic restrictions or detours, as shown on the timeline in Exhibit 4-6.

Exhibit 4-7 shows how long key routes would be affected by roadway restrictions during construction.

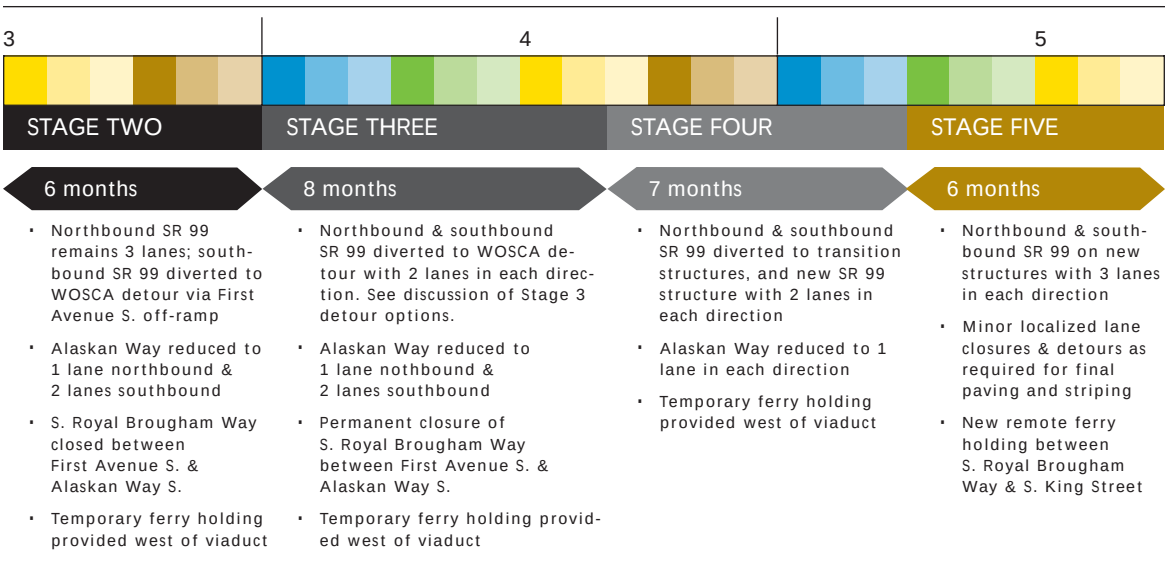
Exhibit 4-7

Duration of Roadway Restrictions on Key Routes

Affected Roadway	Duration of Roadway Restructions
SR 99	2 years – 3 months *beginning in early 2011*
Alaskan Way S.	2 years – 9 months *beginning midyear in 2010*
S. Royal Brougham Way	Traffic detoured on S. Royal Brougham Way for 6 months at the end of the first 17 months of construction (Stage 1); S. Royal Brougham Way would be closed permanently where it crosses underneath the existing viaduct after Stage 1, midyear in 2011.

Exhibits 4-8 through 4-12 summarize the traffic restrictions and detours for each stage.

Prior to Stage 1 there would be 8 months of utility relocation work. Water, communication, and electrical lines would be



Stage 1 Construction

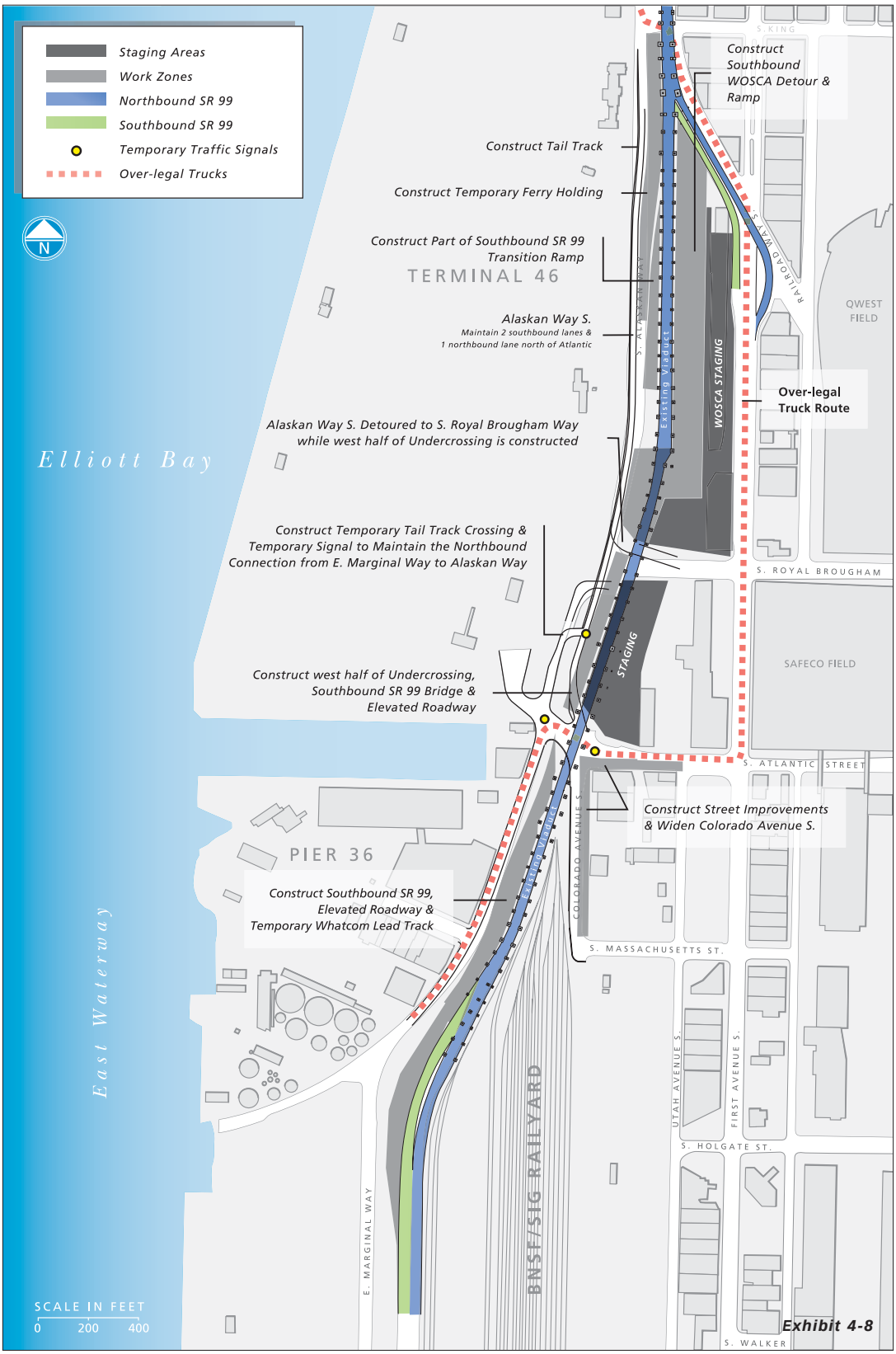


Exhibit 4-8

moved during this time so that they are not in the path of the major construction activities. There would be lane closures and restrictions during this 8-month period at various locations on the surface streets. These locations would change as the utilities are relocated.

Stage 1

The first construction stage would last about 17 months. Traffic on SR 99 would be unchanged for the first 11 months of Stage 1. During the last 6 months, southbound traffic would be reduced to two lanes from just north of Railroad Way S. to S. Holgate Street.

During Stage 1, local streets in the area would be periodically closed for utility relocations. On Alaskan Way S., northbound and southbound lanes would remain open until construction of the undercrossing begins. Construction of the west half of the undercrossing is expected to take about 6 months. During that time, traffic on Alaskan Way S. would be detoured to S. Royal Brougham Way, First Avenue S., and S. Atlantic Street. On S. Atlantic Street, at least one lane of traffic in each direction would remain open throughout Stage 1.

In addition, relocation of rail lines in the Whatcom Railyard would require an 8-hour rail closure and a weekend closure of S. Atlantic Street. During this brief closure, both motorized and nonmotorized traffic would be detoured to S. Royal Brougham Way.

Stage 2

Stage 2 would last about 6 months. During this stage, the three northbound lanes of SR 99 would remain unchanged. All southbound traffic would be diverted to the WOSCA site, east of SR 99, via the First Avenue S. off-ramp along Railroad Way S.

Traffic on Alaskan Way S. would be reduced to one northbound lane and two southbound lanes. A connection to E. Marginal Way S. would be maintained. S. Royal Brougham Way would be permanently closed between First Avenue S. and Alaskan Way S. Temporary remote ferry holding would be located to the west of the viaduct south of S. King Street and would be accessed via S. Atlantic Street.

Stage 3

Stage 3 would last approximately 8 months. During Stage 3, when the existing viaduct is demolished, both northbound

What is the WOSCA Detour?

A temporary at-grade connection would be built between SR 99, S. Royal Brougham Way, and the WOSCA property. Traffic would travel on a temporary roadway across the WOSCA property. During Stage 2, southbound SR 99 traffic would be diverted off of the existing viaduct between S. Royal Brougham Way and Railroad Way S. During Stage 3, both northbound and southbound SR 99 traffic would use the WOSCA detour in this section, as shown in Exhibit 4-10. At the north end of the detour, traffic would connect to SR 99 via temporary ramps that link up to the existing First Avenue S. ramp.

Stage 2 Construction

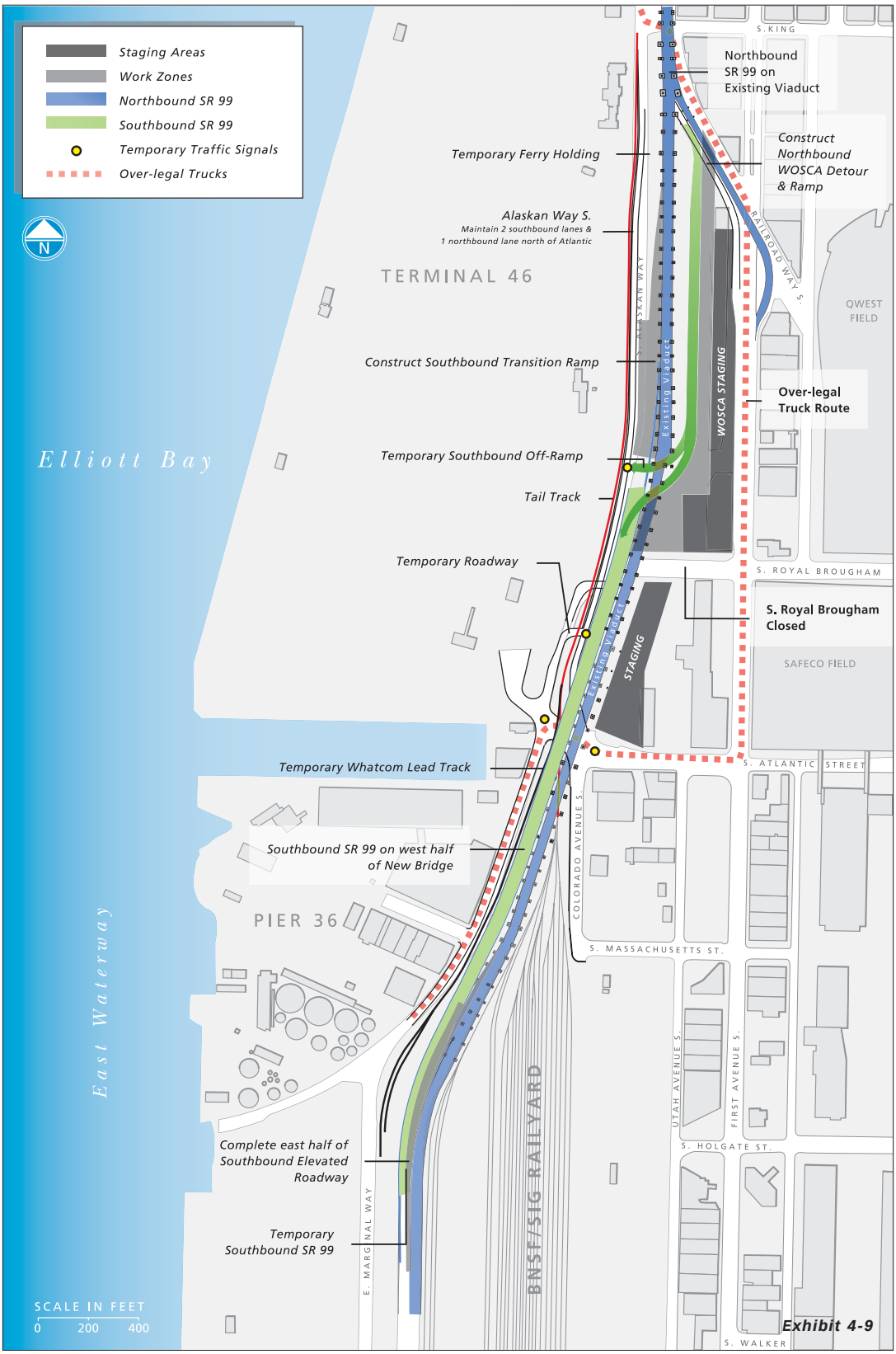


Exhibit 4-9

Stage 3 Construction

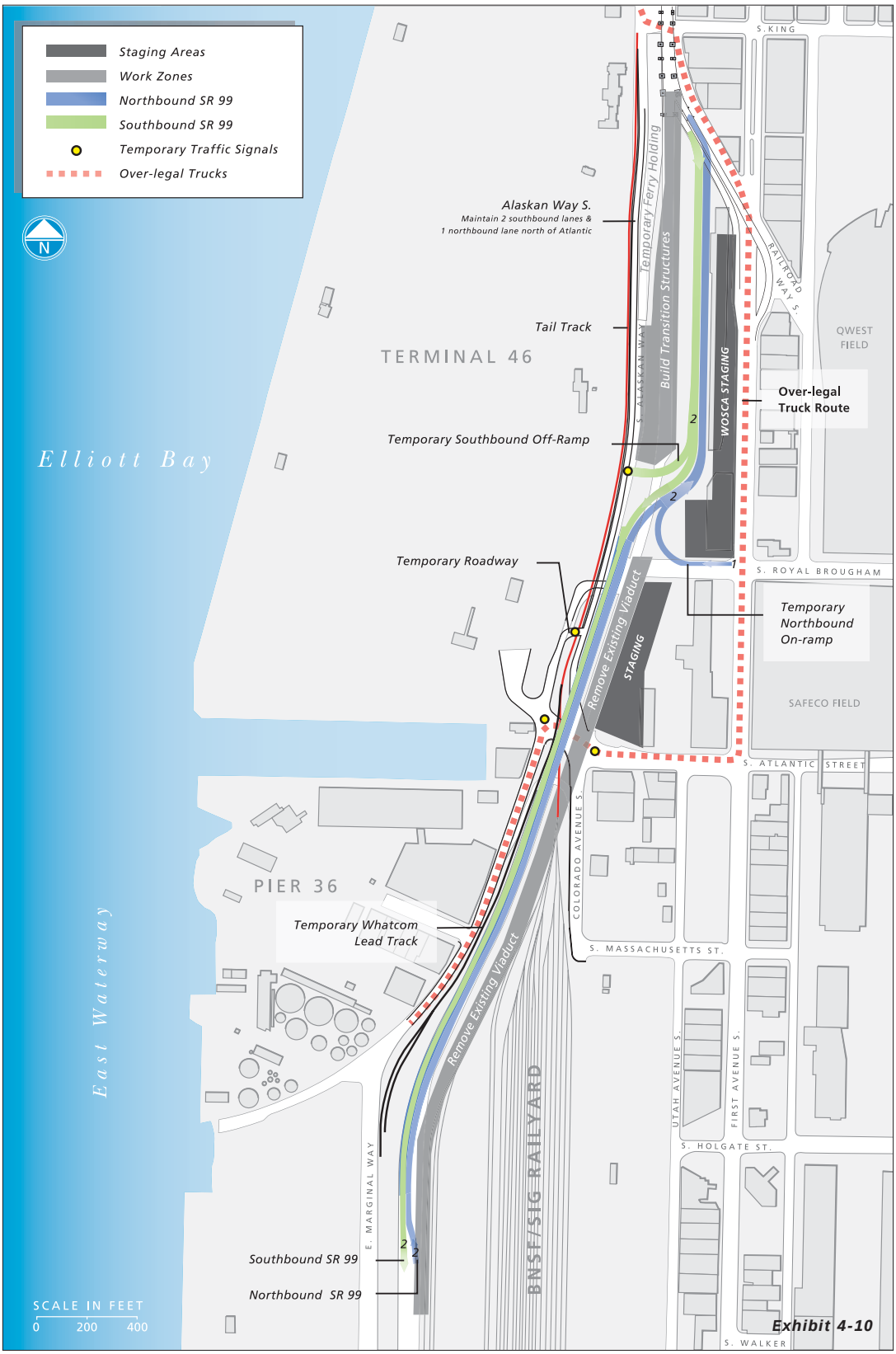


Exhibit 4-10

Stage 4 Construction

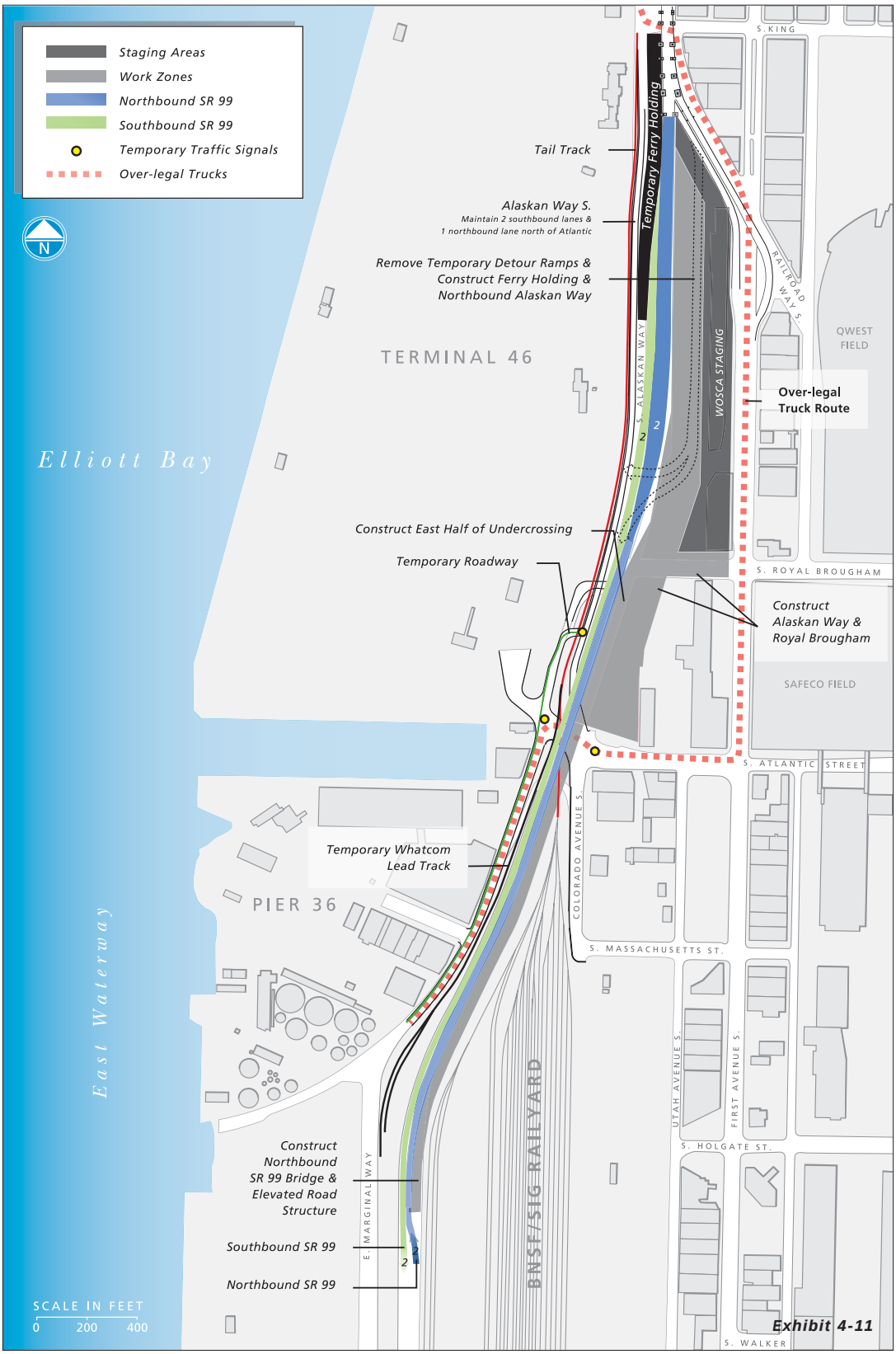


Exhibit 4-11

Stage 5 Construction

Exhibit 4-12

and southbound SR 99 traffic would use the WOSCA detour between S. Royal Brougham Way and Railroad Way S.

South of S. Royal Brougham Way, both southbound and northbound SR 99 traffic would use the new southbound SR 99 structure. Two traffic lanes would be provided in each direction on SR 99.

Traffic on Alaskan Way S. would be reduced to one northbound lane and two southbound lanes with a connection to E. Marginal Way S. maintained by decking over the undercrossing. The temporary remote ferry holding would continue to be located west of the viaduct.

Stage 4

Stage 4 would last for approximately 7 months. Northbound and southbound SR 99 traffic would continue to be on the new southbound SR 99 structure, with two lanes in each direction, south of S. Royal Brougham Way. Just north of S. Royal Brougham Way, traffic would be at-grade on SR 99 and connect to the new transition structures that join this project to the existing viaduct near S. King Street.

During Stage 4, Alaskan Way S. would be reduced to one northbound lane and two southbound lanes with a connection maintained to E. Marginal Way S. The temporary remote ferry holding would continue to be located west of the viaduct.

Stage 5

Stage 5 would last about 6 months. Northbound and southbound SR 99 traffic would travel on new structures from S. Holgate Street to Railroad Way S. with three lanes in each direction.

Local streets would be open for general purpose, ferry, and nonmotorized traffic. However, some minor localized lane or street closures and detours would be needed for final paving and striping. The new remote ferry holding area would also be open between S. Royal Brougham Way and S. King Street along the east side of SR 99. Vehicles would access the new holding area from either S. Atlantic Street or S. Royal Brougham Way.

How would access to SR 99 be affected during construction?

Access between SR 99 and the stadium area would be maintained throughout the construction period. Today, the First

Avenue S. ramps provide an exit for vehicles traveling southbound on SR 99 and an entrance for vehicles heading to northbound SR 99. These access points would remain open during the beginning and end of construction (Stages 1 and 5), but would be relocated during Stages 2 through 4.

During Stages 2 through 4, the southbound First Avenue S. off-ramp would be closed. Traffic would be relocated to a temporary off-ramp to Alaskan Way S. located just north of S. Royal Brougham Way. The First Avenue S. on-ramp to SR 99 would remain open during Stage 2. Traffic would use a temporary on-ramp from S. Royal Brougham Way west of First Avenue S. during Stages 3 and 4 to access northbound SR 99. The temporary ramp would provide similar access as the current on-ramp.

How would access to local streets be maintained during construction?

Construction activities would disrupt traffic on several streets within the project area, including S. Royal Brougham Way, S. Atlantic Street, Colorado Avenue S., Alaskan Way S., and E. Marginal Way S. Local access to businesses within the project area would be maintained throughout the construction period.

S. Royal Brougham Way would be closed between Alaskan Way S. and First Avenue S. beginning in Stage 2 and would remain closed after construction is complete. A portion of the roadway west of First Avenue S. would remain open to provide access to adjacent businesses and the temporary entrance ramp to northbound SR 99. Drivers that currently use S. Royal Brougham Way to travel east-west between Alaskan Way S. and the stadium area, SR 519, or First Avenue S. would instead use S. King Street to the north or S. Atlantic Street, located one block to the south.

Since S. Royal Brougham Way would be closed, maintaining access on S. Atlantic Street is critical. Throughout the construction period, a minimum of four lanes would be provided on S. Atlantic Street east of Colorado Avenue S., and a minimum of two lanes would be provided on S. Atlantic Street west of Colorado Avenue S. to Alaskan Way S.

To accommodate construction activities, Alaskan Way S. would be relocated east of its current alignment, and connections between S. Atlantic Street and E. Marginal Way S. would be modified. Temporary connections would be provided as

necessary to maintain these routes throughout the construction period.

The temporary southbound off-ramp from SR 99 would allow southbound traffic to access Alaskan Way S. and eastbound traffic to access S. Atlantic Street. A minimum of two southbound and eastbound lanes would be maintained on these streets to accommodate these trips.

During construction, one lane would be open in each direction on Colorado Avenue S. Construction of improvements to

SR 99 Existing Bus Routes

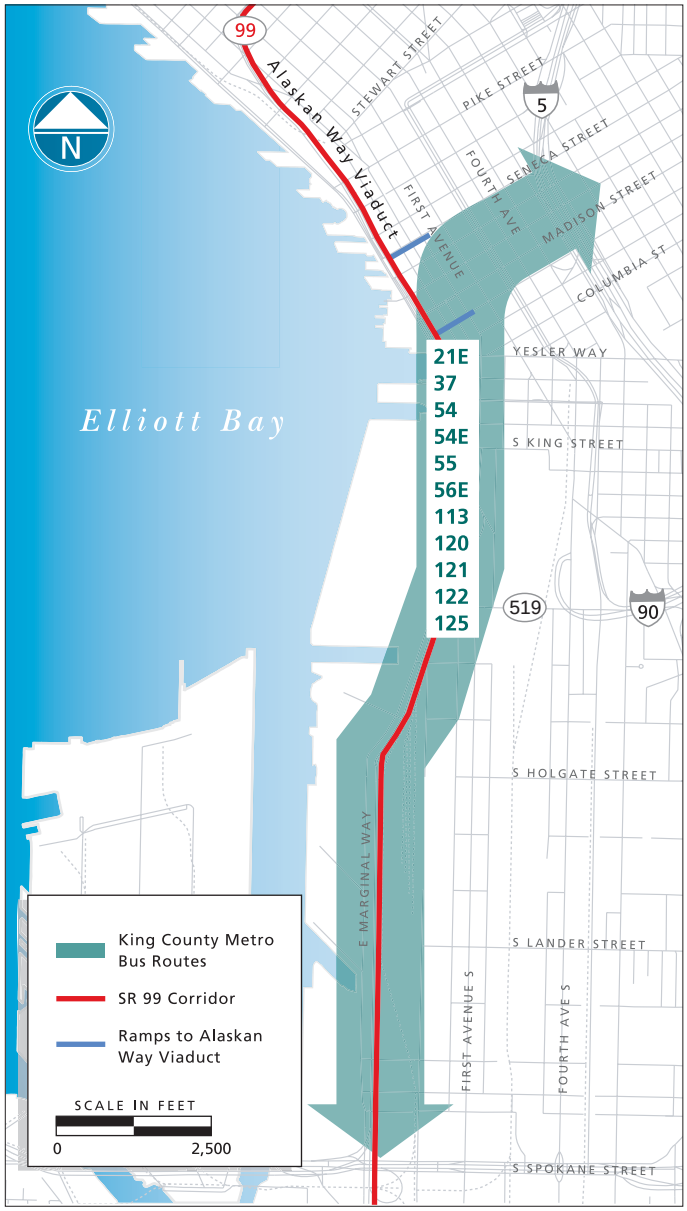


Exhibit 4-13

Colorado Avenue S. may increase delays along this street. Improvements include building two southbound and one northbound truck-only lanes on the west side of the street, and one general purpose lane in each direction on the east side of the street.

What is a queue bypass lane?

A queue bypass lane for transit would provide a dedicated lane and often traffic signal priority, allowing transit to "jump ahead" of other traffic on the roadway.

How would transit be affected during construction?

During construction, King County Metro Transit bus services using SR 99 would be affected by lane reductions on SR 99 through the construction zone. Transit would be affected in the same way as general purpose traffic. The affected bus routes are shown in Exhibit 4-13. With lane reductions on SR 99 through the construction zone, buses are expected to take longer to reach their destinations if no alternative routes or mitigation measures are provided.

Although SR 99 would remain open, King County Metro Transit may decide to make some routing changes for SR 99 bus routes to help reduce effects to transit riders. Potential mitigation measures on SR 99 and alternate transit paths are being identified in coordination with Seattle Department of Transportation and King County Metro Transit staff. Mitigation measures and alternative paths are being considered for SR 99, First Avenue S., Fourth Avenue S., and the E-3 Busway and include possible transit priority treatments. These options, described below, are in the process of being refined.

SR 99

Three potential transit enhancements are being considered for SR 99 during the construction period. These include:

1. Adding a directional queue bypass lane for both northbound and southbound SR 99. In the northbound direction, the queue bypass lane could extend from the Spokane Street Viaduct to the approximate start of the construction zone at S. Holgate Street using one of the three available lanes. The southbound transit queue bypass lane could begin at the Columbia Street on-ramp and end near the First Avenue S. off-ramp using one of the available three lanes. The southbound transit queue bypass lane may only be feasible if the Columbia Street on-ramp were designated as transit and high-occupancy vehicle (HOV) only during peak periods, as discussed below. Variations on the transit queue bypass strategy will be assessed as the project progresses.
2. Converting the Seneca and Columbia Street ramps to transit/HOV only during peak periods. This conversion would also allow transit to better accommodate trips into and out of downtown during the peak periods when

SR 99 is most heavily used, and would retain more capacity for through trips on SR 99 through downtown. Converting the Seneca and Columbia Street ramps would displace a relatively high amount of traffic onto the downtown street grid, particularly those trips from West Seattle. Converting these ramps from general purpose to transit and HOV only would require a policy decision from WSDOT, as well as coordination with and agreement from the City of Seattle, King County, and FHWA.

3. Adding a transit-only off-ramp to First Avenue S. near S. Royal Brougham Way. This northbound off-ramp could allow transit to bypass some of the congestion resulting from the detour through the WOSCA property that could back up onto SR 99 at the First Avenue S. ramp. A southbound transit-only on-ramp from Alaskan Way S. is also being considered.

First Avenue S.

Two transit enhancements are being considered on First Avenue S. during the construction period.

1. Transit-only lanes on First Avenue S. could be provided. Transit priority could be provided through parking restrictions in the existing parking lane. This could be replaced by or combined with a two-way, center turn lane between S. Spokane Street and S. Atlantic Street to provide northbound and southbound transit lanes. The transit lanes could either be adjacent to the curb or run down the center of the roadway. Regardless of the transit lane placement (curb or center), transit would have to use the general purpose lanes through the most congested segment on First Avenue S. (between S. Holgate Street and S. Royal Brougham Way) and would continue north to S. Washington Street or S. Main Street. The structural stability and ability of the areaways on First Avenue S. to withstand continual transit usage would need to be assessed.

2. The eastbound Spokane Street Viaduct exit ramp to First Avenue S. could be converted from general purpose to transit and HOV only. This designation change could provide transit with a designated path to the transit lanes on First Avenue S. and therefore would support a higher level of reliability and improved speed. Converting the ramp from general purpose to transit and HOV only would require a policy decision from the Seattle Department of Transportation and agreement from WSDOT and King County. This concept assumes that the added eastbound lane on the Spokane Street Viaduct to the Fourth Avenue Loop Ramp from the City's Spokane Street Viaduct Widening Project would be designated as general purpose to facilitate auto traffic's use of the Fourth Avenue Loop Ramp.

Fourth Avenue S.

Potential transit enhancements on Fourth Avenue S. were considered but not found to be practical. Fourth Avenue S. is a one-way northbound road north of S. Jackson Street. It experiences considerable congestion between S. Royal Brougham Way and S. Jackson Street, which is largely unavoidable, and it also lacks corresponding southbound access to the Spokane Street Viaduct.

E-3 Busway

Potential transit enhancements on the E-3 Busway were considered but found to be a less viable option because there is insufficient capacity for additional buses in the tunnel, which will have joint operations with light rail. In addition, the existing E-3 Busway ends at S. Royal Brougham Way, prior to entering the Downtown Seattle Transit Tunnel and prior to the bottleneck north of S. Royal Brougham Way. As with Fourth Avenue S., there is no corresponding southbound access to the Spokane Street Viaduct.

How would pedestrians and bicycles be affected during construction?

During Stage 1, pedestrians and bicyclists would use the existing combined path south of S. Atlantic Street. Between S. Atlantic Street and S. Royal Brougham Way, the path would cross under the existing viaduct and run along a temporary path east of the viaduct. North of S. Royal Brougham Way, the sidewalk on the west side of Alaskan Way S. would be closed and pedestrians and bicyclists would be routed along the existing combined pedestrian/bicycle path on the east side of the street. Signs would be posted to help direct pedestrians and bicycles through the construction zone.

During the last 6 months of Stage 1 when construction for the west half of the undercrossing begins, bicyclists using the bike lane on Alaskan Way S. could be detoured as will vehicular traffic. Traffic on Alaskan Way S. would be detoured to S. Atlantic Street, S. Royal Brougham Way, and First Avenue S. Bicyclists would have the option of sharing the roadway with vehicles on the detour routes or using the existing combined pedestrian/bicycle path on the east side of Alaskan Way S.

During Stages 2 through 4, a combined pedestrian/bicycle path would be provided on the west side of Alaskan Way S., close to the location of the existing sidewalk. The existing path located on the east side of Alaskan Way S. would be closed

south of S. King Street. A pedestrian/bicycle connection to S. Atlantic Street would be provided. As in Stage 1, bicyclists would need to use the combined pedestrian/bicycle path or share the roadway with vehicles.

During Stage 5, localized lane closures would be required for final paving and striping. Bicyclists and pedestrians may be detoured to other routes for brief periods before the final facilities are open for use.

How would ferry traffic be affected during construction?

Although the Seattle Ferry Terminal is located north of the project area, many drivers heading to or from the ferry terminal would need to pass through the construction zone. Currently, vehicles traveling to the terminal sometimes overflow under the existing viaduct north of S. Royal Brougham Way when the terminal is full during busy times. There would be no changes to ferry holding during Stage 1. During Stages 2 through 5, a temporary remote ferry holding area would be located west of Alaskan Way S. and south of S. King Street.

With S. Royal Brougham Way permanently closed after Stage 1 of the construction period, most vehicles would use S. Atlantic Street and Alaskan Way S. to access the Seattle Ferry Terminal and the temporary remote holding area.

Vehicles exiting the Seattle Ferry Terminal would also be rerouted during the construction period. With S. Royal Brougham Way closed, traffic exiting the ferry terminal and traveling southbound on Alaskan Way S. would instead use S. King Street, S. Atlantic Street, and First Avenue S. when traveling through the project area. The tail track would be relocated to the west of Alaskan Way S. to prevent train blockages from affecting vehicles traveling southbound on Alaskan Way S. and eastbound on S. Atlantic Street.

How would freight access and connections be affected during construction?

S. Atlantic Street, SR 519, First Avenue S., and E. Marginal Way S. are key freight routes that serve several important freight handling sites in the project area. Freight trucks would be able to continue to use these routes during the construction period. Although maintaining these routes is a priority, there would be instances when freight traffic would be affected by construction activities. Alaskan Way S. and E. Marginal Way S. are significant routes for over-legal (oversized) vehicles

transporting freight in the area. A route for over-legal vehicles will be maintained throughout construction.

Throughout the construction period, S. Atlantic Street would remain open between Alaskan Way S. and First Avenue S. Similar to today, this route would be blocked by train activity during train switching operations. During these periods, trucks could use S. Horton Street or S. Hanford Street to make trips between Terminal 46, S. Atlantic Street, SR 519, the North SIG Railyard, and other points east. During Stage 1, traffic on S. Atlantic Street would be reduced from four to two lanes between Alaskan Way S. and Colorado Avenue S.

S. Royal Brougham Way would be permanently closed between Alaskan Way S. and First Avenue S. after Stage 1. Trucks that currently use this segment of roadway would instead travel one block to the south to use S. Atlantic Street to access freight-related sites on Alaskan Way S. and E. Marginal Way S.

How would rail operations be affected during construction?

Rail in the project area can remain open and in operation for most of the construction period. There would be instances when rail operations would be affected due to temporary track relocations during Stage 1 and construction of the final track configuration during Stages 3 and 4. The tail track would be permanently relocated west of the new SR 99 roadway.

The Whatcom Railyard's lead track would also be temporarily relocated during construction to connect to the relocated tail track. In addition, the easternmost Union Pacific track in the Whatcom Railyard would be out of service for approximately 3 years during construction of the southbound bridge between S. Walker and S. Atlantic Streets. This track would be available when construction is completed.

Maintenance of rail operations is a priority, and the project will strive to expedite track construction and minimize effects to rail operations.

How would traffic safety be maintained during construction?

The traffic safety hazards associated with work zones are greater than on normal roadways. New and unfamiliar traffic patterns, signage, and cones/barricades in temporary work

zones can be confusing and unexpected for drivers. A traffic management plan will be coordinated with the City of Seattle, Seattle Police Department, Seattle Fire Department, Port of Seattle, King County Metro Transit, Safeco Field, Qwest Field, and Qwest Field Event Center to identify detours and traffic management strategies. This plan would address traffic safety and control throughout the work zone. Work zone management strategies may include using Intelligent Transportation Systems (ITS), traveler information, real-time work zone monitoring, traffic incident management, and enforcement components.

What is ITS?

Intelligent Transportation Systems (ITS) use advanced electronic and computer technology to automate highway and vehicle systems that improve safety and efficiency on roadways.

During much of the construction period, the bicycle lane on Alaskan Way S. south of S. Royal Brougham Way would be removed. Bicycles would use the shared pedestrian/bicycle path, although some may opt to share the roadway with vehicles. This would increase the potential for vehicle-bicycle conflicts. The combined pedestrian/bicycle path is unlikely to be highly used by pedestrians through the construction area, so bicycle-pedestrian conflicts are not expected to be frequent.

4 How would construction affect traffic and congestion on SR 99 and other city streets?

How would construction affect traffic and congestion on SR 99?

Vehicles would experience the most traffic disruption on SR 99 during Stage 3, when traffic on mainline SR 99 is detoured onto the WOSCA property. A traffic analysis was completed using these worst-case assumptions, and for the majority of the construction period, traffic conditions would be better and overall congestion would be less than the conditions described below.

Travel Patterns and Traffic Volumes

For a period of about 2 years and 3 months beginning late in Stage 1 and continuing through Stage 4, traffic congestion and travel times on SR 99 are expected to increase due to lane restrictions and detours. Because of this, some SR 99 users are expected to make other travel choices. These changes may include switching to other routes, changing travel modes (such as using transit), making fewer trips, or choosing other destinations.

Exhibit 4-14 shows how AM and PM peak hour traffic volumes may change on SR 99 during Stage 3. When compared to esti-

mated year 2010 baseline volumes, traffic volumes on SR 99 are expected to decrease by 30 to 35 percent.

Exhibit 4-14

Peak Hour SR 99 Traffic Volumes

	AM PEAK HOUR			PM PEAK HOUR		
SOUTHBOUND	2010 Baseline Volumes	Stage 3 Volumes	% Decrease	2010 Baseline Volumes	Stage 3 Volumes	% Decrease
SR 99 north of the stadium area	3,900	2,730	30%	5,400	3,510	35%
Off SR 99 to the stadium area	1,480	1,040	30%	850	560	35%
SR 99 south of the stadium area	2,420	1,690	30%	4,550	3,000	35%
NORTHBOUND						
SR 99 south of the stadium area	4,540	2,950	35%	3,620	2,560	30%
On to SR 99 from the stadium area	800	520	35%	1,260	820	35%
SR 99 north of the stadium area	5,330	3,470	35%	4,880	3,360	31%

Why are projected traffic volumes for 2010 used to assess traffic conditions during construction?

Project construction is expected to begin in the fall of 2009. Therefore, projected traffic volumes in 2010 would be more reflective of actual traffic conditions at the time of construction.

Exhibit 4-15 (following page) shows how peak hour traffic volumes during the construction period would compare to normal traffic levels throughout the day on the SR 99 mainline. As shown in Exhibit 4-15, hourly traffic volumes during the construction period are expected to be lower than the traffic volumes that would normally occur for several hours during both the AM and PM peak travel periods. Midday traffic volumes on a normal day are usually lower than traffic volumes during the peak periods. During Stage 3, however, traffic volumes during the midday hours could mirror those experienced during the peak hours. This is because congested conditions and changes in travel times during the construction period could result in more trips being made midday than normal.

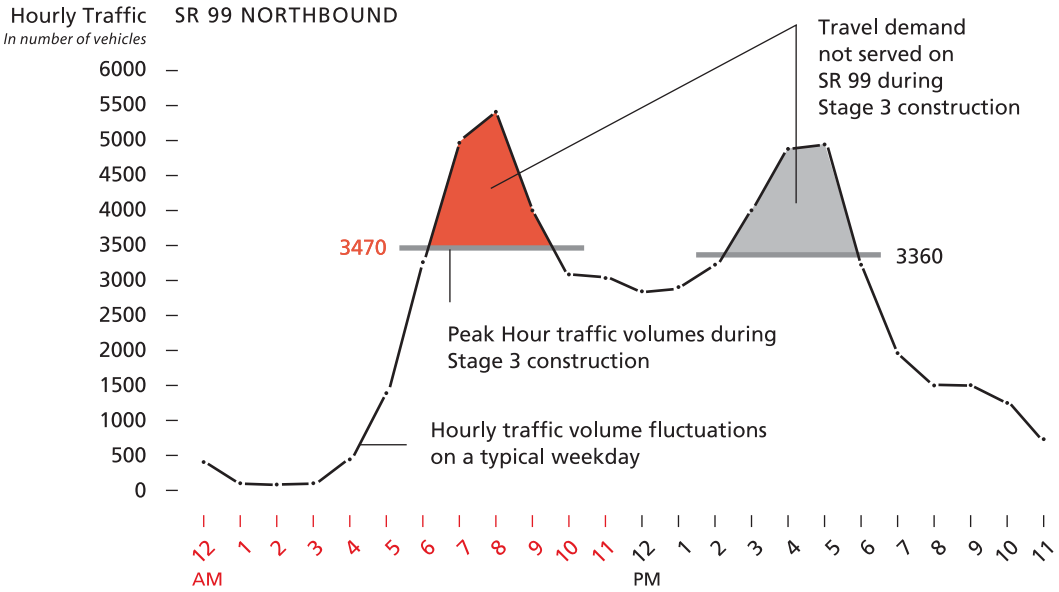
Travel Speeds and Queues

Congested conditions are expected on the SR 99 mainline throughout the construction period, though the most congested conditions are expected during Stage 3. As shown in Exhibit 4-16, travel speeds are generally expected to decrease as vehicles approach the WOSCA detour. Through the WOSCA detour, vehicles would travel at approximately 8 to 20 miles per hour (mph) and then accelerate to free-flow speeds after the detour. Currently, speeds on this section of SR 99 are approximately 30 to 40 mph for southbound traffic and 20 to 40 mph for northbound traffic during the peak hour.

Exhibit 4-15

SR 99 Peak Hour Traffic Volumes

During Construction Stage 3



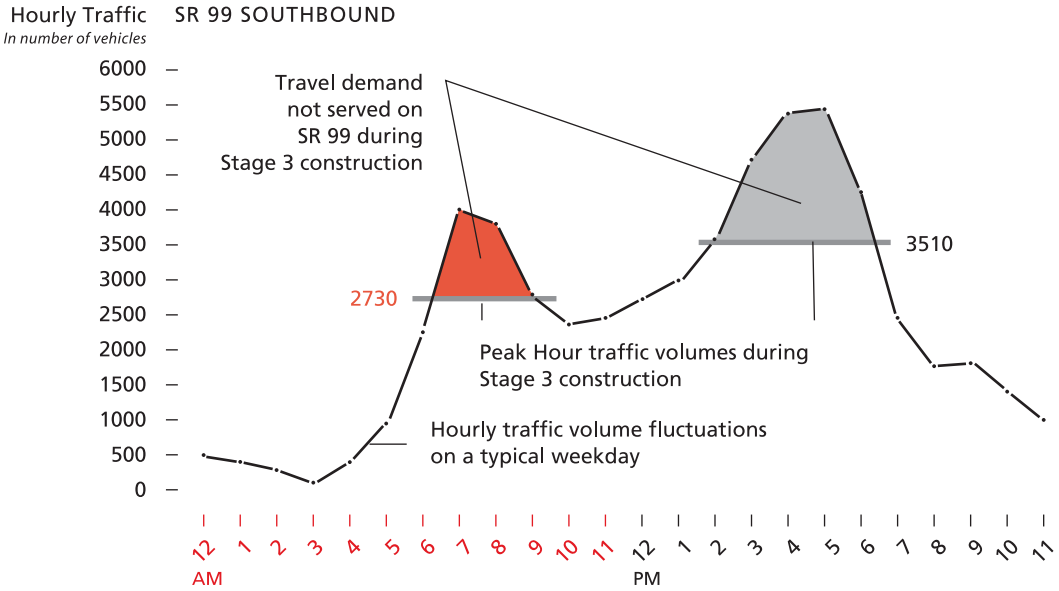


Exhibit 4-16

SR 99 Peak Hour Travel Speeds during Construction Stage 3
in miles per hour (mph)

SOUTHBOUND	AM Peak Hour	PM Peak Hour
North of WOSCA Detour	28	27
Through WOSCA Detour	12 to 20	8 to 20
South of WOSCA Detour	Free-flow	Free-flow
NORTHBOUND		
South of WOSCA Detour	40	40+
Through WOSCA Detour	12 to 20	10 to 20
North of WOSCA Detour	Free-flow	Free-flow

Because of traffic congestion on the detour, vehicles traveling southbound on the SR 99 mainline could experience traffic queues extending back to the vicinity of the Elliott Avenue on-ramp during the AM peak hour and towards the Battery Street Tunnel during the PM peak hour. Northbound, vehicles on the SR 99 mainline could experience traffic queues extending south toward S. Spokane Street during the AM peak hour. During the PM peak hour, congested conditions and northbound traffic queues are expected to remain in the vicinity of the detour.

How would construction affect traffic and congestion on city streets?

Trucks traveling to and from the staging areas and work zones are expected to use established truck routes, including First and Fourth Avenues S., S. Atlantic Street, E. Marginal Way S., S. Michigan Street, SR 519, and I-5. Material hauled along these routes would include new construction materials as well as demolished structure materials, excavated soil, and spoils created by soil improvements.

Before and after special events at the stadiums and event center, traffic normally becomes congested on First Avenue S., S. Royal Brougham Way, S. Atlantic Street, and other nearby streets. These conditions would likely be worse during construction, depending on construction stage and time of the event.

Traffic disruption caused by construction would also affect traffic conditions on nearby local streets. Some drivers would choose to divert to alternate routes. In particular, First and Fourth Avenues S. offer direct, alternate routes to SR 99 in the project area.

Exhibit 4-17 shows the intersections that would be congested during Stage 3 of the construction period. Traffic conditions

Congested Intersections
CONSTRUCTION STAGE 3
PM Peak

Exhibit 4-17

What are congested intersections?

For the traffic analysis conducted for this project, congested intersections are intersections that cause drivers considerable delay. A driver might wait one minute or more to get through a traffic signal at a congested intersection.

during the 8 months of Stage 3 construction represent the most congested conditions expected during the five construction stages.

First Avenue S.

Expected traffic volumes along First Avenue S. during Stage 3 of the construction period are shown in Exhibit 4-18. Construction effects to traffic volumes would peak during Stage 3 when all SR 99 traffic is routed to the WOSCA detour.

Exhibit 4-18

PM Peak Hour Traffic Volumes on First Avenue S.

SOUTHBOUND	2010 Baseline Volumes	Stage 3 Option 2 Volumes	% Change
North of First Avenue S. ramps	540	800	*48%*
Between First Avenue S. ramps & the stadium area	1,650	980	*-40%*
South of the stadium area	1,210	1,180	*-2%*
NORTHBOUND			
South of the stadium area	1,470	1,330	*-10%*
Between First Avenue S. ramps & the stadium area	1,800	830	*-54%*
North of First Avenue S. ramps	470	780	*67%*

Two primary factors would affect traffic volumes on First Avenue S. during Stage 3: the temporary relocation of the First Avenue S. ramps and lane closures on SR 99.

The southbound First Avenue S. off-ramp would be relocated to Alaskan Way S. just north of S. Royal Brougham Way, and the northbound First Avenue S. on-ramp would be relocated to S. Royal Brougham Way on the west side of First Avenue S. The temporary ramps would provide similar access to SR 99 as the current ramps. Traffic volumes would decrease on First Avenue S. between S. Royal Brougham Way and Railroad Way S. because of the ramp relocations and the lane closures on SR 99. The traffic volumes north of the current First Avenue S. ramp location would increase due to the additional traffic displaced from SR 99.

South of the stadium area (near S. Atlantic Street), peak hour traffic volumes are expected to decrease by 2 to 10 percent. While some diverted traffic is expected on First Avenue S., this traffic increase is more than offset by traffic reductions associated with temporarily relocating the First Avenue S. ramps.

First Avenue S. has adequate capacity to accommodate the construction traffic volumes forecasted for the construction

period. The projected traffic volumes could be accommodated under congested conditions, even with only one lane of travel provided in each direction north of S. Royal Brougham Way. However, there is a possibility First Avenue S. may attract more traffic than indicated by the forecasting model, given the high levels of congestion forecasted for SR 99 and Fourth Avenue S. during the construction period. Should First Avenue S. attract more traffic than indicated by the forecasting models, parking restrictions would be needed along First Avenue S. in Pioneer Square during both the AM and PM peak periods, to create an additional travel lane north of S. King Street. These parking spaces are currently restricted for the AM peak period.

Fourth Avenue S.

During Stage 3, traffic would also divert from the SR 99 mainline to Fourth Avenue S., as shown in Exhibit 4-19. Traffic volume increases on Fourth Avenue S. would not be offset by the changes associated with the SR 99 First Avenue S. ramps to the same degree as on First Avenue S.

Exhibit 4-19

PM Peak Hour Traffic Volumes on Fourth Avenue S.

SOUTHBOUND	2010 Baseline Volumes	Stage 3 Volumes	% Change
North of Airport Way S.	1,160	1,950	*68%*
North of I-90	1,520	2,100	*39%*
Between I-90 ramps & S. Royal Brougham Way	2,320	2,780	*20%*
South of S. Atlantic Street	1,190	1,860	*56%*
NORTHBOUND			
South of S. Atlantic Street	1,130	1,600	*42%*
Between I-90 ramps & S. Royal Brougham Way	640	900	*41%*
North of I-90	930	1,320	*42%*
North of Airport Way S.	1,390	1,900	*37%*

North of Airport Way S., PM peak hour traffic volumes on Fourth Avenue S. are expected to increase by 37 to 68 percent during Stage 3 of the construction period because vehicles displaced by the SR 99 closure would likely use this parallel route between the downtown business district and the stadium area. During the AM peak hour, northbound traffic is expected to be more constrained on this segment of Fourth Avenue S. than during the PM peak hour.

Between the I-90 ramps and S. Royal Brougham Way, traffic volumes are typically heavier in the southbound direction as

vehicles travel from the I-90 off-ramp to SR 519. During Stage 3, traffic volumes in this segment of Fourth Avenue S. are expected to increase by 20 to 41 percent during the PM peak hour. South of S. Atlantic Street, PM peak hour traffic volumes are projected to increase by 42 to 56 percent during Stage 3.

Even without these traffic volume changes, southbound traffic on Fourth Avenue S. north of S. Royal Brougham Way is already heavily congested during the PM peak hour. As shown in Exhibit 4-17, a number of intersections on Fourth Avenue S., including the intersection at Airport Way S. and intersections associated with the I-90 off-ramp, are expected to operate poorly during Stage 3 of the construction period. These results show that Fourth Avenue S. would not be able to effectively move a substantial amount of additional traffic in the peak commute direction. Despite operational problems on Fourth Avenue S., eastbound traffic on S. Atlantic Street would still flow quite well.

Alaskan Way S and S. Atlantic Street

S. Royal Brougham Way between Alaskan Way S. and First Avenue S. would be closed during the majority of the construction period. During this time, traffic exiting SR 99 in the stadium area would likely be redirected to Alaskan Way S. With these traffic routing changes during construction, a minimum of two travel lanes need to be provided for southbound traffic on Alaskan Way S.

During Stage 3, the intersection of Alaskan Way S. and Colorado Avenue S. at S. Atlantic Street, which operates in tandem with the adjacent E. Marginal Way S./Terminal 46/S. Atlantic Street intersection, would be reconfigured. This intersection would operate poorly during the AM and PM peak hours, with congestion forming along southbound Alaskan Way S., northbound E. Marginal Way S., and Colorado Avenue S.

5 What would we do to keep people and traffic moving during construction?

We plan to develop and deliver enhancements and improvements to help keep traffic moving during the construction of this project and other projects proposed as part of the Alaskan Way Viaduct and Seawall Replacement Program. These enhancements and improvements are independent projects that benefit all pending improvements under the Alaskan Way Viaduct and Seawall Replacement Program. As such, they are not part of the S. Holgate Street to S. King Street Viaduct

Replacement Project and will each be evaluated separately. Up to $125 million has been set aside for funding these enhancements and improvements. The projects and strategies include additional transit service hours and capital equipment (i.e., buses), transit speed and reliability improvements, traveler information systems, improving arterial and street traffic operations, and supporting transportation demand management efforts and other projects.

The project team has begun work on identifying candidate projects and programs that could be eligible for funding. Projects planned for implementation are discussed below. In addition, WSDOT, the City of Seattle, and King County are considering establishing an oversight committee called the Downtown Transportation Operations Committee. This committee would be tasked with monitoring and coordinating construction activities in the greater downtown Seattle area. This committee would lead the coordination efforts to ensure that transportation operations for all modes (general purpose traffic, transit, and freight) are as effective as possible during downtown construction activities. This committee would provide for real-time communications and information linkages to better manage the multimodal transportation system.

We will also prepare a traffic management plan in coordination with City of Seattle, Seattle Police Department, Seattle Fire Department, Port of Seattle, King County Metro Transit, Safeco Field, Qwest Field, and Qwest Field Event Center. The plan will identify ways to minimize construction effects to traffic. Procedures in the plan would include:

- Agency coordination.
- Flexible and responsive management of traffic before, during, and after stadium events.
- Strategies for redirecting traffic.
- Notification of detours, lane closures, nighttime construction, or other relevant information.

Proposed Projects to Keep Traffic Moving During Construction

The projects listed in Exhibit 4-20 (following page) have been identified to help keep traffic moving during construction.

Transit Priority Routes and Strategies

As noted earlier, a number of potential transit enhancements are being considered for SR 99 and First Avenue S. during the

Exhibit 4-20

Proposed Projects to Keep Traffic Moving during Construction

PROJECT NAME	TRAVEL MARKET	GOALS
SR 519 Intermodal Access Project Phase 2	• Freight to/from the Port of Seattle • SODO	• Improve highway & street system reliability • Improve freight connections
Spokane Street Viaduct Widening Project	• West Seattle • SODO • Duwamish	• Improve highway & street system reliability • Improve freight connections • Help redistribute traffic to/from West Seattle
Elliott Avenue W. to 15TH Avenue W. Corridor Improvements	• Ballard • Magnolia/Interbay	• Improve highway & street system reliability • Provide information to travelers • Improve ITS infrastructure to support transit signal priority & provide real-time transit information
West Seattle Corridor Improvements	• West Seattle	• Improve highway & street system reliability • Provide information to travelers • Improve ITS infrastructure to support transit signal priority & provide real-time transit information
SODO/Integrated Corridor Management Improvements	• SODO • Georgetown • I-5	• Improve highway & street system reliability • Provide information to travelers • Improve ITS infrastructure to support transit signal priority & provide real-time transit information
I-5 Travel Time Signs	• Regional through trips on I-5	• Provide information to travelers
Secure use of new buses & transit service hours	• West Seattle • Burien • White Center • Ballard • Aurora • I-5 Corridor	• Increase transit capacity • Increase transit frequency • Increase transit system reliability
Bus Travel Time Monitoring System	• Transit System	• Improve transit system reliability
I-5 Active Traffic Management	• Regional through trips on I-5	• Improve highway system reliability • Reduce the number of roadway incidents • Reduce the severity of roadway incidents
Ballard and SODO Arterial Travel Time System	• Ballard • Magnolia/Interbay • SODO	• Improve street system reliability • Provide information to travelers
Denny Way Corridor Improvements	• Ballard • Queen Anne • South Lake Union	• Improve street system reliability • Provide information to travelers
South End Transportation Demand Management	• West Seattle • South Seattle • Burien • Tukwila	• Encourage shifts in travel modes for single-occupant vehicles • Provide information to travelers
Downtown Transportation Demand Management	• Downtown Seattle	• Provide travel information for visitors • Encourage shifts in travel modes for single-occupant vehicles • Improve parking management
In Construction Adaptation Project	• All	• Modify the system as needed to adapt to ongoing construction activities

construction period. Some of the considerations would require a policy decision or agreement from the City of Seattle, WSDOT, and King County. The projects include:

- Implementing a directional queue bypass lane for both northbound and southbound SR 99 ramps.
- Converting the Seneca and Columbia Street ramps to transit and HOV only during peak periods.
- Implementing a transit-only northbound off-ramp to First Avenue S. near S. Royal Brougham Way.
- Implementing transit-only lanes on First Avenue S.
- Converting the Spokane Street Viaduct eastbound ramp to First Avenue S. from general purpose to transit and HOV only.

Managing Event Traffic

Safeco Field, Qwest Field, and Qwest Field Event Center host many sporting and other events, which generate high volumes of traffic. Typical attendance at these facilities is shown in Exhibit 4-21. The home game schedules for the Mariners and Seahawks during the construction period are expected to be similar to their existing schedules. Forty-eight of the 81 Mariners home games in 2008 are scheduled on weekday evenings, which can affect the evening peak hours of travel. All of the Seahawks regular season home games in 2008 are scheduled on Sundays and do not affect the weekday commute periods; however, there is a possibility that a game could occur on a different day, such as a weekday night.

Exhibit 4-21

Typical Event Attendance in the Stadium Area

Event	Average Number of Attendees (Approximate)
Safeco Field – Mariners game	37,000
Qwest Field – Seahawks game	58,000
Event Center – large trade show	20,000 - 65,000
Event Center – small trade show	5,000 - 20,000

Source: SR 519 Intermodal Access Project Phase 2, WSDOT and FHWA 2008

During construction, events that overlap with peak commuting hours are likely to create very congested traffic conditions. Traffic flow during events is managed by the Seattle Police Department. The traffic control officers adapt to specific conditions and use their professional judgment regarding how traffic restrictions are applied under specific circumstances. Pedestrian traffic before and after events at the stadiums is

also heavy and controlled at intersections by the Seattle Police Department.

Other Potential Projects

Construction traffic mitigation projects will continue to be developed, with the goal of having critical projects in place by the time major construction effects to SR 99 traffic occur. We will coordinate with other agencies and projects as applicable. In addition, more localized mitigation measures will be developed as project construction details are refined. Some localized mitigation measures during construction might include:

- Temporarily widening Alaskan Way S. from S. Atlantic Street to S. King Street to accommodate two southbound lanes and one northbound lane of traffic during Stages 2 through 4, including ferry traffic.
- Providing temporary traffic signals.
- Providing flaggers at certain intersections to facilitate freight movements and other traffic as necessary.

6 How would noise be affected during construction?

Construction would typically take place 5 days per week, 10 hours per day. However, construction may occur up to 24 hours per day, 7 days per week at times during the construction period. Some night or weekend work may be required for roadway crossings, tail track relocation, or other critical construction activities. Nighttime work would be completed in compliance with the City of Seattle Noise Ordinance. Any noise variances would need to be obtained prior to any nighttime construction.

Construction noise would be bothersome to nearby residents and businesses. The loudest construction activity would be the demolition of the existing viaduct. The most common noise source near construction work zones would be from engines. Earth-moving equipment, material-handling equipment, and stationary equipment are all engine-powered. Stationary equipment (e.g., pumps, generators, and compressors) operates at sound levels that are fairly constant over time. Because trucks would be present during most phases and would not be confined to the project site, noise from trucks could affect more receptors. Other noise sources would include impact equipment and tools such as pile drivers.

Construction noise could last for several weeks in any one area. Construction noise would be intermittent, occurring at

different times and locations during the construction. Construction noise levels would depend on the type, amount, and location of construction activities. The maximum noise levels of construction equipment would be similar to the typical maximum construction equipment noise levels presented in Exhibit 4-22.

Exhibit 4-22

Typical Sound Levels

Transportation Sources	Other Sources		Description
Jet Takeoff (200 feet) Car horn (3 feet)		120 dBA	*Maximum vocal effort*
	Pile Driver (50 feet)	110 dBA	
	Shout (1/2 foot)	100 dBA	*Very annoying*
Heavy truck (50 feet)	Jackhammer (50 feet) Home shop tools (3 feet)	90 dBA	*Loss of hearing with prolonged exposure*
Train on a structure (50 feet)	Backhoe (50 feet)		
City Bus (50 feet)	Vacuum cleaner (3 feet) Bulldozer (50 feet)	80 dBA	*Annoying*
Train (50 feet) City bus at stop (50 feet) Freeway traffic (50 feet)	Blender (3 feet) Lawn mower (50 feet) Large office	70 dBA	*Intrusive*
Train in Station (50 feet)	Washing machine (3 feet)		
	Television (10 feet)	60 dBA	
Light Traffic (50 feet)	Talking (10 feet)		
Light traffic (100 feet)		50 dBA	*Quiet*
	Refrigerator (3 feet)		
	Library	40 dBA	
	Soft whisper (15 feet)	30 dBA	*Very quiet*

Source: FTA 1995, EPA 1971, EPA 1974

As shown in Exhibit 4-22, maximum noise levels from construction equipment would range from 69 to 106 dBA L_{max} at 50 feet. Construction noise at locations farther away would decrease at a rate of 6 to 8 dBA per doubling of distance from the source. The number of occurrences of the maximum noise peaks would increase during construction, particularly during pile-driving activities. 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 short-term tasks at any given location, average L_{eq} daytime noise levels would be 10 to 20 dBA less than the typical maximum construction equipment noise levels. Construction noise levels may not exceed a maximum L_{eq} (7.5 minutes) of 99 dBA at 50 feet or the nearest property line (whichever is farther) within the city of Seattle (SMC 25.08.425).

What is a dBA?

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

To the human ear, a 1- to 3-dBA change is hard to distinguish, but a 5-dBA change in noise levels is readily noticeable. A 10-dBA decrease would sound like the noise level has been cut in half.

What are L_{max} and L_{eq}?

The maximum sound level (**L_{max}**) is the loudest short-duration sound level that occurs during a single event. L_{max} is related to effects such as speech interference and sleep disruption.

The L_{eq} is a measure of the average sound energy during a specified period of time.

What types of mitigation measures would be used to minimize these effects?

To reduce construction noise at nearby receptors, mitigation measures would be incorporated where feasible into construction plans, specifications, and variance requirements. Mitigation could include the following measures:

- Crush and recycle concrete off-site, away from noise-sensitive uses, to decrease construction noise effects.
- Construct temporary noise barriers or curtains around stationary equipment and long-term work areas that must be located close to residences. This would decrease noise levels at nearby sensitive receptors and could reduce equipment noise by 5 to 10 dBA.
- Designate specific construction activities as high-impact noise-generating activities and assign noise limits that cannot be exceeded during specific time periods.
- Limit the noisiest construction activities to between 7 a.m. and 10 p.m. on weekdays and holidays, and between 9 a.m. and 10 p.m. on weekends to reduce construction noise levels during sensitive nighttime hours.
- Restrict impact construction activities, such as pile driving.
- Equip construction engines with adequate mufflers, intake silencers, and engine enclosures; this could reduce their noise by 5 to 10 dBA[1].
- Use the quietest equipment available; this could reduce noise by 5 to 10 dBA.
- Require broadband backup alarms approved by the Occupational Safety and Health Administration (OSHA); this could reduce disturbances to nearby residents from backup alarms during quieter periods.
- Turn off construction equipment during prolonged periods of non-use; this could eliminate noise from idling construction equipment during those periods.
- Require all equipment to be maintained and equipment operators to be trained; this could reduce noise levels and increase operational efficiency. Out-of-specification mufflers can increase equipment noise by 10 to 20 dBA.

Additional noise mitigation measures are described in Appendix B. Other mitigation measures could also be specified in a noise variance. WSDOT would coordinate with nearby businesses and residents to notify them if there are circumstances that require nighttime construction activities to occur nearby.

Appendix G Technical Memoranda

Appendix G contains technical memoranda that support conclusions discussed in this EA:

- *Alternative Description and Construction*
- *Archaeological Resources*
- *Economics*
- *Environmental Justice*
- *Geology and Soils*
- *Hazardous Materials*
- *Historic Resources*
- *Land Use and Shorelines*
- *Noise and Vibration*
- *Parks and Recreation*
- *Public Involvement*
- *Public Services and Utilities*
- *Relocations*
- *Social Resources*
- *Visual Quality*
- *Water Resources*

[1] EPA 1971

7 Would vibration affect the project area during construction?

Vibration and settlement caused by construction could damage existing structures and utilities. Construction activities that would result in the highest levels of ground vibration are the demolition of the existing viaduct structure and impact pile driving. During viaduct demolition, buildings closer than 100 feet could potentially exceed the vibration damage risk criterion for extremely fragile buildings. The majority of buildings along the proposed alignment for this project are not considered to be fragile. Two historic buildings are located near the viaduct, the Bemis Building and the Triangle Hotel. The Bemis Building is about 65 feet away from the viaduct, and the hotel is approximately 160 feet away from the viaduct and about 40 feet from the First Avenue S. ramp columns, which will remain in place. For newer buildings, the risk for vibration damage would not be exceeded when construction activities are more than 25 feet away. For pile driving, buildings closer than 400 feet would exceed the damage risk criterion for extremely fragile buildings, while at 50 feet they would not exceed the criterion for newer buildings.

Settlement could occur where soils are excavated. If any existing pile foundations are to be removed, vibration techniques should be avoided in areas where adjacent structures or utilities are present. Soil improvement methods could also cause vibration and potentially damage utilities. We will coordinate with Seattle Public Utilities and affected utility providers to identify nearby utilities that should be avoided. Effects could be mitigated by monitoring activities and altering construction methods if needed.

What types of mitigation measures would be used to minimize these effects?

To reduce construction vibration effects, mitigation measures would be incorporated into construction plans and specifications. Several potential measures and construction methods can be used to reduce vibration from impact pile driving, when appropriate for specific site conditions, such as:

- Jetting.
- Pre-drilling.
- Cast-in-place or auger piles.
- Pile cushioning.

What are the construction vibration criteria?

The potential for cosmetic or structural damage due to construction activities is assessed on the basis of effect criteria developed by the Acoustical Society of America (2001), the International Organization for Standardization (ISO 1989), and the Federal Transit Administration (FTA 2006).

The highest levels of vibration would be during the demolition activities. The expected peak particle velocity of ground vibration levels at 25 feet from the demolition activities ranges from 0.24 to 0.42 inch/second. This would exceed the damage risk criterion of 0.12 inch/second for older extremely fragile buildings but would not exceed the project's damage risk criterion for newer buildings of 0.50 inch/second.

Appendix B. Potential Mitigation Measures

Appendix B lists potential mitigation measures being considered for this project.

- Alternative non-impact drivers.
- Use of vibratory pile drivers instead of impact drivers.

Vibration from other construction activities can be reduced by either restricting their operation to predetermined distances from historic structures (such as the Triangle Hotel) or other sensitive receivers, or using alternative equipment or construction methods. An example would be the use of saws or rotary rock cutting heads to cut bridge decks or concrete slabs instead of using a hoe ram. Vibration mitigation measures are described further in Appendix B.

WSDOT could implement vibration monitoring at the nearest historic structure or sensitive receiver to the construction activities. The monitoring data would 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 to determine if mitigation measures are needed.

8 How would air quality be affected during construction?

Dust from demolition, excavation, and truck-hauling activities and emissions from heavy-duty construction equipment could affect air quality in the immediate vicinity of construction activities. Air pollutant emissions that result from construction activities were qualitatively assessed for the project. Equipment emissions could come from:

- Gas and diesel-fueled construction equipment, such as bulldozers, backhoes, and cranes.
- Diesel- and gas-fueled generators.
- Other project-generated vehicles (such as service trucks and pickups).

Fugitive PM_{10} emissions from construction activities could be noticeable, if uncontrolled. These emissions would be temporary and limited to the immediate area surrounding the construction site.

What types of mitigation measures would be used to minimize these effects?

During construction, specific avoidance and minimization measures will help reduce pollutant emissions. These measures could include spraying exposed soil with water, covering truck loads and materials as needed, washing truck wheels before leaving the site, removing particulate matter from

Appendix E Air Quality Discipline Report

Appendix E Appendix E contains information that supports conclusions discussed in this EA about air quality during construction.

What are Fugitive PM_{10} emissions?

Fugitive PM_{10} emissions are associated with demolition, land clearing, ground excavation, grading, cut-and-fill operations, and structure erection. PM_{10} emissions would vary from day to day, depending on the level of activity, specific operations, and weather conditions.

roads, routing and scheduling construction trucks to reduce delays, staging materials and construction areas in a way that reduces standing wait time for equipment, ensuring that equipment is well-maintained, and implementing other temporary mitigation measures as needed and considered appropriate. Reducing delays and ensuring that equipment operates at efficient levels will reduce fuel consumption and emissions, which contribute to climate change. Due to space constraints at the work site and the benefit of additional emission reductions, we recommend that ridesharing and other commute trip reduction efforts be promoted for employees working on the project. Air quality mitigation measures are described further in Appendix B.

9 How would economic conditions in surrounding areas be affected?

Benefits

Increased employment and economic stimulus to the local economy from construction activities would be the primary economic benefit from the project. About 1,600 new jobs would be directly associated with the project as a result of new money entering the Puget Sound regional economy. The amount of new earnings (wages) entering the Puget Sound regional economy would be about $59 million.

The project would generate $15 million in sales tax revenue through the purchase of goods and materials related to construction.

Businesses and Employees

The project requires a construction period of about 4 years and 4 months that would disrupt normal business activities in the project area. Approximately 308 businesses (including multi-family residential buildings) were identified within one block of SR 99 that could be disrupted by construction activities. These temporary effects include the following:

- Increased activity from construction workers, heavy construction equipment, and materials.
- Temporary road closures, traffic diversions, and alterations to property access.
- Noise and vibrations from construction equipment and vehicles.
- Decreased business visibility and times when customer access to businesses may be more challenging due to reduced parking and traffic restrictions.

Locations of Parking Removed during Construction

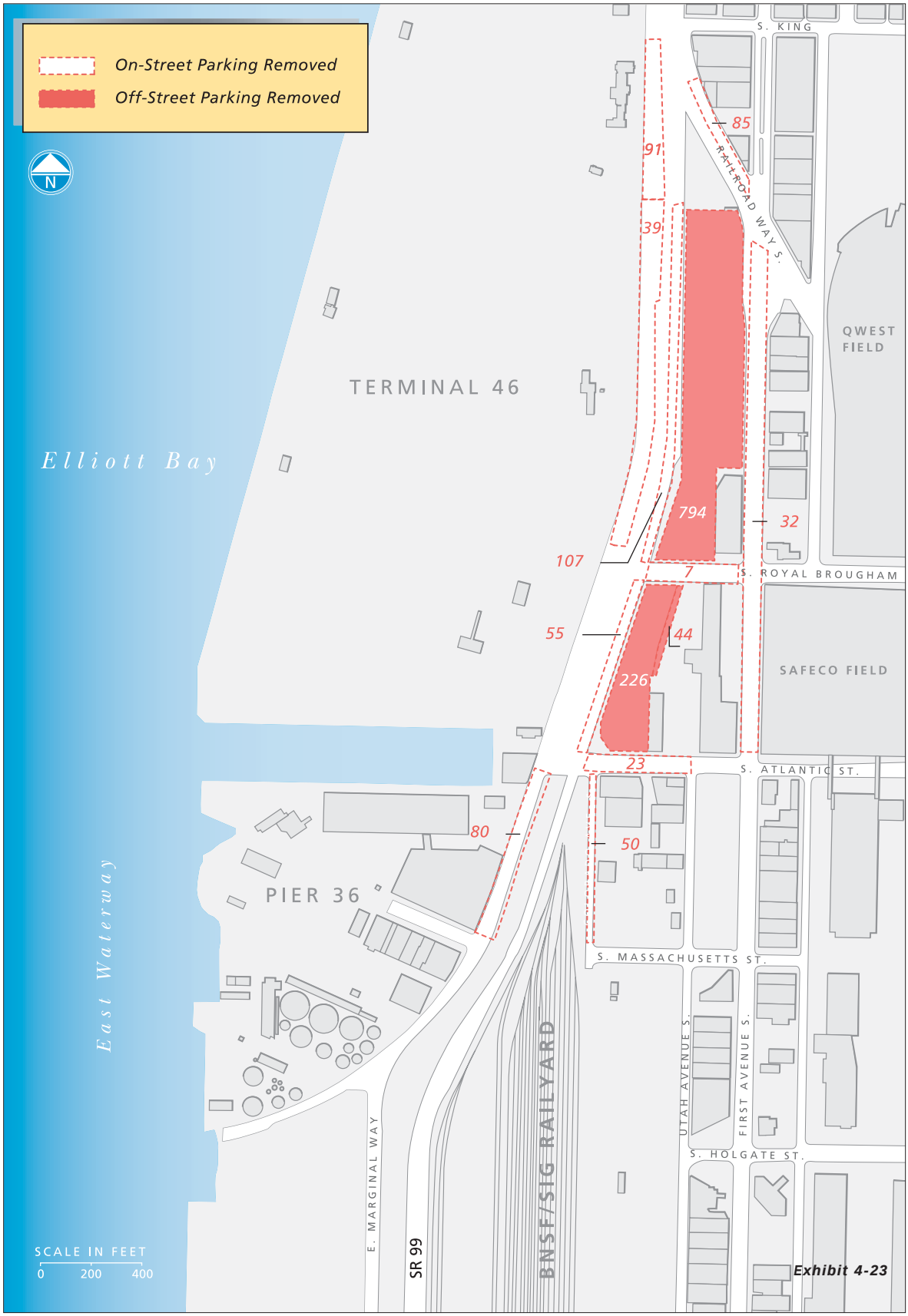


Exhibit 4-23

Up to 19 active commercial and industrial buildings are within 50 feet of the proposed SR 99 alignment and would not be acquired. Some businesses in these buildings may suffer little or no adverse effects, while others may experience a noticeable temporary decline in sales, increase in costs, or decrease in efficiency.

What types of mitigation measures would be used to minimize effects to businesses and employees?

Construction activities would likely interfere with access to businesses and properties adjacent to the project on each side of the right-of-way. A primary goal of construction planning is to maintain adequate access to all businesses so they can continue to operate. WSDOT would coordinate with affected businesses to minimize the amount of disruption from construction activities and provide signage to identify that businesses are open during construction. Mitigation measures during construction would include having a communications plan and providing advance notice to property owners in the project area regarding construction activities, utility disruptions, and detours.

Parking

Approximately 1,633 parking spaces would be removed during the first stage of construction, which is expected to last 17 months. Exhibit 4-23 shows the locations of parking removed in the project area. As shown in Exhibit 4-24, some spaces would become available again in Stages 2 through 5. Approximately 1,267 of the parking spaces removed during construction would be removed permanently.

Exhibit 4-24

Parking Removed during Construction

	Spaces Removed During Stage 1	Spaces Removed During Stages 2 - 4	Spaces Removed During Stage 5	Spaces Removed Permanently
On-Street short-term parking spaces	146	146	29	29
On-Street long-term parking spaces	423	423	423	418
Off-Street parking spaces	1,064	1,020	1,020	820
Total	**1,633**	**1,589**	**1,472**	**1,267**

Removing 146 on-street short-term parking spaces would result in an annual revenue loss of approximately $365,000 for the City of Seattle. The City would also lose revenue associated with the license fees and user tax for affected off-street parking lots. During normal business hours, the existing on-

street short-term parking is underutilized, and many spaces are typically available within two blocks of the removed spaces.

Free on-street long-term parking is available within several blocks of the project. The spaces closer to the railyards are more highly utilized than spaces farther south. People who normally park in the long-term free spaces that are being removed could choose to park farther away, pay for parking, or change their mode of travel.

Approximately 1,064 off-street parking spaces would be removed. However, many other parking lots are available in the project area. About 37 percent of the off-street parking spaces in the stadium area are utilized on an average non-event weekday, according to the Puget Sound Regional Council[2].

[2] PSRC 2006

Construction would affect on-street parking on First Avenue S. north of S. Atlantic Street during Stages 1 through 4. However, these spaces already tend to be restricted before, during, or after events at either stadium or the event center. During events such as Seahawks or Mariners games, parking is highly utilized, and private lots charge a premium for event parking. During construction, it could become more difficult to find parking during an event. As they are today, event-goers would be encouraged to use bus and rail service and to car-pool to the stadiums.

Surrounding businesses could be affected by reduced parking if their customers and employees have to pay or park farther away. However, south of S. Atlantic Street, there is free parking with 1- and 2-hour limits along First Avenue S. In addition, several blocks of free parking with no time limits are currently located near the project south of S. Massachusetts Street on Utah Avenue S. and Occidental Avenue S. Pay parking lots are also available near the businesses.

For the duration of project construction, the average workforce would be about 350 construction workers. Considering overlapping work schedules, parking demand could average 250 vehicles per day, Monday through Friday. Construction workers who are not able to park within the construction zone would likely seek available long-term parking at pay lots. The use of any on-street parking spaces by construction workers would have to be coordinated and approved by the City. This could make it more difficult for the customers of local businesses to find parking. There is the potential to inconvenience some customers and employees.

What types of mitigation measures would be used to minimize these effects?

Because parking lots are generally underutilized south of downtown Seattle, parking spaces are not anticipated to be difficult to find during non-event days. People who normally park in the long-term free spaces that are being removed could choose to park farther away, such as in the unrestricted spaces south of S. Atlantic Street, pay for parking, or change their mode of travel. Therefore, no mitigation is needed. No mitigation is planned for parking during special events.

Public street right-of-way will not be set aside as construction worker parking unless approved by the City of Seattle.

10 Would any properties be needed specifically for construction?

Six of the seven properties where permanent property acquisitions or utility easements would be required (as described in Chapter 3, Question 4 and Exhibit 3-11) also require a small amount of additional property for temporary construction easements. Approximately 0.36 acre over and above the permanently affected properties would be needed for temporary construction easements. The affected properties include Terminal 46, Pier 36, a Port of Seattle property south of S. Massachusetts Street, Pyramid Alehouse, the Fortune Warehouse, and vacant BNSF land. Only the easement on Terminal 46 would be used for the duration of construction. The other easements would be needed for approximately 1 to 4 months for sidewalk or sewer line construction.

What types of mitigation measures would be used to minimize these effects?

WSDOT staff would work with affected property owners to assess their needs and minimize the amount of disruption that could result from temporary construction easements. Mitigation measures during construction activities would include providing advance notice to property owners in the project area regarding construction activities, utility disruptions, and detours. Local access to adjacent residences and businesses would be maintained during construction.

11 How would historic resources be affected during construction?

Possible effects to historic resources from construction activities are similar to potential effects to other buildings in the project area. However, since historic resources have elements

that could be damaged irreparably, there is a greater need for protective measures during construction. The possible effects include increased vibration, increased traffic congestion, loss of parking, increased noise and dust, and loss of business if people avoid the area during construction. Construction effects would vary during the construction period. Direct effects would be more intense when construction is adjacent to an area and less intense when the activity moves elsewhere.

During some parts of the demolition and construction period, the southwest portion of Pioneer Square would be affected by increased traffic congestion, loss of parking, and changes to business access. Traffic barriers and detours may make it harder for people to get to the area, and businesses and residents closest to the project may experience construction noise and dust. These effects may inconvenience people, but they would be of limited duration and are not expected to have a substantial effect. The discussion of how to mitigate or minimize the effects of traffic congestion (Questions 4 and 5), noise (Question 6), dust (Question 8), loss of parking (Question 9), and changes to business access (Question 9) are described previously in this chapter.

Before viaduct demolition begins, adjacent historic buildings will be evaluated to determine their vulnerability to potential damage from vibration. If necessary, modified demolition and construction methods will be used. Refer to Question 7 of this chapter for further detail on potential effects due to increased vibration.

One building, the Bemis Building, would experience an indirect adverse effect from construction activities. Tenants would experience noise and dust during construction, with interruptions or modifications to building access at times during the construction period. Construction would prevent use of their primary loading dock at times. Because this would potentially affect the economic viability of the building, it is considered an adverse effect. This effect would be mitigated by improvements to an alternative loading dock facing the south parking lot, which would allow business operations to continue. Construction would also reduce on-street short-term parking near the Bemis Building.

What types of mitigation measures would be used to minimize these effects?

Since the project is not anticipated to have a substantial effect on the Pioneer Square Historic District, general business miti-

gation measures are not needed. The only historic resource that may be substantially affected during construction is the Bemis Building, so mitigation is focused on these effects.

In addition to mitigation measures previously described related to minimizing effects from noise and air quality, specific mitigation for effects to the Bemis Building would include the following measures:

- Communicate regularly with affected residents and businesses in the Bemis Building about construction issues.
- Maintain adequate access to the property, including the loading dock, so that businesses can continue to operate.

Mitigation measures for historic resources will be described in a Memorandum of Agreement among WSDOT, FHWA, the Washington State Department of Archaeology and Historic Preservation (DAHP), the Advisory Council on Historic Preservation (ACHP), affected tribes, and the City of Seattle. The draft Memorandum of Agreement is included in Appendix H.

12 Would construction affect archaeological resources?

Soil excavation and soil improvement activities may affect unknown, important pre-contact and historic-era archaeological deposits potentially located on the former tideflats of Elliott Bay and in historic-era fill layers.

There is a low to moderate probability that evidence of fish weirs, such as wood stakes, basketry, matting, or rock alignments, could be located in the project area. Shell and/or rock concentrations from shellfish gathering and processing could be present on old beaches and tideflats, from seasonal camps, villages, or processing localities. Archaeological materials could include food refuse, rock features, stone tools, bone tools, and debris from tool manufacturing, dating from as early as 2,000 years ago to about A.D. 1900.

There is a moderate to high probability that construction could affect historic-era archaeological resources associated with industrial, commercial, and residential development of the Elliott Bay tideflats in the 1890s through early twentieth-century development.

Archaeological study of the project area in two phases in the summer of 2007 and early 2008 included the sampling of 49 boreholes between S. Atlantic Street and S. King Street. Archaeologists chose the borehole locations based on extensive historical research conducted in 2006 in preparation for

the sampling program. Materials recovered from the 2007 and 2008 samples included sparse historic-era artifacts and thick deposits of industrial debris such as lumber and coal. Most of the boreholes also contained some shell, but this was determined to be natural in origin rather than part of an archaeological site. The borehole data will allow archaeologists to define areas for further investigation and monitoring during construction.

Construction activities have the potential to encounter historic material related to transportation, primarily railroad tracks, trestles, and support facilities; infrastructure in the form of a fire station, pipes, hydrants, and other early utilities; and commerce as represented by retail establishments, warehouses, offices, and freight facilities. Historic industrial remains may also be discovered, including those from manufacturing establishments, lumber mills, foundry, metal fabricators, and machine works. Evidence could also be found of residential use from shanties on floats and other small dwellings and cabins in limited areas dating back to 1904 and after.

Sites discovered during construction will be considered eligible for the National Register of Historic Places under Section 106 unless research and documentation prove otherwise. Any discoveries would need to be documented and addressed through scientific data recovery or other suitable measures determined in consultation with SHPO and the affected tribes.

What types of mitigation measures would be used to minimize these effects?

Because the project could have an adverse effect on significant, eligible sites, mitigation measures will be described in a Memorandum of Agreement among WSDOT, FHWA, DAHP, ACHP, affected tribes, and the City of Seattle. The draft Memorandum of Agreement, developed in compliance with Section 106 of the National Historic Preservation Act of 1966, is included in Appendix H. Mitigation measures would consider subsurface conditions and the likelihood of encountering archaeological material during excavation or construction activities. Mitigation may also include a combination of archaeological investigation and monitoring of subsurface excavations and/or borings conducted for geotechnical studies prior to construction.

We will use the information gathered from pre-construction studies as we work with the tribes and SHPO to develop a

Appendix B. Potential Mitigation Measures

Appendix B lists potential mitigation measures being considered for this project.

monitoring and treatment plan for properly addressing any effects to significant, eligible archaeological sites.

13 What other elements of the environment were studied, and what were the results?

The following elements of the environment either do not have extensive effects that require special mitigation measures during construction or have required measures that are standard for a roadway project such as this. These elements of the environment include views, park and recreational facilities, neighborhoods, low-income and minority populations (environmental justice), police and fire services, water resources, and soil and contaminated materials.

How would views be affected during construction?

During construction, views in the project area would be cluttered with heavy equipment, drill rigs, scaffolding, fencing, dust, noise barriers or curtains, and storage of construction materials. Distant views of water and mountains might be somewhat cluttered by construction activities throughout the construction period. These temporary effects do not require mitigation.

Would any park or recreational facilities be affected?

The Jack Perry Memorial Viewpoint, Waterfront Bicycle/Pedestrian Facility, and the Mountains to Sound Greenway Trail would be affected during construction. Construction effects could include noise, blocked and cluttered views, dust, traffic delays, and congestion. Construction would make it more difficult for people to reach parks and recreation facilities and to travel within the project area once they arrive.

Access to Jack Perry Memorial Viewpoint would be limited due to lane restrictions on E. Marginal Way S. and Alaskan Way S. The viewpoint is not expected to be affected by noise and dust from construction activities, and views of Elliott Bay and the Duwamish East Waterway would not be obstructed.

During construction, the Waterfront Bicycle/Pedestrian Facility along Alaskan Way S. would be removed. Until the new pathway is complete, bicyclists and pedestrians would use alternate routes such as First Avenue S., as described in Question 3 of this chapter. People using the proposed route for the Mountains to Sound Greenway Trail along S. Atlantic Street west of First Avenue S. would also be required to use an alternate route during construction. The experience of bicy-

clists and pedestrians on the alternative routes would likely be less scenic and perhaps less conducive to recreational walking and bicycling than the existing pathways.

For some people, construction would be interesting to watch as they traveled through the project area. For others, increased traffic congestion, noise, vibration, and dust would make the project area a less desirable destination. Construction would make it harder for people to get to the project area because of traffic detours and the removal of parking. The construction site may seem like a barrier to some people, even when temporary sidewalks or other routes are available. These temporary effects do not require mitigation beyond providing temporary sidewalks and detour routes, and other measures described in Appendix B.

How would neighborhoods be affected?

For people working or living right next to the worksite, construction would sometimes be inconvenient and at other times would be quite disruptive. Construction noise, lights, and traffic changes could affect people within one to two blocks of the construction zone or a staging area. The noise (Question 6) and visual (Question 13) effects of construction are discussed elsewhere in this chapter.

For some people, the construction sites may seem like a barrier, even when temporary sidewalks or other routes are available. Because they are perceived as barriers, construction sites would temporarily increase separation between parts of each neighborhood.

Many temporary road closures, lane restrictions, and detours would be needed, generally for a number of months. The closures and detours may be inconvenient and disruptive to adjacent businesses and residents. WSDOT will work with local residents and businesses to minimize disruption to the extent practicable. These temporary effects to neighborhoods do not require mitigation beyond the efforts described for traffic (Question 5) and noise (Question 6) in this chapter, and in Appendix B.

Would low-income or minority populations be affected?

Construction effects to disadvantaged populations would be similar to those discussed for the general community. These effects include increased traffic congestion, reduced mobility, a potential for increased response times for emergency services, and increased noise. Temporary traffic congestion during

construction would affect low-income, homeless, elderly, or disabled people and the organizations that strive to serve them. These people are heavily dependent on transit, whose service would be affected by detours, lane restrictions, and resulting traffic congestion. As part of the project mitigation strategy, funding will be provided to enhance transit operations during construction, as described in Question 5 of this chapter. Traffic congestion would also make deliveries to service providers more difficult. Construction activities may bring additional effects to portions of the homeless population. Traffic detours, barricades, and other temporary construction measures can present hurdles for all of these disadvantaged populations.

Although construction effects to disadvantaged populations are probable, outreach efforts will help to avoid, minimize, or mitigate these effects. As part of the effort to forecast possible construction effects to these populations, individual meetings with social service providers and public outreach meetings where people can find out about the project, express their opinions, and give input about the project have been held.

We will continue working to find ways to avoid or reduce construction-related effects on these populations through careful planning and design and by providing fair and thorough solutions to construction-related problems when they do occur. We recognize the potential dangers of homeless persons seeking shelter within construction areas and will work with construction personnel to provide and maintain a safe worksite. These efforts are described further in Appendix B and will ensure that the project will not have a high or disproportionate effect on low-income or minority populations. No other mitigation is required for these temporary effects.

Would police and fire services be affected?

Police and fire services would be affected by traffic delays and detours caused by construction activities. Construction could require additional police support services to direct and control traffic and pedestrian movements and could result in increased response times to certain destinations. Law enforcement services outside of the project area may be affected due to changes in traffic patterns on local roads. During construction, fire hydrants may need to be relocated, which could temporarily affect water supplies used for fire suppression. Fire watches, or stationing fire trucks in the vicinity, could be required if the water supply and power must be turned off.

We will continue coordinating with City of Seattle and Port of Seattle police and fire departments to ensure that general emergency management services are not compromised. Early notice about detours or lane restrictions will be provided to emergency and non-emergency public service providers to help mitigate any potential effects to response time. These standard mitigation measures are described in detail in Appendix B. No substantial effects on police or fire services or other mitigation measures are expected.

What is a BMP?

A Best Management Practice (BMP) is an action or structure that reduces or prevents pollution from entering the stormwater or treats stormwater to reduce possible degradation of water quality.

How would water resources be affected?

Construction activities, such as grading, dewatering, and soil improvements, could result in temporary effects to water quality. BMPs would be used to minimize or prevent temporary effects. BMPs are required mitigation measures that are standard for a roadway project.

Any construction-related water quality effects would likely be caused by erosion of disturbed or graded soil areas or soil stockpiles in construction staging areas and work zones. These areas could result in silt and sediment being transported to Elliott Bay, the Duwamish River's east waterway, or Puget Sound in stormwater runoff. BMPs would prevent or minimize runoff from transporting sediment from disturbed soil areas or soil stockpiles, which can affect water quality in nearby areas by increasing turbidity and sometimes affecting other water quality parameters.

Stormwater runoff from construction staging areas may also carry other contaminants, such as fuel or oil from construction equipment. BMPs would be in place to prevent or minimize runoff from carrying contaminants from construction equipment to Elliott Bay, the Duwamish River's east waterway, or Puget Sound. BMPs could include covering stock piles, silt fences, catch basin inserts, and settling and contaminant testing of dewatering water and sediment prior to discharge from the construction site.

Dewatering would likely be necessary during construction of the undercrossing and in some locations where utilities would be relocated. Groundwater sampling in the project area indicated that the level of metals, volatile organic compounds, and oil-range petroleum hydrocarbons do not exceed the King County Wastewater Treatment Division Discharge Limits[3,4]. Because there would be no surface water discharge from construction dewatering, and treatment BMPs would be provided as needed prior to dewatering water being discharged to the

[3] Shannon Wilson Inc. 2007

[4] Parametrix 2007

combined sewer system or reinjected into the groundwater, no water quality effects are expected from dewatering.

Soil improvements would likely consist of a combination of stone columns (vibro-replacement), jet grouting, and deep soil mixing, which are intended to improve soil stability. Jet grouting produces a waste slurry that has high pH, which could affect the quality of stormwater leaving the site and the receiving water if not properly managed. Any dewatered slurry would be treated using BMPs as needed prior to discharge to the stormwater system or receiving water or disposed of in an approved off-site facility. Additional standard mitigation measures are described in Appendix B.

How would soil and contaminated material be affected during construction?

The project would partially acquire property on three parcels and require temporary or permanent easements on four additional parcels. These parcels contain 32 potentially contaminated sites, a majority of which are associated with the terminals, which have long and varied historical uses. In addition, five parcels with three potentially contaminated sites have already been purchased by WSDOT for the project.

The project has the potential to generate approximately 222,000 cubic yards of excavated soil, materials, and spoils. This amount of material would bury a football field just over 100 feet deep. Approximately 204,000 cubic yards of the material is potentially contaminated. Contaminated soil and material would require special handling and would be treated and disposed of according to State regulations. Spoils from activities such as jet grouting and deep soil mixing would be contained by constructing berms or other barriers around the construction area to prevent the spread of any contamination. Soil that does not pose an unacceptable threat to human health and the environment and meets the Washington State Department of Ecology's Model Toxics Control Act (MTCA) requirements may be used as fill in other areas of the project.

Standard mitigation measures include BMPs that would be implemented to reduce or prevent soil erosion and sediment from being transported outside the work area by the wind, surface water, or construction vehicles so that any contamination does not spread. A temporary erosion and sediment control plan would be prepared in accordance with WSDOT's *Highway Runoff Manual*. A Health and Safety Plan would be prepared that describes monitoring requirements and the use

Planned Area Construction Projects

Exhibit 4-25

of personal protective equipment for workers that come in contact with contaminated materials. Additional standard mitigation measures are described in Appendix B.

14 What indirect or cumulative effects are expected from construction, and what mitigation is proposed?

One building, the Bemis Building, would experience an indirect adverse effect from construction activities. Tenants would experience noise and dust during construction, with interruptions or modifications to building access at times during the construction period. Construction would prevent use of their primary loading dock at times. Because this would potentially affect the economic viability of the building, it is considered an adverse effect. This effect would be mitigated by improvements to an alternative loading dock facing the south parking lot, which would allow business operations to continue. Construction would also reduce on-street short-term parking near the Bemis Building.

Cumulative effects could occur during construction because several projects in nearby areas are expected to be under construction at the same time as the S. Holgate Street to S. King Street Viaduct Replacement Project, as shown in Exhibit 4-25. Potential cumulative effects from these overlapping projects and proposed mitigation for these effects are discussed below.

Cumulative Traffic Effects

Traffic congestion is expected to increase in the project area, including SODO and the Duwamish industrial area, due to roadway restrictions on SR 99 and other local streets during construction. Specifically, we expect SR 99 and adjacent streets such as Alaskan Way S., S. Royal Brougham Way, and First Avenue S. to be affected for the durations indicated in Exhibit 4-26. The total construction period is expected to last about 4 years and 4 months, beginning in mid-2009 and continuing through fall 2013.

Exhibit 4-26

Duration of Roadway Restrictions on Key Routes

Affected Roadway	Duration of Roadway Restructions
SR 99	2 years – 3 months *beginning in early 2011*
Alaskan Way S.	2 years – 9 months *beginning midyear in 2010*
S. Royal Brougham Way	Traffic detoured on S. Royal Brougham Way for 6 months at the end of the first 17 months of construction (Stage 1); S. Royal Brougham Way would be closed permanently where it crosses underneath the existing viaduct after Stage 1, midyear in 2011.

Cumulative Construction Effects

Supporting information about cumulative effects is provided in **Section 7.2** of ***Appendix F,*** the ***Transportation Discipline Report***, and ***Appendix G, Technical Memoranda.***

Congestion may intensify in the area if other nearby planned projects require lane closures as well. This could cause problems for all drivers, including transit, freight, and emergency service providers. Some commercial activity within the project area would also be affected by the accumulation of direct construction effects, such as traffic restrictions, traffic congestion, and noise. Much of the roadway work in the downtown and SODO areas would likely be completed with partial lane closures and/or evening and weekend construction to help minimize effects to the overall transportation system.

We know the projects shown in Exhibit 4-25 are scheduled to have some overlap with construction for the S. Holgate Street to S. King Street Viaduct Replacement Project. WSDOT and the City of Seattle have been monitoring these projects' construction schedules and coordinating to avoid major construction conflicts and minimize effects to traffic to the extent practicable. Information about the planned timelines for these projects is provided below:

- **SR 519 Intermodal Access Project, Phase 2** – Construction is planned to begin in fall of 2008 and be completed by 2011.
- **S. Spokane Street Viaduct Phase 1** – Construction for widening the Spokane Street Viaduct is expected to begin in June 2009 and be completed in June 2011.
- **S. Spokane Street Viaduct Phase 3, Fourth Avenue S. Loop Ramp** – Construction of this ramp is scheduled to begin in October 2008 and be completed in September 2010.
- **Port of Seattle Terminal 46** – The Port of Seattle projects an increased volume of container processing over the next 7 years.
- **Port of Seattle Terminal 91 Cruise Ship Terminal Construction Project** – The Port is moving the cruise ship terminal from Terminal 30 and constructing a new cruise ship facility at Terminal 91 during 2008 and 2009.
- **Port of Seattle Terminal 30 Container Terminal** – This project will convert Terminal 30's current use as a cruise terminal back to its original use for container operations.
- **I-5 Pavement Repair** – This project is expected to begin in 2009 and includes repairing pavement and replacing 58 roadway panels from Boeing Access Road up to the King/Snohomish County line. Work will be done during evening and weekend closures of I-5.
- **E. Marginal Way Overpass** – Construction for this project is expected between 2007 and 2010. The Port of

Seattle will construct a grade-separated crossing of the BNSF rail lines (used by both BNSF and Union Pacific) and an improved intersection between E. Marginal Way and S.W. Spokane Street (to Harbor Island and West Seattle).

- **Bridging the Gap Projects** – Construction for projects that are part of this Seattle levy began in 2007 and is expected through 2013. Considerable road work is expected on downtown streets and First Avenue S. in 2008. In 2010, Airport Way S. and Fourth Avenue S. north of S. Royal Brougham Way would have partial closures for roadway resurfacing. In 2011, additional resurfacing work is planned on Airport Way S. north of S. Massachusetts Street and on S. Dearborn Street east of Fifth Avenue S.
- **Commercial Development** – This office and retail development, located on the south side of S. Atlantic Street and the west side of First Avenue S., is expected to be constructed between 2010 and 2012.
- **S. Massachusetts Street to Railroad Way S. Electrical Line Relocation Project** – This electrical line relocation project will relocate electrical lines currently located on the existing SR 99 structure. Relocation of these lines is expected to take place from August 2008 through December 2009.
- **SR 99 Battery Street Tunnel Fire and Safety Improvements** – Construction for this project is expected to begin in June 2009 and continue through February 2011. This project will require evening and weekend closures of SR 99 through the Battery Street Tunnel.
- **S. Lander Street Overcrossing** – The construction schedule for this project is currently unknown, since the project is not fully funded. It's possible that it may overlap with a portion of the S. Holgate Street to S. King Street Viaduct Replacement Project.
- **U.S. Coast Guard Integrated Support Command** – The U.S. Coast Guard is proposing changes to its facility located on Alaskan Way S. The schedule for this work is unknown.

Additionally, construction of the central waterfront portion of the Alaskan Way Viaduct and Seawall Replacement Program may begin as early as 2012.

At this time, we do not know specific details about lane restrictions, detours, and local street closures that may be required for the projects listed above. As design and construction planning move forward for the S. Holgate Street to S. King Street Viaduct Replacement Project, WSDOT and other agencies will continue to work together to minimize possible cumulative

effects and coordinate construction schedules. For example, as shown in Exhibit 4-25, the City of Seattle plans to repave several streets in the SODO/Duwamish industrial area over the next few years as part of the Bridging the Gap Projects. WSDOT and the City have been working together to make sure that projects in the vicinity of the S. Holgate Street to S. King Street Viaduct Replacement Project are completed before or after major lane restrictions are in place on SR 99.

To aid in this coordination effort, WSDOT, the City of Seattle, and King County are considering establishing an oversight committee called the Downtown Transportation Operations Committee. This committee would be tasked with monitoring and coordinating construction activities in the greater downtown Seattle area. This committee would lead coordination efforts to ensure that transportation operations for all modes (general purpose traffic, transit, and freight) are as effective as possible during downtown construction activities. This committee would provide real-time communications and information linkages to better manage the multimodal transportation system.

In addition to ongoing coordination between agencies, WSDOT has committed up to $125 million for various enhancements and improvements designed to keep transit and traffic moving. Many of these investments will be made in the SODO/Duwamish area during construction. These enhancements and improvements are discussed in Question 5 of this chapter and would help to alleviate traffic congestion that may be caused by constructing projects near one another.

FHWA, WSDOT, the City of Seattle, and King County continue to work collaboratively with the community to find a solution for the SR 99 corridor through the central waterfront. It is uncertain what will replace the existing viaduct in the central waterfront at this time. If a decision is made for the central waterfront after construction has been started on the S. Holgate Street to S. King Street Viaduct Replacement Project, this project could be altered north of S. Royal Brougham Way.

Other Cumulative Effects

In addition to the potential cumulative traffic effects discussed above, possible cumulative construction effects may:

- Increase construction noise and temporary air quality effects, such as those related to dust and emissions from construction equipment.

- Cause problems for utility providers. Most of the proposed projects require utilities to be relocated. Funding, having enough skilled workers, and ensuring minimal utilities disruptions could be a challenge or cause delays in construction.
- Cause additional erosion and sediment transport to the Duwamish River or Elliott Bay.

Mitigation

Mitigation measures discussed for this project throughout this chapter would help to mitigate this project's effects to noise, air quality, utilities, and water quality. We will continue to work with the agencies leading other proposed projects in the surrounding area to help avoid and minimize potential cumulative effects.