3.11 Geology and Soils

What methods were used to evaluate the project's effect on geology and soils?

Existing information about the soils and geology in the study area was collected by reviewing published maps and geotechnical reports for the area. The information that was collected and reviewed included published USGS maps, City of Seattle maps, and selected boring logs from the Pacific Northwest Center for Geologic Mapping Studies (GeoMapNW) at the University of Washington (formerly the Seattle-Area Mapping Project). The seismicity for the area was developed from information in the USGS seismic hazard website (http://earthquake.usgs.gov/hazmaps/).

What are the general geological conditions in the study area?

The regional geology has been formed by past glacial activities. The historical glaciations resulted in a series of ridges located in an approximately north-south direction. The south end of Lake Union appears to be in one of the troughs. Soils in the study area before the glaciations were loaded by the weight of the glaciers, which has resulted in very hard or dense soil consistency in most locations. Soils deposited after the glacial retreat are softer or less dense in consistency, particularly where they accumulated near rivers and lakes. At these locations, thick deposits of compressible or liquefiable soil can occur.

The geology maps and geotechnical reports for the study area indicate that the project limits are underlain by lake deposits, recessional outwash deposits, recessional lacustrine deposits, ice-contact deposits, and Vashon till. The majority of the central portion of the study area is underlain by soft lake deposits; loose/soft fill was also encountered in this area. The western and eastern portions are underlain by ice-contact deposits that are generally loose to very dense. Minor portions of the furthest western and eastern extents of the project limits are mapped as underlain by loose to dense, recessional lacustrine deposits and very dense glacial till, and the southern extents are mapped as loose to dense, recessional outwash deposits.

Because of previous development of the study area, the upper 10 feet of soil often consists of fill deposits placed as part of construction. These deposits can range from sands and gravels that have been compacted prior to placement to debris comprised of soil, bricks, wood, and other similar discarded material.

The native soils in the study area are the result of glacial and post-glacial processes. Landforms within the study area are primarily the result of recent glaciation, erosion, sedimentation, and modification by human activities. The glacial deposits are derived from several regional glaciations. The Vashon stade is the most recent, which occurred from about 13,500 to 15,000 years ago.

Deposits within the study area associated with the Vashon stade include the following deposits, listed in descending order from most recent to oldest: recessional outwash, glacial till, advance outwash, and transitional beds.

What are the geological hazards in the study area?

The City of Seattle Critical Areas map indicates that portions of the study area are mapped as liquefaction hazard areas and steep slopes (40 percent).

Liquefaction Areas: The northern portion of the project limits (from Lake Union to the north, to halfway between Valley Street and Republican Street to the south) is mapped as a liquefaction hazard area. This area is mostly mapped as lake deposits. Boring logs indicate that there are areas of up to 35 feet of loose/soft fill in the liquefaction zone. Areas underlain by soft soils should be assessed during design.

Steep Slope Areas: Small portions in the southeastern part of the study area are mapped as steep slopes (40 percent). These areas are located on the southeast corner of Mercer Street and Fairview Avenue North and the southeast corner of Republican Street and Fairview. These areas are mapped as ice-contact deposits and recessional outwash deposits, respectively. Boring logs closest to the southeast corner of Mercer Street and Fairview Avenue indicate that the soils consist of about 5 feet of loose fill, underlain by dense glacial till. Boring logs closest to the southeast corner of Republican Street and Fairview Avenue North indicate that the soils consist generally of about 5 feet of medium dense sand or sand with silt, underlain by dense/very stiff to very dense glacial soils. Nearby boring logs indicate that there are areas of very loose fill up to 9 feet deep.

Seismicity

The seismicity of the study area is well documented. Earthquakes in the Puget Sound region can result from any one of three sources: the Cascadia subduction zone interplate source off the coast of Washington, the deep intraslab subduction zone located approximately 19 to 25 miles below the Puget Sound area, or shallow crustal faults. The closest active crustal source is the Seattle Fault, which is located approximately 2 miles south of the study area.

What are the subsurface geology and groundwater conditions?

The near-surface soil and groundwater conditions in the study area are summarized in the following subsections.

Mercer Street On-/Off-Ramp Area

The area of the off-/on-ramp revision is mapped as very dense glacial till and loose to dense, ice-contact deposits. Boring logs indicate that on the southern side of the on-ramp, there is up to 8 feet of soft/loose fill, underlain by dense glacial till west of Pontius Avenue North. East of Pontius, the fill is underlain by about 5 feet of very loose to loose silt and silty sand, which is in turn underlain by medium dense/stiff to very dense, silt, clay, and silty sand. The silt and clay become very dense with depth and may be a deposit of Lawton Clay.

Available information suggests that Esperance sands over Lawton Clay is the basic geologic layering beneath this area. The Lawton Clay is a highly overconsolidated deposit of silt and clay that is quite strong in its undisturbed state, but can become very weak when allowed to deform. In many locations, deformation due to stress relief during deglaciation or undercutting of the toe of slope during highway construction has caused fissures, slickensides, and movement that reduced the material to its residual strength. Several landslides occurred in this area during the original construction of I-5. These landslides were stabilized by a series of cylinder pile walls.

Mercer Street Area

The area beneath the Broad Street ramp is mapped as ice-contact deposits. Boring logs indicate up to 14 feet of soft/loose fill may be found in this area, underlain by dense to very dense glacial deposits. The central portion of Mercer Street within the project limits is mapped as lake deposits, and the western and eastern extents of Mercer Street within the project limits are mapped as ice-contact deposits. Boring logs between Ninth and Boren Avenues North indicate up to 29 feet of soft/loose fill containing wood. The fill thickness lessens toward the western and eastern edges of the project limits to 0 feet at Dexter on the western side of the project and 13 feet of fill at Fairview Avenue North on the eastern side of the project limits.

Valley Street Area

The soil beneath Valley Street is mapped as very soft to medium stiff lake deposits. Boring logs indicate up to 35 feet of soft/loose fill containing wood, lumber, and bricks may be encountered along Valley Street. Logs taken from borings just north of the planned substation on Valley Street indicate that subsurface soils consist of up to 10 feet of loose/soft fill that contains wood debris and organics, underlain by medium dense to dense sand or hard clay.

Results of previous explorations in the study area indicate that groundwater along Valley Street and Eastlake Avenue will be about 7 feet below ground surface (bgs). Groundwater in other portions of the study area was usually encountered deeper that 15 feet bgs.

How will construction affect geology and soils?

Excavation

The proposed project would require removing existing pavement, soil excavation for utility installation and to bring the land surface to desired grades, and filling to widen the I-5 ramps. Approximately 40,100 cubic yards of soil would be excavated and approximately 3,500 cubic yards of fill would be needed for construction. Excavated soils would be stockpiled for use as fill if suitable for reuse.

Excavations for below-ground vaults and utilities would most likely require some type of shoring during construction (because there is not enough room to cut side slopes back at a safe angle, particularly if the base of the excavation is below the water table). There are various ways to shore an excavation, such as with sheet piles vibrated into the ground. There are also methods for using drilled-in shoring systems. Ground freezing can also be considered as a way of avoiding vibrations.

Typically, the issue of vibrations is handled in the contract specifications. If there are vibration-sensitive structures, inspection would be required before the work is started and monitoring would occur during the construction. Sometimes the means and methods that can be used by the contractor will be limited. Whether vibration would be an issue is a function of the distance of the receiver from the construction work, the type of construction, and the conditions of the facilities that would be affected.

Erosion

The proposed project would replace the existing pavement with new pavement. The roadway would be widened by clearing and grading the area, laying the aggregate roadway foundation, and placing a pavement overlay. Construction equipment such as backhoes, excavators, front loaders, pavement grinders, jackhammers, trucks, and grading and paving equipment would be used. Erosion of surface soils would result from exposed ground surfaces, earthfill, and stockpiles of earthfill and aggregates. The eroded soils could be transported with surface water runoff.

High Groundwater

Construction below the groundwater table would require dewatering. It is possible that dewatering could be handled with sump pumps in the bottom of the excavation. However, the occurrence of more permeable sands could require a well point system for dewatering in some areas. One of the considerations in dewatering would be the potential for settlement from groundwater drawdown. This potential would have to be evaluated after the construction requirements are established. Another alternative would be to drive sheet piles and then use sump pumps. In this case the potential effects of construction vibrations from sheetpile installation would need to be considered. As described above, the issue of vibrations is handled in the contract specifications. If there are vibration-sensitive structures nearby, inspection would be required before the work is started and monitoring would occur during the construction.

Fine-grained Soils

Near-surface soil generally has a high percentage of fine-grained soil, and some of these soils contain wood, brick, and other debris. The percentage of fines in the near-surface soils, as well as other debris, would generally make much of this soil unsuitable for reuse in other locations without conditioning the soil or adding amendments. It is likely that most excavated soils would have to be disposed of offsite, and structural fill would be brought to the site for areas that require changes in grade.

Existing Development

The study area is developed with buildings and associated utilities. Additional investigations would be required to determine the types of foundations used to support these buildings and the potential for construction effects on existing buildings. These effects could be from settlement of soils supporting the buildings or vibrations associated with construction equipment. Another important consideration would be the protection of buried utilities, particularly in the Valley Street area. The soils in this area are compressible, and any new loads could result in settlement of the compressible soil and the utilities supported in the soil.

How will the completed project affect geology and soils?

Liquefaction should be a general consideration for the completed project. Liquefaction occurs in sandy soils that are located below the groundwater surface during large earthquakes. The consequences of liquefaction could be loss in bearing capacity, settlement, and lateral movement of the soil.

The loss in bearing capacity is due to loss in strength of the soil when the soil is in a liquefied state. If the bearing capacity of the soil is exceeded during liquefaction, a structure supported on the soil would settle and it could tilt. Generally, loss in bearing capacity is more relevant to buildings; however, it could apply to a retaining wall that is used for a grade separation. During the geotechnical design, the potential for loss in bearing capacity is evaluated, and provisions are normally taken to avoid this occurrence. Liquefaction, loss of bearing capacity, settlement, and lateral spreading issues are of most concern in the vicinity of Valley Street.

What effects on geology and soils occur if nothing were built?

Under the No Action Alternative, there would be no impacts on geology and soils.

What measures are proposed to avoid or minimize effects on geology and soils during construction?

The effects from most construction activities will be mitigated by implementing standard design and construction procedures. The measures range from implementation of BMPs during construction to modifying the design requirements for the proposed project. By implementing these mitigation measures, the previously described effects will be reduced or eliminated.

A number of other ground improvement or mitigation methods may have to be considered for project elements in areas where substantial thickness of soft, compressible soil occurs. These methods generally consist of (1) excavation and replacement, (2) use of lightweight fills, such as geofoam, or (3) use of deep foundations. For example, it may be desirable to use piles to support pipelines and vaults. The need for ground improvement or use of structural systems to support utilities should be made on a site-specific basis when the preferred alternative is defined.

What measures are proposed to avoid or minimize effects on geology and soils after the project is built?

While various methods exist for mitigating the potential damage from liquefaction, the cost of mitigation could outweigh the repair cost following an earthquake. For this reason, it will be important to consider project elements on a specific basis and decide whether the cost of mitigation is justified.

3.12 Fish, Wildlife, and Vegetation

How was information collected?

Several sources of information were used for the assessment of fish, wildlife, and vegetation conditions and impacts on the project. Information relating to existing conditions was gathered from several sources including Washington Department of Ecology, King County Department of Natural resources web pages, and City of Seattle web pages. In addition, information was available from the Denny Way/Lake Union CSO Control Project EIS and BA (King County and City of Seattle 1998).

What are the regulations governing vegetation, wildlife, and fisheries resources in the study area?

The federal Endangered Species Act (ESA) protects plants and animals listed as endangered or threatened under federal law. The ESA regulations require consultation with National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS).

Sections 401 and 404 of the Clean Water Act (CWA) are administered by the Washington State Department of Ecology through the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers, respectively. The CWA implements pollution protection, wetlands protection, and dredging provisions in waters of the United States.

The State of Washington Hydraulic Code is administered by Washington State Department of Fish and Wildlife (WDFW) and requires a permit for work that will affect the bed or flow of any state waters. The state Hydraulic Code contains rules that protect all fish and wildlife that use aquatic habitat.

The State of Washington Shorelines Management Act is administered by cities and counties for the WDOE. The Shoreline Act rules include conservation measures for riparian and aquatic resources near waters with an average flow greater than 20 cubic feet per second (cfs).

The State of Washington Growth Management Act (GMA) is administered by cities and counties with oversight from the WDOE. Local jurisdictions formulate critical area ordinances using GMA guidelines. The regulations protect the critical habitat areas for plants and animals within each respective jurisdiction.

What vegetation, wildlife, and fisheries resources are in the study area?

The dense and highly urban study area does not provide any notable vegetation or natural habitat for wildlife on the land. Vegetation in the area is primarily ornamental shrubs and trees. Along the shore of Lake Union (outside of the area that would be disturbed by the project), there is some native vegetation and manicured grass. No threatened or endangered plant species are known to be on or near the site.

Wildlife known to be near the study area include songbirds, seagulls, and Canada geese. There are no federally listed threatened or endangered species present in the study area. Bald eagle, a federally threatened species, may forage in the Lake Union area.

Lake Union, immediately north of the study area, receives runoff from the west and east ends of the project through two separate outfalls located at the ends of Minor Street and Broad Street. Bull trout, Puget Sound Chinook salmon, coho salmon, sockeye salmon, and steelhead trout are found in Lake Union on a seasonal basis as they migrate to other locations. Puget Sound Chinook salmon and bull trout are federally listed species. Fish species resident to Lake Union are listed in Appendix D.

How will construction affect vegetation, wildlife, and fisheries resources?

Project construction could require the removal of some existing streetscape vegetation (shrubs and/or trees). No native vegetation would be affected.

During construction, erosion of soils from cleared and excavated areas and/or accidental spills of fuel, lubricants, and other construction-related hazardous material could cause these materials to enter storm sewers that drain to Lake Union. However, water collected by the sewer system would be treated before entering the lake, and should not adversely affect lake water quality unless there is an unusually large spill or contaminants bypass the sewer system. Contaminants that inadvertently enter the lake could adversely affect aquatic communities in Lake Union if measures were not taken to prevent or minimize their occurrence.

How will the completed project affect vegetation, wildlife, and fisheries resources?

The design for the proposed project includes a vegetated median along Mercer Street and tree plantings along the sidewalk, in an area that is currently lacking vegetation. Trees would also be planted along Valley Street. These plantings would provide limited habitat for birds and other urban-adapted species that use the area.

The proposed project would improve stormwater quality and management through reduction of total impervious surface and reduced runoff. Most of the runoff from streets within the Mercer Corridor project limits is currently conveyed to the City's combined sewer system, which flows to the West Point treatment plant and discharges to Puget Sound. Runoff from two small areas at the east and west ends of the project limits drain to Lake Union through two separate outfalls located at the end of Minor Avenue and Broad Street. Exhibit 3-12 shows portions of the proposed improvements draining to the combined sewer and to Lake Union, along with the existing conveyance systems (refer to section 3.5 Surface Water

Quality for a more detailed discussion of stormwater treatment and water quality).

After the Mercer Corridor Improvements Project is constructed, total impervious surface would decrease by 0.7 acre, compared to existing conditions. Most of the stormwater from the study area would continue to drain to the City's combined sewer system. For portions of the project that would continue to drain to Lake Union, pollutant-generating impervious surface would increase by approximately 0.52 acre. However, stormwater draining to the lake would be treated prior to discharge. Because runoff would be treated, total pollutant loads from the study area to Lake Union would be reduced compared to existing conditions. Better stormwater quality would improve water quality and aquatic habitat in Lake Union. Therefore the project would not affect fish and fish habitat, and would have no effect on threatened and endangered fish species (refer to Appendix D).

What effects on vegetation, wildlife, and fisheries resources would occur if nothing were built?

Under the No Action Alternative, there would be no change to the existing vegetation and wildlife in the study area. Runoff from a portion of the study area would continue to be discharged untreated into Lake Union, and the benefits to the aquatic environment associated with constructing water quality improvements described above would not occur.

What measures are proposed to avoid or minimize effects on vegetation, wildlife, and fisheries resources during construction?

No adverse effects on vegetation and wildlife are expected during project construction,

As noted in section 3.5, the Mercer Corridor Improvements Project must meet erosion and sediment control requirements specified in the City drainage code as well as the state NPDES regulations. Therefore, the potential for erosion and transport of sediment away from the construction site would be minimized.

The potential for erosion and sedimentation resulting from construction is related to construction phasing instead of the overall amount of excavation. With proper use of BMPs, effects on surface water would be minimal.

What measures are proposed to avoid or minimize effects on vegetation, wildlife, and fisheries resources after the project is built?

Treatment BMPs meeting the requirements of the City's Stormwater, Grading and Drainage Control Code for facilities on city streets and the HRM (WSDOT 2006) for facilities in WSDOT right-of-way would be installed to further improve the proposed project's positive water quality effects on Lake Union. Additional opportunities to detain and/or treat stormwater runoff and water quality would be examined and considered during future design phases.

3.13 Transportation

What methods were used to evaluate the project's effect on transportation?

For potential effects on transportation resulting from the Mercer Corridor Improvements Project, the traffic analysts evaluated the three scenarios listed below. In addition to existing conditions, they performed analyses for two forecast years to illustrate the short- and long-term effects of the project on the transportation system. All scenarios included analysis of both the morning (AM) and afternoon (PM) peak hours of traffic.

Existing conditions. A "snapshot" of 2005 traffic operations in the study area was taken to provide a point of reference to compare with the future scenarios.

No Action condition. No Action Alternative traffic operations were analyzed for both the proposed year of opening (2010) and a future design horizon year (2030). The No Action condition includes all planned infrastructure and land developments within the study area.

Build condition. The build condition (Build Alternative) was also analyzed for both 2010 and forecast conditions in 2030. The build condition includes the background projects included in the No Action Alternative and incorporates the Mercer Street Improvements Project, including redistribution of traffic within the study area due to the two-way traffic on Mercer Street.

Level of service (LOS) – describes typical traffic conditions in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. There are six LOS classifications, each given a letter designation from A to F. LOS A represents the best operating conditions and LOS F represents the worst. For intersections, LOS is measured in terms of delay (seconds per vehicle)

The analysts used two software packages (Synchro and Corsim) to capture the full traffic-related effects on 30 intersections. The Synchro analysis quantified traffic operations in terms of level of service (LOS) and vehicle delays and queuing. The Corsim software was used to develop measures of effectiveness (MOEs) for I-5 and the interface between the freeway and local roadway system. Operations were quantified in terms of travel time, vehicle delay, and queuing. Vehicle queue results were used to support the design to ensure that appropriate channelization is provided. Additionally, two MOEs were used to analyze traffic operations, travel times, and screenline volumes. (A screenline is an imaginary boundary through which all of the entering/exiting vehicles are collectively viewed.) Existing travel times were calculated and physically verified. Year 2010 and 2030 travel times were derived from speed and delay output from the Synchro and Corsim analyses. In this study, one screenline was placed on each side of the study area to compare vehicle demand between scenarios (Exhibit 3-35).

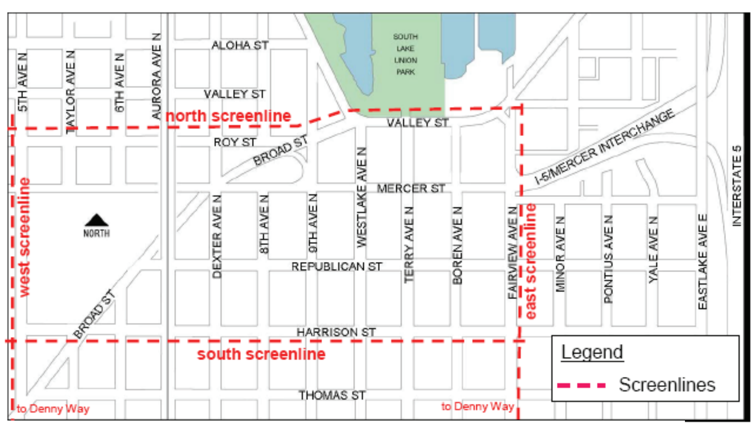

EXHIBIT 3-35. Screenline Boundaries

What is traffic like in the study area currently?

In the westbound direction, vehicle travel follows a circuitous path of multi-lane, high-volume right and left turns (Photo 3-3). A return trip in the eastbound direction can also be confusing as drivers are required to either locate Mercer Street (west of Aurora Avenue North) or use Broad Street and then perform two quick turns (right and left) to get onto Mercer Street to proceed onto I-5. East-west travel is also constrained by Aurora Avenue North because it acts as a barrier; vehicles can only cross Aurora on Broad Street (via Valley Street) in the westbound direction and on Mercer Street and Broad Street in the eastbound direction. As a result, most east- and westbound traffic in the study area travels along the Mercer Street and Valley Street corridors. These east-west paths are shown in Exhibit 3-36. Other east-west routes such as Harrison, Republican, and Thomas streets are greatly underused because they do not provide access across Aurora Avenue North. North- and southbound travel is divided along a number of routes, including Fairview, Dexter, Fifth, and Westlake Avenues North, and one-way on Ninth Avenue.

Photo 3-3. Current East-West Circuitous Travel Mercer Street at Valley Street

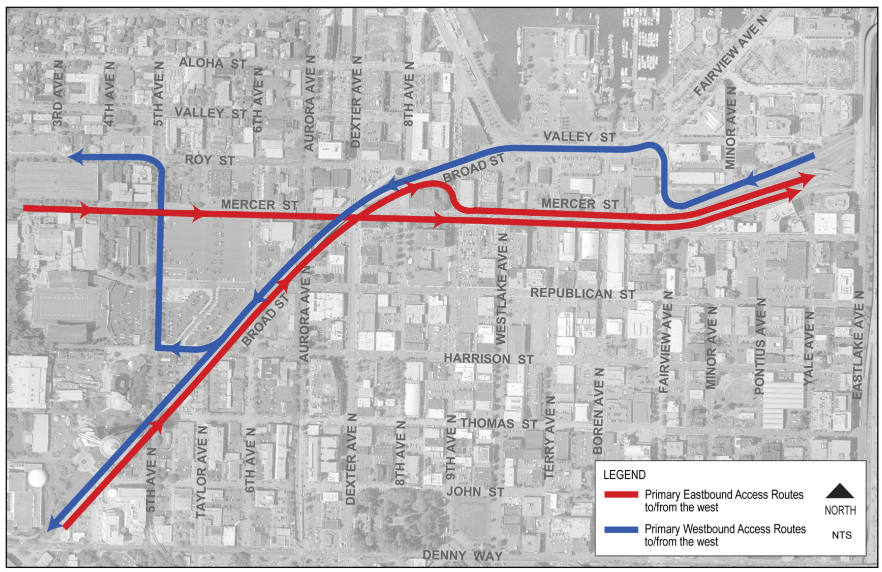

Exhibit 3-36. Current East- and Westbound Travel Paths

Currently, traffic volumes represent a directional flow during the commuter peak periods. The AM peak serves an inbound demand, flowing through the study area towards the west and south. The PM peak serves an outbound travel demand with heavier traffic in the east- and northbound directions.

How does traffic operate in the study area?

Traffic operation analyses at the study intersections were performed using the existing AM and PM peak hour traffic volumes, traffic controls, and roadway characteristics. Operations are quantified in terms of level of service. Exhibit 3-37 shows the LOS at the 30 study intersections within the Mercer corridor (see the *Transportation Discipline Report* for detailed intersection information on the intersection channelization and control, AM and PM peak hour volumes, LOS, and intersection delay). Most of the study area operates at LOS D or better conditions. Two intersections along Fairview Avenue North operate at LOS E/F during both peak hours: Mercer Street and Valley Street. Three additional intersections operate at LOS E/F during the afternoon peak: Fifth Avenue North/Roy Street, Dexter Avenue North/Republican Street, and Valley Street/Terry Avenue

North. Lastly, the Fifth Avenue North and Broad Street intersection operates at LOS E in the morning peak.

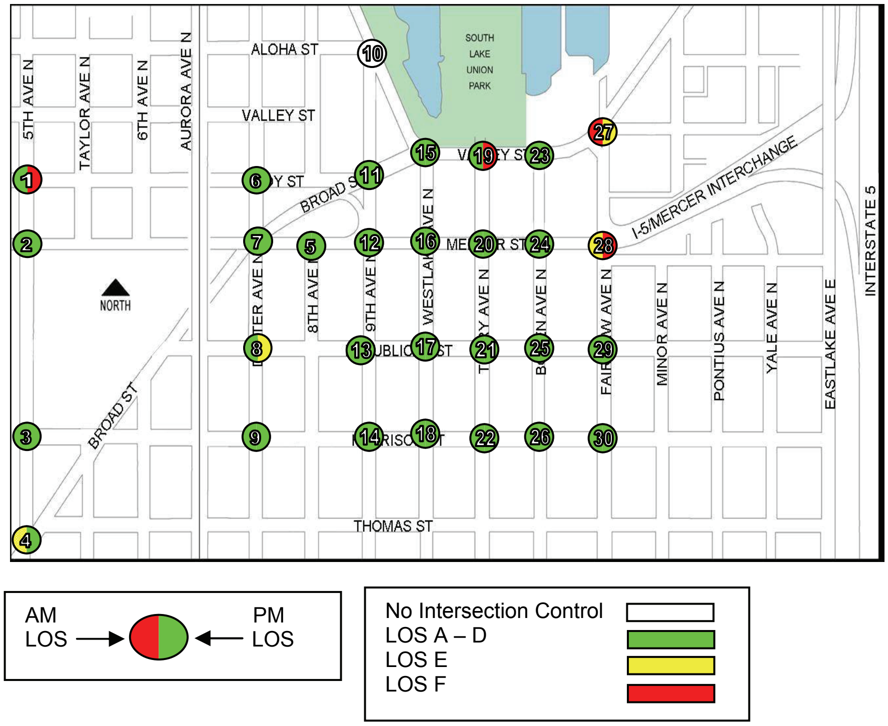

Exhibit 3-37. Existing Intersection Operations

Exhibit 3-38 presents existing travel times through the study area calculated by the software. Calculated travel times were verified in the field to calibrate the analysis software to reflect accurate operating conditions. Between I-5 and the Seattle Center, the westbound travel time is approximately 7 to 11 minutes. In the eastbound direction, the travel time is approximately 3 to 8 minutes.

Terry Avenue North/Valley Street and Republican Street/Dexter Avenue North are both two-way, stop-controlled intersections. The volume of traffic along the free-flowing corridor provides insufficient gaps for the stop-controlled vehicles' access, thus causing long delays and poor LOS for the stop-controlled approaches. The intersections of Fairview Avenue North/Valley Street and Mercer Street/I-5 interchange have substantial volumes during the peak traffic hours associated with I-5 access. In addition, the current one-way operation on Mercer Street requires numerous low-capacity turning movements at both of these intersections. The combination of these conditions creates high levels of delay. The Fifth Avenue North/Roy Street intersection operates poorly during the PM peak primarily as a result of its signal timing interaction with the Mercer Street's signal coordination plan and the high volume of northbound vehicles turning left onto Roy Street due to the Mercer and Roy streets one-way couplet.

EXHIBIT 3-38
2005 Existing Travel Times

East-West Paths	AM Peak Hour	PM Peak Hour
	Existing (min.)	Existing (min.)
WB - I-5 to (north) Seattle Center[a]	8.9	11.5
EB – (north) Seattle Center to I-5	2.9	3.9
WB - I-5 to (south) Seattle Center[a]	8.6	7.1
EB – (south) Seattle Center to I-5	3.7	7.6
WB - I-5 to Westlake[a]	6.4	5.7
EB - Westlake to I-5	2.6	5.3
NB - Westlake Avenue	3.2	4.3
SB – Westlake Avenue[b]	N/A	N/A
NB – Ninth Avenue[b]	N/A	N/A
SB - Ninth Avenue	3.5	4.9

Note: While individual vehicles travel differently, these travel times are an average based on the vehicle mixture on each road segment.

WB = westbound, EB = eastbound, NB = northbound, and SB = southbound

[a] Travel times from I-5 are a vehicle weighted average between the northbound and southbound off-ramps.

[b] Existing travel times reflect northbound travel on Westlake Avenue and southbound travel on Ninth Avenue North.

The freeway and ramp modeling used for the westbound travel time calculations show that vehicle queuing occurs on both the north- and southbound off-ramps, but does not reach the I-5 mainline during typical AM and PM peak hour conditions (during non-event conditions at the Seattle Center).

What are the pedestrian and bicycle facilities in the study area?

Pedestrian facilities are provided in the form of sidewalks throughout most of the study area. However, the quality and continuity of the sidewalk are in poor or unacceptable condition within much of the project limits. Two corridors have short segments of missing sidewalks. Poor pedestrian conditions are present intermittently throughout the study area (Photo 3-4). Some facilities are non-compliant with the Americans with Disabilities Act (ADA), most have worn and cracked surfaces, and some have narrow sidewalk widths. There is typically no buffer between the high-volume travel lanes and pedestrians. Signalized crosswalk locations within the study area are also limited and are of poor quality, with faded striping and uneven, worn pavement.

Photo 3-4. Typical Sidewalk Conditions in the Mercer Corridor

A pedestrian path is located around the south side of

Lake Union from approximately Galer Street on the east to just east of the Aurora Bridge on the west. Through the study area, the path is situated north of Valley Street, separated from traffic by a narrow shoulder and traffic curb (Photo 3-5). In the South Lake Union neighborhood, the pavement condition varies, but large portions are in poor shape and characterized by cracks, patches, and uneven pavement, which allow puddles to form. Uneven sidewalk poses a safety concern for pedestrians, especially those with disabilities.

Photo 3-5. South Lake Union Pedestrian Path

Existing bicycle facilities within the study area are limited. Dexter Avenue North is the only roadway with bicycle lanes within the study area. The bicycle lanes extend from the Fremont Bridge to Denny Way on both sides of the road.

The pedestrian path around the south side of Lake Union also allows bicycle use, but because of the mix of pedestrians and bicycles, the path is limited in utility for commuter bicyclists, who prefer higher speed facilities.

What transit service is provided in the study area?

Transit service is provided on each of the north-south arterial streets in the study area and links South Lake Union with downtown Seattle, the University District, and other neighborhoods to the north. Metro Transit buses serve the Fairview, Westlake /Ninth, Dexter, Fifth, and Aurora avenues corridors. The South Lake Union Streetcar began operation in December 2007 on Westlake, Terry, and Fairview and along Valley. Coverage along the east-west corridors is limited to Denny Way to the south, which is outside the study area. Transit service from I-5 is currently not provided.

What truck facilities are provided in the study area?

The study area serves commercial traffic to and from I-5 and major commercial industrial destinations, including South Lake Union, Fremont, Ballard, Interbay, and North Downtown. The Valley Street and Mercer Street couplet is a designated “Major Truck Street” to and from Westlake and Ninth Avenues North and Broad Street in the Seattle Comprehensive Plan. The westbound route requires trucks to perform weaving maneuvers and many multi-lane turn movements to access Valley Street (Photo 3-6). Broad Street, Westlake Avenue North, and Ninth Avenue North, north of Mercer Street, are also designated Major Truck Streets by the City.

Photo 3-6. Truck Maneuvering through Mercer/Valley Turns

Aurora Avenue North also serves as a Major Truck Street that traverses the study area limits.

Are there any safety issues in the project area?

Seattle Department of Transportation defines a high accident intersection as having 10 or more accidents per year if the intersection is signalized, and 5 or more if unsignalized. There are six high accident intersections within the Mercer corridor study area. Six street segments (between intersections) within the study area also have higher than the City's average numbers of accidents. One such high-accident segment is Valley Street between Westlake and Terry Avenues North (Photo 3-7).

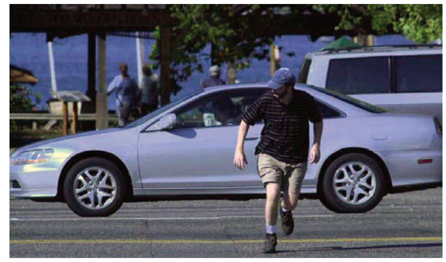

Photo 3-7. Pedestrian Crossing Valley Street

Within the last 3 years at least one accident involving a motorized vehicle and a pedestrian or bicyclist was reported at most intersections within the study area. Along Mercer Street, pedestrian or bicycle accidents occurred at the intersections with Dexter, Westlake, Terry, Boren, and Fairview Avenues North. Along Valley Street, pedestrian or bicycle accidents occurred at the Westlake Avenue North and Broad Street intersections. Within mid-block segments, pedestrian or bicycle accidents occurred along Mercer Street between Terry and Boren and Boren and Fairview Avenues North and along Fairview between Mercer and Valley streets. Accidents involving pedestrians and bicyclists could be attributed to few protected pedestrian crossing opportunities, narrow or missing sidewalks, narrow lanes, lack of delineated bicycle facilities, and high-volume vehicle turning conflicts.

WSDOT defines a high accident location (HAL) as a section of state highway less than a mile long that has experienced a higher rate than the state's average of severe accidents during the previous 2-year period. Six locations on I-5 in the vicinity of the study area are identified by WSDOT as being HALs. Five of those locations are segments of I-5 ramps within the Mercer Street interchange, and one location is I-5 southbound mainline between Mile Post 164.90 and 167.52 (Lakeview entrance ramp to just north of the South Jackson Street undercrossing). In addition to these locations, the I-5 ramp terminal intersection with Mercer Street/Fairview Avenue North experienced a high number of accidents during the 3-year period reviewed.

Is on-street parking provided in the study area?

Existing on-street parking was inventoried as part of the *South Lake Union On-Street Parking Plan* published in November 2005 (Nelson/Nygaard Consulting Associates 2005). On-street parking is allowed throughout most of the study area, with the exception of Mercer and Valley streets. On-street parking can be useful in supporting retail development.

The Mercer and Valley street corridors generally have no on-street parking. Within the proposed project limits, only two segments allow unrestricted parking: the north side of Mercer Street between Terry and Boren Avenues North, and the north side of Valley Street between Boren and Fairview Avenues North.

How would traffic be affected during construction of the project?

The construction of the Mercer Corridor Improvements Project would occur in three major phases, occurring over approximately a 2.5-year period.

To maintain maximum capacity and circulation within the study area, improvements to Mercer Street (Phases 1 and 2) would be completed prior to construction of improvements along Valley Street (Phase 3). Construction along the parallel corridors of Ninth Avenue North and Westlake Avenue North would be performed independently of each other to maintain mobility while minimizing disruptions. Generally, Mercer Street would be widened to the north side within new right-of-way that would be acquired for the proposed project. This would minimize disruptions, leaving the south side of Mercer Street available for eastbound traffic movements. During most of the construction, three eastbound lanes would be maintained on Mercer Street to minimize congestion and vehicle queues.

During construction, on-street parking would be removed on Westlake Avenue North, Ninth Avenue North, and a one-block section of Mercer Street between Boren and Terry Avenues North.

Ninth and Westlake Avenues North would maintain two-lane roadways with shoulders for vehicles to pull over for emergency vehicle access. Bicycle and freight travel would generally maintain the same travel patterns within the study area, and would be provided with lane geometry similar to existing conditions.

Existing Major Truck Streets in the study area, designated in the Seattle Comprehensive Plan, would be maintained during the first two phases of construction. For Phase 3, the area's Major Truck Streets would be relocated to Mercer Street (both directions) and Ninth/Westlake Avenues North corridors.

Transit service impacts during construction would include temporary relocation of bus zones. During the construction of Ninth Avenue South, buses would be shifted to the parallel arterial Westlake Avenue North. Conversely, when Westlake Avenue is under construction, buses would be shifted to Ninth Avenue. Travel speed and reliability would be affected for buses routed along Fairview Avenue North. Mitigation for the speed and reliability impact to the Fairview Avenue trolley bus (Route 70) service could include the following elements:

- Reroute to Eastlake Avenue utilizing diesel coaches (weekends and/or weekdays), or
- Pole and overhead line relocations to electrify a trolley bus reroute or a turn-around avoiding Fairview reconstruction. A reroute or turn-around would affect on-street parking.

How would traffic be affected after the project is built?

The Mercer Corridor Improvements Project would provide three through-travel lanes for both east- and westbound travel on Mercer Street through the study area. By providing westbound access on Mercer Street, travel demand would be greatly reduced on Valley Street, thereby allowing the roadway to be downsized to one travel lane in each direction. The two-way operations on Westlake Avenue North and Ninth Avenue North implemented under separate projects would be extended to the north with the two-way Mercer Street. The two north-south two-way conversions would extend north to the Ninth Avenue North /Westlake Avenue North intersection.

In general, the project would place a higher travel demand on the Mercer Street corridor due to the improved westbound route. Operations for eastbound traffic would be slightly negatively affected; however, westbound travel would follow a less circuitous path, reducing driver confusion and circuitous travel in neighborhoods and thereby improving access, removing barriers (turn restrictions), and improving pedestrian/bike access and safety. It is expected that the westbound operations would be improved by modifying the current lower-capacity right and left movement with a more direct through movement at the I-5 off-ramp.

In the westbound and eastbound direction, response times along Mercer Street would be similar to No Action or slightly worse. By improving the traffic circulation in the South Lake Union neighborhood, overall emergency response times should not be degraded. Providing emergency vehicles with route options would be a benefit during congested periods.

Along Valley Street, even with only one travel lane in each direction, the emergency vehicle response times could get slightly better as intersection LOS improves at key intersections due to greatly reduced traffic on this street. By providing a bicycle lane and parking in each direction, adequate space would be provided for a vehicle to pull over and allow emergency vehicles to pass. All new traffic signals would be equipped with emergency vehicle pre-emption to minimize effects on response times.

2010 Operations

Intersection operations along Valley Street would improve in 2010 because of the reduced vehicular demand on this corridor, making it an excellent corridor for pedestrian and bicycle travel. Mercer Street intersections at Ninth and Westlake Avenues North would experience higher delays with the proposed connection to Broad Street and the two-way operation along Ninth Avenue North (constructed by others). The intersection of Mercer Street and Fairview Avenue North is expected to improve with the additional lane capacity and revised configuration of Mercer Street and the I-5 on- and off-ramps. Instead of forcing vehicles to perform two low-capacity turns to access South Lake Union from I-5, vehicles would have a direct through movement that improves drivers' expectations. The proposed traffic signal at the Mercer Street/Fairview Avenue intersection would provide a greater percentage of westbound green time compared to the current combined signal operations at Mercer and Valley streets.

Travel time estimates for 2010 are shown in Exhibit 3-39. Travel time savings are expected in the AM peak hour for the westbound travel paths, while eastbound travel times would remain similar. During the PM peak hour, travel times are expected to degrade slightly with four eastbound lanes on Mercer Street, particularly in the eastbound direction due to increased delays along Mercer Street at the intersections with Ninth and Westlake Avenues North.

EXHIBIT 3-39
2010 Travel Time Comparison

Travel Route Paths	AM Peak Hour			PM Peak Hour		
	No Action (minutes)	Build 7-lane[c] (minutes)	Build 6-lane[d] (minutes)	No Action (minutes)	Build 7-lane[c] (minutes)	Build 6-lane[d] (minutes)
WB - I-5 to (north) Seattle Center[a]	10.9	8.4	8.3	10.8	12.4	11.4
EB – (north) Seattle Center to I-5	3.7	3.5	3.5	7.3	10.2	18.0
WB - I-5 to (south) Seattle Center[a]	10.4	6.5	6.3	6.7	8.1	7.6
EB – (south) Seattle Center to I-5	3.8	3.8	4.0	9.5	8.9	16.1
WB - I-5 to Westlake[a]	8.4	5.1	5.2	6.6	6.1	5.2
EB - Westlake to I-5	3.0	3.6	4.0	8.3	7.6	15.1
NB - Westlake Avenue	3.6	3.6	3.6	3.7	3.5	7.1
SB – Westlake Avenue	3.7	3.2	3.1	3.1	3.1	3.1
NB – Ninth Avenue[b]	3.8	3.7	3.7	5.0	4.8	4.9
SB - Ninth Avenue[b]	4.5	4.8	4.8	3.5	3.9	4.0

[a] Travel times from I-5 are a vehicle-weighted average between the northbound and southbound off-ramps.
[b] Ninth Avenue is proposed to be converted to two-way operations in the future.
[c] With four eastbound travel lanes on Mercer Street from Ninth Avenue to Fairview Avenue.
[d] With on-street parking and three eastbound travel lanes on Mercer Street from Ninth Avenue to Boren Avenue and four travel lanes on Mercer Street from Boren Avenue to Fairview Avenue.
Note: Travel time results above were estimated using Synchro software in 2006.

Between I-5 and Westlake Avenue North, directly west of Lake Union, travel times are expected to slightly improve in the PM peak hour with four eastbound lanes. In both AM and PM peak hours, the north-south paths are expected to have similar travel times between the No Action Alternative and the Build Alternative.

Providing on-street parking along the south side of Mercer Street is an option under consideration in the interim 2010 design. This parking would reduce the number of eastbound lanes from four to three between Ninth and Boren avenues, and it would reduce the crossing distance for pedestrians. This option is expected to not change the AM peak-hour travel times, as the eastbound direction is the non-peak direction during that period. In the PM peak hour, the eastbound travel times would increase because the peak direction of travel is in the eastbound direction and overall congestion is high. These travel times are also indicated in Exhibit 3-39.

The traffic analysis for 2010 was updated in fall 2008 to support design refinements and evaluate trade-offs between the six-lane and seven-lane options. This analysis compared the six-lane and seven-lane Build options to the No Action alternative in the PM peak period. VISSIM traffic simulation software was used for this analysis because it provides a more accurate simulation of traffic operations through an urban street network with closely-spaced signals and interactions with pedestrians and transit than Synchro, and is therefore more appropriate for the design analysis. Assumptions regarding traffic signal operations for the No Action alternative were also updated to reflect current operations with the South Lake Union Streetcar. While the previous analysis included operation of the streetcar, the current signal phasing is different than what was assumed for the 2006 analysis. The streetcar receives a preemption phase for the following movements: northbound Terry Avenue at Mercer Street intersection, both directions at Fairview Avenue and Valley Street intersection, westbound Valley Street at Terry Avenue intersection, and westbound Valley Street at Westlake Avenue intersection. This is necessary to maintain reliable streetcar operations through these complex intersections with the current street configuration. The streetcar would not have signal preemption with the Mercer Corridor Project.

The updated VISSIM analysis indicates that the Mercer Corridor project with four eastbound travel lanes would improve travel times for the eastbound direction by 3.5 to 5.5 minutes. If the Mercer Corridor project is operated with only 3 lanes in the eastbound direction (west of Boren Avenue), the project would improve eastbound travel by up to 3 minutes, while westbound travel times would increase by approximately 1 minute compared to the No Action Alternative. The increase in westbound travel time is due to the conflict between westbound left turns and eastbound traffic. The six-lane option would have a shorter left-turn phase than the seven-lane option. In addition, both the six-lane and seven-lane options accommodate approximately 12 to 14 percent more traffic from the I-5 off-ramp at Mercer. The updated travel times are summarized in Exhibit 3-40.

To better understand the effects of the Mercer Corridor project compared to the No Action street network without the effects of the streetcar, a second No Action scenario was modeled. The second No Action scenario assumes the streetcar is operating without the preemption at the intersections listed above, with the exception that preemption would remain at the Fairview Avenue and Valley Street intersection. Compared to this No Action scenario, travel times for seven-lane Mercer Street would be maintained or improved for the four east-west travel paths. Travel times for the six-lane Mercer Street would increase by 0.5 to 1.5 minutes on the four east-west paths compared to the second No Action scenario.

EXHIBIT 3-40

Updated 2010 East and Westbound PM Peak Hour Travel Time Comparison

Travel Route Paths	No Action Current Streetcar Preempt[a] (minutes)	No Action Limited Streetcar Preempt[b] (minutes)	Build 7-lane[c] (minutes)	Build 6-lane[d] (minutes)
WB - I-5 to Northside Seattle Center	7.8	7.2	7.3	8.5
EB – Northside Seattle Center to I-5	12.0	8.7	6.4	9.1
WB - I-5 to Southside Seattle Center	6.9	6.4	6.7	7.8
EB – Southside Seattle Center to I-5	12.0	9.5	8.4	10.5
WB - I-5 to Westlake[a]	5.2	5.1	6.0	6.8
EB - Westlake to I-5	6.1	7.3	6.7	8.5
NB - Westlake Avenue	3.7	2.9	3.6	2.7
SB - Ninth Avenue[b]	3.6	4.6	3.7	4.9

[a] Streetcar signal preemption at four intersections.

[b] Streetcar signal preemption at Fairview and Valley intersection only.

[c] With four eastbound travel lanes on Mercer Street from Ninth Avenue to Fairview Avenue. No streetcar preemption.

[d] With on-street parking and three eastbound travel lanes on Mercer Street from Ninth Avenue to Boren Avenue and four travel lanes on Mercer Street from Boren Avenue to Fairview Avenue. No streetcar preemption.

Note: Travel time results in Exhibit 3-40 were estimated using VISSIM software in October 2008.

The updated 2010 traffic analysis using VISSIM software is documented in a technical memorandum that is an addendum to the Transportation Discipline Report.

Safety and mobility for nonmotorized modes would be improved within the study area. Pedestrian connections to the proposed South Lake Union Park would include new sidewalks, ADA-accessible ramps, new signalized crosswalks, curb bulbs, and much shorter crossing times along the Valley Street corridor. Tight intersection turn radii (20-foot radius) combined with on-street parking and curb bulbs are proposed at most intersection corners along Valley and Roy streets to improve pedestrian visibility for right-turning traffic, reduce vehicle speeds, and improve the pedestrian experience and safety. On Mercer Street, pedestrian crossing times would be longer than they are currently, but the traffic signals along Mercer would allow pedestrians to cross in one cycle. In addition, intersection bulb-outs would reduce the pedestrian crossing times as well as provide better pedestrian visibility for right-turning traffic. New traffic signals (constructed as part of the South Lake Union Streetcar project) on both Mercer and Valley streets at Terry Avenue North added safe places for pedestrian crossings.

To further enhance the pedestrian connections across Mercer Street, there is an option to provide a protected pedestrian crossing at Boren Avenue. This option would reduce the out-of-distance travel pedestrians would experience walking to protected crossings at Fairview or Terry avenues and would reduce the potential for jaywalking. This signalized crossing would not accommodate any vehicular movements; therefore it would only be activated when pedestrians are present and would be coordinated with the traffic signal at the Mercer Street and Fairview Avenue intersection. This pedestrian signal was included in the updated VISSIM analysis summarized in Exhibit 3-40. The pedestrian crossing time needed at Boren would be timed concurrent with the north-south pedestrian and vehicle crossing times needed at Fairview Avenue.

Sidewalks would be improved and widened throughout the Mercer Street corridor. New or reconstructed sidewalks would also be constructed to at least meet the City standard width of 10.5 feet to complete the pedestrian grid within the South Lake Union neighborhood. Pedestrian access across Aurora Avenue North would be maintained along Broad Street, with connections at Mercer Street and Eighth/Ninth Avenues North. Bicycle lanes would also be constructed along Valley Street to complete the bicycle system along the south side of Lake Union and would connect riders from Fairview Avenue North to the existing lanes along Dexter Avenue North and the proposed bicycle lanes on Ninth Avenue North.

The truck route from I-5 to Fremont and Ballard would use Ninth Avenue North between Mercer Street and Westlake Avenue North, thereby separating it from the pedestrian environment along Westlake Avenue and Valley Street. Intersection curb radii would be designed to accommodate a 75-foot design vehicle, resulting in longer pedestrian crossings at:

- Mercer Street at Fairview Avenue intersection - southwest, southeast, and northeast corners
- Mercer Street at Ninth Avenue North intersection – northeast corner

A new signal would also be constructed at the Ninth Avenue North/Westlake Avenue North intersection to provide movement priority to the Ninth Avenue North corridor. Truck movements to and from Interbay would likely use the Mercer/Broad street connection to Elliott Avenue.

Existing parking on Ninth and Westlake Avenues North (north of Mercer Street) would be removed during peak periods. Overall, the on-street parking in the South Lake Union neighborhood would increase with the new stalls on Mercer and Valley streets. To improve overall operations in the year of opening, some on-street parking along the south side of Mercer Street could be limited (potentially by time of day restrictions) to provide more throughput during peak periods.

While no changes to transit service are proposed as part of this project, transit is a realistic and viable mode within this dense urban environment. The proposed project would better accommodate transit service on east-west streets such as Valley, Republican, and Harrison and the north-south corridors. As recommended in the *South Lake Union Transportation Study*, with the growth and types of land use planned in the area, there will be substantial demand for increased and additional transit services. Based on the updated VISSIM traffic analysis, travel times for the South Lake Union streetcar would increase with the proposed project and, assuming no signal preemption, would add 2.5 to 3 minutes to the southbound trip. The signal phasing could be adjusted to balance operations for the streetcar with overall traffic operations.

Overall vehicle and pedestrian safety in the corridor is expected to improve with the proposed direct route to and from I-5 via Mercer Street, which would reduce driver confusion, especially for tourists visiting the Seattle Center and South Lake Union area, and reduce pedestrian conflicts with high-volume turning movements. Vehicular and pedestrian safety would improve along the narrowed Valley Street corridor as traffic demand and truck traffic are redirected to the Mercer Corridor. Improving access with additional pedestrian crossings and delineated bicycle lanes as well as updating and completing substantial portions of the study area's sidewalks would improve the safety for pedestrians and bicyclists. The potential for additional vehicle conflicts, such as opposite direction left-turns, would be introduced to Mercer Street associated with two-way traffic, and on-street parking may contribute to an increase in side-swipe and rear-end accidents. However, opposite direction vehicle conflicts would be minimized with the proposed median and protected left-turn signal phasing for all intersections on Mercer Street.

2030 Operations

By 2030, with anticipated growth in the South Lake Union neighborhood and other areas served by the Mercer corridor, any available capacity will be reached because traffic is expected to become more balanced throughout the transportation network. Likewise, many intersections in the study area would operate at LOS E or F without the proposed project. These levels are expected for a densely developed urban environment such as the South Lake Union neighborhood. In both AM and PM peak hours, the Mercer Corridor Improvements Project would improve intersections along Valley Street/Roy Street and Republican Street as vehicular demand is shifted to Mercer Street. Most intersections along Mercer Street would operate at LOS E or F with the proposed project.

Travel time estimates for 2030 are shown in Exhibit 3-41. Overall, slight travel time savings would occur during both the AM and PM peak hours under the Build Alternative for the east-west paths. Changes in the travel patterns would result from the direct I-5 connections at Mercer Street with two-way operations, combined with AWV&SRP'S new Aurora Avenue North crossing opportunities at Harrison and Thomas streets, and removal of the interim Broad Street connection to Mercer Street.

EXHIBIT 3-41 2030 Travel Time Comparison				
	AM Peak Hour		**PM Peak Hour**	
Travel Route Paths	**No Action (minutes)**	**Build (minutes)**	**No Action (minutes)**	**Build (minutes)**
WB - I-5 to (north) Seattle Center[a]	15.9	11.9	14.3	13.8
EB – (north) Seattle Center to I-5	7.3	10.0	18.9	18.7
WB - I-5 to (south) Seattle Center[a]	13.8	11.4	14.2	14.3
EB – (south) Seattle Center to I-5	8.6	10.4	20.2	18.8
WB - I-5 to Westlake[a]	11.3	6.4	14.2	9.9
EB - Westlake to I-5	4.7	8.8	18.8	21.1
NB - Westlake Avenue	4.3	4.0	12.1	12.2
SB – Westlake Avenue	7.5	6.3	4.0	4.2
NB – Ninth Avenue[b]	4.3	5.4	13.5	6.7
SB - Ninth Avenue[b]	6.4	5.5	10.4	12.4

[a] Travel times from I-5 are a vehicle weighted average between the northbound and southbound off-ramps.
[b] Ninth Avenue is proposed to be converted to two-way operations in the future.

These changes would improve the overall efficiency of the South Lake Union traffic grid network and accommodate more trips. Travel-time savings would occur during the PM peak for northbound travel as a result of the extension of the two-way traffic along Ninth Avenue North. Exhibit 3-42 shows the direct east-west route on Mercer Street and additional Aurora Avenue North crossings at Harrison and Thomas Streets.

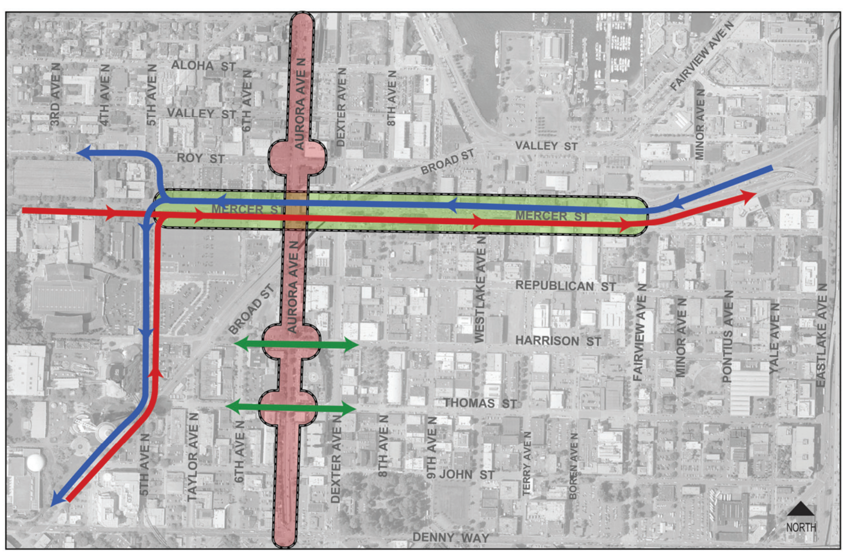

Exhibit 3-42. Future 2030 East- and Westbound Travel Paths

Overall, the pedestrian and bicycle operations would be improved over Year 2010 conditions. Improvements in the pedestrian sidewalk and crossing locations will occur along Mercer Street, west of Ninth Avenue North, as part of the Alaskan Way Viaduct and Seawall Replacement project, which will also remove the Broad Street roadway and pedestrian connection. This would include removal of the pedestrian crossing of Mercer Street at Eighth Avenue North installed as part of the 2010 improvements.

These facilities would be replaced by continuation of the Mercer Street sidewalk to the west. By 2030, with new connections across Aurora Avenue North, transit will become a more viable alternative. Transit service along Republican and

Harrison streets could provide key east-west transit connections while serving the South Lake Union neighborhood.

Truck, transit, and vehicular safety would be similar in 2030 to 2010 operations. On-street parking would also be similar, with some additional parking along both sides of Mercer Street between the Dexter and Ninth Avenues North intersections.

While some intersections would operate at LOS E and F by 2030, this is not uncommon given the system and dense urban environment of the future South Lake Union neighborhood. Of more importance is ensuring the most efficient use of the transportation network. Linkages across Aurora Avenue North and improved property access would make greater use of the roadways. This would also provide greater opportunities to implement intelligent transportation systems (ITS) with this project throughout the study area to improve system efficiency. Strategies include advanced traveler information systems (linked to Seattle Center and downtown traffic) as well as signal timing, cameras, and coordination strategies. Coordination with WSDOT on ITS and integration of operations would be emphasized during the deign phase to ensure maximum benefit to travelers to and from I-5. Improved detection of vehicles and possibly pedestrians, and signal timing and phasing changes throughout the day would provide the most efficient use of the street grid network in the South Lake Union neighborhood.

What effects on transportation would occur if nothing were built?

No Action Alternative conditions were analyzed for both the opening year 2010 and design year 2030. Planned projects within the study area were included in the No Action travel demand model to depict an accurate portrait of travel patterns during the study years. Three No Action improvement projects were assumed to have major effects on the study area: the new South Lake Union Streetcar (running between Westlake Center and the Fred Hutchinson Cancer Research Center), Ninth Avenue North reconstruction to two-way traffic, and the Alaskan Way Viaduct and Seawall Replacement Project. While the streetcar and Ninth Avenue North projects are assumed in both 2010 and 2030 conditions, the Alaskan Way Viaduct and Seawall Replacement Project is only assumed in only 2030.

Overall, the 2010 and 2030 population and employment forecasts show a high level of growth; however, the forecasts and screenline analyses indicate fairly low annual traffic growth rates. This low traffic growth is due to many factors, including peak-hour spreading, increased trips within the area due to new mixed land uses, mode shifts to higher occupancy vehicles and transit, mode shifts to nonmotorized travel, and the inability for trips to enter and exit the South Lake Union area due to regional capacity constraints outside of the study area. The current state of pedestrian infrastructure is poor. Sidewalks are uneven and in disrepair. They provide a poor pedestrian experience and do not link or provide amenities for current and future transit connections. Pedestrian facilities are not well defined or delineated, which creates safety issues for pedestrians. Overall, the lack of pedestrian and bicycle improvements in the study area would limit the system's ability to support any mode shift to transit or nonmotorized travel.

2010 and 2030 Traffic Volumes

Generally, annual traffic growth rates around 1 percent per year or less are forecasted through 2030 for both AM and PM peak hours with the No Action Alternative. The PM peak hour is expected to exhibit slightly more growth than the AM peak hour.

2010 and 2030 Operations

The 2010 AM peak hour LOS operations would remain similar to 2005 conditions. However, there would be operational effects along the streetcar route on Valley Street as additional delays occur due to the revised traffic signal phasing required to accommodate the streetcar. In the PM peak hour, similar effects would be created by the streetcar as it increases delays along Terry Avenue North and at the Mercer Street approach to Terry. The expected conversion of Ninth Avenue North to two-way operation will include bicycle lanes. Throughout the system, increased pedestrian activity will need to be balanced with vehicle use at the signals.

During Year 2030 operations, intersections along the streetcar route would continue to experience additional delays. In addition, operations at several intersections in the vicinity of the Aurora Avenue North access points at Roy and Republican streets would deteriorate. PM peak operations on Mercer Street are expected to deteriorate to LOS F conditions at Ninth, Westlake, Terry, and Fairview avenue intersections. Operations on Valley and Roy streets would also deteriorate to LOS F conditions at Dexter, Ninth, Westlake, and Boren avenue intersections. If the two-way Mercer Street is not constructed, circulation and routing would continue to be confusing and circuitous with business access limited. With the Alaskan Way Viaduct and Seawall Replacement and two-way Mercer Street projects, travel time in the westbound direction would achieve substantial benefits. Just constructing AWV&SRP alone would still constrain east-west circulation, especially in the westbound direction as the circuitous and inefficient routing via Fairview and Valley streets for westbound traffic would remain.

What measures are proposed to avoid or minimize effects on transportation during construction?

Driveway and cross-street access would generally be maintained throughout the construction period to minimize effects on properties and businesses within the study area. Necessary closures would be outlined in the contractor's Traffic Management Plan (TMP) and approved by the City. The TMP would detail any detours, signing plans, and duration/timing of required closures. To minimize congestion and emergency response effects, lane closures will be scheduled outside of the peak travel demand periods, such as commute peak travel hours and special events at Seattle Center. Temporary signals can provide emergency vehicle preemption to minimize effects for emergency responders. Lane widths would be a minimum of 11 feet through all construction zones, similar to existing conditions. In addition, a shoulder will be provided for all roadway segments with only one travel lane in each direction. This provides vehicles an area to pull over and allow emergency vehicles to pass.

The contractor would maintain ADA-accessible pedestrian paths and design pedestrian detours in their TMP. Pedestrian paths along the roadway lanes would be separated from vehicular traffic with a barrier.

Existing Major Truck Streets in the study area, designated in the Seattle Comprehensive Plan, would be maintained during the first two phases of construction. For Phase 3, the area's Major Truck Streets would be relocated to Mercer Street (both directions) and Ninth/Westlake Avenues North corridors.

Public outreach communications would inform motorists of construction activities. These would include informational and variable message signs, radio announcements, and website postings. Construction activities would be coordinated with other projects and services within the study area, such as Metro Transit, to minimize disruptions. Existing CCTV cameras in the corridor would allow SDOT staff opportunities to monitor and adjust traffic control for various conditions during construction (e.g., special events).

What measures are proposed to avoid or minimize effects on transportation after the project is built?

While slight impacts to travel times and intersection LOS are documented on some travel paths and intersections, the overall transportation system is improved with this project. In 2010 the analysis shows some intersection impacts for the PM peak period and general improvements for the AM peak period.

Implementation of Intelligent Transportation System elements will be further studied during the design phase of the Mercer Corridor Improvements Project. Coordination with WSDOT on ITS and integration of operations would be emphasized during the design phase to ensure maximum benefit to travelers to and from I-5. Improved detection of vehicles and possibly pedestrians, and signal timing and phasing changes throughout the day would provide the most efficient use of the street grid network in South Lake Union. Technologies that could be implemented include: variable message signs, closed circuit TV, traffic sensors, traffic adaptive signal controllers, pedestrian countdown signal displays, and peak-hour directional lanes. SDOT will install positive guidance truck route signing at appropriate locations on the major truck streets in the study area. The ITS elements would improve utilization and efficiency of the network.