This chapter describes generally how construction would take place, including what activities construction crews would be doing, the kinds of equipment they would be using and how long the project would take to build. It also discusses how construction would affect aspects of the natural and built environment in the project area.

Chapter 8: Construction Effects

Construction of the SR 520 Bridge Replacement and HOV Project would take place over a total period of approximately 7 to 8 years for both the 4-Lane and 6-Lane Alternatives. This time frame is based on the assumption that the project would receive full funding; if funding is allocated in phases over multiple years, the construction process could take longer. Within this overall schedule, specific construction activities would affect portions of the project area for varying amounts of time. All of the effects of the construction activities would be temporary, and areas outside the SR 520 right-of-way would be restored as soon as possible after construction.

This chapter begins with a general description of construction activities to allow readers to understand how the project would be built. Following this is a discussion of how construction would affect the natural and built environment in the project area. The No Build Alternative is not discussed in this chapter because this alternative would not involve any construction and would not have construction effects. The 6-Lane Alternative options also are covered in this chapter to the extent that their construction methods, timing, and/or effects differ from those of the 6-Lane Alternative.

What activities would take place during construction?

The SR 520 project would involve construction of bridges on land and in the water, roadways, retaining walls, sound walls, local street crossings, and lids (with the 6-Lane Alternative). Because the project is at a preliminary level of design, project details and construction methods have not been fully defined and may change somewhat as the design team develops the preliminary concepts further. In addition, construction contractors typically choose many of the construction methods to be used for their projects. However, the descriptions provided below are a reasonable estimate of how the project could be constructed.

More details on construction are available in Appendix A, Description of Alternatives and Construction Techniques. WSDOT will develop further information on construction methods after a preferred alternative has been identified.

Roadway Reconstruction

The build alternatives would replace the existing pavement on SR 520 with new concrete pavement. Most of the asphalt removed from the existing roadway would be recycled. Some of the existing support material beneath the roadway, such as gravel and sand, would also be removed and replaced with new material. Concrete paving machines would be used to place the new concrete pavement.

As shown in *Exhibit 8-1*, there would be some differences among the alternatives and options in the extent of roadway reconstruction. Although the 4-Lane and 6-Lane Alternatives would remove similar amounts of existing pavement, the 6-Lane Alternative would create more new pavement than the 4-Lane Alternative because of its greater width. The Pacific Street Interchange option would include an additional 8.1 acres of new pavement because of the new Union Bay Bridge and connecting ramps, and because it would widen Montlake Boulevard Northeast. The Second Montlake Bridge and the South Kirkland Park-and-Ride options would also create some additional pavement compared to the 6-Lane Alternative. The two options that remove freeway stations would slightly reduce the amount of paving required.

Exhibit 8-1. **Additional Pavement for SR 520 Build Alternatives**

	Total Paved Surface (acres)	
Alternative	**Seattle**	**Eastside**
Existing Conditions	25.3	26.1
4-Lane Alternative	33.6	35.6
6-Lane Alternative	38.2	40.8
Pacific Street Interchange Option	46.3	
Second Montlake Bridge Option	41.7	
No Montlake Freeway Transit Stop Option	36.7	
South Kirkland Park-and-Ride Transit Access –108th Avenue Northeast Option		44.0
South Kirkland Park-and-Ride Transit Access – Bellevue Way Option		42.0
Bicycle/Pedestrian Path to the North Option		40.5
No Evergreen Point Freeway Transit Stop Option		39.9

Retaining Walls

Because very few areas in the SR 520 corridor have perfectly flat ground, road construction would require that contractors cut into hillsides or fill depressions. Cuts and fills must be stable to prevent the slopes from collapsing onto or beneath the roadway. Depending on the amount of space available and other considerations, designers may either construct a stable, gradual slope from the edge of the roadway to the top or bottom of the hill, or use a retaining wall to hold back the soil in a vertical slope. Although retaining walls are more expensive than unretained slopes, they help keep the project within WSDOT's right-of-way and minimize the overall project footprint, thereby reducing the need to acquire property, affect wetlands, or remove vegetation. *Exhibits 8-2 through 8-4* show different types of retaining walls.

Different types of walls have different effects outside the wall's footprint. Walls built in fill locations (where the roadway is higher than the surrounding area) may consist of reinforced concrete, soldier pile, or structural earth, which is soil that has been mechanically stabilized. Walls built in cut locations (where the roadway is lower than the surrounding area) may consist of reinforced concrete, soil nail, or soldier pile. Concrete walls have a footing that requires excavation outside the outer edge of the wall *(Exhibits 8-2)*. Soil nail and soldier pile walls don't require this additional excavation, but do require that anchors be driven some distance into the soil behind the wall *(Exhibits 8-3 and 8-4)*. Specific wall types for this project will be determined after a preferred alternative is identified and additional engineering is completed. In general, the amount of retaining wall built would be similar between the 4-Lane and 6-Lane Alternatives, except that the 6-Lane Alternative could require additional retaining walls because its greater width could affect more hillsides. The Pacific Street Interchange option would add more retaining walls along Montlake Boulevard to allow it to be lowered in the vicinity of its intersection with Pacific Street.

Exhibit 8-2. Example of a Concrete Retaining Wall in a Cut Slope

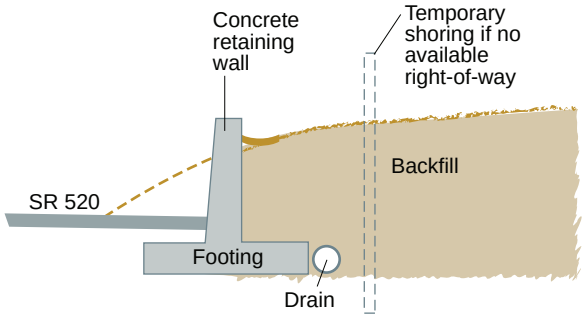


Exhibit 8-3. Example of a Soil Nail Retaining Wall

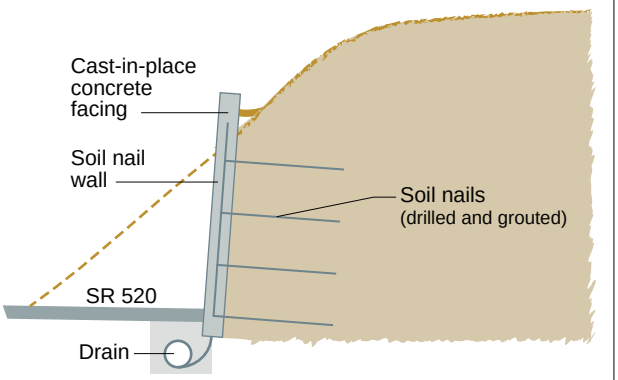
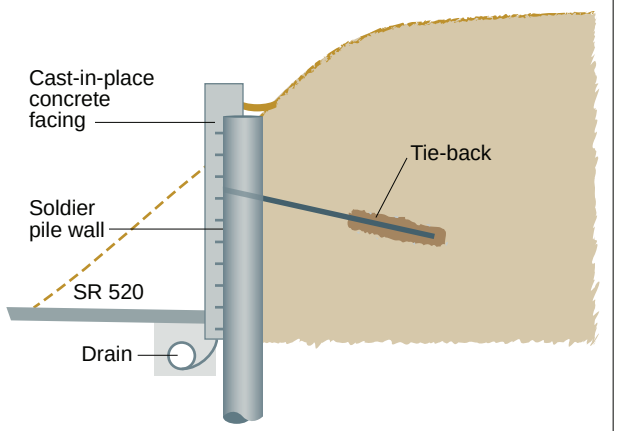


Exhibit 8-4. Example of a Soldier Pile Retaining Wall



Sound Walls

In general, WSDOT uses precast panels to construct sound walls along highways; however, we sometimes also use cast-in-place concrete or masonry. Later in the design stage for this project, the inside face of the sound walls (i.e., the side facing the highway) would be designed to create an aesthetically pleasing appearance within the highway corridor. Some sound walls that are highly visible to public spaces would also include a special texture or design on the outside face. WSDOT has already initiated workshops with community representatives to develop corridor aesthetic guidelines for use with all of the build alternatives.

Local Street Crossings

WSDOT would construct new bridges where local streets cross over SR 520. These crossing locations would be the same for all 4-Lane and 6-Lane Alternatives and options. The new bridges would be built using precast concrete girders and cast-in-place decks. Placement of girders over the existing highway would require closures or detours of highway traffic. Closures for girder placement are typically performed at night; each bridge would require three to four such closures.

Local street crossings over SR 520 would remain open during most of the construction period for the replacement crossing structures. There would be a few short-term (up to 8-hour) closures. The exception is Delmar Drive, which would remain closed for 9 to 12 months while the replacement crossing structure is built. Delmar Drive has very little traffic, and there are a number of good detour options in the vicinity.

WSDOT would ensure that local traffic flows continuously during construction through several possible methods, depending on the bridge and roadway:

- Building a new bridge in a temporary location next to the old one, shifting traffic onto the new bridge, demolishing the old bridge, and then moving the new bridge into its permanent location
- Building a temporary bridge to carry traffic while the new bridge is being built
- Under the 6-Lane Alternative, building a portion of the lid, detouring traffic onto the lid, and then demolishing the old bridge and completing the lid

The project team will determine and recommend the best construction method for each bridge during final design.

How Street Crossings are Built

The bridges on which local streets cross SR 520 would be relatively simple structures, consisting of multiple concrete girders (strong horizontal beams) topped with a concrete deck for vehicles. The girders would rest on concrete abutments (vertical support slabs) at either end of the span. WSDOT would build the abutments first, then lift the girders into place with a portable crane. Concrete for the bridge decks would be cast in place rather than pre-formed offsite.

Lids

Under the 6-Lane Alternative and its options, lids would be built instead of bridges at 10th Avenue East and Delmar Drive, Montlake Boulevard, Evergreen Point Road, 84th Avenue Northeast, and 92nd Avenue

Northeast. The lids would use precast concrete girders spaced 5 to 10 feet apart. For safety reasons, SR 520 traffic would be shifted to lanes not under construction when girders are being placed.

In most cases, the lids would be constructed in three sections across the width of SR 520. Four lanes of traffic can be maintained beneath a single section of the lid, which would allow the lids to be constructed while maintaining the four general-purpose lanes.

Bridge Foundations

Bridge foundations are the structures on which a bridge rests. The foundations support and stabilize the bridge, and therefore must be firmly anchored in rock or well-compacted soil or sediment. For this project, structures on land would have spread footings, shaft, or pile foundations, and structures over water would have shaft or pile foundations. When the preferred alternative is identified, WSDOT will perform additional geotechnical investigations before making a final decision on the most appropriate foundation type.

Spread footings would likely be used in dry areas with stiff soils, but would not be used under water. Shaft foundations can be used on land or in water, although they need to be built in fairly dry conditions. To do this, the construction contractor uses dewatering methods to remove groundwater from the excavation, or (when the shafts are installed in a water body) installs the shaft inside a large steel shell or casing that isolates the shaft from the surrounding water. Construction of shaft foundations is considerably quieter than pile driving for pile foundations.

Pile foundations are often used for in-water work because they do not require a dry working environment. They consist of a group of driven piles, which can be easier to install than shafts. However, installing pilings is noisy (up to 115 decibels at a distance of 50 feet) and creates vibration that can affect fish and wildlife and damage nearby sensitive structures. When piles are installed within a water body, air bubble curtains or other methods to reduce the extreme sound energy could be used to minimize these effects. Wherever possible, WSDOT will avoid the use of pile foundations, especially near noise-sensitive areas. When pile foundations are necessary, WSDOT will use best management practices to reduce the effects from pile driving on fish and wildlife and will adhere to applicable construction noise regulations.

Spread Footing, Shaft, and Pile Foundation Methods for Bridges

Spread footings involve a relatively shallow concrete pad that provides a large area to transmit the weight of the bridge to the soil. This type of footing requires soils that can support the weight of the bridge.

Shaft installation uses steel casing to achieve strong footings and columns. When a shaft is installed in water, it has a large steel shell that isolates the shaft construction from the water to protect aquatic species and allows the column to be built in a dry environment. This steel shell acts as the form for the shaft construction and the installation of reinforcing steel.

Pile foundations consist of multiple driven piles, covered by a concrete cap to support the column. Pile foundations are easier to install than shafts, especially in soils that contain boulders. However, piling installations are very noisy. Wherever possible, the SR 520 project would avoid pile foundations, especially near noise-sensitive areas.

Temporary Work and Detour Bridges

To safely construct the proposed 4-Lane and 6-Lane Alternatives, WSDOT would build temporary work bridges next to the Portage Bay Bridge and a detour bridge in Union Bay and the Arboretum area. The temporary work bridges would allow the new bridge to be built in halves while traffic used the existing bridge first, then switched to the new north

DEFINITION

Superstructure

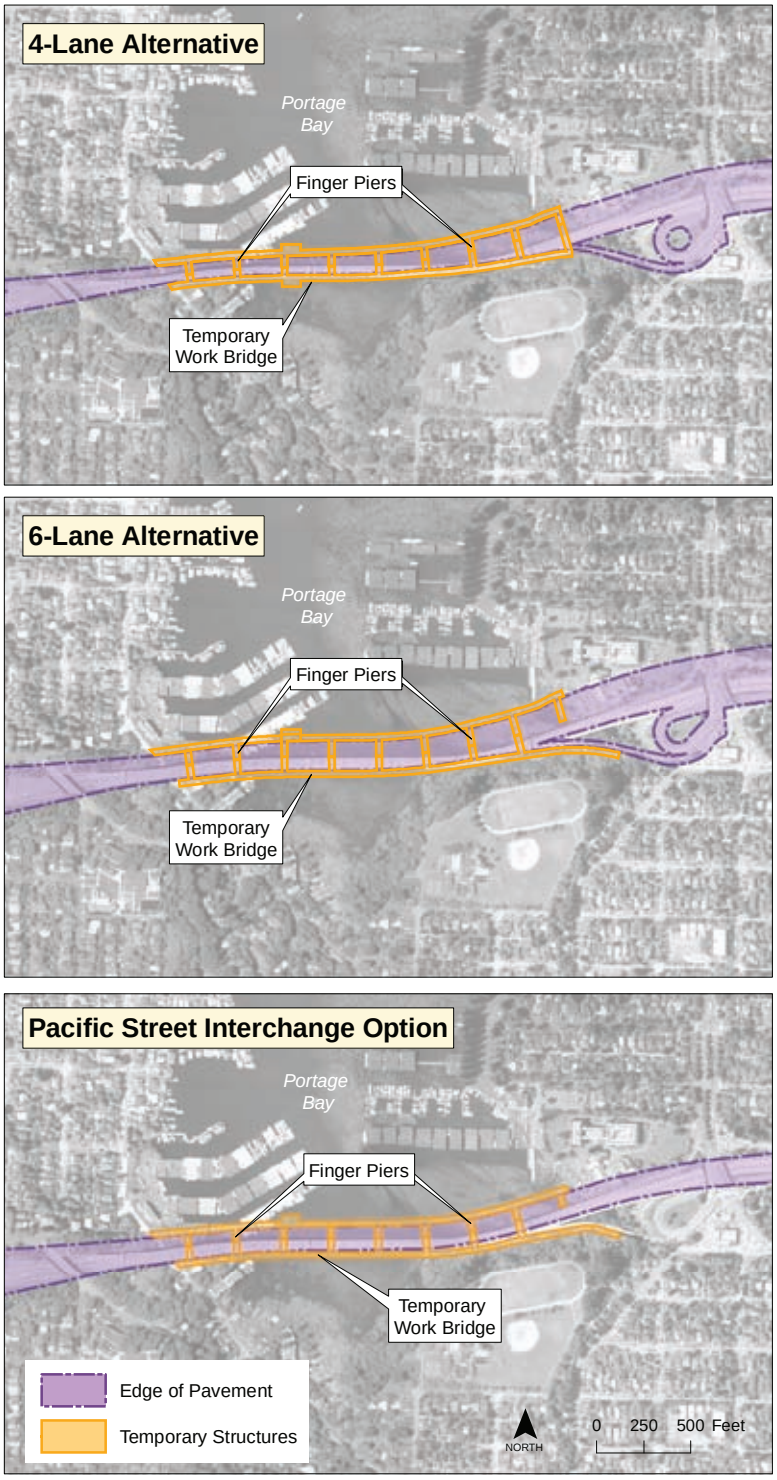
The term superstructure refers to all elements of a bridge that are above the columns and/or pontoons. This includes the girders and the bridge deck or roadway.

half while the south half was built. The detour bridge would allow traffic to pass while construction is occurring. Much of the temporary work area would be located within the proposed project footprint, which would limit the area disturbed. At times, however, the construction limits would extend beyond the area affected by the permanent structure.

At Portage Bay, WSDOT would build 30-foot-wide temporary work bridges on the north of the proposed new bridge and south sides of the existing bridge. Portions of the bridges over water would have pile foundations. Workers would begin by driving 18- to 24-inch steel piles, installing a cap, and then building the bridge structure atop this foundation. A crane would be placed on the completed portion of the work bridge to reach out and construct each connecting span. Finger piers extending laterally from the work bridge would allow workers to install the foundations and erect the superstructure of the permanent bridge. *Exhibit 8-5* shows the work bridges in Portage Bay for the 4-Lane and 6-Lane Alternatives and the Pacific Street Interchange option. Because of the freeway operational benefits of the Pacific Street Interchange option, the width of the Portage Bay Bridge can be reduced by three traffic lanes, resulting in a narrower construction effect than the 6-Lane Alternative. The 4-Lane Alternative would have bridges in similar locations, but they would be somewhat smaller.

At Union Bay and through the Arboretum, WSDOT would build a 60-foot-wide temporary detour bridge on the south side of the existing west approach to the Evergreen Point Bridge. The detour bridge would connect back

Exhibit 8-5. **Temporary Work Bridges in Portage Bay**



in with the existing floating bridge near the S-curve northeast of Madison Park. *Exhibit 8-6* shows the detour bridge for the 4-Lane and 6-Lane Alternatives and the Pacific Street Interchange option; again, the 4-Lane Alternative detour bridge would be similar but smaller. Construction methods for the detour bridge would be similar to those described for the Portage Bay work bridges. After rerouting traffic onto the detour bridge, workers would use the existing bridge for access and as a work platform. When traffic is shifted to the new SR 520 roadway, the detour bridge would be used to erect additional work bridges for construction of the new Lake Washington Boulevard ramps and to demolish the existing ramps.

The Pacific Street Interchange option would use work bridges and detour bridges similar to the 6-Lane Alternative in Portage Bay and Union Bay and through the Arboretum *(Exhibits 8-5 and 8-6)*. The Union Bay Bridge would be constructed mainly from barges on the north side of Marsh Island, although the southern foundation would be built from the detour bridge (which would be used as a work bridge after traffic has been shifted to the new roadway). The Second Montlake Bridge option would be constructed from land and from barges and would not require work or detour bridges.

These temporary bridges would remain in place for approximately 4 to 6 years. All temporary bridges would be removed at the end of the construction period, and the areas would be restored.

Pontoons under construction for the Evergreen Point Bridge in 1961

Floating Bridge Pontoons

The pontoons and anchors for the floating portion of the Evergreen Point Bridge would be fabricated offsite at a facility with deep-water access,

Building Pontoons for the Evergreen Point Bridge

What are pontoons and why do we need them?

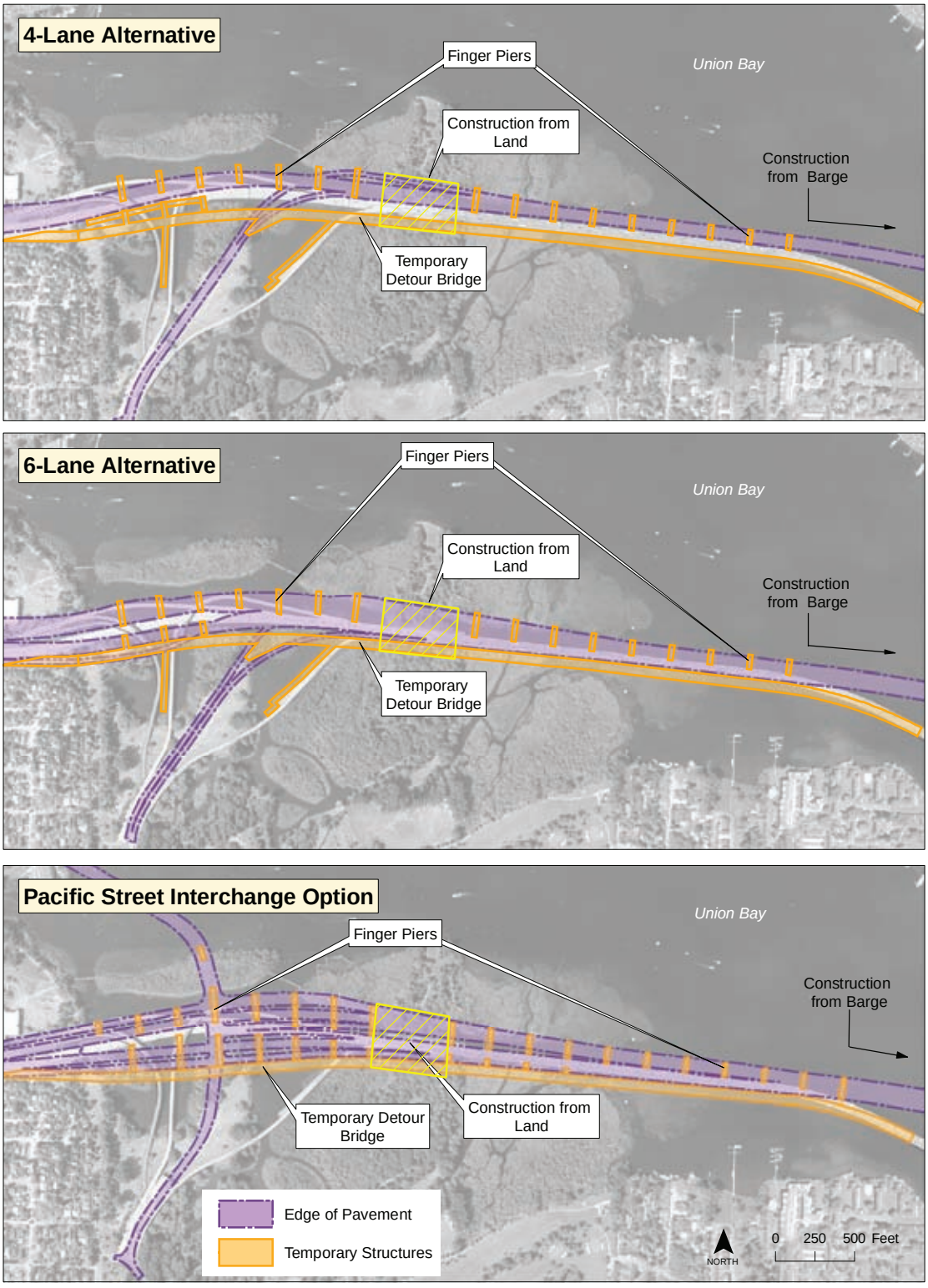
Bridge pontoons are large, hollow concrete boxes that are pieced together to form a floating bridge. They float in the water and support the bridge structure and roadway above. The new Evergreen Point Bridge would have up to 55 heavy concrete pontoons tightly connected and anchored end-to-end. The pontoons would be sized to provide adequate buoyancy to support construction of either build alternative and to also accommodate future high-capacity transit across the bridge.

The first step in building pontoons is to identify a construction site, which is a large plot of land in a harbor or along a waterfront. Workers would construct the pontoons onsite, then float them into the open water for their journey to Lake Washington. The pontoons would need to be available for bridge construction, which could start as early as 2009. To meet the project's overall schedule, it is critical to select and develop a construction facility or group of facilities well ahead of the projected construction start date.

Has WSDOT identified a construction site for the Evergreen Point Bridge pontoons?

An assortment of existing sites was selected to handle pontoon construction for the Hood Canal Bridge East-half Replacement Project; however, these sites cannot be used for construction of the Evergreen Point Bridge because its construction would require larger and many more pontoons than the Hood Canal project. After exploring a number of possibilities, WSDOT is considering a location in Grays Harbor County for a special projects construction site; it could be used to build pontoons for the Evergreen Point Bridge. Development of this site is being evaluated through a separate environmental process. As part of this process, WSDOT is using cultural resource experts to conduct literature reviews, perform site investigations, and monitor geotechnical borings to determine the probability of encountering significant historic or cultural resources. WSDOT is also consulting on a regular basis with Tribes and resource agencies to ensure that effects are avoided, minimized, and/or mitigated.

Exhibit 8-6. **Temporary Structures in Union Bay and the Arboretum**



similar to a drydock, that can handle construction of multiple pontoons and anchors. When a group of pontoons has been constructed, the facility is flooded, the gates are opened, and the pontoons are floated out. The anchors could be placed on the pontoons or loaded onto a separate large barge prior to flooding the facility. The pontoons and anchors are then towed to the construction site. Crews would float the constructed pontoons into Lake Washington, where they would be anchored and connected to adjacent pontoons. Pontoons that cross the existing draw span on SR 520 would be the last ones floated into position in order to keep the navigation channel open for as long as possible. Workers would assemble the bridge onsite by connecting the superstructure between adjacent pontoons, constructing the barriers, and then completing work on the superstructure.

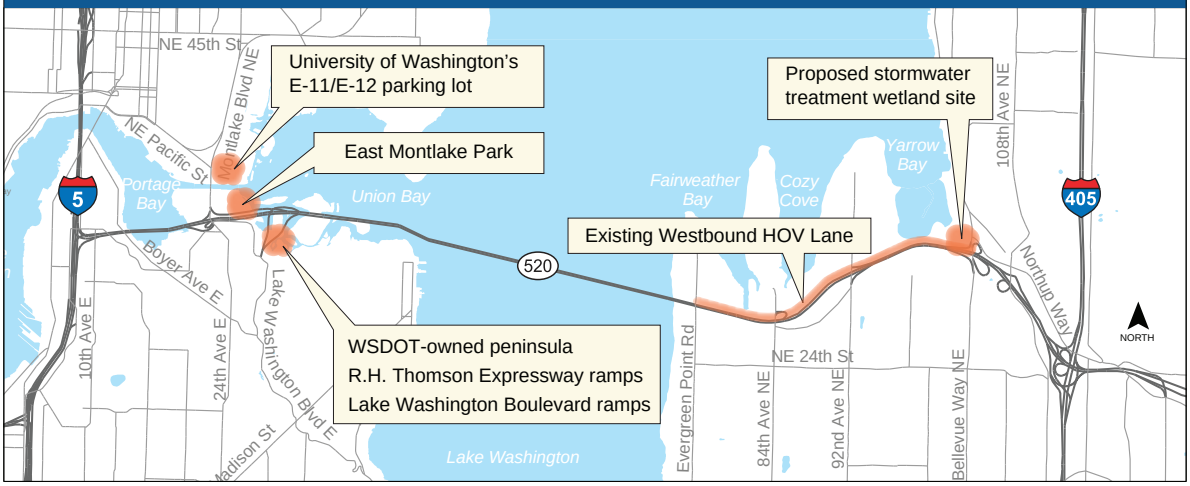
Removal of Existing Bridges

The superstructure of the existing Portage Bay Bridge and the approach spans and ramps of the Evergreen Point Bridge consist of precast concrete girders with cast-in-place concrete decks. WSDOT would dismantle these bridges by sawing the decks into pieces, removing the existing caps, and pulling out the piles. As an alternative, the piles could be cut off where the lake sediments begin, but this could be difficult and time-consuming. Depending on the location, the work would be done from barges, from the work bridges, or from the existing structures. The floating bridge pontoons would be separated and floated out of the lake.

Where are the construction staging areas?

Construction staging areas are the areas where WSDOT would store and prepare equipment and materials for construction. Typically, these areas are located as close as possible to the right-of-way. Not all of these areas are known yet, but WSDOT has identified several potential locations *(Exhibit 8-7)*.

Exhibit 8-7. **Construction Staging Areas**



In Seattle, the potential areas for construction staging are at East Montlake Park, which is assumed to be temporarily acquired for the project; the WSDOT-owned peninsula near the Arboretum; the unused R.H. Thomson Expressway Ramps; and the closed Lake Washington Boulevard ramps. The Pacific Street Interchange option would use the University of Washington's E-11/E-12 parking lot as a staging area for construction of the new Union Bay Bridge and the Pacific Street/Montlake Boulevard intersection.

On the Eastside, WSDOT anticipates that the construction staging areas would lie within the project footprint. The existing westbound SR 520 HOV lane would be closed during construction and used as a staging area. Further coordination with Sound Transit, Metro Transit, and Community Transit is needed to better understand how transit levels of service can be maintained during construction with the HOV lane out of service. The By-the-Way Espresso and adjacent buildings, located in Kirkland just west of Lake Washington Boulevard and north of SR 520, would be acquired as the site for a stormwater treatment wetland and could also serve as a staging area during construction.

WSDOT would use the staging areas during the entire construction duration. These areas would be used for employee parking, large equipment storage, and material stockpiles waiting for installation. WSDOT would avoid the use of sensitive areas, such as wetlands or steep slopes, for construction staging.

How long would it take to build the project?

This section describes the stages of project construction and how long each stage would last. The sequence of stages discussed here represents one of many possible ways that the project could be built. WSDOT would sequence construction similarly for the 4-Lane and 6-Lane Alternatives, but it would generally take longer for the 6-Lane Alternative. The 6-Lane Alternative options could be constructed within the overall time frame of the 6-Lane Alternative, although different components could take more or less time.

WSDOT has divided the project into nine construction components for the 4-Lane and 6-Lane Alternatives; the 6-Lane Alternative options include additional components. WSDOT intends to construct all components together as one project, although they could be built as separate projects if full funding is not available. *Exhibit 8-8* presents the construction components and the length of time it would take to build each.

The construction sequencing is designed to keep open a minimum of two lanes in each direction on SR 520 during peak weekday traffic periods for the duration of the project. All on- and off-ramps would be open during reconstruction, except that the Lake Washington Boulevard ramps

Exhibit 8-8. **Construction Duration of the 4-Lane and 6-Lane Alternatives and Options**

Component	4-Lane Alternative	6-Lane Alternative	6-Lane Alternative Options
I-5/SR 520 Interchange	13 months	15 months	15 months
Portage Bay Bridge	28 months	28 months	28 months
Montlake Interchange	20 months	26 months	26 months (less with Pacific Street Interchange option)
Union Bay Bridge	N/A	N/A	24 months
Pacific Street/Montlake Boulevard Intersection[a]	N/A	N/A	12 months
Pacific Street Interchange[a]	N/A	N/A	Included in west approach construction
Montlake Boulevard Widening[a]	N/A	N/A	Included with intersection construction
Second Montlake Bridge[b]	N/A	N/A	18 months
West Approach to the Evergreen Point Bridge	41 months	52 months	60 months, including Pacific Interchange construction
Floating Section of the Evergreen Point Bridge	66 months	75 months	75 months
East Approach to the Evergreen Point Bridge	35 months	43 months	43 months
Evergreen Point Road	20 months	25 months	25 months
84th Avenue Northeast and 92nd Avenue Northeast	27 months	23 months	23 months
Bellevue Way and 108th Avenue Northeast	N/A	13 months	26 months, due to interchange reconfiguration and new ramps

NOTE: Availability of funding will dictate the actual construction schedule and staging.
[a]Required for Pacific Street Interchange option only.
[b]Required for Second Montlake Bridge option only.
N/A = not applicable.

would be closed for 3 to 5 years during construction of the west approach structure. Portions of SR 520 and its ramps would be closed at night and on many weekends for the duration of the project. Any needed lane shifts would use temporary ramp connections.

WSDOT intends to minimize disruption and maintain the best possible traffic flow, while allowing construction to occur on a schedule that reflects the availability of funding and other factors. Early action projects, which may help improve traffic flow during construction, will be considered during final design. If all of the components are constructed together as one project, the total length of construction would be approximately 7 to 8 years for the 4-Lane and 6-Lane Alternatives. Work on the 6-Lane Alternative options could be completed during the same overall time frame as for the 6-Lane Alternative. Appendix A, Description of Alternatives and Construction Techniques, provides more information on the anticipated sequence of project construction.

How would construction affect the project area?

How would construction affect traffic flow?

To understand the effects of construction on project area traffic, the design team prepared an estimate of potential construction-related truck traffic and likely haul routes. Readers should note that construction schedule scenarios are still being evaluated and refined. Overall, effects on traffic would be slightly greater for the 6-Lane Alternative than for the 4-Lane Alternative. This is because the larger roadway footprint and construction of the five lids would require more earthwork and more trucks, and the construction period would be longer.

What lanes, ramps, and local streets would be closed during construction?

Under all build alternatives and options, SR 520 would remain open with two lanes in each direction during peak weekday traffic periods throughout the construction period. The most substantial effects of construction on weekday peak-period traffic would be the proposed closure of the westbound HOV lane on the Eastside and the Lake Washington Boulevard ramps in Seattle. Under either build alternative and all options, the westbound HOV lane east of the floating bridge would be closed for approximately 2 years. The effects of the closure on transit, as well as ways to mitigate those effects, are discussed in the *How would project construction affect transit?* section of this chapter.

The Lake Washington Boulevard ramps would be closed for a little more than 3 years during construction of the 4-Lane Alternative and about 4-1/2 years for the 6-Lane Alternative (5 years for the Pacific Street Interchange option). Potential mitigation could include detour signing and improvements to intersections and/or signals along the detour routes.

Other than these effects and the closure of the Delmar Drive bridge for 9 to 12 months, the project would not substantially affect most local arterials. An exception is the Pacific Street Interchange option, which would affect Montlake Boulevard Northeast between the Montlake Cut and Northeast Pacific Place. During construction, the existing travel lanes on Montlake Boulevard would be shifted west into two temporary detour lanes and the current southbound, transit-only, right-turn lane. The number of lanes and the channelization of the travel lanes would remain the same as they are today. In addition, the Pacific Street Interchange option would require closure of Northeast Pacific Street between the University of Washington Medical Center emergency entrance and Montlake Boulevard for approximately 12 months.

KEY POINTS

Road Closures

SR 520 would remain open with two lanes in each direction during peak weekday traffic periods throughout construction.

The westbound HOV lane on the Eastside would close for about 2 years, resulting in increased transit travel times, decreased reliability, and increased costs.

The Lake Washington Boulevard ramps in Seattle would close for approximately 3 years (4-Lane Alternative) to 5 years (6-Lane Alternative with Pacific Street Interchange option).

The Delmar Drive bridge would close for 9 to 12 months.

The Pacific Street Interchange option would maintain existing levels of traffic flow along Montlake Boulevard Northeast during construction, but would require partial closure of Northeast Pacific Street for up to 1 year.

The Lake Washington Boulevard ramps would be closed during construction of both the 4-Lane and 6-Lane Alternatives.

How would construction affect traffic congestion and parking?

During construction, traffic could be slower on SR 520 and local streets due to driver distraction, temporary detours, and intermittent closures. In addition, closure of the westbound HOV lane on the Eastside would require buses and 3+ carpools to use the general-purpose lanes. This closure would increase overall congestion and travel times on SR 520. Closing the Lake Washington Boulevard ramps would increase congestion at the Montlake Boulevard interchange. Some drivers might choose to go south to the I-90 corridor instead, thus increasing local street traffic as well as I-90 traffic. During construction, the Montlake Boulevard Northeast/ Northeast Pacific Street intersection would be congested during peak hours. Traffic could be disrupted during off-peak times to allow construction vehicle access to the construction site.

With the Pacific Street Interchange option, and assuming that typical traffic volumes would continue to use the Montlake Boulevard and Pacific Street corridors, drivers at the intersections near Husky Stadium would experience delays during the closure of Northeast Pacific Street. Emergency vehicles approaching from the south on Montlake Boulevard might also need to take a more circuitous route to the Medical Center emergency room; however, the most direct and safe route available through the construction area will be provided at all times.

WSDOT would provide temporary lane configurations to keep traffic moving through the project area and would apply traffic management strategies to reduce the adverse effects of congestion. These strategies could include providing incentives for the contractor to accelerate construction, scheduling construction during the lowest traffic season, restricting construction activities during major University of Washington events, providing alternative routes, and increasing bus service. WSDOT would also work with the University of Washington Medical Center to ensure that emergency vehicles could reach the hospital in a timely manner. WSDOT is currently evaluating several options for construction staging that would facilitate both emergency and transit operations.

Increasing bus service is one traffic management strategy that could help reduce the adverse effects of congestion in the Montlake area.

The Pacific Street Interchange option would use the University of Washington's E-11/E-12 parking lot as a staging area for construction of the new Union Bay Bridge and the Pacific Street/Montlake Boulevard intersection. As a result, approximately 400 parking spaces would be displaced for 6 to 12 months. WSDOT would work with the University of Washington to find suitable measures to mitigate the loss of parking.

Several sizable construction projects in the University of Washington south campus area, including development of Sound Transit's University Link light rail station at Husky Stadium, are proposed in the same general time frame during which the Pacific Street interchange could be built. Chapter 9 describes the potential cumulative effects of these projects.

How would project construction affect transit?

Road closures, detours, and increased traffic congestion during construction would affect transit service in the project area. These effects would primarily be on bus routes that use local streets affected by construction, such as those in the Montlake area. WSDOT will work with the transit service providers to relocate transit stops and/or temporarily change bus routes to avoid construction zones. These factors, along with traffic congestion in the construction area, would result in delays for transit riders. WSDOT would coordinate with service providers to reduce these effects as much as possible, and to assist transit riders by publicizing service changes well in advance and providing clear signage indicating relocated stops.

The closure of the HOV lane on the Eastside for construction staging would severely affect bus routes that use westbound SR 520 in the Eastside project area. Buses would operate in general-purpose lanes and would therefore be affected by congestion that they can now bypass. This would result in longer travel times, decreased reliability, and increased costs. Both the 4-Lane and 6-Lane Alternatives could also affect transit access to the University of Washington Link light rail station if construction increases traffic congestion in the Montlake area.

WSDOT will work with Metro Transit and Sound Transit to determine ways to avoid or minimize these adverse affects on transit service during project construction, including evaluating alternatives to the HOV lane closure and/or ways to provide priority access for transit. Other potential strategies include providing incentives for the contractor to reopen the HOV lanes as soon as possible, minimizing or prohibiting construction haul trips during peak periods to the extent practicable, and reducing overall peak-period traffic levels on SR 520 by increasing rideshare and transit service during construction.

Proposed work at the Hop-In Market would need to avoid the University Link vent facility proposed for this location. WSDOT is working with Sound Transit to identify and avoid potential design and construction conflicts between the two projects so they can be coordinated smoothly.

Construction effects on transit would be greater for the Pacific Street Interchange option, which has the potential to affect the University Link light rail station at Husky Stadium. Depending on the schedules of each project, these effects could occur during either construction or operation of the station. For example, shifting lanes east and west on Montlake Boulevard as it was being widened would affect Sound Transit's proposed replacement parking area at the Triangle garage and its proposed staging area just west of Husky Stadium. If the station were complete by the time of SR 520 construction, there would be conflicts with pedestrian access to the station area, such as sidewalk closures and entrance remodeling, while the Montlake Boulevard/Pacific Street intersection is expanded and reconstructed. In addition, the Pacific Street Interchange option

would require temporary closure of the east end of Northeast Pacific Street, preventing transit use of the eastbound HOV lane that connects to Montlake Boulevard. Unlike the 4-Lane and 6-Lane Alternatives, this option would not affect Sound Transit's proposed vent facility near the Hop-in Market, so no design coordination would be required for that location. Instead, this option would require coordination in the vicinity of the University Link light rail station to identify and avoid potential design and construction conflicts between the two projects.

What routes would WSDOT use to haul construction materials?

Seattle local arterials that may be used as part of a haul route include Montlake Boulevard, 24th Avenue East, East Roanoke Street, Harvard Avenue East, Boylston Avenue East, East Miller Street, East Newton Street, Fuhrman Avenue East, Eastlake Avenue East, Northeast 45th Street, Boyer Avenue East, Northeast Pacific Street, 10th Avenue East, 11th Avenue East, and 15th Avenue East. Construction is not anticipated to substantially affect traffic on the local arterial network. On average, truck trips during work hours would range from about two to three trips per hour for the 4-Lane Alternative, and two to five trips per hour for the 6-Lane Alternative. During the peak of construction activity, there could be as many as 3 to 12 trips per hour for each alternative. Overall effects on these roadways would be minor. WSDOT would work with the Seattle Department of Transportation (SDOT) to identify appropriate haul routes and identify any existing regulations that could affect construction. WSDOT would also work with SDOT to reduce and/or mitigate damage to pavement caused by construction vehicles on local streets.

Local Eastside arterials that could be affected as part of haul routes include Evergreen Point Road, 84th Avenue Northeast, 92nd Avenue Northeast, Bellevue Way Northeast, and Northeast 24th Street. Under both build alternatives, two to eight truck trips per hour, on average, are expected to use Eastside arterials. In the peak of the construction period, trips along these arterials might range from three to nine trips per hour, or one truck trip every 6 to 20 minutes. Even during the peak of construction activity, construction traffic would not substantially affect the overall traffic flow. As discussed for Seattle effects, WSDOT would work with local jurisdictions to reduce and/or mitigate other potential effects.

Would project construction affect navigation channels?

As described above, construction of the 4-Lane and 6-Lane Alternatives would take place within the open waters of Lake Washington and Portage Bay. None of these construction activities are expected to create more than minor temporary effects on navigation channels in these water bodies. However, two of the 6-Lane Alternative options—the Pacific Street Interchange option and the Second Montlake Bridge option—would use barges during new bridge construction. Construction for both of these

options could require closing up to half the navigation channel within or to the east of the Montlake Cut for up to 2 weeks at a time. Any such closures would be publicized in the *Local Notice to Mariners,* distributed electronically by the U.S. Coast Guard, to alert commercial and recreational boaters of possible delays. WSDOT will develop additional detail on schedules, equipment, and numbers of barges as part of the Final EIS if either of these options becomes part of the preferred alternative.

What would the project area look like while the project is being built?

Construction of the project would be very noticeable both to drivers on the roadway and to viewers looking at SR 520 from nearby vantage points. The largest visual effects would come from the temporary work bridges, the removal of vegetation outside of the existing roadway, and the presence of construction equipment along with the associated work staging areas.

As described above, construction crews would erect temporary work bridges alongside the Portage Bay Bridge, and a temporary detour bridge just south of the existing west approach to the Evergreen Point Bridge through Washington Park Arboretum. The temporary bridges would be trestle-like structures, which would contrast with the smooth lines of the existing bridges. Contractors also would use temporary work bridges in areas where other roads cross SR 520, although these would be much smaller than the over-water bridges.

For the Pacific Street Interchange option, construction of the Union Bay Bridge and Pacific Street interchange would create additional effects because of the openness of the area and the height of the bridges. Views in the area near the existing intersection of Montlake Boulevard and Northeast Pacific Street also would be adversely affected by construction equipment, traffic detours, and excavation. If the University Link station at Husky Stadium were to be open by the time SR 520 construction occurs, it could be more difficult for light rail riders to visually locate the station because of construction-related activities and detours. The Second Montlake Bridge option would also cause additional visual effects in the immediate area of the bridge.

Construction equipment and other related activities would be noticeable throughout the active construction period.

Vegetation removal would create very apparent changes to drivers all along SR 520 on the Eastside, and also to drivers and other viewers in Montlake and the Arboretum. Some of this vegetation would be replaced, as in the Arboretum where a 60-foot-wide swath would be cleared for the detour bridge and then replanted as soon as the bridge is gone. The Pacific Street Interchange option would have greater effects in Montlake and the Arboretum than the 6-Lane Alternative. The South Kirkland Park-and-Ride Transit Access options would remove screening vegetation, thereby changing the area's visual character. Through the Eastside, as much vegetation as possible would be replanted after construction to improve

the appearance of the highway and screen the residences to the north. The 6-Lane Alternative would remove more vegetation than the 4-Lane Alternative because of its greater width.

Construction equipment would be noticeable throughout the active construction period, whether moving next to the traffic lanes during work hours or parked beside the roadway after hours. Also visible would be the results of ongoing construction and mitigation activities, such as exposed cut areas, stockpiled soil, silt fences and mulched areas, and temporary sedimentation ponds. These sights would be out of character with the project area and would greatly detract from visual quality, but they would be temporary. WSDOT would remove equipment and restore the areas as soon as construction is complete.

How noisy would construction activities be?

The State of Washington and local jurisdictions regulate construction noise through a set of specific allowable noise level limits. The regulations cover several different categories of noise, including general construction equipment and impact-type equipment like jackhammers and pile drivers. For each category, the state identifies the amount by which construction activities are allowed to exceed the overall (nonconstruction) standards set forth in the state's noise control ordinance (Chapter 173-60, Washington Administrative Code).

General construction equipment is allowed to exceed the noise standard by up to 25 decibels (in this Draft EIS, the term "decibels" refers to decibels on an A-weighted scale). Impact equipment may exceed the noise levels allowed for general construction equipment for up to an hour, but is not allowed to exceed the levels shown in *Exhibit 8-9*. Between 10:00 p.m. and 7:00 a.m. on weekdays and between 10:00 p.m. and 9:00 a.m. on weekends, no activity is allowed to exceed any state noise criteria without getting a variance from the city in which construction is taking place. WSDOT may seek variances for nighttime construction in order to

Exhibit 8-9. **Amounts by Which Construction Noise May Exceed State Limits[a]**

Allowable Exceedance	Type of Equipment
25 decibels	Equipment on construction sites, including but not limited to crawlers, tractors, dozers, rotary drill and augers, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, trenchers, compactors, compressors, and pneumatic equipment
20 decibels	Portable power equipment used for temporary locations in support of construction activities, such as chainsaws, log chippers, lawn and garden equipment, and powered hand tools
15 decibels	Powered equipment used in temporary repair or periodic maintenance of the grounds such as lawn mowers and powered hand tools

Source: WAC173-60.

[a]Washington State Noise Control Regulation limits the level of noise to 60 decibels from an industrial source to a residential receiver.

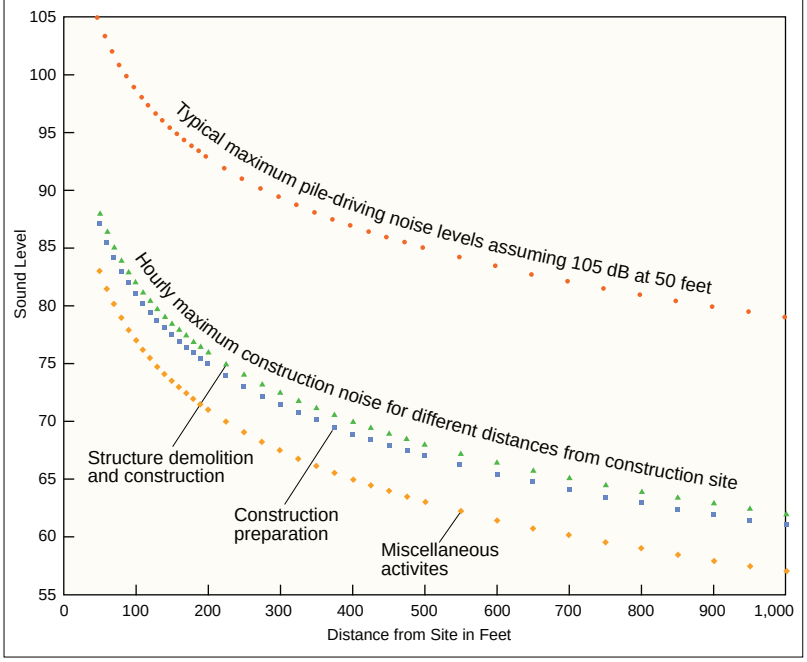
complete time-critical activities; the need for such variances will be determined as project details and construction methods are further defined.

The project team evaluated potential noise levels from four construction-related activities: site preparation, demolition of existing structures, construction of new structures and paving, and miscellaneous activities (such as striping, lighting, and sign installation). Other than pile-driving, all of these activities would have noise levels ranging from below 80 decibels (for miscellaneous activities) up to about 94 decibels at the closest receiver locations. Pile-driving can produce maximum short-term noise levels of 99 to as high as 115 decibels at a distance of 50 feet. This noise level can be compared to the noise level that a floatplane takeoff would make at a distance of 100 feet. Since all sounds diminish rapidly with distance, people farther away from the construction site would hear less noise.

Pile-driving would occur in Union Bay and Portage Bay, both for temporary construction bridges and for the permanent bridge and approach structures. A few residences located at the west end of Portage Bay would be close to pile-driving areas. Madison Park residences would be at least 300 feet away from pile-driving. *Exhibit 8-10* illustrates maximum construction noise levels at different distances from the noise source. Effects would generally be similar for the 4-Lane and 6-Lane Alternatives.

The temporary detour bridge paralleling SR 520 during construction would be, in effect, a temporary four-lane highway that would place traffic closer to several residential areas in Seattle. This would cause increases in

Exhibit 8-10. **Hourly Maximum Construction Noise for Different Distances from the Site**



traffic noise in portions of the Arboretum and Madison Park while the detour bridge is in use (a period of 4 to 5 years). The increase in noise levels is expected to be about 3 to 7 decibels over current levels, depending on proximity to the existing bridge.

Construction that generates noise may also create vibration. Generally, vibration results from demolition and impact construction activities such as pile-driving, soil compaction, and installation of sheet piles in trenches. The U.S. Department of Transportation has established guidelines for acceptable vibration from construction, and WSDOT would rely on these guidelines to minimize potential vibration effects. In its construction specifications, WSDOT would require vibration-producing activities to be monitored within 50 to 75 feet of a vibration-sensitive property. Such properties include the University of Washington Medical Center and the NOAA Northwest Fisheries Science Center.

WSDOT would ultimately be responsible for mitigating construction noise through enforcement of standards provided to the construction contractor. A number of noise mitigation measures could be included in the contract specifications:

- Requiring all engine-powered equipment to have mufflers installed according to the manufacturer's specifications, with regular inspections and replacement of mufflers that are not functioning properly
- Requiring all equipment to comply with pertinent U.S. Environmental Protection Agency equipment noise criteria
- Prohibiting operation of construction equipment within 500 feet of any occupied dwelling in evening or nighttime hours and on Sundays and legal holidays
- Limiting jackhammers, concrete breakers, saws, and other demolition to daylight hours of 8:00 a.m. to 5:00 p.m.
- Installing temporary or portable sound barriers around stationary sources of construction noise and along the sides of temporary bridges where feasible, and locating stationary construction equipment as far from noise-sensitive properties as possible
- Shutting off idling equipment
- Establishing a construction noise monitoring and complaint program, including a complaint hotline
- Notifying residents when extremely noisy work would be occurring, and rescheduling construction activities to avoid any periods of noise annoyance identified in complaints
- Restricting the use of backup beepers outside of daytime hours

How would construction affect neighborhoods and parks?

In both Seattle and Eastside neighborhoods, construction could result in traffic congestion and changes in access, increased noise and dust, decreased visual quality, and the loss of on-street parking. It also would

affect parks and trails. Effects on Seattle and Eastside neighborhoods are discussed separately below.

In Seattle, the Roanoke/Portage Bay and Montlake neighborhoods would experience noise from construction activities, including pile-driving for construction of the Portage Bay Bridge and the Evergreen Point Bridge west approach. Along with the North Capitol Hill neighborhood, these neighborhoods also would experience dust during demolition of the bridges at Delmar Drive and 10th Avenue East, as well as the Portage Bay Bridge. Demolition of the Portage Bay Bridge would affect the properties immediately below it, especially the Queen City Yacht Club and the Portage Bayshore Condominiums.

Demolition of the existing Portage Bay Bridge would affect the Queen City Yacht Club.

Under the 6-Lane Alternative and options, the work bridge just south of the Portage Bay Bridge would displace a dock at a single-family residence and one dock at the Portage Bayshore Condominiums. In addition, one residence would be demolished to accommodate the work bridge. Although WSDOT is classifying this relocation as a permanent effect, a house could be rebuilt in the original location after construction is complete.

Disruption of traffic would be most severe in Montlake because of the 3- to 5-year closure of the Lake Washington Boulevard ramps. Although project designers have developed detour routes to deal with the ramp closure, Montlake would likely absorb most of the detour traffic, increasing congestion in an already congested area. This, in turn, could affect air quality and increase traffic noise. There may be disruption in other areas as a result of temporary closures, and access to transit, recreation, and community facilities may be affected. Overall, difficulties in access and the other effects of construction could affect the interaction of residents in neighborhoods and temporarily reduce community cohesion. These effects would be more pronounced under the Pacific Street Interchange option because it would involve partial closure of Northeast Pacific Street. This option would also affect the University of Washington through construction activities and traffic congestion in the University of Washington Medical Center and Husky Stadium area. Effects could include disruptions in access to the medical center and to stadium and campus events. WSDOT is working with the University of Washington to understand these effects and develop potential traffic managements strategies if this option is identified as part of a preferred alternative.

Traffic during project construction would increase congestion in Montlake.

Construction would also affect access to and use of Seattle parks. As discussed in Chapter 5, project construction would require temporary use of parts of the Bagley Viewpoint, McCurdy Park, East Montlake Park, and the Washington Park Arboretum. It also would affect the portion of the Bill Dawson Bike Trail (Montlake Bike Path) that runs under SR 520. All in all, construction would temporarily occupy 2.97 acres of park land under the 4-Lane Alternative and 4.55 acres of park land under the 6-Lane Alternative. (These temporary effects are in addition to the permanent

effects described in Chapter 4 and 5.) WSDOT would return these areas to park use at the end of construction, but in the meantime, people would not be able to use them. Access to portions of the parks and trail would be closed for part or all of the construction period. The temporary occupancy of Bagley Viewpoint and East Montlake Park during construction would be large enough in area and duration that it is expected to constitute a "use" of the park according to Section 4(f) regulations under both build alternatives and all options.

The 6-Lane Alternative options would involve some different effects on parks than would the 6-Lane Alternative. Construction of the Pacific Street Interchange option would require periodic closure of the University of Washington Waterfront Activities Center, Canoe House, and East Campus bicycle route. For the most part, the buildings would remain open, but the dock and boat launching area would close for up to 6 months. The Burke-Gilman Trail could also require periodic detours during the widening of Montlake Boulevard Northeast. With the Second Montlake Bridge option, portions of the East Campus bicycle route and the Ship Canal Waterside Trail would need to be closed from time to time, with users detoured around construction areas. WSDOT will work with the University of Washington to identify ways to accommodate waterfront and trail activities during construction.

The University of Washington Waterfront Activities Center boat launching area would close up to 6 months if the Pacific Street Interchange option is constructed.

On the Eastside, construction effects would be greatest in neighborhoods near the Evergreen Point Bridge and the bridges over SR 520. This is because construction activities would be most extensive in these areas—for example, pile-driving for the east approach of the Evergreen Point Bridge and the demolition and reconstruction of the bridges or lids at Evergreen Point Road Northeast, 84th Avenue Northeast, and 92nd Avenue Northeast. Among the Eastside communities, Medina would experience the most effects. As in Seattle, the long duration of construction activities could have an effect on community cohesion if traffic congestion, noise, and reduced access to community and service facilities affect the interaction of neighborhood residents. Fairweather Park and Wetherill Park would probably experience some degree of noise and dust from construction, and rerouting and reconstruction of the Points Loop Trail is likely to result in temporary closure of the trail for some length of time.

A retaining wall being constructed

The 6-Lane Alternative would have effects similar to the 4-Lane Alternative, but in general these effects would be somewhat greater in magnitude and would last slightly longer. In particular, the greater amount of earth moved for the 6-Lane Alternative (over twice as much as the 4-Lane Alternative in Seattle and over 2.5 times as much as the 4-Lane Alternative on the Eastside) means that more construction trucks would be needed to haul material into and out of construction sites. This additional traffic would increase the amount of noise and dust in neighborhoods compared to the 4-Lane Alternative.

Mitigation measures proposed to reduce the effects of construction noise and dust are described in the sections *How noisy would construction activities be?* and *Would air quality change as a result of construction?* Other measures to mitigate construction effects on neighborhoods and parks include:

- Implementing the traffic mitigation measures described earlier in this chapter to reduce local areas of congestion near construction and closures and minimize traffic detouring through neighborhoods.
- Working with existing community groups, or helping establish new community groups, to develop specific neighborhood mitigation measures. This could include scheduling neighborhood meetings as often as needed to keep residents informed of construction activities in advance and ensure that mitigation measures are effective.
- Working closely with the University of Washington to further define construction effects (particularly those related to the Pacific Street Interchange option) and provide appropriate measures to avoid, minimize, and mitigate these effects.
- Continuing to use the project Web site and newsletters (in appropriate languages to communicate with project area communities) to provide construction information such as notification of road closures and detour routes. This would include providing contact numbers to allow residents to voice concerns.
- Minimizing temporary road and trail closures to the extent possible, and providing good signage on detour routes for both motorized and nonmotorized travelers.
- Returning park areas used temporarily during construction to their preconstruction condition.
- Working with providers of public services, such as school districts and senior centers, to inform them of proposed detour routes and make any necessary changes.

What would happen to cultural and/or historic resources during construction?

Access to several houses in the potentially NRHP-eligible Roanoke Park Historic District could be limited during construction, especially during rebuilding of the 10th Avenue East and Delmar Drive bridges over SR 520. The Mason House on Boyer Avenue may be affected by vibration during demolition and construction of the Portage Bay and Delmar Drive bridges; it could also experience periods of restricted access.

Cars passing the southern edge of Roanoke Park

In the potentially NRHP-eligible Montlake Historic District, access to the four houses on East Montlake Place East and the house at 2209 Lake Washington Boulevard could be limited when the adjacent intersection is widened. Houses near the 24th Avenue East bridge and the west approach of the Evergreen Point Bridge may be affected by vibration when the existing bridges are demolished. There may also be some access restrictions

related to the 24th Avenue East bridge demolition. Effects would generally be somewhat greater for the 6-Lane Alternative than for the 4-Lane Alternative because construction activities would take place within a wider right-of-way. The Pacific Street Interchange option would have the additional effect of periodically closing the University of Washington Canoe House and surrounding facilities during construction and restricting access to the east end of the Montlake Cut while the Union Bay Bridge is built. The Second Montlake Bridge option would introduce construction effects to the historic Montlake Bridge and the portion of the potentially NRHP-eligible Montlake Historic District that abuts it, including noise, vibration, dust, traffic detours, and vegetation removal.

On the Eastside, demolition of the east approach of the Evergreen Point Bridge and construction of columns for the new bridge could cause vibration at three historic properties on Evergreen Point Road under both build alternatives. These properties may also be affected by construction staging operations. Access to 2851 Evergreen Point Road may be restricted during construction of the new bicycle/pedestrian path access ramp located across the street; 2857 Evergreen Point Road is likely to experience short-term noise, dust, and vibration from construction of the bridge operations facility, dock, and access road. Noise and dust may affect the use of outdoor walkways and an outdoor play area at the Bellevue Christian School/Three Points Elementary. None of the 6-Lane Alternative options for the Eastside would result in additional construction effects on cultural or historic resources.

Neither build alternative nor any of the options would affect any known archaeological or ethnographic sites; however, it is possible that sites could be discovered during construction. WSDOT is currently conducting subsurface investigations in archaeological high-probability areas to reduce this potential. WSDOT would also develop an inadvertent discovery plan to address discovery of cultural resources, if any are found during construction. In accordance with the provisions of an inadvertent discovery plan, WSDOT would work with the affected tribes and the SHPO to identify measures to mitigate the project's effects, if avoidance of the discovered cultural resource is not possible. These measures could include data recovery programs to collect and document materials found at the site, and potentially other offsite mitigation measures that would be negotiated among FHWA, the Tribes, the SHPO, and WSDOT.

Measures to reduce or mitigate effects on cultural resources during construction include:

- Monitoring and ensuring compliance with noise regulations for construction and equipment operation, as described above, and monitoring vibration in cases where impact construction techniques are used close to historic properties
- Protecting facades of historic buildings from accumulation of excessive dirt and dust during construction in accordance with the recommendations of the appropriate historic preservation officer

Construction of the Pacific Street Interchange option would periodically close the historic University of Washington Canoe House, visible in front of Husky Stadium.

WSDOT is conducting investigations in the Foster Island area to reduce the potential of disrupting archaeological or ethnographic sites during project construction.

- Maintaining access to historic properties, except for unavoidable short periods during construction
- If archaeological or ethnographic sites are discovered during construction, consulting with Tribes and the SHPO to identify options for avoidance or mitigation measures

What would happen to water quality during construction?

Construction of the new bridges would involve work in and near the waters of Portage Bay and Lake Washington. Construction of work bridges, installation of new columns for the Portage Bay Bridge and the approaches to the Evergreen Point Bridge, and anchoring of the floating bridge pontoons would all take place in the open water, as would construction of the Union Bay Bridge under the Pacific Street Interchange option. Construction on the Eastside, such as replacing or extending culverts and installing retaining walls, would also be close to Lake Washington shoreline, streams, and wetlands.

Example of fencing to protect a wetland buffer during construction.

Construction activities can affect water quality by increasing turbidity (suspended soils or sediments) in water bodies. Turbidity can harm aquatic life, especially benthic (sediment-dwelling) organisms that are an important part of the food chain. It can also cause fine sediments to settle onto gravels where salmon spawn, smothering eggs that may already be in the gravel and making the stream channel unsuitable for future spawning. Turbidity can result from direct disturbance of sediments through activities like placement of columns or anchors, or from construction-exposed soil eroding during rainstorms and flowing into nearby water bodies. Another potential risk to water quality during construction occurs when pollutants such as fuel or lubricants are spilled. Such spills can seriously damage nearby aquatic organisms and habitat.

To avoid, minimize, and mitigate the project's potential effects on water quality, WSDOT would develop and implement plans to control erosion, sedimentation, and spills during construction. These plans would be consistent with the requirements of federal, state, and local permits related to in-water work, such as the Section 401 Water Quality Certification issued by Ecology and the Hydraulic Project Approval issued by the Washington Department of Fish and Wildlife.

A key component of in-water work permits is a temporary erosion and sediment control (TESC) plan. The TESC plan would identify areas where erosion and sediment disturbance would be a problem and specify best management practices to reduce the risks. The sidebar at right provides some examples of construction best management practices. The plan would include performance standards, based on state regulations, that would define the maximum levels of turbidity and suspended particles that would be allowed in stormwater discharged from construction areas. It would also identify measures to limit the degree to which sediments at the

Best Management Practices

Best management practices followed during construction may include:

- Using containment measures during shaft drilling and installation to keep potentially contaminated lake bottom sediments from reaching other parts of the lake
- Placing staging and stockpiling areas far away from streams and bays
- Limiting the area of exposed soil at any given time during construction
- Controlling erosion and sediment through mulching, matting, and netting; filter fabric fencing; covering of stockpiled soils; placing quarry rock entrance mats to reduce tracking dirt from construction vehicles; regular sweeping and washing of adjacent roadways; sediment traps and ponds; and surface water interceptor swales and ditches

bottom of water bodies are stirred up during in-water construction. With stringent enforcement of best management practices, construction would have a minor effect on water quality.

To prevent pollutants from spilling into the water, WSDOT would also prepare and implement a spill prevention, control, and countermeasures (SPCC) plan. Like the TESC plan, the SPCC plan would specify measures to avoid, minimize, or respond to spills and would contain performance standards to ensure that stormwater leaving the construction site meets state water quality requirements.

Yarrow Bay Wetland; the use of best management practices to maintain water quality would avoid or minimize most potential construction effects on wetlands.

What effects would construction have on ecosystems?

Installing the temporary work bridges, finger piers, and detour bridge over Portage and Union Bays could affect nearby wetlands. Some temporary effects would be the removal of vegetation in these areas and an increased potential for erosion and sediment discharge into the wetlands. On the Eastside, stormwater flow could cause soil and sediment to erode from the construction work areas into nearby wetlands. As described in the previous section, the use of best management practices to maintain water quality would avoid or minimize most potential construction effects. Some wetland vegetation could be removed temporarily during construction; depending on the type of vegetation and its growth rate, these effects could be long term (although not permanent). After construction, contractors would replant with appropriate wetland vegetation to restore the area as closely as possible to preconstruction conditions.

WSDOT would mitigate for effects on wetlands by developing and implementing plans to control erosion, sedimentation, and spills during project construction.

Construction activities in the waters of Lake Washington and Eastside streams could have a variety of effects on fish and other aquatic species. These activities include noise and vibration from pile-driving; temporary shading from work and detour bridges; and turbidity resulting from lengthening culverts in streams and from anchor placement and column removal in the lake. Of these, pile-driving would have the greatest potential for severe short-term effects on aquatic species. Pile-driving creates noise and vibration within the aquatic environment, and can kill fish that are close to the pile-driving location. To minimize these effects, WSDOT could use construction mitigation measures such as air bubble curtains, which reduce noise from in-water construction work and deter fish from coming into the immediate work area. WSDOT will work with resource agencies during development of the project's Biological Assessment to identify suitable measures to minimize effects on endangered species.

All in-water project work would be done during "work windows" established by regulations to protect fish migrating through the Montlake Cut.

Construction of either the Union Bay Bridge under the Pacific Street Interchange option or a second Montlake Bridge would have the additional effect of blocking portions of navigational channels that are used by some fish species, especially migrating salmon. In addition, the temporary work bridges and platforms used for the Pacific Street Interchange option would shade about one more acre of vegetation than

the 6-Lane Alternative, and would involve more pile-driving. Both of these options would involve the use of barge-mounted cranes to lift portions of the bridge superstructure into place. Thus, overall construction disturbance from these two options (especially the Pacific Street Interchange option) would be somewhat greater than for the 6-Lane Alternative.

All in-water work for the project would be done within the regulatory work windows established for Lake Washington, Union Bay, and the Montlake Cut. Best management practices would limit the effects of construction activities on water quality. Other temporary effects are unavoidable, but ultimately they would be offset by the overall improvement in water quality when the project is completed. WSDOT plans to implement a mitigation plan to improve existing habitat conditions through activities like shoreline planting, which would provide long-term benefits for fish and other aquatic species. WSDOT will also work closely with resource agency representatives to reduce the effects of in-water work.

The Yarrow Bay heron rookery is far enough away from the project construction areas to avoid adverse effects.

Noise from construction activities and pile-driving could affect bird species, including nesting and foraging bald eagles in the Broadmoor/Arboretum area. The Broadmoor eagle pair would be most susceptible to noise effects because their three nests are within 900 to 1,500 feet of the construction area. This disturbance could affect the nesting success of the eagles over 4 to 5 years while construction takes place. However, the pair has demonstrated a tolerance to noise and urban conditions, and it is possible that they would tolerate the new disturbance. Their foraging area is large enough that, even if they avoided areas of construction disturbance, they would still be able to obtain sufficient food. One measure to reduce effects on nesting is to minimize pile-driving near the nest sites during the early part of the nesting season, when the birds are most sensitive to disturbance. Construction effects on Eastside wildlife and habitat are expected to be limited because habitats of concern (in particular, the Yarrow Bay heron rookery and the Hunts Point eagle nesting territory) are far enough from construction areas that effects would be negligible.

Overall, the 6-Lane Alternative and the Pacific Street Interchange, Second Montlake Bridge, and South Kirkland Park-and-Ride Transit Access options would have more construction effects on ecosystems than the 4-Lane Alternative because of their larger footprint and longer time of construction within sensitive areas.

How would construction affect geology and soils?

Construction effects could include erosion of exposed soils, landslides during slope excavation, and the need to temporarily lower groundwater levels in areas where groundwater lies near the surface. The avoidance, minimization, and mitigation measures discussed above for water quality would be effective against erosion; however, landslides and groundwater effects would require additional measures, as described below. The Pacific

Street Interchange option would expose more erosion-prone soils than the 6-Lane Alternative and would include more walls and bridge abutments in landslide hazard areas. The Second Montlake Bridge option would slightly increase the potential for erosion of slopes along the Montlake Cut, but would reduce the amount of construction in liquefiable soils. The need for importing and exporting soil and gravel to build the roadway is considered a long-term effect and is discussed in Chapter 4, Comparison of the Alternatives.

Geotechnical engineers will closely review and augment the original 1963 construction records to reduce the possibility of landslides and slope failures.

During the original construction of SR 520 in 1963, slopes failed and caused landslides at 10th Avenue East and Delmar Drive in Seattle, and in the area between 98th and 102nd Avenues Northeast on the Eastside. Because these areas have a history of slope instability, they are at risk for sliding again when contractors cut into the slopes to widen SR 520. WSDOT still has the original construction records, which contain extensive information about the geology of these areas and the measures that were used at the time to stabilize the slopes. During detailed project design, geotechnical engineers will closely review these records and augment them with additional subsurface investigations and testing to identify the nature and extent of the slide-prone materials. Retaining walls, and possibly subsurface drainage systems, would help prevent slope movement. Detailed construction specifications would limit the height of temporary roadway cuts and control the exposure of soils to rainfall and runoff, which can saturate exposed soils and result in slides.

Many excavations for bridge and wall footings, vaults, and piping would require dewatering, which is a localized lowering of the groundwater table to allow construction to take place in drier conditions. Based on the types of soils found in the project area, most groundwater flows are expected to be minimal and easily handled with sump pumps. However, permeable soils that could discharge larger amounts of groundwater into excavations have been found on the Eastside, between about 98th Avenue Northeast and the eastern end of the project area. More aggressive dewatering methods, such as wells to extract groundwater from below the excavation, may be necessary there.

Would air quality change as a result of construction?

Roadway construction would increase soil disturbance, involve the use of heavy-duty equipment, and increase traffic near the construction site. All of these factors may generate emissions that can temporarily affect air quality. The amount and timing of the emissions would vary depending on the phasing of construction and the alternative selected.

WSDOT will take specific measures to control dust and other emissions from construction sites.

Typical sources of emissions during construction of transportation projects include:

- Dust (particulate matter) generated during excavation, grading, loading, and unloading and during demolition of structures and pavement.

- Engine exhaust emissions from construction vehicles, worker vehicles, diesel-fired construction equipment, and increased traffic congestion. Emissions could include volatile organic compounds, oxides of nitrogen, particulates, air toxics, and greenhouse gases.

In general, the air quality effects of the 6-Lane Alternative would be greater than those of the 4-Lane Alternative because of the larger area disturbed, the greater amount of equipment needed, and the longer duration of construction in specific areas. The Pacific Street Interchange and Second Montlake Bridge options would have more air quality effects than the 6-Lane Alternative because they would increase the area of construction disturbance. Of particular concern for the Pacific Street Interchange option are the potential effects of dust on patients at the University of Washington Medical Center. Some of these patients have suppressed immune systems and are especially vulnerable to the effects of dusty air.

Washington state law requires construction site owners and/or operators to mitigate temporary construction effects by taking reasonable precautions to prevent dust from becoming airborne. WSDOT has entered into a memorandum of agreement with the Puget Sound Clean Air Agency that specifies measures for controlling dust and other emissions from WSDOT construction sites. These measures include:

- Spraying exposed soil with water or other suppressants to reduce emissions of particulate matter
- Wetting down fill material and using other measures to minimize dust emissions from haul trucks en route to and from construction sites
- Providing wheel washers to remove dust from vehicle tires before leaving the site, and promptly cleaning up any spills of transported material on roads
- Scheduling construction tasks to minimize disruption of existing vehicle traffic
- Restricting traffic on the construction site to minimize soil disturbance and transport onto roadways
- Locating construction equipment and truck staging areas away from sensitive receptors, such as residences
- Covering dirt, debris, and gravel piles to reduce dust and wind-blown debris
- Keeping mechanical equipment in good operating condition to reduce exhaust emissions

WSDOT will require mechanical equipment to be in good operating condition to reduce exhaust emissions.

WSDOT will also work closely with the University of Washington Medical Center on measures to minimize or mitigate dust and other emissions during the reconstruction of Pacific Street if the Pacific Street Interchange option becomes part of the preferred alternative. This coordination will include identifying measures to avoid concentrating emissions near hospital air vents, for example, by identifying locations where construction vehicles would not be allowed to idle.

New federal regulations now require the use of low-sulfur diesel fuel in on-road trucks as of 2006 and in construction equipment by 2010. Low-sulfur fuel will reduce emissions of both sulfur dioxide and particulate matter from diesel engines. This will reduce the sulfur content of diesel fuel from its current level of 500 parts per million to 15 parts per million—a decrease of 97 percent. These new regulations will be in effect during virtually all of the construction period.

How could construction affect hazardous materials?

As described in Chapter 4, both the 4-Lane and 6-Lane Alternatives could affect sites where regulatory agencies have documented past or present contamination. Most of the contamination at these sites consists of petroleum products and volatile organic compounds associated with petroleum. Although most of the sites have completed cleanup activities required by the agencies, it is possible that some contamination may remain. In addition, construction could encounter previously unknown contamination that has not been controlled or cleaned up. In either case, the risks of disturbing contaminated soils and/or groundwater include:

- Potential release of contaminants into air, soil, sediment, surface water, and groundwater
- Potential alteration of contaminated groundwater flow and generation of contaminated water during construction dewatering
- Potential changes in the migration pathways of contaminants as a result of excavation and other construction activities

The 76 service station in Montlake is a possible location of soil or groundwater contamination.

Another potential effect common to the build alternatives is the accidental release of a hazardous substance (such as fuels and oils needed for heavy equipment) during construction. This is a hazard common to all construction projects, but particularly acute for construction over water or in areas where stormwater runs off into water bodies such as Lake Washington. Spills of any size, if not contained, could harm water quality, vegetation, and wildlife in the immediate area and downstream, and large spills could require emergency response.

In Seattle, as shown in *Exhibit 4-8*, possible locations of contamination within the footprint of the 4-Lane and 6-Lane Alternatives include the Queen City Yacht Club, the 76 service station (formerly Texaco) on East Montlake Place East, the NOAA Northwest Fisheries Science Center, and MOHAI. With the exception of the NOAA facility, no records indicate that any of these sites has released contaminants to the environment, although it is possible that historical boat maintenance practices at the yacht club may have contaminated sediments in Portage Bay. In addition, remnants of old landfills may exist around Foster Island and Lake Washington Boulevard. Demolition of older buildings, such as MOHAI, could disturb materials like asbestos, lead-based paint, and polychlorinated biphenyls (PCBs), all of which were commonly used prior to the 1970s.

The Pacific Street Interchange option could disturb three other known contaminated sites: the Montlake Landfill, the former Fox Cleaners, and Village Auto Care. All of these sites may have contaminated the surrounding environment to some degree, and project contractors could encounter soil and groundwater contaminated with landfill debris and petroleum products. It is also possible that construction could encounter methane gas migrating underground from the landfill. However, unlike the 6-Lane Alternative, this option would avoid construction at the 76 service station on East Montlake Place East.

On the Eastside, as shown in *Exhibit 4-9*, both build alternatives would affect four sites where contamination is known to have occurred: a service station on 84th Avenue Northeast, the Puget Sound Energy site on Northeast Points Drive, a service station on Lake Washington Boulevard, and the Randi's Foods site on Bellevue Way. Cleanup has been completed at all of these sites except Randi's Foods, which may still contain contamination; based on its age, the building itself is also likely to contain hazardous building materials such as asbestos and lead-based paint. The 6-Lane Alternative would affect three more sites than the 4-Lane Alternative, all of which have completed hazardous materials cleanup. The 6-Lane Alternative options would not affect any additional Eastside sites.

Environmental regulations require that project owners use appropriate techniques to manage contaminated soil and groundwater, strictly manage and control hazardous wastes, and adhere to established criteria for transporting hazardous substances. Other measures WSDOT would use to minimize the potential for contaminants release during construction include:

- Conduct assessments of sites where contamination may be present to identify the presence and extent of any contaminants. Sites where stormwater facilities are proposed are especially important to survey, since any contaminants exposed there could be carried offsite when the stormwater is discharged.
- Locate underground storage tanks and fuel lines before construction to reduce the potential for breakage and resulting spills.
- Survey structures that would be demolished to determine whether they contain hazardous building materials like asbestos, lead-based paint, and PCBs.
- Specify construction techniques that minimize disturbance to areas where contamination may exist, and phase construction activities to follow cleanup activities whenever possible.
- Comply with Section 620.08 of WSDOT's Environmental Procedures Manual, which provides standard protocols for dealing with hazardous materials during construction.
- Prepare a comprehensive contingency and hazardous substance management plan and a worker health and safety plan to reduce potential risks to human health.

- Prepare an SPCC plan and a stormwater pollution prevention plan to prevent the release of pollution and hazardous substances to the environment.

How would construction affect the local and regional economy?

In Seattle and on the Eastside, project construction could affect local businesses by changing access (due to road and interchange closures and detours) or by changing conditions in the local area (through increased traffic congestion, noise, and dust). It could also temporarily affect property values in the immediate construction area if nearby properties went on the market while active construction is taking place. These effects would be greater for the 6-Lane Alternative and, in particular, for the Pacific Street Interchange option, where construction of intersection improvements to Montlake Boulevard and Pacific Street could discourage shoppers from patronizing Montlake area businesses. Construction could also affect patronage at the University of Washington Medical Center.

View looking west from Evergreen Point Road Bridge

Overall, the detour routes proposed for the construction period (see Appendix R, Transportation Discipline Report, for details of these routes) would maintain access to businesses throughout the construction period, and mitigation measures for noise and air quality would keep these effects to a minimum. Nevertheless, construction could temporarily reduce patronage at the few businesses near active construction areas, especially those that depend on "street appeal" for drive-by or walk-up sales.

In Seattle, under the 4-Lane Alternative, the southernmost dock at the Queen City Yacht Club would be temporarily displaced by the work bridge used to build the new Portage Bay Bridge. The displaced dock could be replaced in its original location after construction is completed. That would not be true, however, for the 6-Lane Alternative and options, which would permanently displace the dock.

Drivers in the SR 520 corridor and elsewhere in the region would experience some delays during construction.

Under both build alternatives, positive effects would result from jobs and income created as a result of construction. Highway projects can increase output, income, and employment from construction spending that would not otherwise have occurred in the region. Effects from construction spending are likely to be greater for the 6-Lane Alternative and its options than the 4-Lane Alternative because construction costs would be higher.

Motorists in the SR 520 corridor and elsewhere in the region would be likely to experience some delay during construction. This would have negative effects on worker productivity and business travel. Again, such effects are likely to be greater for the 6-Lane Alternative and its options than the 4-Lane Alternative.

How would construction affect energy consumption?

Project construction would consume energy during the mining and production of construction materials, during transportation of materials to the project site, and during operation of construction equipment and worker vehicles. In general, the amount of energy consumed is proportional to the cost of building the project. To calculate how much energy would be used for construction of the project, analysts applied a construction energy consumption factor, developed by the California Department of Transportation, to the estimated cost of the 4-Lane and 6-Lane Alternatives.

Based on estimated construction costs (less professional engineering and right-of-way costs and escalated to 2013 dollars) of $1.64 billion for the 4-Lane Alternative and $2.1 billion for the 6-Lane Alternative, the project would consume about 16.2 million British thermal units (MBtus) and 19.4 million MBtus, respectively, for the two alternatives. This amount of energy would meet the needs of 19,600 and 27,400 homes over the construction period. The Pacific Street Interchange option would consume an additional 3.3 MBtus compared to the 6-Lane Alternative. The Second Montlake Bridge and South Kirkland Park-and-Ride Transit Access options would each consume about 0.6 MBtu more than the 6-Lane Alternative. The other 6-Lane Alternative options would not vary enough in cost from the original 6-Lane Alternative to result in substantially different energy expenditures.

To minimize energy consumption, construction plans would include measures that minimize roadway congestion and adhere to construction practices that encourage efficient energy use. Examples include maintaining equipment in efficient operating condition, limiting equipment idling, encouraging construction workers to carpool, and locating staging areas close to work sites.

How would construction affect public services and utilities?

Temporary road closures during construction may cause traffic congestion that could affect access and response times of police, fire, and emergency medical services, as well as the travel times of public service providers. In particular, closure of Pacific Street during construction of Montlake Boulevard/Pacific Street intersection improvements could affect emergency access to the University of Washington Medical Center. WSDOT would work with these providers to develop detour routes that would minimize effects on response times and access. Increased police security may be needed to protect equipment and materials at construction sites and staging areas. Although a health and safety plan would be in place, there may still be the potential for onsite accidents and/or increased need for emergency medical aid from the fire department to respond to calls.

Lane closures, other traffic revisions, and construction staging areas would affect traffic on I-5, SR 520, and adjacent local streets. This in turn would affect response and travel times of public service and utility providers. WSDOT's existing system of lighting, traffic control, and ramp metering would continue during construction. The use of temporary electrical systems would ensure that lighting on temporary bridges and construction areas, as well as all traffic control systems, is able to operate without interruption.

WSDOT's existing system of ramp metering would continue during project construction, as shown here in Montlake.

During construction, pile-driving or earth-moving may affect utilities both below ground (pipes and conduits) and above ground (overhead wires). There may be a need to reroute utility lines and/or cables, which could result in intermittent temporary outages. WSDOT would coordinate with utility providers to make sure that all relocations complied with acceptable standards and do not result in long-term effects on facilities or services. Designers and contractors would verify the depth and location of utilities in the field during final design and construction, and would develop utility-specific best management practices to minimize effects. Other potential mitigation measures include:

- Notify service providers and neighborhood residents of construction schedules, street closures, and utility interruptions as far in advance as possible
- Notify and coordinate with fire departments for water line relocations that could affect water supply for fire suppression, and establish alternative supply lines prior to any service interruptions
- Notify and coordinate with police departments to ensure adequate staffing for traffic control and pedestrian movement
- Provide emergency service providers and police departments with advance notice of construction schedules and any planned street closures
- Where feasible, schedule construction outside of hours of peak traffic congestion and times when service providers such as school buses and waste collectors are in the area
- Avoid potential effects on utilities through project design
- Work with utility service providers to prepare a consolidated subsurface utility engineering plan, consisting of key elements such as existing locations, potential temporary locations, and potential new locations for utilities; prepare sequenced and coordinated schedules for utility work; and develop detailed descriptions of any service disruptions
- Coordinate with law enforcement agencies to implement crime prevention plans for construction sites and staging areas