Chapter 5—Freeway Volumes and Operations

What is in this chapter?

This chapter presents the transportation team's findings for the SDEIS freeway analysis. It describes freeway traffic volumes and operations on the SR 520 freeway mainline and ramps during morning (a.m.) and afternoon (p.m.) peak (highest use) periods. The chapter also discusses the results of the freeway traffic volume forecasts and operations analysis of the No Build Alternative and Build (6-Lane) Alternative options.

Did you know?

Freeway traffic volume refers to how many vehicles and/or people use or would like to use a freeway.

Freeway traffic operation refers to how traffic is moving or flowing, and is discussed in terms of speeds, travel times, and congestion.

What is traffic currently like on SR 520?

The existing configuration of SR 520 does not meet current WSDOT design guidelines, which affects the freeway's capacity to provide reliable and safe travel for buses and carpools (HOV) and general-purpose traffic. Roadway capacity in the SR 520 corridor is constrained by:

- Narrow shoulders and lanes on the corridor and across the bridge
- Short acceleration lane lengths at the SR 520/Montlake interchange and Lake Washington Boulevard on-ramps
- Poor sight distance at roadway curves, resulting in slower speeds

These constraints, coupled with high traffic volumes on SR 520, result in regular congestion at the following locations:

- Westbound approaching the bridge (near the HOV lane termination in Medina)
- Westbound on the Portage Bay Bridge between I-5 and the SR 520/Montlake interchange
- Eastbound approaching the west approach span of the SR 520 bridge

Did you know?

Reliability is defined by how travel times vary over time. On any given day, unusual circumstances such as crashes can dramatically change the performance of the roadway, affecting both travel speeds and throughput volumes. Commuters who take congested highways to and from work are well aware of this. When asked about their commute, they will say "it takes me 45 minutes on a good day, but an hour and 15 minutes on a bad day."

Unreliable traffic conditions affect how and when people choose to travel. For example, if a road is known to have highly variable traffic conditions, a traveler using that road to catch an airplane routinely leaves "extra" time to get to the airport. In other words, the "reliability" of this traveler's trip is directly related to the variability in the performance of the route she or he takes.

Reliability, or the ability to predict trip travel time with some certainty, is important. If a commuter has a routine activity that must occur every day—such as picking up children from day care—they must plan on an extra amount of trip time just to be sure they do not arrive late. The same goes for local trucking firms engaged in pickup and delivery of goods.

Several bottlenecks along the I-5 and I-405 corridors limit the amount of traffic that can access SR 520. In Seattle, these areas include northbound and southbound I-5 across the Ship Canal Bridge and through downtown Seattle. The capacity of the I-405/SR 520 interchange and I-405 mainline through downtown Bellevue also limits the amount of traffic than can enter or exit the SR 520 corridor. Traffic volumes and congestion at these locations are discussed in more detail later in this chapter.

What are the current safety concerns along SR 520?

The transportation discipline team evaluated historical crash data for the entire SR 520 corridor, including mainline and ramps, to identify safety concerns. Crash data were obtained from WSDOT for the most recent 3 full years of data (January 2006 through December 2008). Crash data provide information about the frequency, severity, and type of crashes for a given section of the corridor. This section summarizes the crash data for the I-5 to Medina study area.

SR 520 Mainline

Exhibit 5-1 shows east and westbound crash rates, including the nature of the crash, along the SR 520 mainline between I-5 and Medina. The highest crash rates in the Westside analysis were between I-5 and the 24th Avenue East overpass of SR 520 (in both directions). This section of SR 520 had higher crash rates than the SR 520 corridor average of 1.11 crashes/million vehicle miles traveled (mvmt) in both the east and westbound directions. This is likely due to the congested conditions because 83 percent of the eastbound crashes and 86 percent of the westbound crashes are congestion-related (rear-end and sideswipe crashes) along this section.

Fixed-object crashes can result from drivers losing control because of roadway conditions or excessive speed, the proximity of roadside barriers to moving traffic, narrow shoulders, and the avoidance of other traffic. Roadside barriers help to avert more serious crashes and injuries. The placement of roadside barriers close to the roadway is necessary due to the limited width of the SR 520 corridor.

SR 520 crashes are attributed to traffic congestion and narrow roadway design. In most cases, safety could be improved by improving traffic flow and designing the freeway to meet current state and federal

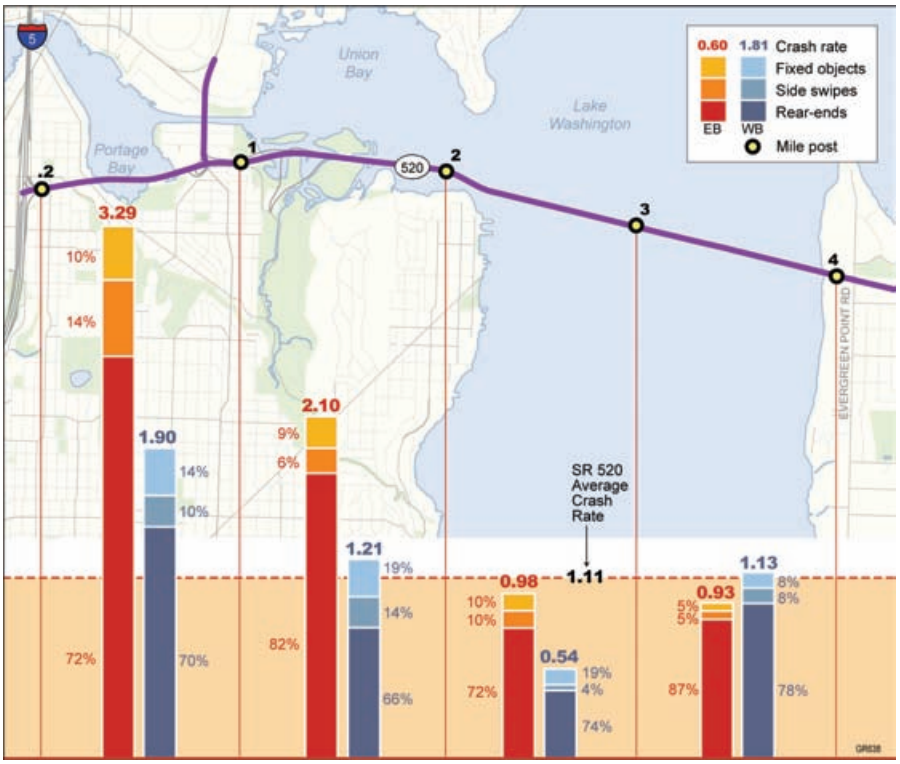


Exhibit 5-1. Distribution and Type of Eastbound and Westbound Crash Rates along SR 520

standards. In many cases, improved design could reduce the potential for crashes along the SR 520 mainline and ramps. This is especially true in areas where current roadway design limitations are updated and/or where congestion occurs and will be reduced.

SR 520 Ramps

The team also reviewed crash data for interchange ramps between I-5 and Evergreen Point Road/76th Avenue NE. Several ramps with higher concentrations of crashes are discussed below.

SR 520 Eastbound Off-Ramp to Montlake Boulevard

Of the 11 crashes that occurred on this off-ramp in a 3-year period, 55 percent were intersection-related (versus ramp-related) and occurred at the ramp intersection with Montlake Boulevard, including two accidents involving pedestrians. The SR 520 I-5 to Medina: Bridge Replacement and HOV Project will improve the eastbound off-ramp alignment to more closely match the receiving lanes on Lake Washington Boulevard. Additional capacity is also proposed at this intersection to help facilitate improved traffic flow for Option A and Suboption A. Options K and L would close the ramp in its current configuration and provide access to the local streets via a new interchange located farther east. This new interchange design would

provide a much improved configuration to potentially reduce the level of crashes associated with the intersection.

SR 520 Eastbound On-Ramp from Montlake Boulevard

There were 27 crashes that occurred on this ramp in a 3-year period. The majority of the rear-end crashes (64 percent) occurred at the beginning of the ramp where traffic from both directions of Montlake Boulevard merges. Possible causes include congestion, inadequate signing, driver inattention, and/or driver expectancy.

SR 520 Eastbound On-Ramp from Lake Washington Boulevard

Fourteen crashes occurred from 2006 to 2008, of which 29 percent were rear-end crashes and 64 percent were fixed-object crashes. The majority of the fixed-object crashes (78 percent) occurred in the curve near the merge end of the ramp. Possible contributing circumstances for these fixed object crashes are roadway design (i.e., super-elevation, shoulder width, signing, etc.), pavement condition, and/or driver inattention.

SR 520 Westbound Off-Ramp to Lake Washington Boulevard

All of the 12 crashes occurring on this ramp were fixed-object crashes, and 92 percent of those occurred on wet pavement. The majority of the crashes on this ramp (67 percent) occurred in the sharp horizontal curve at milepost 0.2. Possible contributing circumstances for these fixed-object crashes are roadway design (i.e., super-elevation, drainage, shoulder width, signing, etc.), pavement condition, and/or driver inattention.

SR 520 Westbound On-Ramp from Montlake Boulevard

Twenty-three crashes occurred from 2006-2008, of which 87 percent were rear-end and 13 percent were fixed-object accidents. The majority of the rear-end crashes (75 percent) occurred after the merge point with the SR 520 mainline, which is indicative of issues likely caused by the short merge distance, the congested mainline conditions, or a combination of both.

What are the safety benefits of this project?

This project will improve the ramp designs in the SR 520 project area to current design guidelines, which will result in improvements to current safety issues.

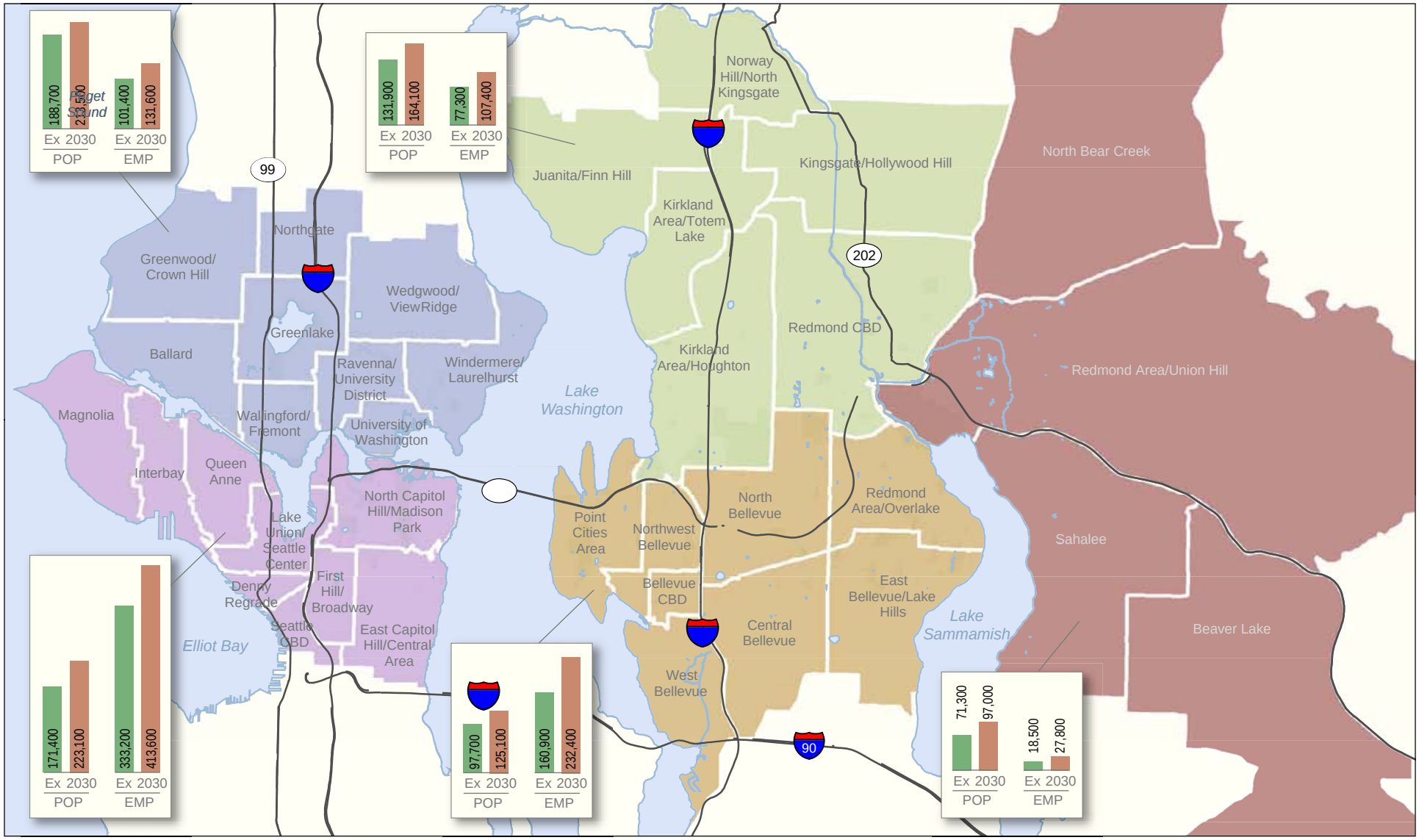
The main safety benefits of this project are summarized below. The improved traffic flow and reduced congestion may have other minor benefits as well.

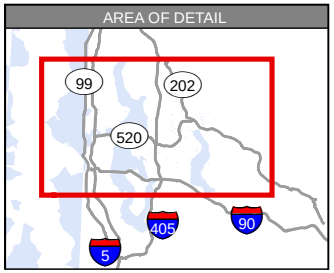
- A decrease in overall crash frequencies and crash rates as a result of widening the roadway and improving traffic operations
- A decrease in fixed-object crashes as a result of widened shoulders, which will provide increased recovery area for errant vehicles
- A decrease in some ramp crashes as a result of improved designs that more closely meet current design guidelines

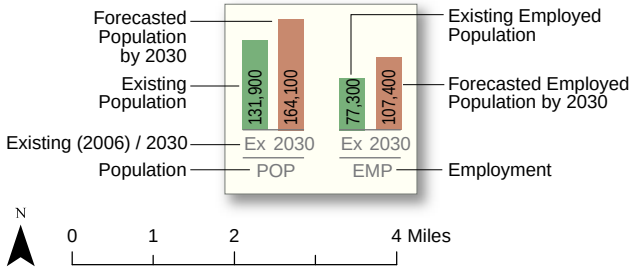
How are population and employment expected to change by the year 2030?

Between today and the year 2030, the population of the region will grow by 1.1 million people, add over 850,000 new jobs, and need to accommodate close to 50 percent more traffic (PSRC 2007). Projected population and employment growth for select Seattle and Eastside areas are shown in Exhibit 5-2. Both Eastside and Seattle forecasts are shown because regional travel patterns, including traffic across SR 520, are influenced by population and employment changes on both sides of the lake.

The largest increases in population and employment in Seattle are forecasted in the South Lake Union, Denny Regrade/Triangle, and downtown Seattle areas. The largest forecasted increases on the Eastside are downtown Redmond, the Redmond/Overlake area, and downtown Bellevue.







Source: WSDOT (2005, 2007, 2008d) Bar Graph Data (Population and Employment)

Map source: King County (2008) GIS Data (Streams, Streets, Water Bodies), PSRC (2006) GIS Data (FAZ Areas). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 5-2. **Existing and Year 2030 Population and Employment**

I-5 to Medina: Bridge Replacement and HOV Project

How would crosslake travel change?

Daily Travel

With the forecasted increases in population and employment, traffic volumes would also increase on major transportation facilities. Exhibit 5-3 shows the forecasted changes in daily vehicle demand volumes on SR 522, SR 520, and I-90 for the No Build Alternative and 6-Lane Alternative options. Person demand at all cross-lake roadways would increase substantially more than vehicle demand, indicating a growth in HOV travel (carpools and buses). Daily vehicle demand volumes for Suboptions K and L would be the same as for Options K and L.

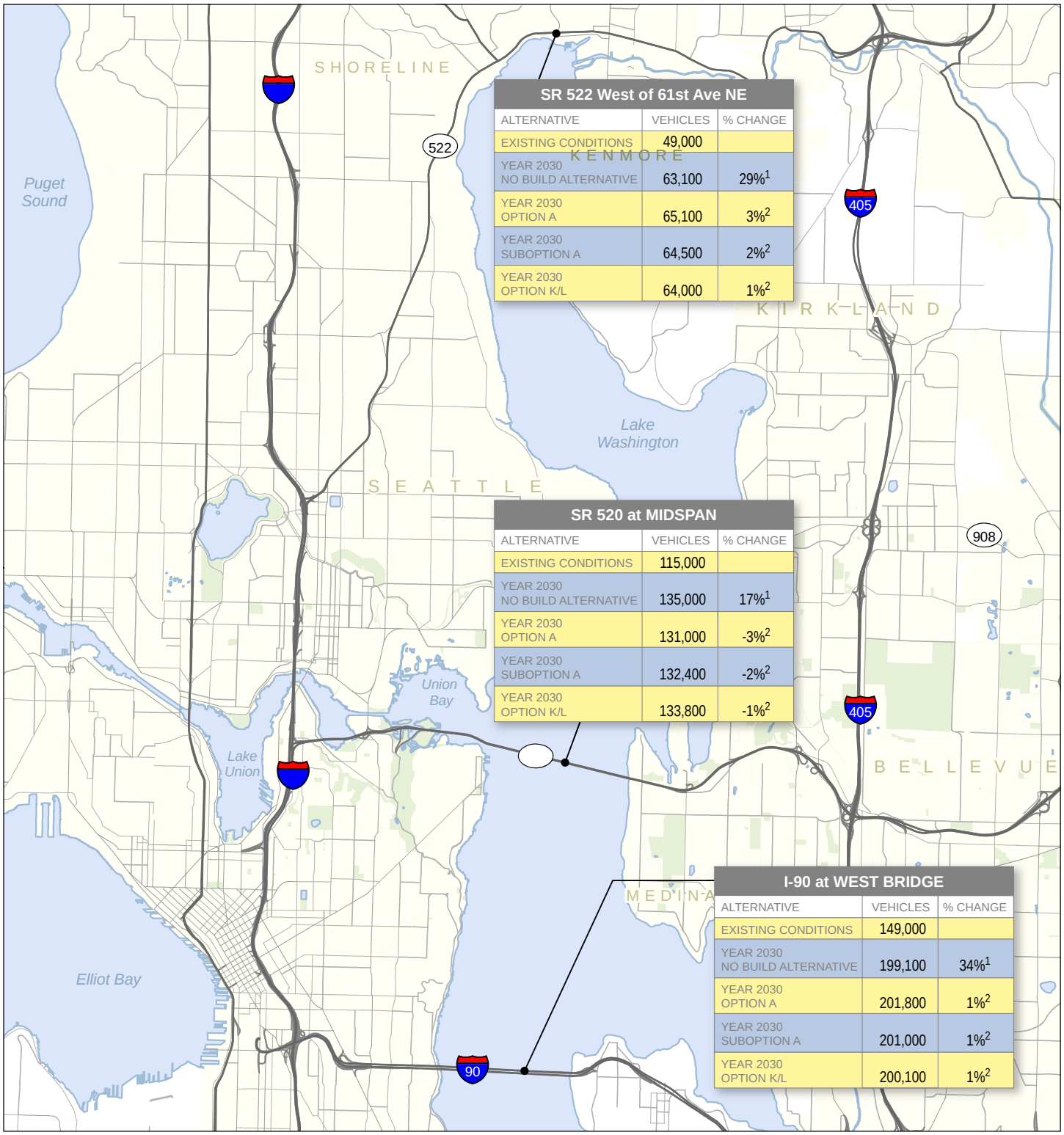
With the 6-Lane Alternative, daily vehicle demand on SR 520 would decrease between 1 and 3 percent. SR 522 would increase between 1 and 3 percent, and I-90 would increase 1 percent compared to the No Build Alternative. Traffic demand on SR 520 would primarily decrease during the off-peak periods when alternate routes are less congested, making drivers more likely to use those routes to avoid a toll.

Exhibit 5-4 provides more detail regarding changes in daily vehicle and person demand by mode across the SR 520 bridge for both the No Build Alternative and 6-Lane Alternative options.

With the 6-Lane Alternative, the person demand for HOV (carpool and bus) would increase by approximately 25,000 (or up to 38 percent) compared to the No Build Alternative. General-purpose vehicle demand would decrease between approximately 8,000 to 10,000 vehicles per day (7 to 8 percent) for all of the Build Alternative options compared to the No Build Alternative. This is because the toll, improved HOV reliability, and reduced HOV travel times would increase the incentive to carpool or take the bus.

Peak Period Travel

Unlike the daily volumes, peak period traffic demand on SR 520 (midspan) would increase up to 500 vehicles per hour (vph), or 6 percent, with the 6-Lane Alternative options compared to the No Build Alternative. Traffic volumes would increase during the peak periods because congestion on the other two primary cross-lake routes (SR 522 and I-90) would make drivers just as likely to choose SR 520, especially if it is the most direct route.



SR 522 West of 61st Ave NE

ALTERNATIVE	VEHICLES	% CHANGE
EXISTING CONDITIONS	49,000	
YEAR 2030 NO BUILD ALTERNATIVE	63,100	29%[1]
YEAR 2030 OPTION A	65,100	3%[2]
YEAR 2030 SUBOPTION A	64,500	2%[2]
YEAR 2030 OPTION K/L	64,000	1%[2]

SR 520 at MIDSPAN

ALTERNATIVE	VEHICLES	% CHANGE
EXISTING CONDITIONS	115,000	
YEAR 2030 NO BUILD ALTERNATIVE	135,000	17%[1]
YEAR 2030 OPTION A	131,000	-3%[2]
YEAR 2030 SUBOPTION A	132,400	-2%[2]
YEAR 2030 OPTION K/L	133,800	-1%[2]

I-90 at WEST BRIDGE

ALTERNATIVE	VEHICLES	% CHANGE
EXISTING CONDITIONS	149,000	
YEAR 2030 NO BUILD ALTERNATIVE	199,100	34%[1]
YEAR 2030 OPTION A	201,800	1%[2]
YEAR 2030 SUBOPTION A	201,000	1%[2]
YEAR 2030 OPTION K/L	200,100	1%[2]

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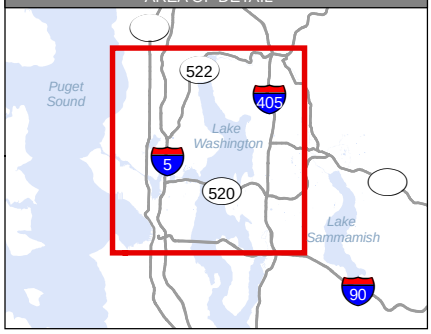

[1]Compared to Existing Conditions
[2]Compared to Year 2030 No Build Alternative

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

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0 0.5 1 2 Miles

Exhibit 5-3. **Daily Vehicle Demand Volumes on SR 522, SR 520, and I-90**

I-5 to Medina: Bridge Replacement and HOV Project

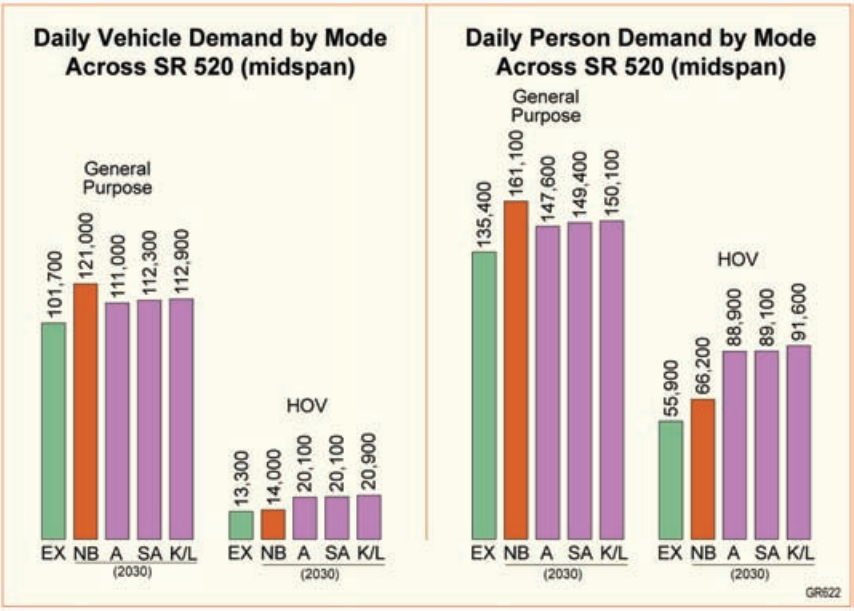


Exhibit 5-4. Daily Vehicle and Person Demand by Mode across the SR 520 Bridge (midspan)

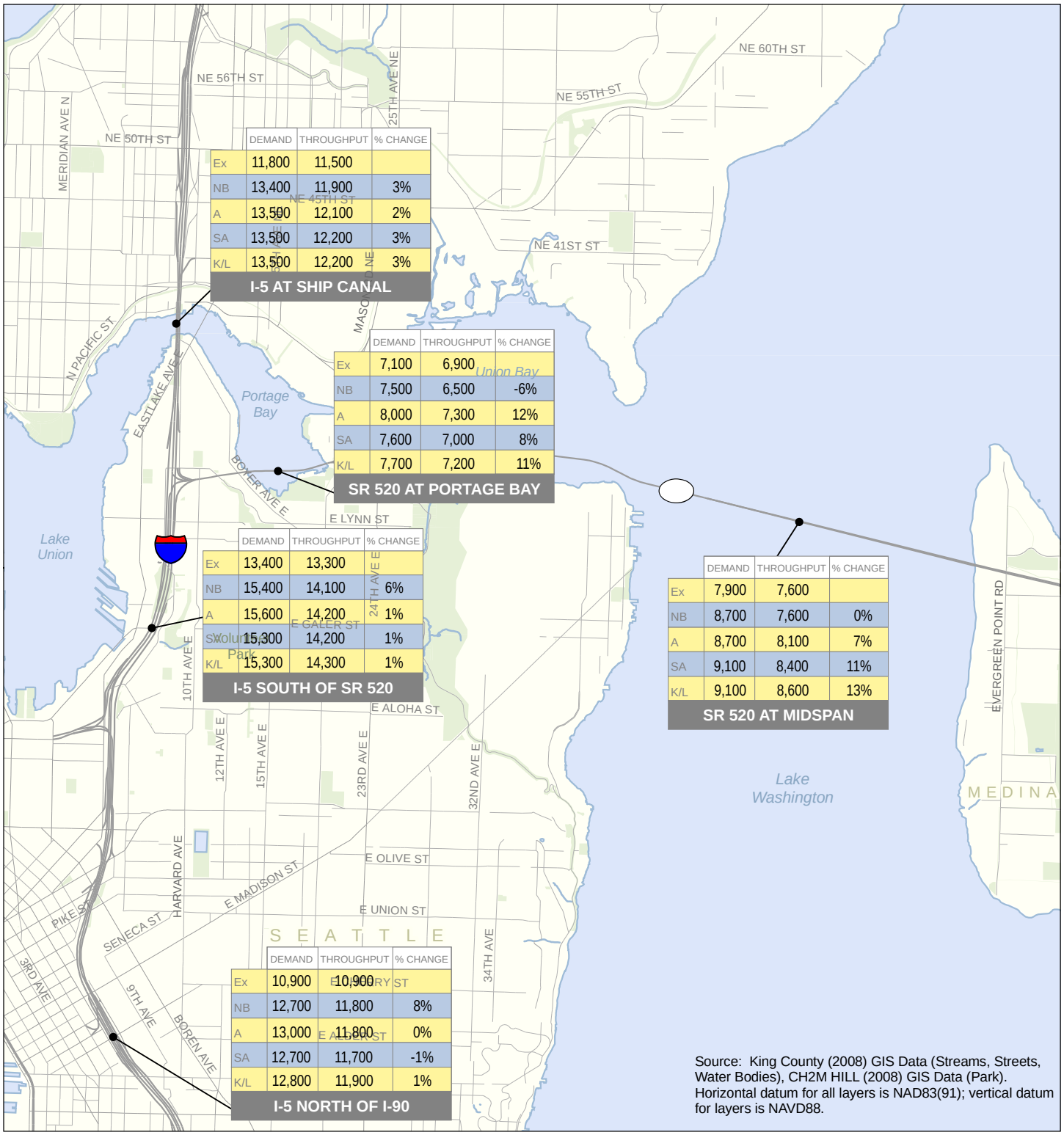
Exhibits 5-5 and 5-6 show changes in traffic demand and throughput at key locations on SR 520, and I-5 during the morning and afternoon commute periods. While more drivers would like to use the roadways in 2030 (represented by demand volumes), congestion would limit how much vehicle traffic could be served (throughput) during the peak periods.

Year 2030 peak period vehicle throughput with the No Build Alternative would not be substantially different than it is today. However, with the 6-Lane Alternative and completion of the HOV lane system across SR 520 to I-5, SR 520 would serve between 15 and 20 percent (total for both directions) more people than the No Build Alternative during the morning peak period and between 15 and 30 percent (total for both directions) more people during the afternoon commute period.

SR 520 peak period vehicle demand is expected to increase more on the east side of the lake than on the west, with more traffic traveling between Eastside destinations and not crossing the lake. Congestion on the I-405 mainline would affect SR 520 traffic operations in the future.

The No Build Alternative would affect existing freeway traffic operations because congestion on I-5 and I-405 would continue to limit access to and from SR 520. In particular:

- I-5 traffic demand would increase up to 20 percent and throughput volume would increase up to 8 percent compared to today.



	DEMAND	THROUGHPUT	% CHANGE
Ex	11,800	11,500	
NB	13,400	11,900	3%
A	13,500	12,100	2%
SA	13,500	12,200	3%
K/L	13,500	12,200	3%

I-5 AT SHIP CANAL

	DEMAND	THROUGHPUT	% CHANGE
Ex	7,100	6,900	
NB	7,500	6,500	-6%
A	8,000	7,300	12%
SA	7,600	7,000	8%
K/L	7,700	7,200	11%

SR 520 AT PORTAGE BAY

	DEMAND	THROUGHPUT	% CHANGE
Ex	13,400	13,300	
NB	15,400	14,100	6%
A	15,600	14,200	1%
SA	15,300	14,200	1%
K/L	15,300	14,300	1%

I-5 SOUTH OF SR 520

	DEMAND	THROUGHPUT	% CHANGE
Ex	7,900	7,600	
NB	8,700	7,600	0%
A	8,700	8,100	7%
SA	9,100	8,400	11%
K/L	9,100	8,600	13%

SR 520 AT MIDSPAN

	DEMAND	THROUGHPUT	% CHANGE
Ex	10,900	10,900	
NB	12,700	11,800	8%
A	13,000	11,800	0%
SA	12,700	11,700	-1%
K/L	12,800	11,900	1%

I-5 NORTH OF I-90

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

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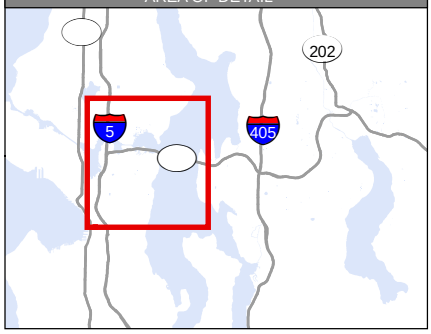

Alternative — Vehicles Per Hour

Year 2030		DEMAND	THROUGHPUT	% CHANGE	
Existing	Ex	13,300	13,210		
No Build	NB	15,090	12,740	-4%	± Change % vs. Existing (Throughput)
Option A	A	15,170	12,660	-1%	± Change % vs. No Build (Throughput)
Suboption A	SA	15,090	12,740	-4%	± Change % vs. No Build (Throughput)
Option K/L	K/L	15,170	12,660	-1%	± Change % vs. No Build (Throughput)
	LOCATION				

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0 1,000 2,000 4,000 Feet

Exhibit 5-5. **A.M. Peak Period Freeway Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project

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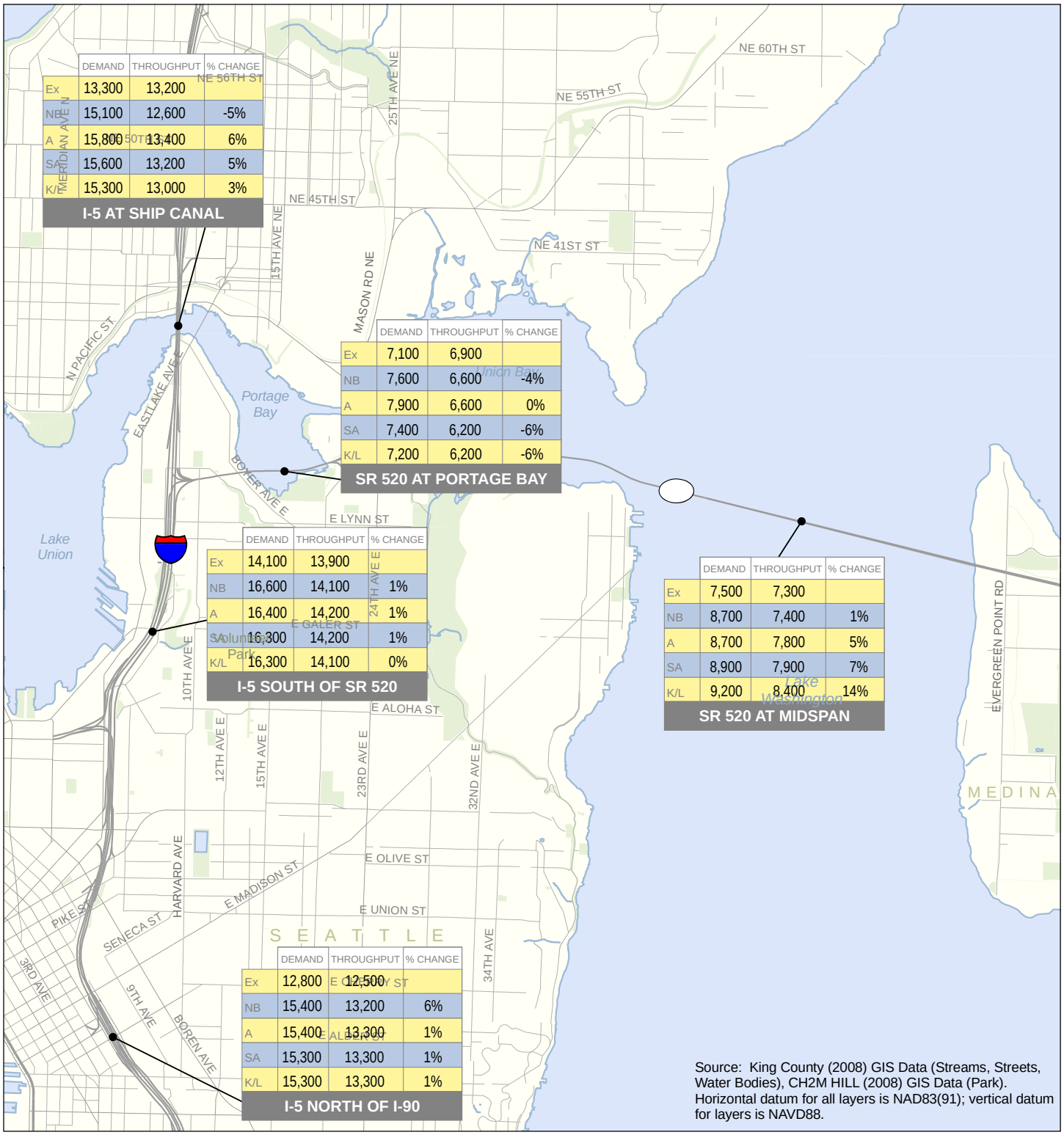

	DEMAND	THROUGHPUT	% CHANGE
Ex	13,300	13,200	
NB	15,100	12,600	-5%
A	15,800	13,400	6%
SA	15,600	13,200	5%
K/L	15,300	13,000	3%

I-5 AT SHIP CANAL

	DEMAND	THROUGHPUT	% CHANGE
Ex	7,100	6,900	
NB	7,600	6,600	-4%
A	7,900	6,600	0%
SA	7,400	6,200	-6%
K/L	7,200	6,200	-6%

SR 520 AT PORTAGE BAY

	DEMAND	THROUGHPUT	% CHANGE
Ex	14,100	13,900	
NB	16,600	14,100	1%
A	16,400	14,200	1%
SA	16,300	14,200	1%
K/L	16,300	14,100	0%

I-5 SOUTH OF SR 520

	DEMAND	THROUGHPUT	% CHANGE
Ex	7,500	7,300	
NB	8,700	7,400	1%
A	8,700	7,800	5%
SA	8,900	7,900	7%
K/L	9,200	8,400	14%

SR 520 AT MIDSPAN

	DEMAND	THROUGHPUT	% CHANGE
Ex	12,800	12,500	
NB	15,400	13,200	6%
A	15,400	13,300	1%
SA	15,300	13,300	1%
K/L	15,300	13,300	1%

I-5 NORTH OF I-90

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

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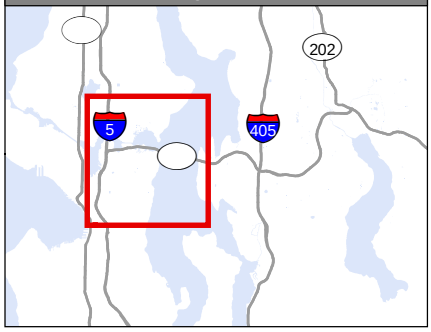


Alternative — Vehicles Per Hour

		DEMAND	THROUGHPUT	% CHANGE	
	Existing	Ex	13,300	13,210	
Year 2030	No Build	NB	15,090	12,740	-4% — ± Change % vs. Existing (Throughput)
	Option A	A	15,170	12,660	-1% — ± Change % vs. No Build (Throughput)
	Suboption A	SA	15,090	12,740	-4% — ± Change % vs. No Build (Throughput)
	Option K/L	K/L	15,170	12,660	-1% — ± Change % vs. No Build (Throughput)

LOCATION

N

0 1,000 2,000 4,000 Feet

Exhibit 5-6. **P.M. Peak Period Freeway Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project

- I-5 congestion would limit how much traffic can enter/exit SR 520, resulting in approximately a 4 to 6 percent decrease in vehicle throughput across the Portage Bay Bridge section of SR 520.

With the No Build Alternative, traffic demand across SR 520 (midspan) would increase up to 16 percent. However, throughput volume would increase up to only 1 percent because of congestion approaching SR 520 and the floating bridge.

The 6-Lane Alternative options would have the following effects on traffic demand and throughput on the SR 520 bridge:

- With the exception of Option A during the afternoon peak period, all of the 6-Lane Alternative options result in a slight increase (up to 6 percent) in vehicle demand across the lake compared to the No Build Alternative. However, project improvements to the SR 520 mainline and an additional HOV lane would substantially increase vehicle throughput across the lake (up to 14 percent) compared to the No Build Alternative. Traffic volumes between Montlake and I-5 would increase with all of the options because of the combined effect of tolling and the completion of the HOV lanes to I-5.
- Option A would have slightly higher traffic volumes between Montlake and I-5 than the other 6-Lane Alternative options because the closure of the Lake Washington Boulevard ramps would divert drivers to I-5 interchanges. The elements and effects of Option A on traffic patterns, volumes, and operations are discussed in greater detail below.
- SR 520 freeway traffic volumes and operations with Suboptions K and L are the same as with Options K and L and, therefore, are discussed together in this chapter.
- The 6-Lane Alternative would not substantially affect traffic volumes on I-5 south of SR 520 or I-405 because it would not add any general-purpose capacity.

SR 520 Travel with the 6-Lane Alternative Options

SR 520 freeway volumes and operations would be similar for all 6-Lane Alternative options (within 500 vph of each other) except westbound Portage Bay Bridge traffic during the afternoon peak period. Traffic volumes and operations differ slightly on the Portage Bay Bridge because of differences in interchange design, summarized below. Changes in traffic volumes and mode choice with the different

alternatives and options are summarized below and shown in Exhibit 5-7.

Option A would decrease capacity at the SR 520/Montlake interchange area by removing the Lake Washington Boulevard ramps but increase capacity between the SR 520/Montlake interchange and I-5 by adding a westbound auxiliary lane. Option A would also increase capacity across the Montlake Cut with a new bascule bridge parallel to the existing bridge.

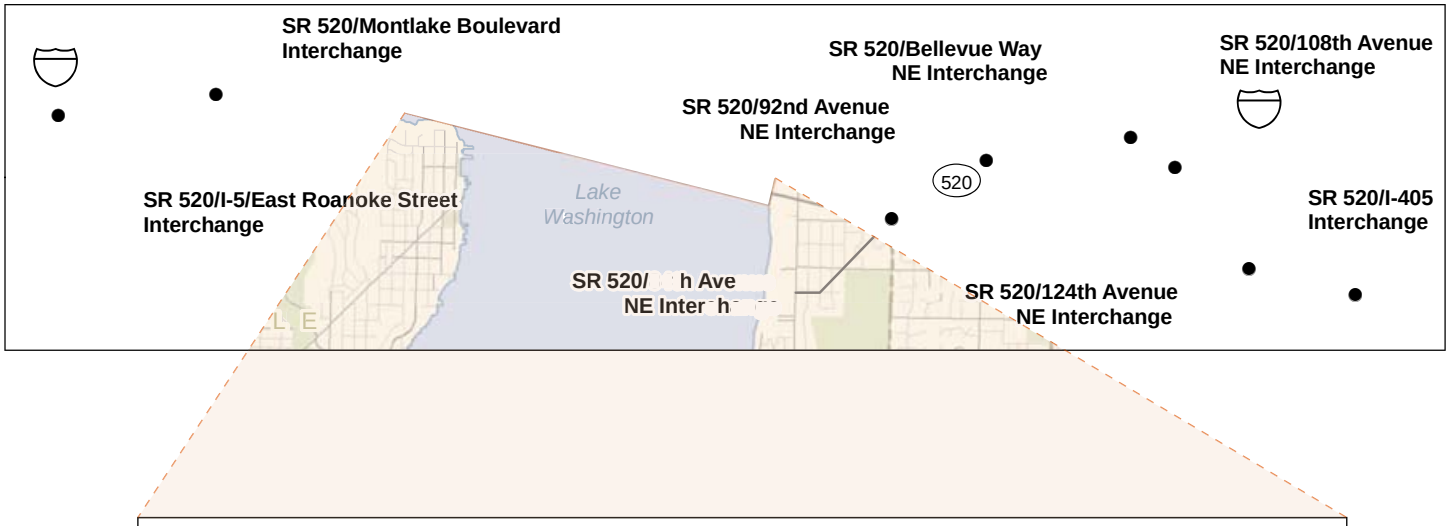
Options K and L would increase capacity at the SR 520/Montlake interchange area, but would not include the westbound auxiliary lane between the new interchange and I-5. Options K and L would also both increase capacity across the Montlake Cut with a second crossing between the new interchange and the Montlake Boulevard/NE Pacific Street intersection.

Key differences in volumes and operations between the options are explained below.

Option A and Suboption

Option A would increase local street capacity by adding a new bascule bridge and more lanes in the Montlake overpass area. The capacity at the Montlake overpass area would be added to accommodate the changes in traffic patterns with removal of the Lake Washington Boulevard ramps, which would increase in the immediate vicinity of the SR 520/Montlake interchange. Drivers that typically use the westbound SR 520 off-ramp to Lake Washington Boulevard would divert to the SR 520/Montlake interchange (increasing volumes at the SR 520/Montlake interchange ramps) or continue across the Portage Bay Bridge to use the SR 520/I-5/East Roanoke or I-5/NE 45th Street interchanges.

Traffic volumes north and west of the Montlake Boulevard NE/NE Pacific Street intersection would be less than under the No Build Alternative. This is because removing the Lake Washington Boulevard ramps would cause drivers to change their routes to access SR 520 at other interchanges (I-5/NE 45th Street and SR 520/I-5/East Roanoke Street).



Bridge Midspan: Volume Trips per Hour

Westbound Demand · Eastbound Demand · Westbound Throughput · Eastbound Throughput

Alternative	AM Peak Hour			PM Peak Hour		
		Vehicle Trips	Person Trips		Vehicle Trips	Person Trips
Existing Conditions	Westbound	4,000	7,000	Westbound	4,000	6,800
		3,900	6,900		3,800	6,500
	Eastbound	3,900	6,800	Eastbound	3,500	6,800
		3,700	6,500		3,500	6,800
Year 2030 No Build Alternative	Westbound	4,400	8,200	Westbound	4,600	8,200
		3,900	7,600		3,800	6,700
	Eastbound	4,300	8,100	Eastbound	4,100	8,200
		3,700	6,900		3,600	7,000
Year 2030 Option A	Westbound	4,500	9,200	Westbound	4,400	8,700
		4,200	8,800		3,800	7,200
	Eastbound	4,200	8,400	Eastbound	4,300	9,100
		3,900	7,700		4,000	8,700
Year 2030 Suboption A	Westbound	4,600	9,400	Westbound	4,500	8,800
		4,200	8,800		3,800	7,600
	Eastbound	4,500	8,800	Eastbound	4,400	9,300
		4,200	8,400		4,100	8,900
Year 2030 Option K/L	Westbound	4,600	9,400	Westbound	4,600	8,900
		4,300	9,000		4,100	8,000
	Eastbound	4,500	8,800	Eastbound	4,600	9,800
		4,300	8,500		4,300	9,400

N

0 0.5 1 Miles

Map Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 5-7. **Peak Period SR 520 Crosslake Volume Trips**

I-5 to Medina: Bridge Replacement and HOV Project

With the westbound auxiliary lane on the Portage Bay Bridge, Option A could serve the traffic demand at the Montlake Boulevard westbound on-ramp. Option A would also increase trips to the SR 520/I-5/East Roanoke or I-5/NE 45th Street interchanges, slightly increasing SR 520 congestion approaching the I-5 interchange ramps. The effects of these volume changes on the local street system are described in Chapter 6.

Suboption A includes adding an eastbound on-ramp and a westbound off-ramp to Lake Washington Boulevard and an eastbound direct access on-ramp for transit and HOV from Montlake Boulevard. The suboption would have traffic volumes and operations similar to the No Build Alternative. The ramp configurations and connections to the local street system would be different than they currently are, but would not substantially change traffic circulation patterns compared to the No Build Alternative.

Option K or L

With the new structure (tunnel or bridge) across the Montlake Cut, both options would increase roadway capacity in the Montlake area. Traffic patterns would shift in response to this new capacity, increasing traffic volumes on the on- and off-ramps at the new Montlake area interchange. Without the westbound auxiliary lane between the new interchange and I-5 and the increase in traffic volumes on the ramps, the westbound on-ramp merge would be over capacity and congestion would spill back onto the local system.

How would westbound SR 520 operate during the morning commute?

Without the project, the SR 520 westbound general-purpose lanes would continue to be congested approaching the bridge on the Eastside. With the I-5 to Medina: Bridge Replacement and HOV Project, this congestion would be substantially reduced because the HOV lanes would be completed across the bridge to the I-5 express lanes. As a result, vehicle and person throughput across the SR 520 bridge would increase. The SR 520 to I-5 express lane connection would serve 200 vph (transit and HOV), which equals 1,500 persons per hour.

Volumes and Mode Share

As shown in Exhibit 5-8, the 6-Lane Alternative would serve up to approximately 1,400 more people than the No Build Alternative (a 20 percent increase) in only 400 more vehicles (a 10 percent increase).

None of the options would be able to serve all of the forecasted traffic demand because of congestion on I-5 and I-405.

Exhibit 5-8. Westbound A.M. Vehicle and Person Trips

With HOV lane improvements and a toll, a little over 10 percent more people would be traveling by carpool and bus. The westbound HOV lane connection to the southbound I-5 express lanes in the morning would allow carpools and buses to bypass congestion on the I-5 mainline.

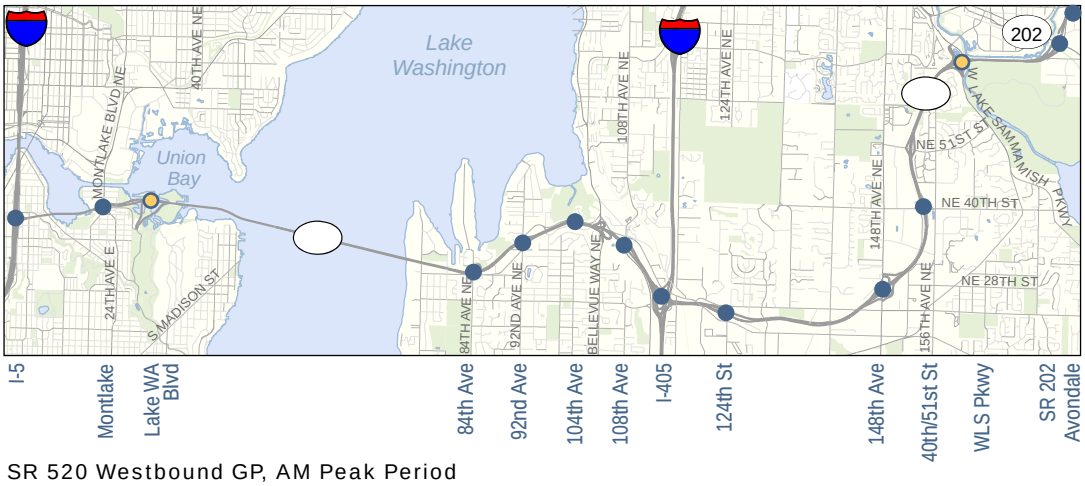
Congestion Points

The transportation team developed speed-flow diagrams using existing data and model output to provide a graphic representation of the congestion that occurs today. Exhibits 5-9 and 5-10 show where congestion would occur on the SR 520 corridor with the No Build Alternative and 6-Lane Alternative options during the westbound morning commute. The worst of the congestion points shown in these diagrams (indicated by the red/orange areas) are discussed below, including a description of how the 6-Lane Alternative operates compared to the No Build Alternative.

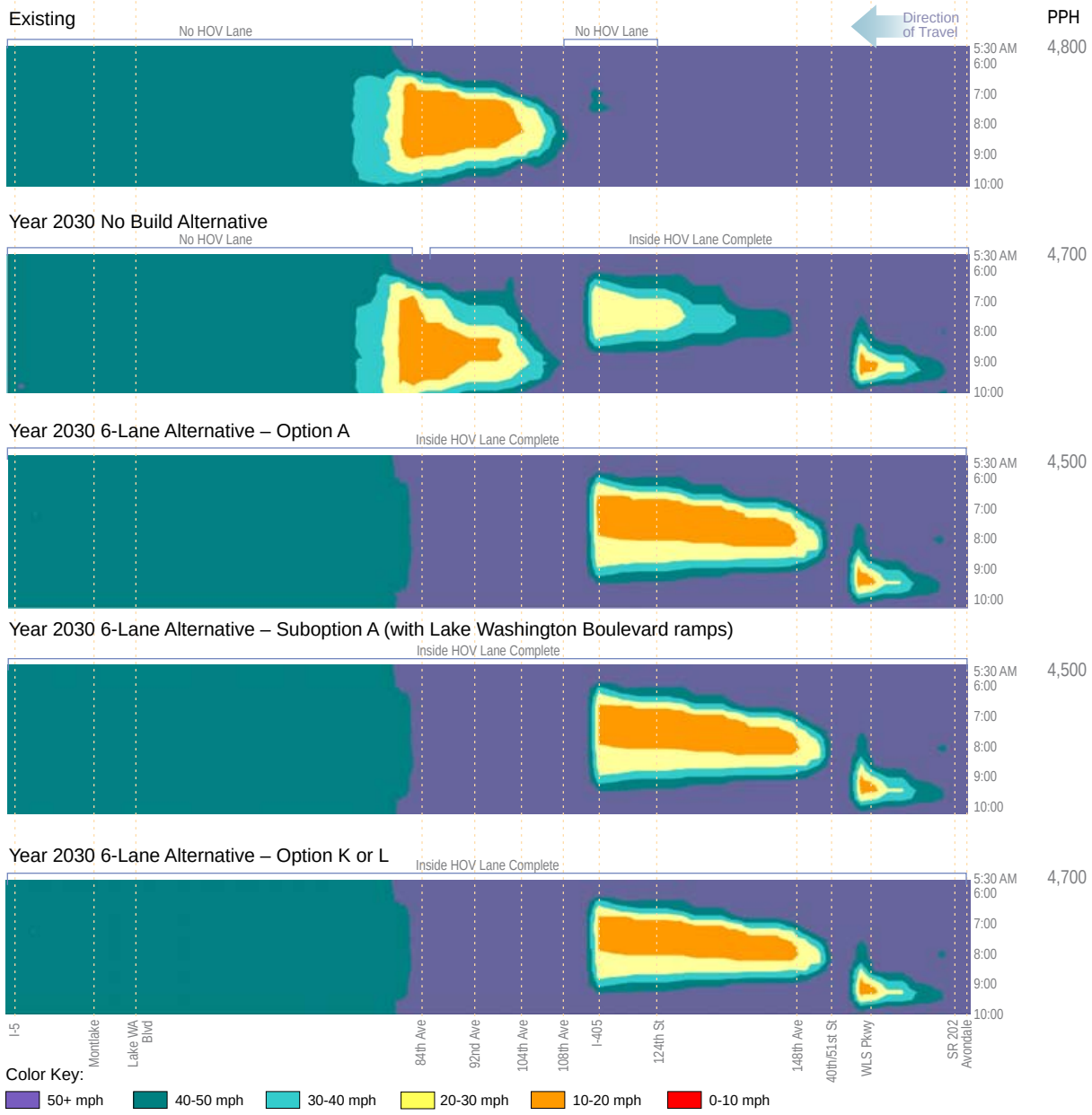
Did you know?

WSDOT's Traffic System Management Center (TSMC) collects traffic volume data along the state highways that can then be used be to create speed flow diagrams [congestion diagrams] to visually determine areas of congestion. These surface plots, similar to a topographical map, plot average vehicle speeds against time and space and create speed contour plots.

These plots help engineers determine the intensity, duration, and length (queue) of congestion throughout the day. The SR 520 transportation team worked with WSDOT's NW Region traffic engineers to develop these diagrams. These speed flow diagrams show that congestion occurs on SR 520, I-5, and I-405 for several hours each day at a number of locations.



SR 520 Westbound GP, AM Peak Period



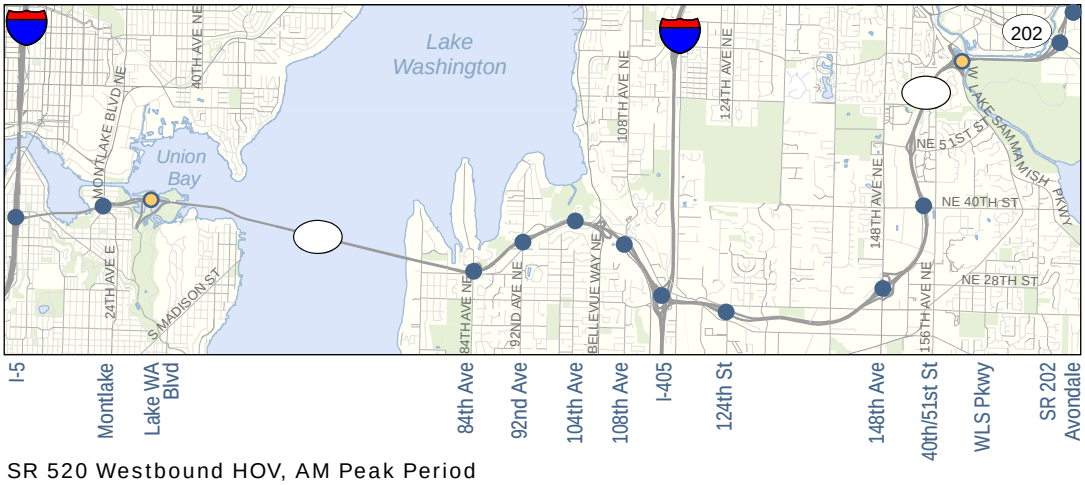
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

PPH = Persons per hour
(average during the peak period)

Exhibit 5-9. **SR 520 Westbound Morning General-Purpose Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project



SR 520 Westbound HOV, AM Peak Period

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

PPH = Persons per hour
(average during the peak period)

Exhibit 5-10. **SR 520 Westbound Morning HOV Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project

Bridge Approach at the Eastern Lake Shore

As shown in Exhibit 5-9, the most severe congestion on westbound SR 520 begins at the east bridge approach, near the 84th Avenue NE on-ramp and the westbound HOV lane termination. Congestion extends back to the SR 520/104th Avenue NE interchange area and lasts for approximately 3-1/2 hours. This congestion limits the amount of traffic that can cross the bridge.

Did you know?

A **travel time** under 14 minutes indicates near free-flow speeds.

A **travel time** of 30 minutes indicates average speeds of 25 mph.

A **travel time** of over an hour indicates average speeds of less than 15 mph.

Congestion at the bridge approach would improve slightly under the No Build Alternative because the Evergreen Point Freeway Station on-ramp merge would be improved as a part of the Medina to SR 202: Eastside Transit and HOV project. This improvement would allow buses to enter the freeway at higher speeds than they currently do. The HOV and general-purpose lanes would both benefit from relocating the HOV lane to the inside of the corridor as well as other roadway improvements associated with the Medina to SR 202 project, such as wider shoulders and lanes and longer on-ramp acceleration lanes.

With the 6-Lane Alternative, the westbound HOV lane would be extended across the SR 520 bridge to I-5, eliminating congestion at this point for both HOV and general-purpose traffic.

I-405/SR 520 Interchange

Today the off-ramp to I-405 southbound is over capacity and a queue spills back onto the SR 520 mainline, causing minor slowdowns. This congestion would worsen with the No Build Alternative (lasting up to 2 hours) because of the increase in traffic volumes forecasted between now and the year 2030. With the 6-Lane Alternative, SR 520 traffic volumes would increase over the No Build Alternative, adding to the already over-capacity ramp and increasing congestion by another hour.

Between West Lake Sammamish Parkway and the NE 40th/51st Street Collector-Distributor

By the year 2030, westbound SR 520 would be congested between the West Lake Sammamish Parkway on-ramp and the NE 40th /51st Street interchange during the morning commute. This congestion is attributed to the high volume (1,500 vph) exiting at the interchange and the proximity of the West Lake Sammamish on-ramp. The 6-Lane Alternative would not affect this congestion point.

Travel Time and Speed

The average travel time between SR 202 and I-5 is currently 16 to 22 minutes during the westbound morning commute (averaging 40 to 50 mph) for both general-purpose and HOV traffic (see Exhibit 5-11). The floating bridge and Portage Bay sections of SR 520 tend to have little to no congestion during the westbound morning commute. HOV travel is slightly faster than general-purpose travel (up to 6 minutes).

As shown in Exhibit 5-11, travel times would increase slightly by the year 2030 for both general-purpose and HOV traffic. With the 6-Lane Alternative, general-purpose and HOV travel time would improve between 2 to 3 minutes. HOV travel would provide a similar benefit to the No Build Alternative, up to 5 minutes faster compared to general-purpose travel.

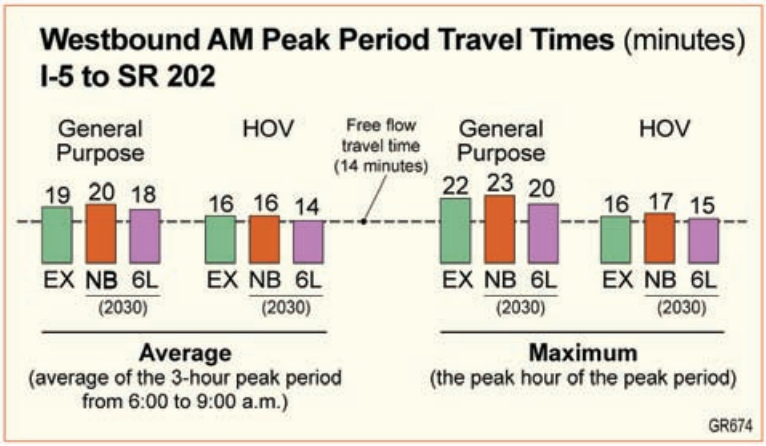


Exhibit 5-11. Westbound Morning Peak Period Travel Times Between I-5 and SR 202

Travel times outside of the study area are also reported because some of the benefits of the 6-Lane Alternative will be realized outside of the project limits, and comparing the travel times between SR 202 and I-5 is an effective way to capture these benefits.

How would eastbound SR 520 operate during the morning commute?

Without the project, SR 520 eastbound would continue to be congested between I-5 and the western approach span of the floating bridge in Seattle. With the project, the SR 520 mainline would be improved and an eastbound HOV lane would be added between I-5 and Medina. As a result, congestion at this location would be substantially reduced and vehicle and person throughput would increase.

Volumes and Mode Share

The 6-Lane Alternative would serve 800 to 1,600 more people (a 12 to 23 percent increase) and 200 to 500 more vehicles (a 5 to 16 percent increase) than the No Build Alternative (see Exhibit 5-12). With the HOV lane improvements and the toll, 7 percent more people would be traveling by carpool and bus. None of the options would be able to serve all of the forecasted traffic demand because of congestion on I-5 and I-405.

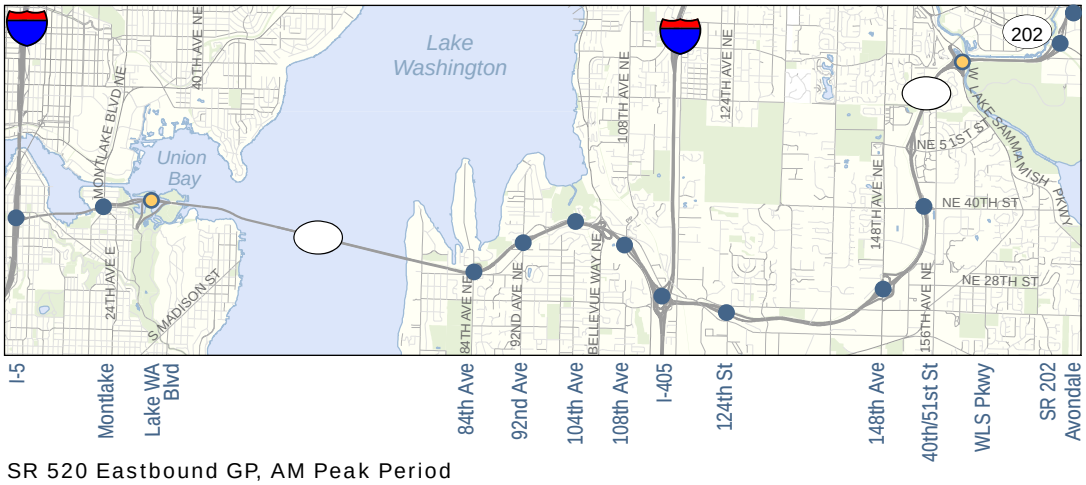
Exhibit 5-12. SR 520 Eastbound Morning Vehicle and Person Trips

Congestion Points

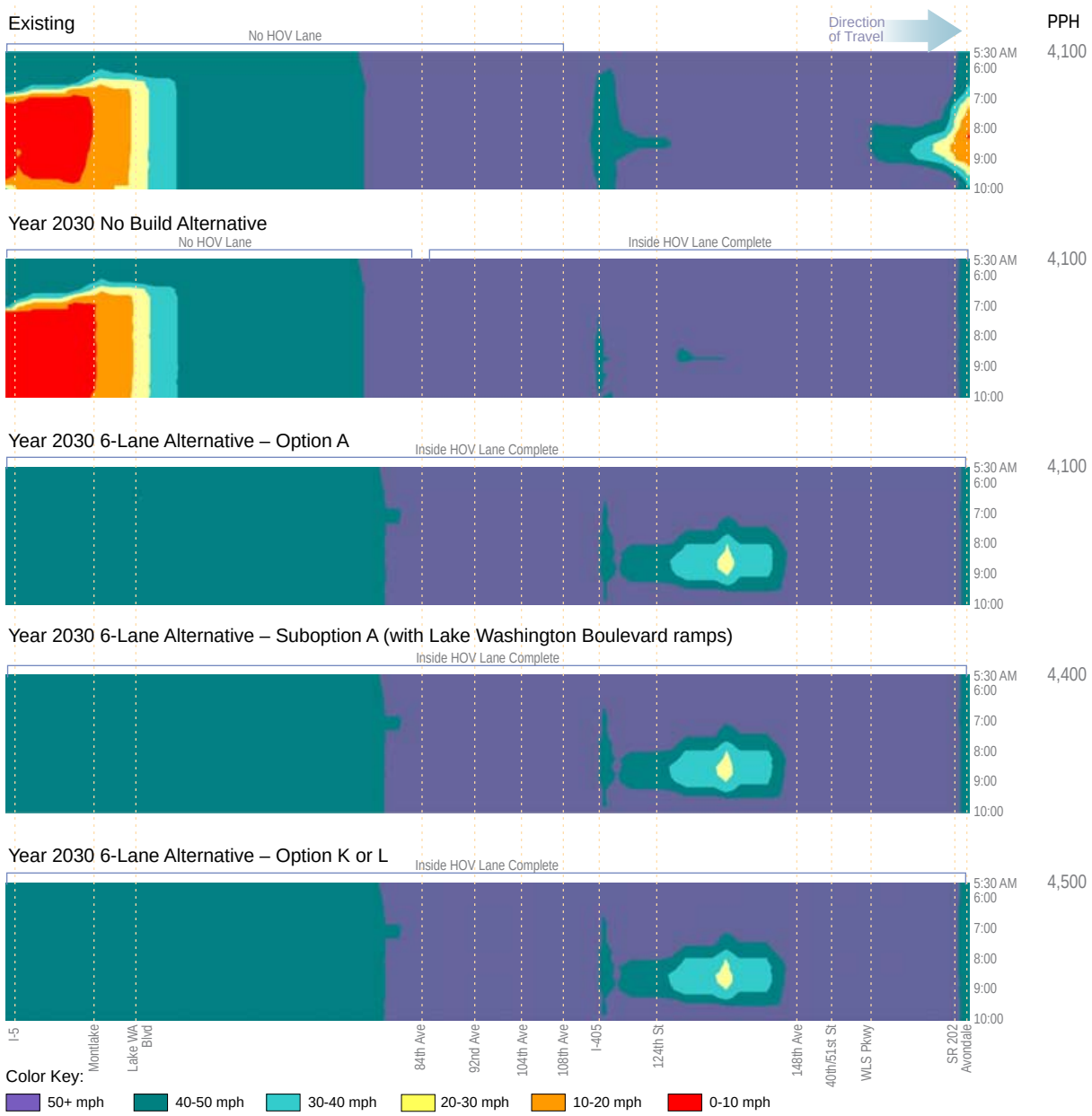
The speed-flow diagrams displayed in Exhibits 5-13 and 5-14 provide a graphic representation of the congestion that occurs today and with the No Build and Build Alternatives during the eastbound morning commute. The worst of the congestion points shown in these diagrams (indicated by the red/orange areas) are discussed below, including a description of how the 6-Lane Alternative operates compared to the No Build Alternative.

Did you know?

Under stop-and-go conditions, 100 cars is about a half mile of congestion in one lane or a quarter mile of congestion in two lanes.



SR 520 Eastbound GP, AM Peak Period



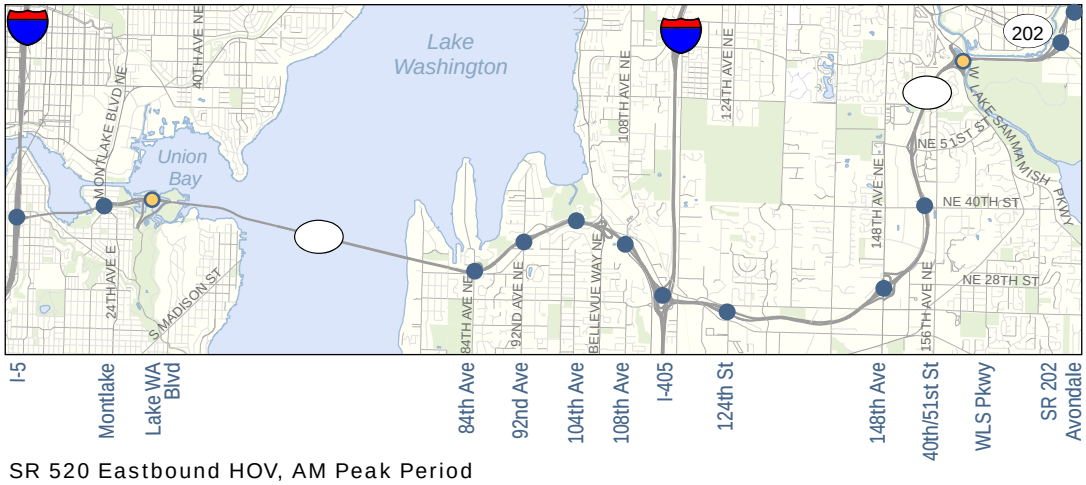
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

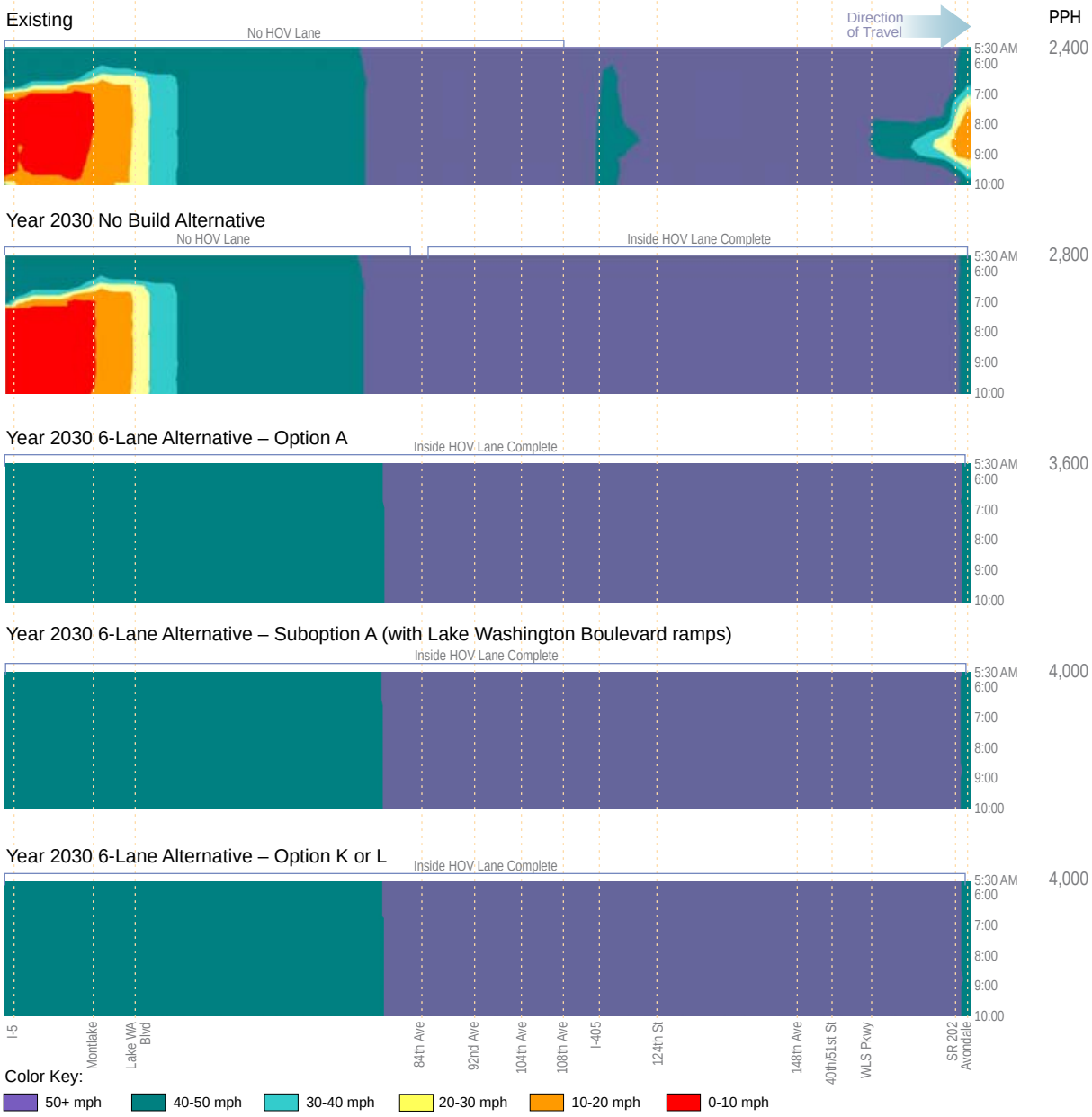
PPH = Persons per hour
(average during the peak period)

Exhibit 5-13. **SR 520 Eastbound Morning General-Purpose Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project



SR 520 Eastbound HOV, AM Peak Period



Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

PPH = Persons per hour
(average during the peak period)

Exhibit 5-14. **SR 520 Eastbound Morning HOV Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project

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West Bridge Approach and Lake Washington Boulevard On-Ramp Merge

Congestion currently occurs approaching the west approach span of the Evergreen Point Bridge because of the short acceleration lane for traffic merging from the Lake Washington Boulevard on-ramp, the mainline grade change approaching the western approach span, substandard shoulder widths, and visual distractions associated with the lake. The congestion at this location lasts for approximately 3 hours and can extend back to I-5. Travel speeds are reduced to below 10 mph. Congestion at this location limits the amount of traffic that can cross the bridge, which prevents traffic congestion on the east side of the bridge.

With the No Build Alternative, these conditions would remain and congestion would be slightly worse than today. With the 6-Lane Alternative, improvements to the SR 520 mainline and the on-ramp merge, as well as the additional capacity provided by the HOV lane, would eliminate this congestion. In addition, more traffic demand (approximately 4,300 vph) would be served across the bridge.

I-405 Northbound Merge

Congestion at this location does not currently occur, nor would it with the No Build Alternative because congestion at the west approach span limits the volume of traffic that can cross the bridge. With the 6-Lane Alternative, this congestion would be reduced, allowing more traffic to cross the bridge and resulting in minor congestion on SR 520 eastbound at the merge from northbound I-405 (speeds between 20 and 30 mph). Congestion would last for approximately 1 hour. As shown in Exhibit 5-14, HOV and transit traffic would be able to bypass this congestion because it occurs in the outside general-purpose lanes.

SR 520 Termination at SR 202/Avondale Road

Congestion currently occurs at the east end of the SR 520 corridor, but does not extend into the project limits (between I-5 and Medina). Congestion occurs at this location because freeway traffic volumes exceed the traffic signal's capacity at the NE Union Hill Road/ SR 520/Avondale Road intersection. Congestion can last approximately 2 hours and extend back to near the SR 202 exit.

By the year 2030, congestion at this location would be substantially reduced due to completion of WSDOT's SR 202 improvement project. The 6-Lane Alternative would not affect this area.

Travel Time and Speed

As shown in Exhibit 5-15, No Build Alternative travel times are expected to be similar to today. With the 6-Lane Alternative, average travel times would improve by 7 to 8 minutes for both general-purpose and HOV trips (with speeds above 50 mph) because an eastbound HOV lane would be added between I-5 and Medina. This additional capacity would improve operations and travel time for both HOV and general-purpose traffic.

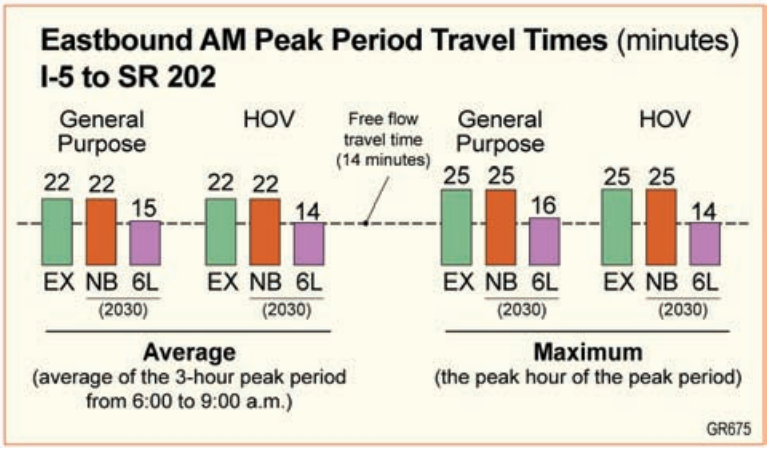


Exhibit 5-15. Eastbound Morning Peak Period Travel Times Between I-5 and SR 202

How would westbound SR 520 operate during the afternoon commute?

The SR 520 westbound general-purpose lanes would continue to be congested approaching the bridge on the east side because of the HOV lane merge near 84th Avenue NE in Medina. With the project, congestion at this location would be substantially reduced and vehicle and person throughput would increase. The 6-Lane Alternative options would affect traffic volumes and operations across the Portage Bay Bridge because of changes in ramp configurations in the Montlake area and westbound lane configuration across the bridge.

Volumes and Mode Share

As shown in Exhibit 5-16, the 6-Lane Alternative options would serve 500 to 1,300 more people (a 7 to 20 percent increase) than the No Build Alternative with an increase of only 300 vehicles (8 percent). With the 6-Lane Alternative's HOV lane improvements and toll, up to 20 percent more people would be traveling by carpool and bus. None of the

options would be able to serve all of the forecasted traffic demand because of congestion on I-5 and I-405.

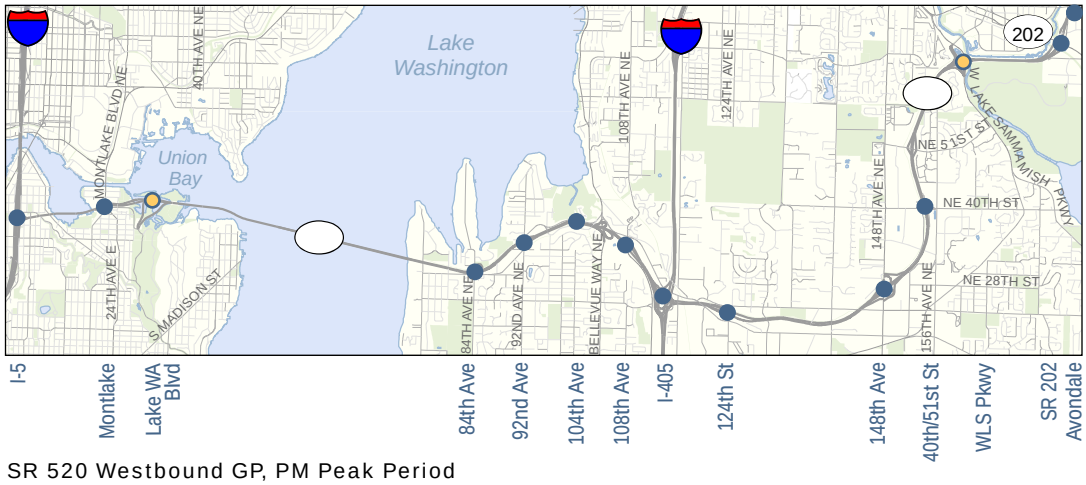
Exhibit 5-16. Westbound Afternoon Vehicle and Person Trips

Congestion Points

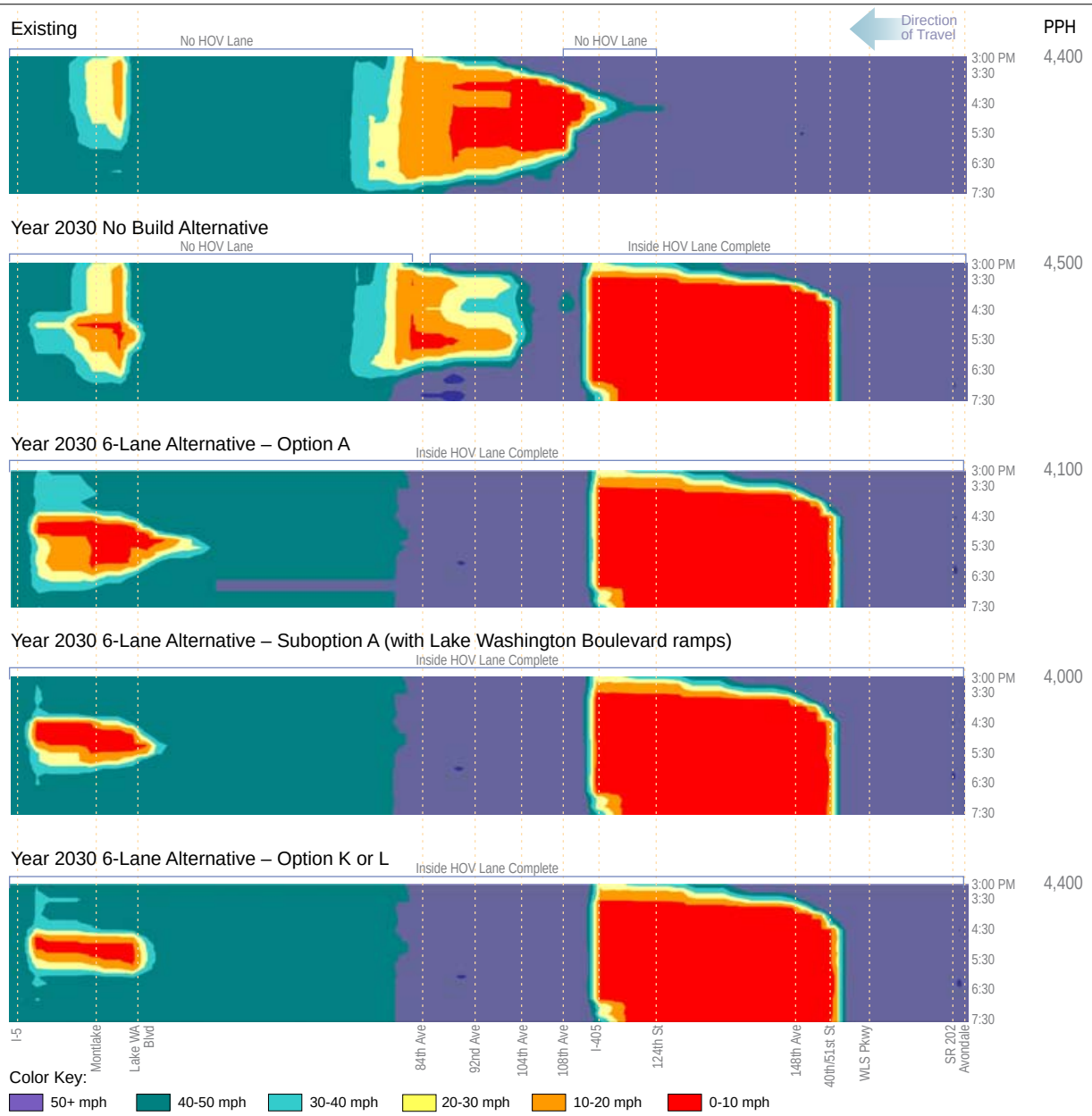
The transportation team developed speed-flow diagrams using existing data and model output to provide a graphic representation of the congestion that occurs today. Exhibits 5-17 and 5-18 show where congestion would occur on the SR 520 corridor with the No Build Alternative and 6-Lane Alternative options during the westbound afternoon commute. The worst of the congestion points shown in these diagrams (indicated by the red\orange areas) are discussed below, including how the 6-Lane Alternative operates compared to the No Build Alternative.

Bridge Approach at the Eastern Lake Shore

As shown in Exhibit 5-17, the most severe congestion on westbound SR 520 begins at the east bridge approach near the 84th Avenue NE on-ramp and the HOV lane termination. Congestion during the afternoon commute extends back to the SR 520/108th Avenue NE interchange area and lasts for approximately 3-1/2 hours. Congestion at this location limits the amount of traffic that can cross the bridge.



SR 520 Westbound GP, PM Peak Period



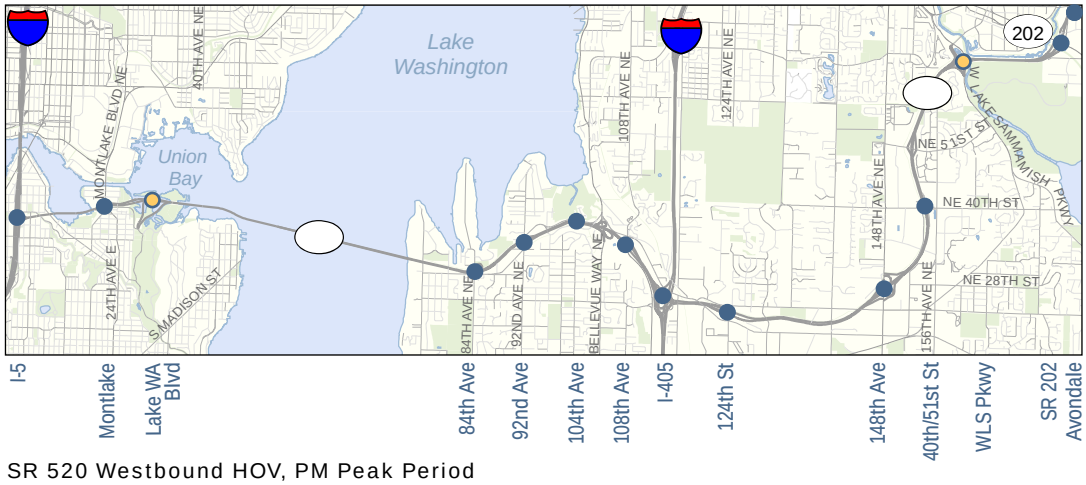
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

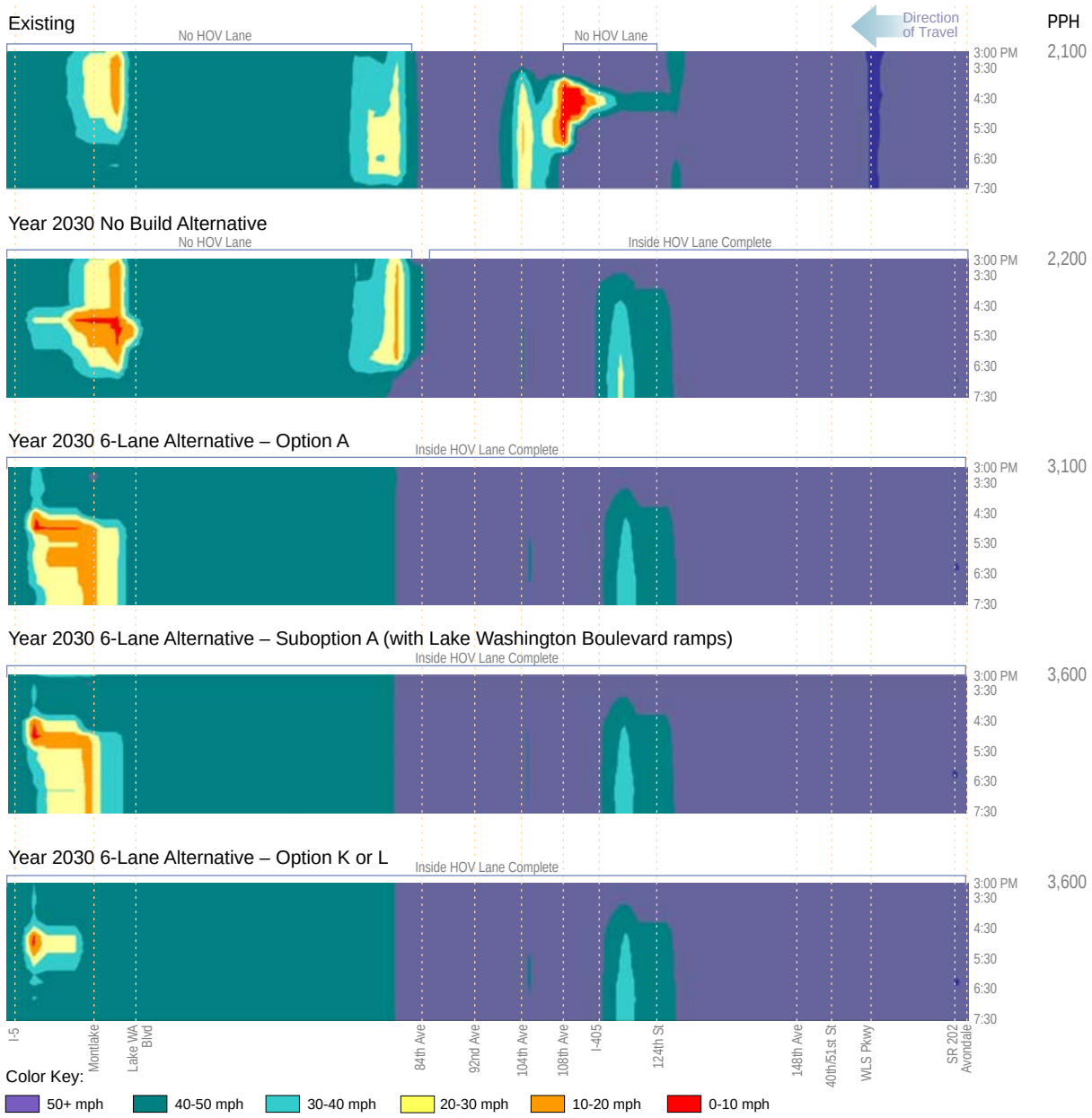
PPH = Persons per hour
(average during the peak period)

Exhibit 5-17. **SR 520 Westbound Afternoon General-Purpose Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project



SR 520 Westbound HOV, PM Peak Period



Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

PPH = Persons per hour
(average during the peak period)

Exhibit 5-18. **SR 520 Westbound Afternoon HOV Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project

This congestion would remain under the No Build Alternative, but improve slightly because the Evergreen Point Freeway Transit Station on-ramp merge would be improved as a part of the Medina to SR 202: Eastside Transit and HOV Project. This improvement would allow buses to enter the freeway at higher speeds than they currently do. The HOV and general-purpose lanes would both benefit from the relocation of the HOV lane to the inside of the corridor and other improvements associated with the Medina to SR 202: Eastside Transit and HOV Project, including wider shoulders and lanes and longer on-ramp acceleration lanes. With the 6-Lane Alternative, the HOV lane would be extended across the SR 520 bridge to I-5, eliminating congestion at this point for both HOV and general-purpose traffic.

I-405 Northbound and Southbound

The I-405 northbound and southbound mainlines are currently congested during the afternoon commute. I-405 congestion causes the I-405/SR 520 interchange ramps to back up onto SR 520, causing congestion that extends back 124th Avenue NE. Congestion limits the amount of traffic that can exit from SR 520 to I-405, and also how much traffic can enter SR 520 from I-405. This congestion would worsen with the No Build Alternative, extending back to the NE 40th/51st Street collector-distributor and lasting for nearly the entire peak period (5 hours). Carpools and buses would be able to bypass this congestion in the inside HOV lane.

The 6-Lane Alternative options would not affect this congestion.

Across Portage Bay Bridge

Today, there is moderate congestion on SR 520 between the Montlake Boulevard on-ramp merge point and I-5 due to the short acceleration lane. Drivers cannot get up to freeway speeds and drivers on the SR 520 mainline must slow down to accommodate entering vehicles. Drivers changing lanes to access the I-5 off-ramps and congestion spilling back from I-5 also contribute to congestion in this area. Traffic speeds average 30 mph for approximately 2 to 3 hours (see Exhibits 5-17 and 5-19).

With the No Build Alternative, congestion would worsen slightly because of the increase in traffic volumes expected between now and the year 2030. This would affect traffic on both the I-5 and SR 520 mainlines. SR 520 congestion across the Portage Bay Bridge would

worsen, lasting approximately 3 to 4 hours with vehicle speeds averaging 20 mph (see Exhibits 5-17 and 5-19).

With the 6-Lane Alternative options, there would also be congestion between the Montlake interchange and I-5, but it would be caused by different factors than the No Build Alternative, including:

- In the afternoon, the westbound HOV lane would terminate before reaching I-5 because the SR 520/I-5 express lanes connection would operate from northbound I-5 to eastbound SR 520. HOVs merging back into the general-purpose lanes would cause traffic to slow.
- Variations would occur in traffic volumes and operations associated with the different ramp configurations in the Montlake area and different lane configurations between the SR 520/Montlake Boulevard interchange and I-5.
- Congestion from I-5 would spill back onto SR 520 westbound mainline.

With the 6-Lane Alternative interchange options, there would still be congestion across the Portage Bay Bridge; however, its duration would be substantially reduced—from 3 to 4 hours under the No Build Alternative to 2 hours or less under the 6-Lane Alternative, depending on the option (see Exhibits 5-17 and 5-19). Vehicle demand on the westbound on-ramp from Montlake Boulevard would be less with the 6-Lane Alternative than the No Build. This is because sections of SR 520 would be tolled, including the Portage Bay Bridge. Vehicles traveling from Montlake Boulevard via westbound SR 520 to I-5 would pay a toll.

Exhibit 5-19. SR 520 Westbound Operations across Portage Bay During the Afternoon Peak Period

	SR 520 Portage Bay Bridge			SR 520/Montlake Area Interchange	
	Volume Demand (vph)	Speed (mph)	Congestion Duration	Westbound On-Ramp Demand	Westbound On-Ramp Throughput
Existing	3,900	30	2-3 hours	930	920
Year 2030 No Build Alternative	4,100	20	3-4 hours	1020	1,000
Year 2030 6-Lane Alternative					
Option A	4,200	20	2 hours	930	690
Suboption A	3,900	20	1-2 hours	930	800
Option K and L	3,800	20	1-2 hours	1,100	910

Option A would remove the Lake Washington Boulevard ramps, providing less capacity to and from SR 520 at the SR 520/Montlake Boulevard interchange than the other options. However, Option A includes more freeway capacity with a westbound auxiliary lane between the SR 520/Montlake Boulevard interchange and I-5. In addition, more traffic (up to 400 vph) would cross the Portage Bay Bridge under Option A than with the other options as trips shift to the SR 520/I-5/East Roanoke and I-5/NE 45th Street interchanges (Exhibits 5-10 and 5-11).

The higher volume results in more congestion spilling back from I-5 onto the Portage Bay Bridge and the local system. Even with the auxiliary lane between the SR 520/Montlake Boulevard interchange and I-5, the merge point of Montlake Boulevard westbound on-ramp and the SR 520 mainline would be over capacity, adding to the congestion spilling back onto the local system.

Suboption A, which would include the Lake Washington Boulevard ramps in the new SR 520/Montlake Boulevard interchange design, would improve these conditions. Traffic volumes between the SR 520/Montlake Boulevard interchange and I-5 would be lower than Option A and similar to the No Build Alternative. Congestion from I-5 would still spill back onto the Portage Bay Bridge and the local street system, but the extent of the congestion would be less than in Option A. Congestion would be reduced because of improvements to the SR 520 mainline and the Montlake westbound on-ramp merge point.

Options K and L would increase ramp and local street capacity to and from the new SR 520/Montlake Boulevard interchange, but would not include the westbound auxiliary lane on SR 520 between the new interchange and I-5. With the increased capacity in the Montlake area with Option K or L, traffic patterns would shift, increasing volumes in the SR 520/Montlake Boulevard interchange area and decreasing volumes on the Portage Bay Bridge compared to the other options (see Exhibit 5-19).

Although Option K or L would have less congestion spilling back from I-5 than Option A, without the westbound auxiliary lane between the new interchange and I-5, the westbound on-ramp merge from the new interchange would add to congestion spilling back onto the local system. The termination of the westbound HOV lane would also contribute to congestion approaching I-5. In the afternoon, the westbound HOV lane would terminate before reaching I-5 because the

SR 520/I-5 express lanes connection would operate northbound to eastbound.

Travel Time and Speed

The average travel time today between SR 202 and I-5 during the westbound afternoon commute is approximately 32 minutes for general-purpose trips and 22 minutes for HOV trips (see Exhibit 5-20). The difference in travel times is due to the westbound congestion approaching the bridge in Medina, which HOVs can bypass. There is also typically some congestion in the SR 520/Montlake Boulevard interchange/Portage Bay sections during the afternoon commute.

As shown in Exhibit 5-20, general-purpose travel times for the No Build Alternative are expected to increase by nearly 20 minutes by year 2030. In 2030, traveling in the HOV lane would be nearly 30 minutes faster on average than the general-purpose lanes. During the peak of the peak, general-purpose travel times could increase to over an hour and HOV travel would result in an even greater travel time savings (over 40 minutes).

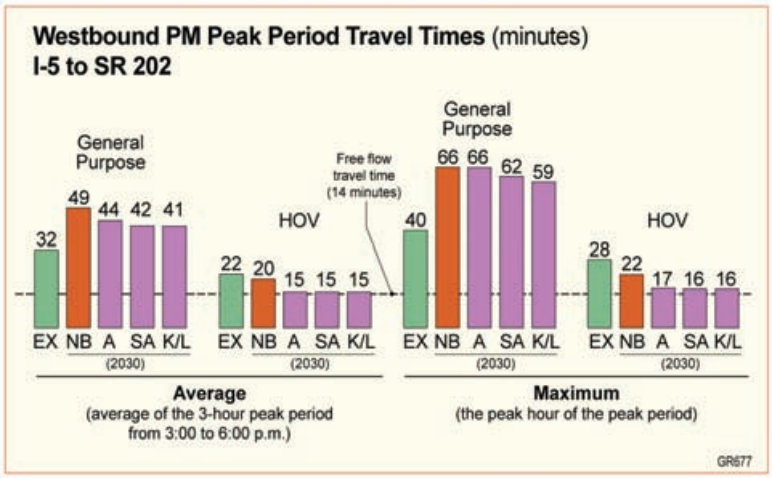


Exhibit 5-20. Westbound SR 520 Travel Times Between I-5 and SR 202 – Afternoon Peak Period

The 6-Lane Alternative options would operate similarly between SR 202 and I-5, with some improvement compared to the No Build Alternative (5 to 7 minutes). When congestion is at its peak, the 6-Lane Alternative would provide an even greater travel time savings for HOV travel compared to general-purpose travel (from a 40-minute savings with the No Build Alternative to a 50-minute saving with the 6-Lane Alternative). The increases in congestion across the Portage Bay Bridge

with the options would not substantially affect travel times on SR 520 between SR 202 and I-5 because it is such a short section of roadway.

How would eastbound SR 520 operate during the afternoon commute?

By the year 2030, traffic congestion on the I-405 mainline would have substantial effects on the SR 520 eastbound afternoon commute. SR 520 congestion could extend as far back as I-5 with the No Build Alternative. The 6-Lane Alternative would substantially reduce this congestion because HOVs would be able to reliably bypass general-purpose congestion after completion of the eastbound HOV lane between I-5 and Medina.

Volumes and Mode Share

The 6-Lane Alternative would serve 1,700 to 2,400 more people (a 24 to 34 percent increase) than the No Build Alternative, with an increase of only 400 to 700 (11 to 19 percent) more vehicles (see Exhibit 5-21). With the HOV lane improvements and toll, up to 12 percent more people would travel by carpool and bus. While none of the options would serve all of the forecasted traffic demand because of congestion on other

Exhibit 5-21. Eastbound Afternoon Vehicle and Person Trips

corridors, the 6-Lane Alternative options would serve 10 percent more people in 6 percent more vehicles than the No Build Alternative.

Congestion Points

The speed-flow diagrams displayed in Exhibits 5-22 and 5-23 provide a graphic representation of the eastbound afternoon commute congestion that occurs today and in the year 2030 with the No Build and Build Alternatives. These congestion points are discussed below, including a description of what causes the congestion at each location.

SR 520 Eastside Freeway Terminus at Avondale

Congestion currently occurs at the east end of the SR 520 corridor, but does not extend into the project limits (between I-5 and Medina). Congestion occurs at this location because freeway traffic volumes exceed the traffic signal's capacity at the NE Union Hill Road/ SR 520/Avondale Road intersection. Congestion can last up to 2-1/2 hours and extend back to NE 40th Street at its peak.

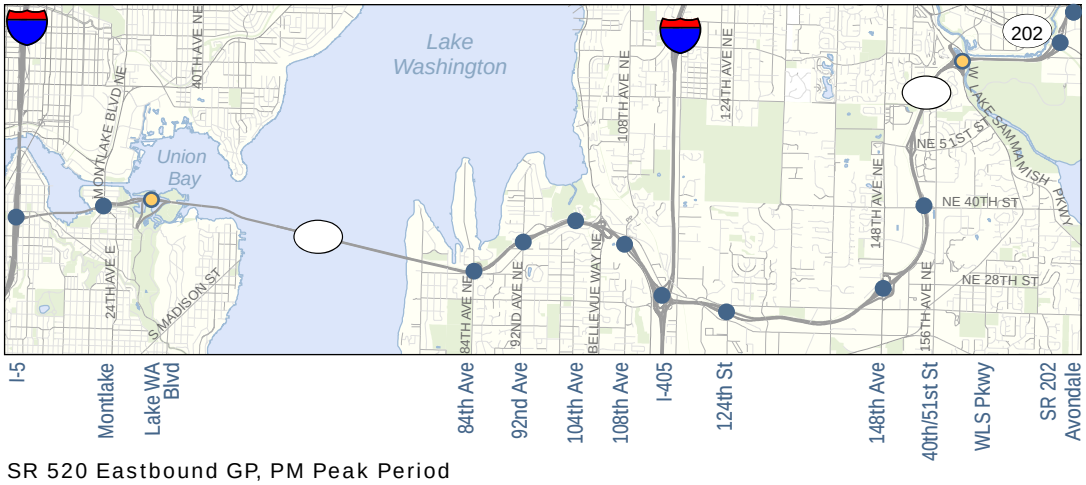
By the year 2030, congestion at this location would be substantially reduced due to completion of WSDOT's SR 202 improvement project. The 6-Lane Alternative would not affect this area.

I-405 North and Southbound

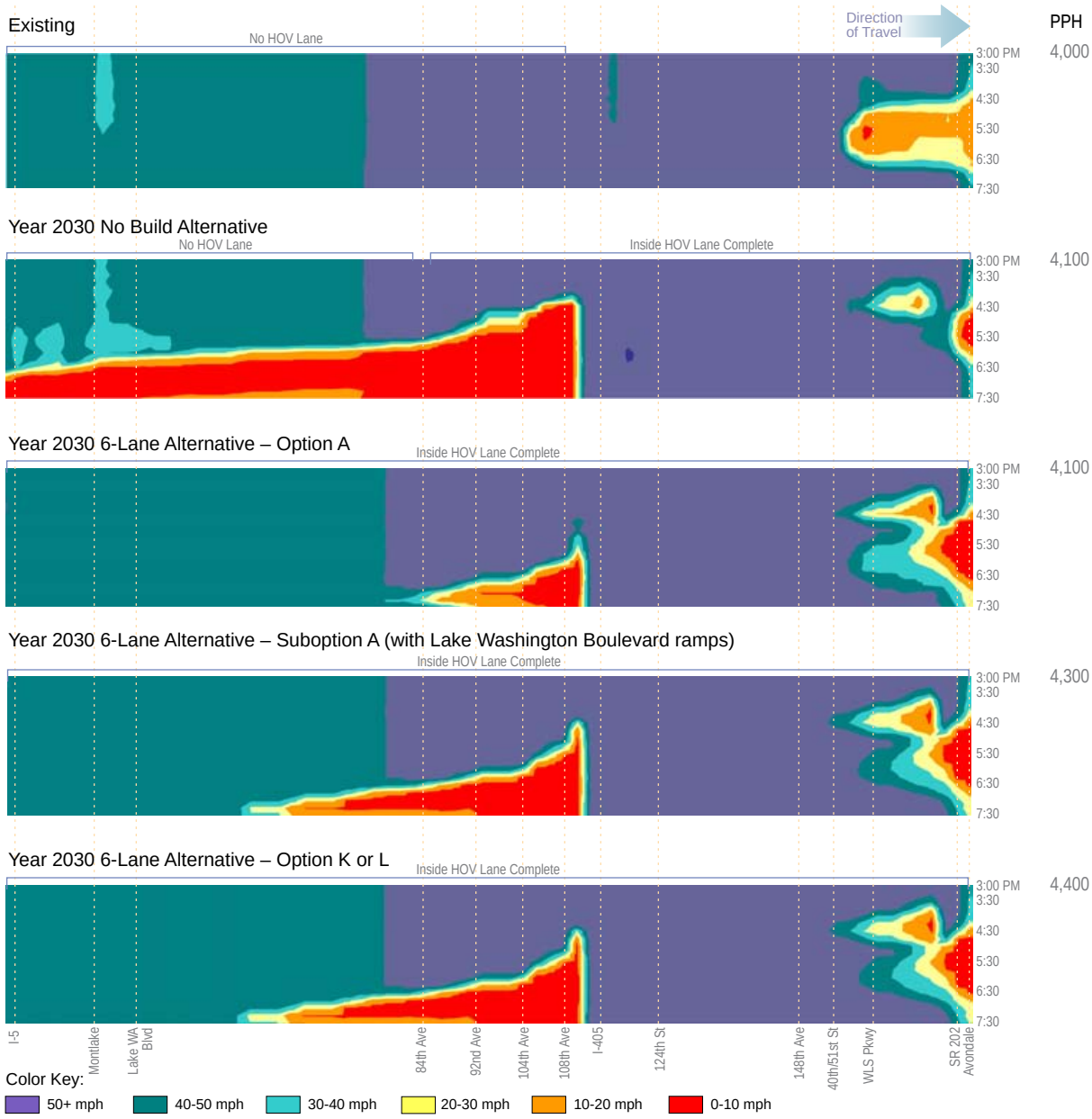
Traffic is currently congested on I-405 through downtown Bellevue during the afternoon commute period because traffic volumes exceed roadway capacity. Some moderate congestion occurs northbound on I-405 between NE 4th Street and the SR 520 off-ramps because the I-405 northbound-to-SR 520 eastbound ramp is over capacity. High traffic volumes and merging vehicles between the NE 8th Street on-ramp and the SR 520 off-ramps also contribute to congestion in this area. Although this congestion typically does not affect SR 520 operations, it likely reduces traffic able to access SR 520.

By the year 2030, congestion on SR 520 approaching the SR 520/I-405 interchange would be worse due to I-405 traffic backing up onto the SR 520 ramps. This congestion would limit the amount of traffic that can exit from SR 520 to I-405. Congestion on the SR 520 off-ramp to northbound I-405 would spill back onto the SR 520 mainline and cause congestion extending back to I-5.

This congestion would be less with Option A compared to the other options because removing the Lake Washington Boulevard ramps



SR 520 Eastbound GP, PM Peak Period



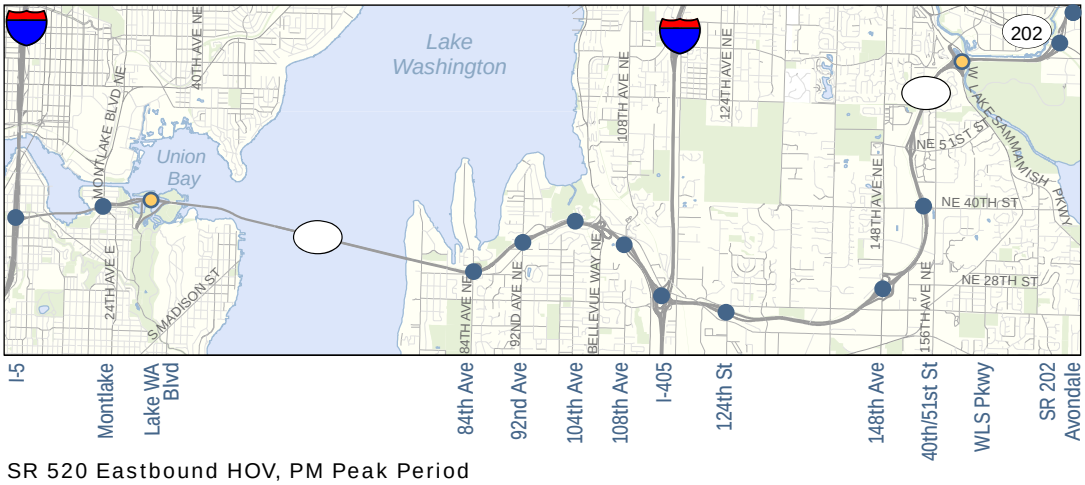
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

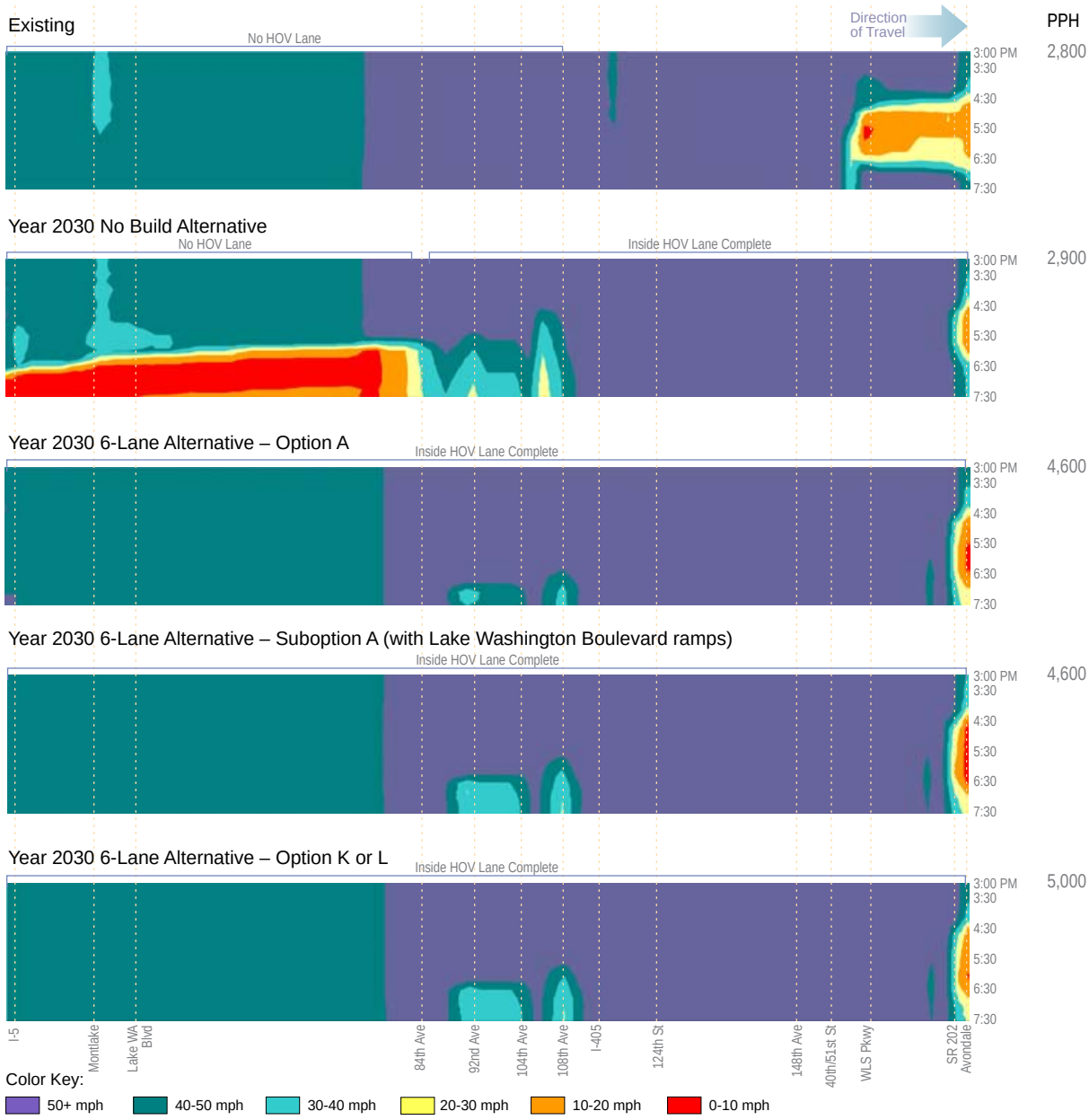
PPH = Persons per hour
(average during the peak period)

Exhibit 5-22. **SR 520 Eastbound Afternoon General-Purpose Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project



SR 520 Eastbound HOV, PM Peak Period



Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

N

PPH = Persons per hour
(average during the peak period)

Exhibit 5-23. **SR 520 Eastbound Afternoon HOV Freeway Operations**

I-5 to Medina: Bridge Replacement and HOV Project

would reduce traffic volumes (approximately 100 vph less) able to access SR 520. In stop-and-go congestion, 100 vehicles equate to approximately a quarter mile of congestion (in two lanes). With the 6-Lane Alternative, HOV and transit trips would bypass this congestion with the inside HOV lane that extends to I-5 (see Exhibit 5-23).

Travel Times and Speed

Today the average travel time between I-5 and SR 202 for general-purpose and HOV traffic is approximately 17 to 21 minutes during the afternoon commute (see Exhibit 5-24). By the year 2030 with the No Build Alternative, both general-purpose and HOV travel times would increase due to I-405 mainline congestion backing up onto SR 520. General-purpose travel times would range between 22 minutes (average) to up to 1 hour and 25 minutes during the peak hour of travel. HOV travel times would range between 15 and 53 minutes. With the 6-Lane Alternative, HOV travel would be 6 to 31 minutes faster than general-purpose travel because an eastbound HOV lane would be added between Medina and the SR 520/I-405 interchange.

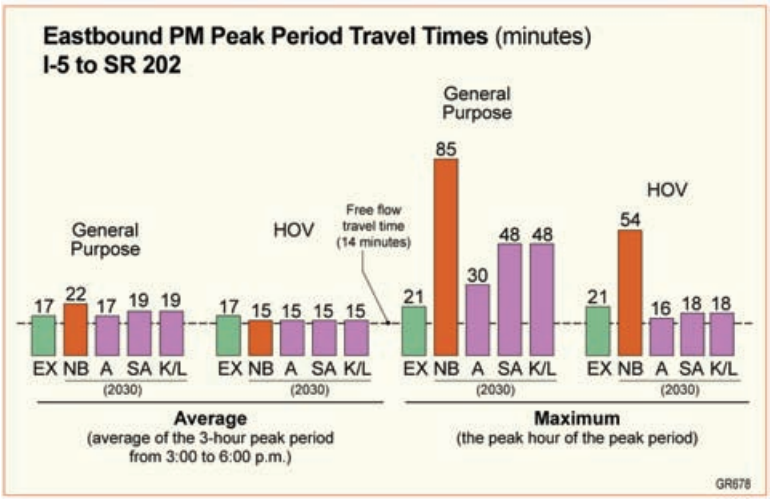


Exhibit 5-24. Eastbound SR 520 Travel Times Between I-5 and SR 202 – Afternoon Peak Period

With the 6-Lane Alternative, I-405 mainline congestion would still back onto SR 520. However, with the additional capacity provided by the extension of the HOV lane to I-5 and roadway design improvements, travel times would improve for both general-purpose and HOV traffic. General-purpose travel times would be reduced between 37 to 55 minutes and HOV travel times by nearly 40 minutes. HOV travel would be 14 to 30 minutes faster than general-purpose traffic.

Chapter 6—Local Volumes and Operations

What is in this chapter?

This chapter discusses the results of the SR 520 transportation team's traffic forecasts and operations analysis of local streets adjacent to SR 520. The analysis results were used to compare existing traffic conditions with the effects of the year 2030 No Build Alternative. This comparison allowed us to determine what local street and intersection traffic operations would be like without the project. The 6-Lane (Build) Alternative was then compared to the No Build Alternative to determine effects on traffic conditions with the project.

Ideally, freeway and local transportation systems should operate in a way that does not adversely affect each other. The intent in making changes to either system is to improve traffic conditions in one or both without adversely affecting the other.

What is traffic like at the study area interchanges today?

Traffic operations at five study area interchanges are discussed in this section. These five interchange areas include SR 520/Montlake Boulevard, SR 520/I-5/East Roanoke Street, I-5/NE 45th Street, I-5/Mercer Street, and I-5/Stewart Street. Because of their proximity to SR 520, these interchanges and adjacent local streets can affect and be affected by freeway operations. Other factors not related to the freeway—including intersection configuration, signal timing, and intersection spacing—can also affect local traffic operations.

SR 520/Montlake Boulevard Interchange Area

The SR 520/Montlake Boulevard interchange area, which provides access to and from SR 520, is congested during the morning and afternoon peak hours. This congestion is partially related to traffic flow on SR 520 (which can affect traffic flow on the local street network), and traffic flow on the local street network (which can affect traffic flow on SR 520).

During the morning and afternoon commutes, traffic typically backs up on Montlake Boulevard southbound approaching the SR 520 eastbound on-ramp. Traffic congestion can extend across the Montlake Bridge to the Montlake Boulevard/NE Pacific Street intersection and as far back as 25th Avenue NE near University Village (approximately 1 mile). Congestion can also occur on NE Pacific Street eastbound, extending back through the NE Pacific Place intersection.

Montlake Boulevard NE is an important transit corridor, serving both local and regional buses between the SR 520/Montlake interchange and the University District. Montlake Boulevard NE, NE Pacific Street, and 15th Avenue NE are considered Urban Village Transit Network corridors as identified in the Seattle Transit Plan (August 2005). Congestion in the Montlake area affects transit service efficiency and reliability, constraining transit service. Factors that contribute to the congestion in the SR 520/Montlake Boulevard interchange area are described below.

- Freeway traffic operations on SR 520 are managed by using the eastbound on-ramp meter to control the flow of traffic entering SR 520. On-ramp traffic volumes at this location exceed the storage capacity on the ramp and queue onto Montlake Boulevard.
- Traffic congestion associated with the eastbound SR 520 on-ramp can extend back across the Montlake Bridge. When traffic is backed up in the outside right lane, Montlake Boulevard southbound is constrained to one lane for drivers destined for areas to the south of SR 520.
- Drivers traveling northbound on Montlake Boulevard NE to access SR 520 westbound must make a U-turn at the Montlake Boulevard/East Hamlin Street intersection. These vehicles often spill out of the U-turn pocket. This blocks the inside northbound lane on Montlake Boulevard, which constrains through traffic to a single lane. This, in turn, affects traffic exiting the eastbound off-ramp and other intersections to the south.
- Some drivers who use the SR 520 westbound off-ramp want to travel southbound on Montlake Boulevard or reach the Shelby/Hamlin neighborhood west of Montlake Boulevard. These drivers stop at the end of the westbound off-ramp to wait for a gap in traffic to cross the two northbound through lanes and access the U-turn at the East Hamlin intersection. Accommodating this

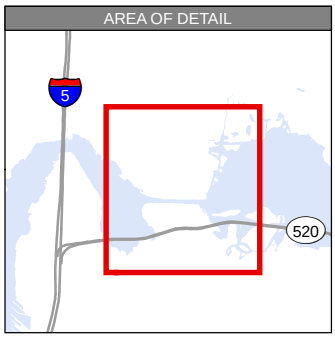
movement can worsen northbound congestion by creating backups on the westbound off-ramp.

- Montlake Bridge openings can have long-lasting effects on traffic flow in this area. The bridge does not open during the morning and afternoon peak periods; however, the last opening at 3:30 p.m. can affect traffic operations throughout the afternoon commute. Bridge openings compound whatever congestion is present on the local street network and can cause traffic on the SR 520 westbound and eastbound off-ramps to back up onto the SR 520 mainline. Congestion on the eastbound off-ramp can also affect traffic on I-5.
- An average of 10 bridge openings occurs during a typical summer weekday (fewer openings occur during other times of the year). Bridge openings typically last 3 minutes, but can extend up to 6 minutes on occasion.
- Montlake Bridge opening delays make it difficult for bus drivers to keep to their schedules, affecting bus travel times and reliability.

Morning and afternoon peak-hour traffic volumes on streets within the SR 520/Montlake Boulevard interchange area are shown in Exhibits 6-1 and 6-2. Traffic volumes are shown for comparison between Options A, K, and L. Volumes for suboptions are shown only where the suboption results in different traffic volumes than the base option. New roadways that would be constructed in Options K and L are depicted in their approximate locations.

Exhibits 6-3 and 6-4 show that most intersections in the SR 520/Montlake Boulevard interchange area currently operate at LOS D or better during the morning and afternoon peak hours (refer to the methodology chapter for a description of LOS). However, the Montlake Boulevard/Lake Washington Boulevard/SR 520 eastbound ramps intersection operates at LOS E during both the morning and afternoon peak hours, with legs of the intersection operating near or over capacity. Congestion from this signal can spill back onto the off-ramp deceleration lane, which can affect SR 520 mainline operations as drivers slow approaching the off-ramp. The Montlake Boulevard/ Roanoke Street and westbound SR 520 ramp intersections are both affected by congestion spilling back from the Montlake Boulevard/ Lake Washington Boulevard/eastbound SR 520 ramp intersection.

Future traffic operations in the year 2030 without and with the project are discussed later in this chapter.



LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

New Roadway

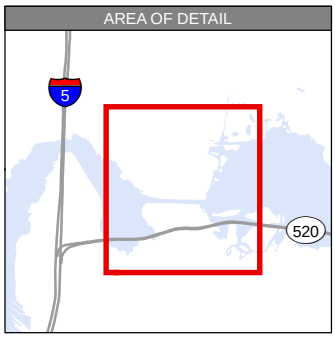
N

0 500 1,000 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-1. **SR 520/Montlake Boulevard Interchange Area – A.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

New Roadway

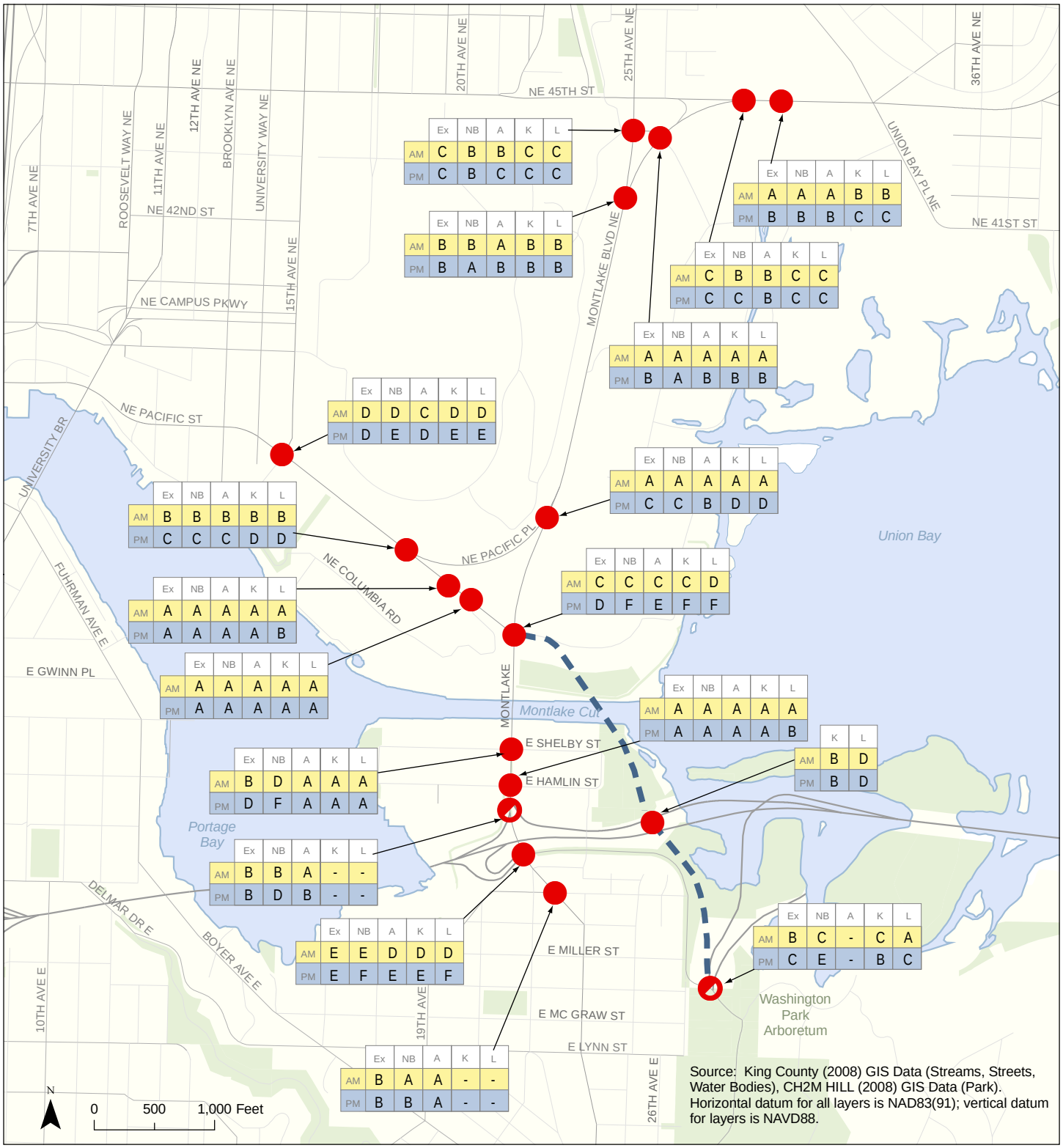
N

0 500 1,000 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-2. **SR 520/Montlake Boulevard Interchange Area – P.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



	Ex	NB	A	K	L
AM	C	B	B	C	C
PM	C	B	C	C	C

	Ex	NB	A	K	L
AM	B	B	A	B	B
PM	B	A	B	B	B

	Ex	NB	A	K	L
AM	A	A	A	B	B
PM	B	B	B	C	C

	Ex	NB	A	K	L
AM	C	B	B	C	C
PM	C	C	B	C	C

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	B	A	B	B	B

	Ex	NB	A	K	L
AM	D	D	C	D	D
PM	D	E	D	E	E

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	C	C	B	D	D

	Ex	NB	A	K	L
AM	B	B	B	B	B
PM	C	C	C	D	D

	Ex	NB	A	K	L
AM	C	C	C	C	D
PM	D	F	E	F	F

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	B

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	B

	K	L
AM	B	D
PM	B	D

	Ex	NB	A	K	L
AM	B	D	A	A	A
PM	D	F	A	A	A

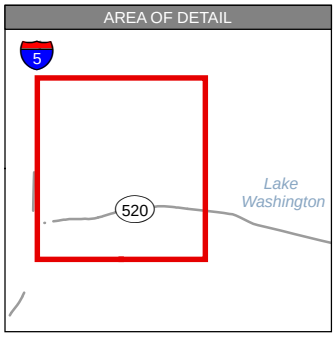
	Ex	NB	A	K	L
AM	B	B	A	-	-
PM	B	D	B	-	-

	Ex	NB	A	K	L
AM	E	E	D	D	D
PM	E	F	E	E	F

	Ex	NB	A	K	L
AM	B	C	-	C	A
PM	C	E	-	B	C

	Ex	NB	A	K	L
AM	B	A	A	-	-
PM	B	B	A	-	-

AREA OF DETAIL



No Build
Existing
Option A
Option K
Option L

		Ex	NB	A	K	L
A.M. Peak Hour	AM	B	C	B	B	C
P.M. Peak Hour	PM	C	E	C	C	D

Alternatives
Year 2030

LEVEL OF SERVICE

A-C	No/Little Congestion
D	Moderate Congestion
E	Heavy Congestion
F	Severe Congestion/Over Capacity

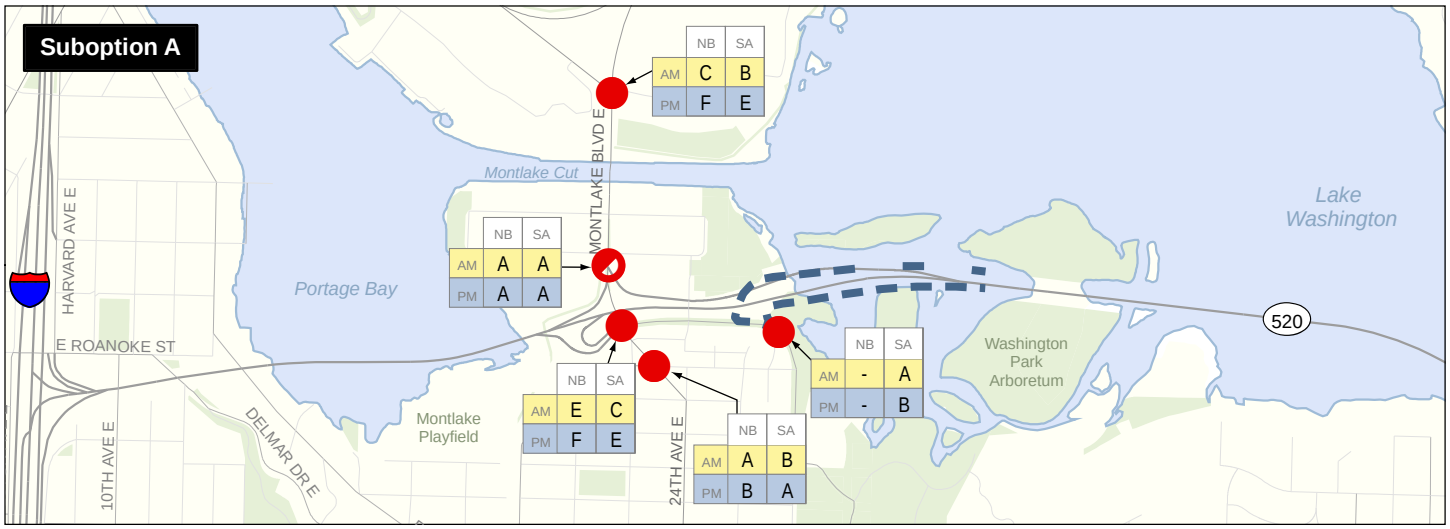
Signalized Intersection

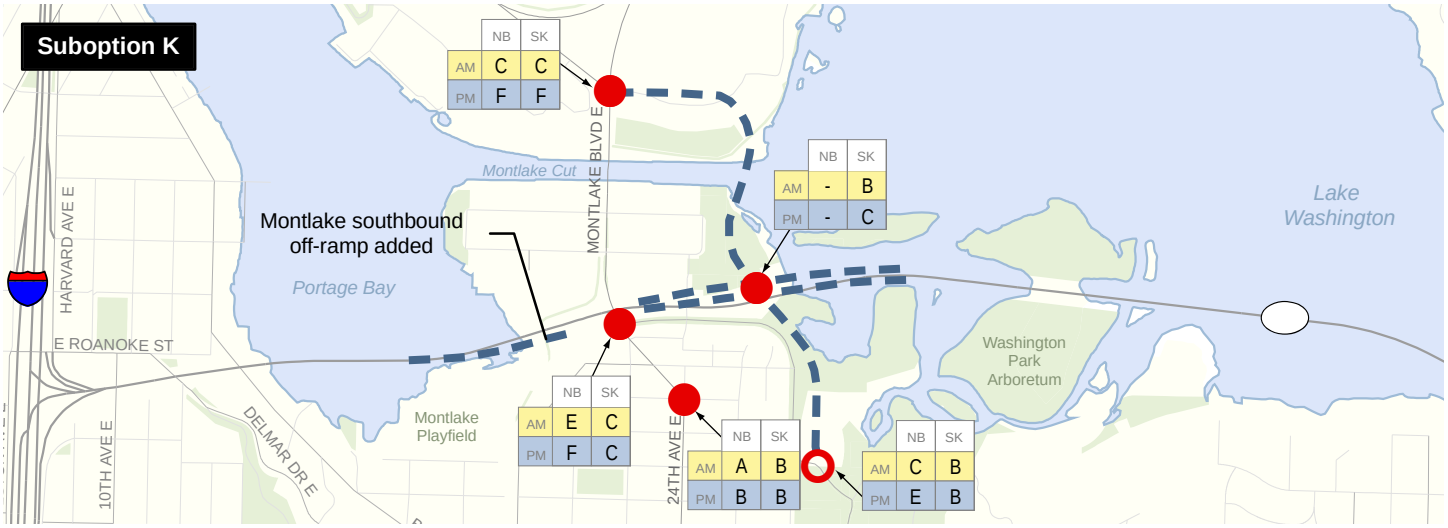
Signalized Intersection with Project

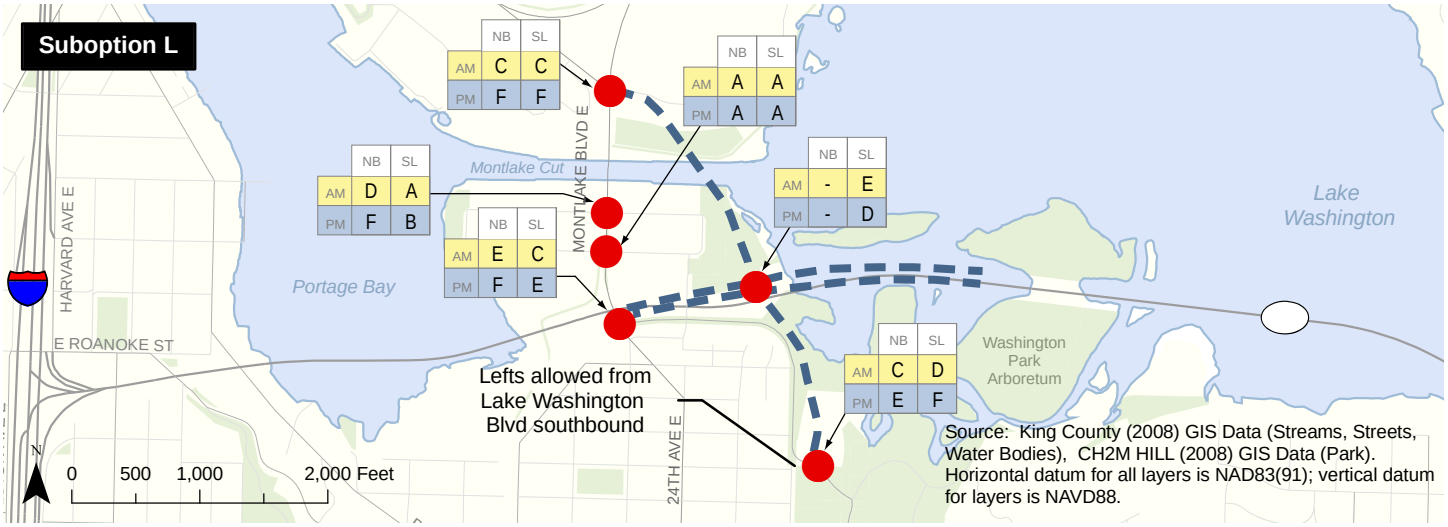
New Roadway

Exhibit 6-3. **SR 520/Montlake Boulevard Interchange Area LOS**

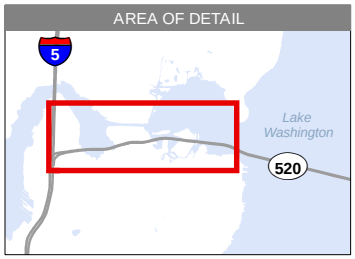
I-5 to Medina: Bridge Replacement and HOV Project







Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.



No Build — Suboption (A, K, or L)

	NB	SA
A.M. Peak Hour (AM)	C	D
P.M. Peak Hour (PM)	E	F

Alternatives

- Signalized Intersection
- Unsignalized Intersection
- Signalized Intersection with Project
- New Roadway

LEVEL OF SERVICE

A-C	No/Little Congestion
D	Moderate Congestion
E	Heavy Congestion
F	Severe Congestion/Over Capacity

Exhibit 6-4. **SR 520/Montlake Boulevard Interchange Area Suboption LOS**

I-5 to Medina: Bridge Replacement and HOV Project

SR 520/I-5/East Roanoke Street Interchange Area

The SR 520/I-5/East Roanoke Street interchange area provides access between I-5, SR 520, and the Eastlake, Portage Bay, Montlake, and Broadway neighborhoods. During the morning and afternoon peak hours, travelers encounter congestion in the area, which is partly related to freeway access and associated traffic volumes. Morning and afternoon peak-hour traffic volumes on streets within the SR 520/ I-5/East Roanoke Street interchange area are shown in Exhibits 6-5 and 6-6.

There is only one intersection in the SR 520/I-5/East Roanoke Street interchange area where traffic operations fall below LOS D (see Exhibit 6-7). During the morning and afternoon peak hours, the signal at the East Roanoke Street/Harvard Avenue East/SR 520 westbound off-ramp intersection provides access from westbound SR 520 to nearby neighborhoods.

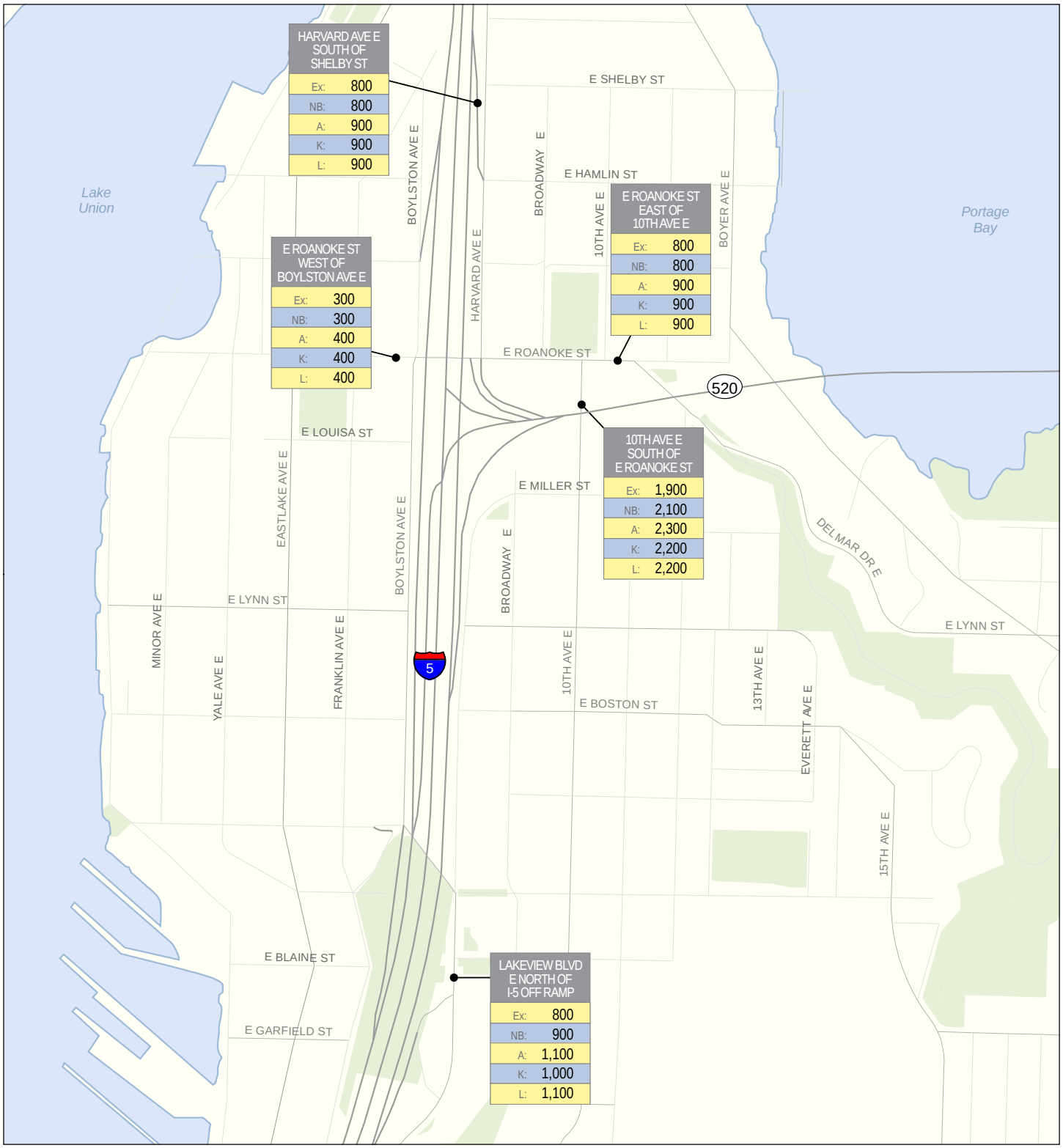
During the morning peak hour, this intersection operates at LOS F because westbound through traffic on East Roanoke Street is over capacity. Congestion spills back and affects operations at the East Roanoke/10th Avenue East intersection.

During the afternoon peak hour, this intersection operates at LOS F because westbound through traffic on East Roanoke Street and southbound left-turning traffic on Harvard Avenue East are over capacity. Generally, the westbound SR 520 off-ramp queue does not extend onto the SR 520 mainline.

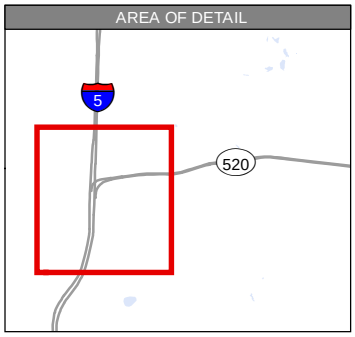
I-5/NE 45th Street Interchange Area

The I-5/NE 45th Street interchange area provides access between I-5, the I-5 express lanes, and the Wallingford and University District neighborhoods. Morning and afternoon peak-hour traffic volumes on streets within the I-5/NE 45th Street interchange area are shown in Exhibits 6-8 and 6-9.

Travelers encounter some moderate congestion in the area during the morning and afternoon peak hours, which is partly related to freeway ramp meter operations. Today, all of the study intersections at the I-5/NE 45th Street interchange area operate acceptably at LOS D or better during both peak periods, as shown in Exhibit 6-10.



AREA OF DETAIL



LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

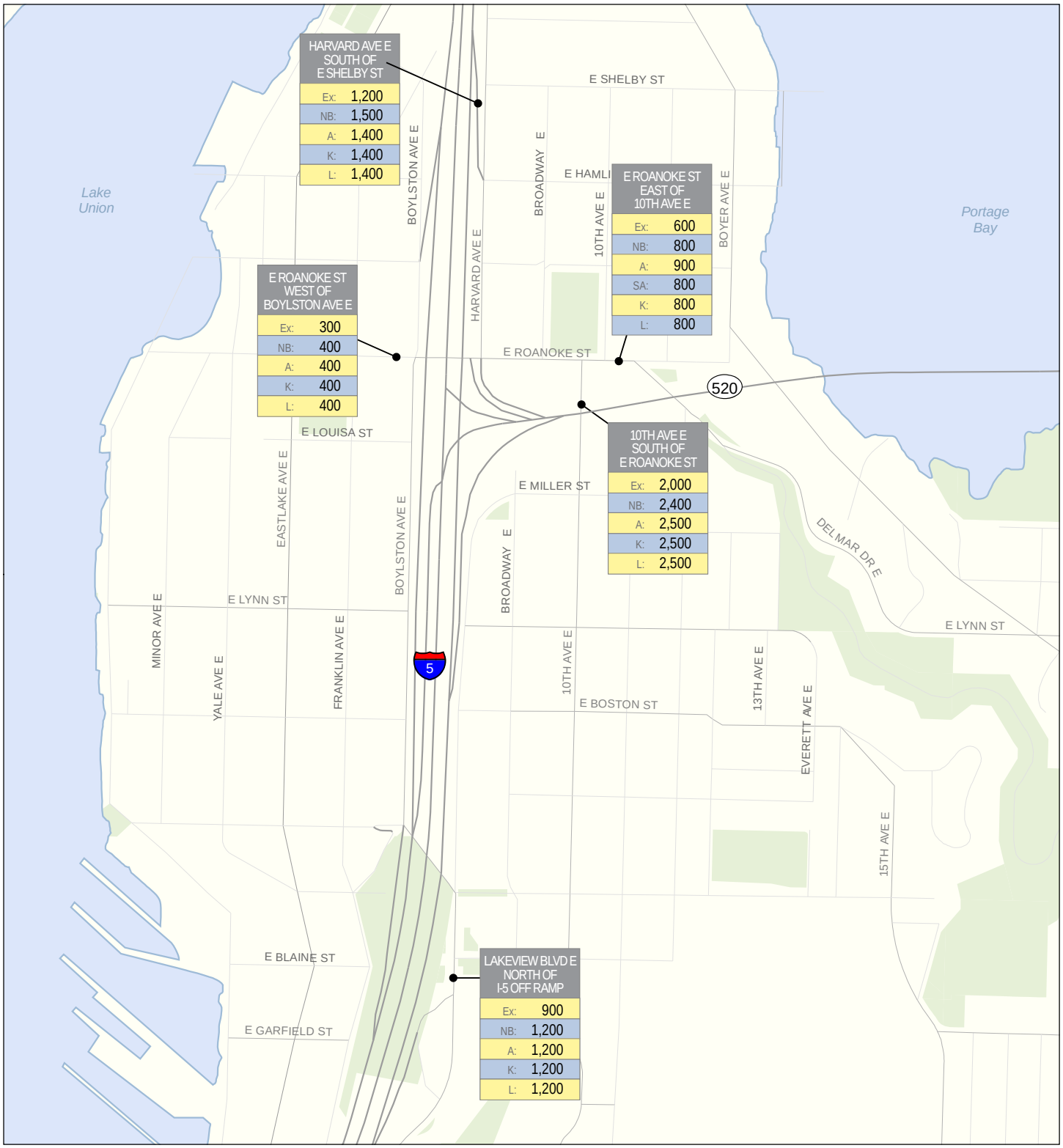
N

0 500 1,000 Feet

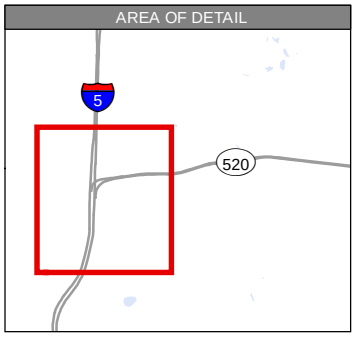
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-5. **SR 520/I-5/East Roanoke Street Interchange Area – A.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



AREA OF DETAIL



LOCATION	
Existing	Ex: Volume
No Build	NB: Volume
6L Option	A: Volume
6L Suboption	SA: Volume

Volumes are totals for both directions

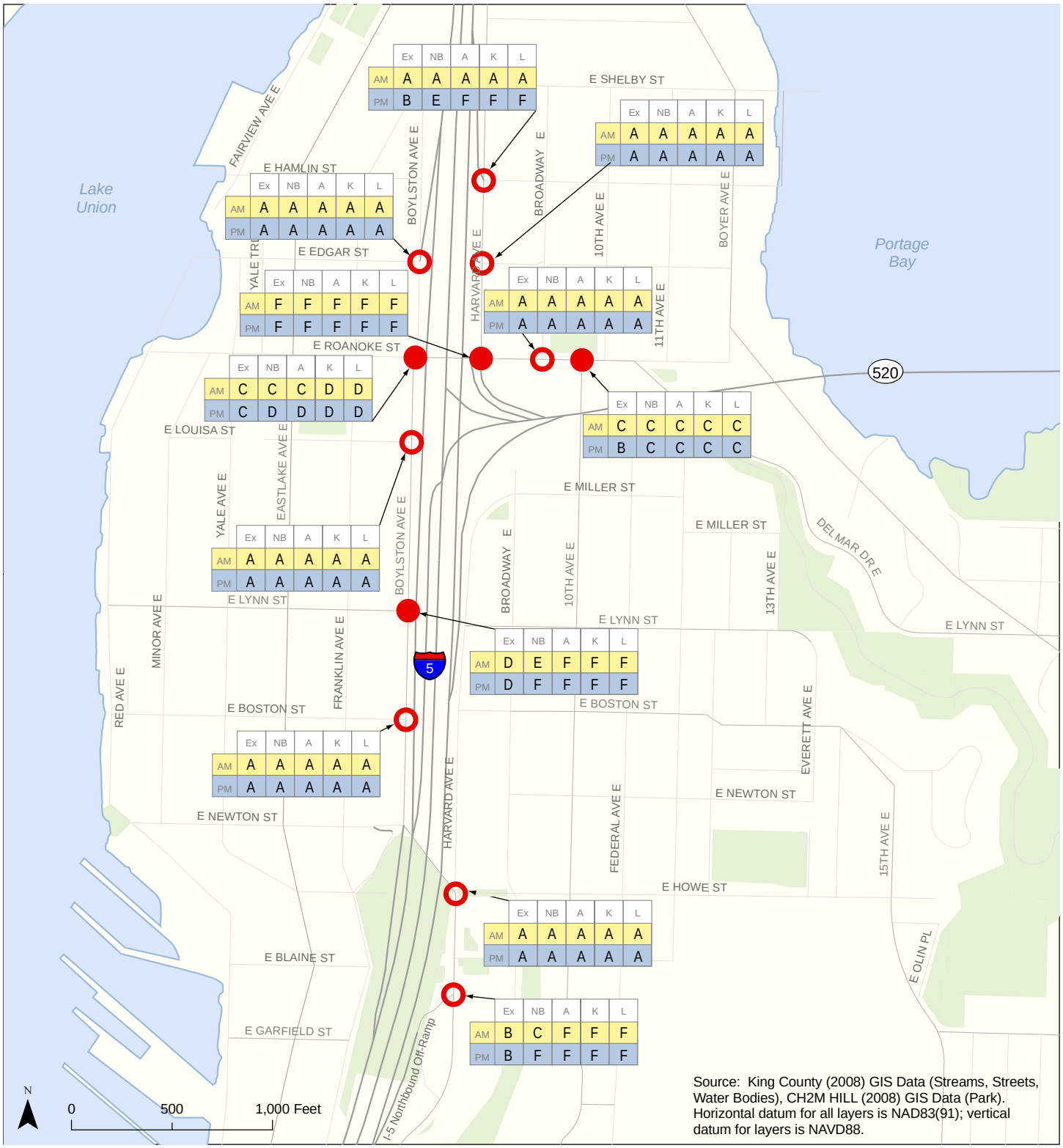
N

0 500 1,000 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-6. **SR 520/I-5/East Roanoke Street Interchange Area – P.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	B	E	F	F	F

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

	Ex	NB	A	K	L
AM	F	F	F	F	F
PM	F	F	F	F	F

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

	Ex	NB	A	K	L
AM	C	C	C	D	D
PM	C	D	D	D	D

	Ex	NB	A	K	L
AM	C	C	C	C	C
PM	B	C	C	C	C

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

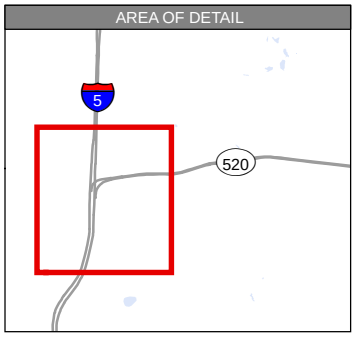
	Ex	NB	A	K	L
AM	D	E	F	F	F
PM	D	F	F	F	F

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

	Ex	NB	A	K	L
AM	A	A	A	A	A
PM	A	A	A	A	A

	Ex	NB	A	K	L
AM	B	C	F	F	F
PM	B	F	F	F	F

AREA OF DETAIL



No Build
Existing
Option A
Option K
Option L

	Ex	NB	A	K	L
A.M. Peak Hour AM	B	C	B	B	C
P.M. Peak Hour PM	C	E	C	C	D

Alternatives
Year 2030

LEVEL OF SERVICE

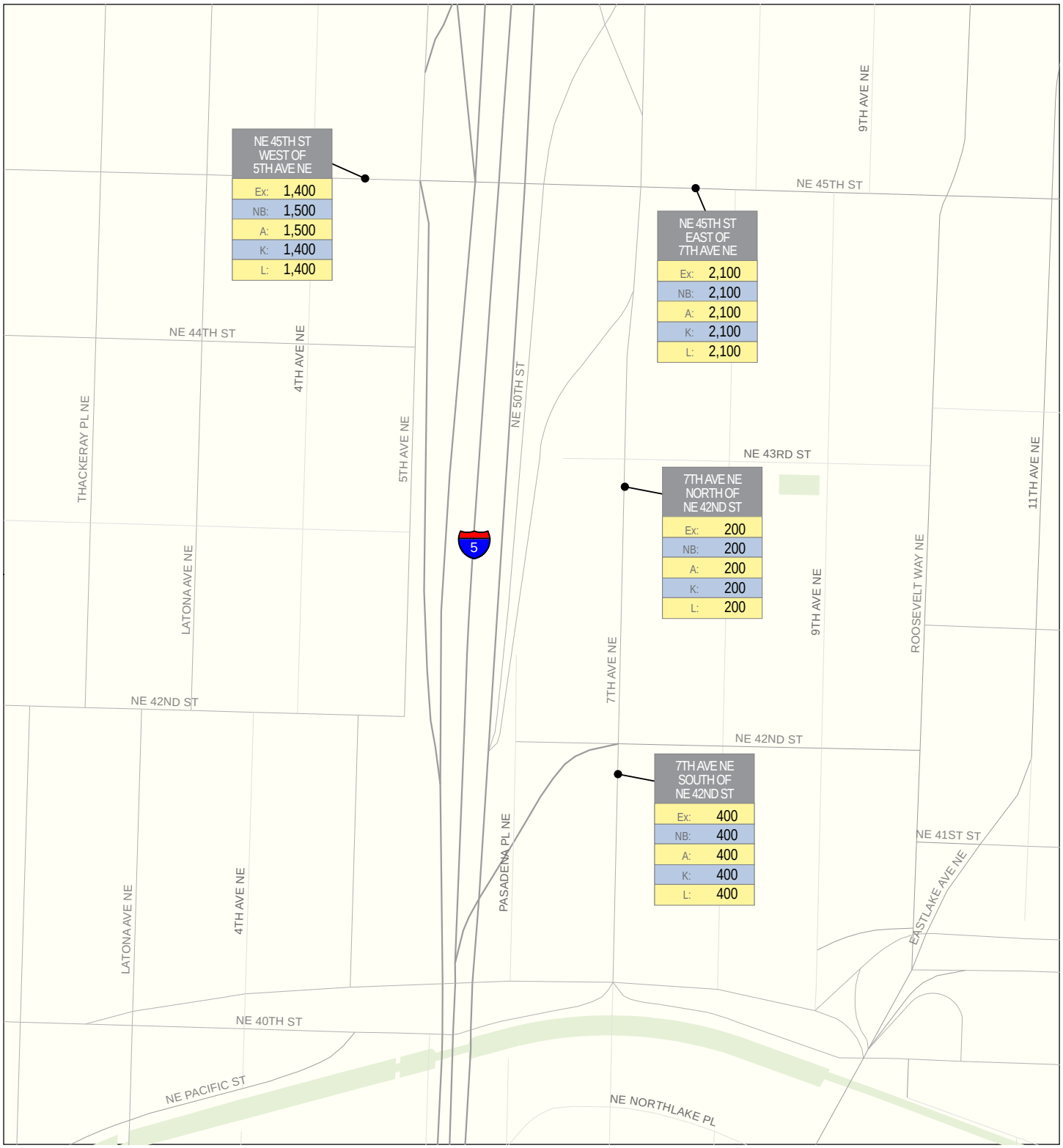
A-C	No/Little Congestion
D	Moderate Congestion
E	Heavy Congestion
F	Severe Congestion/Over Capacity

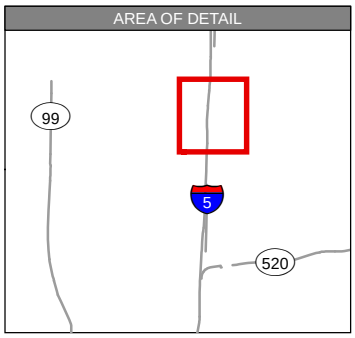
Signalized Intersection

Unsignalized Intersection

Exhibit 6-7. **SR 520/I-5/East Roanoke Street Interchange Area LOS**

I-5 to Medina: Bridge Replacement and HOV Project





LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

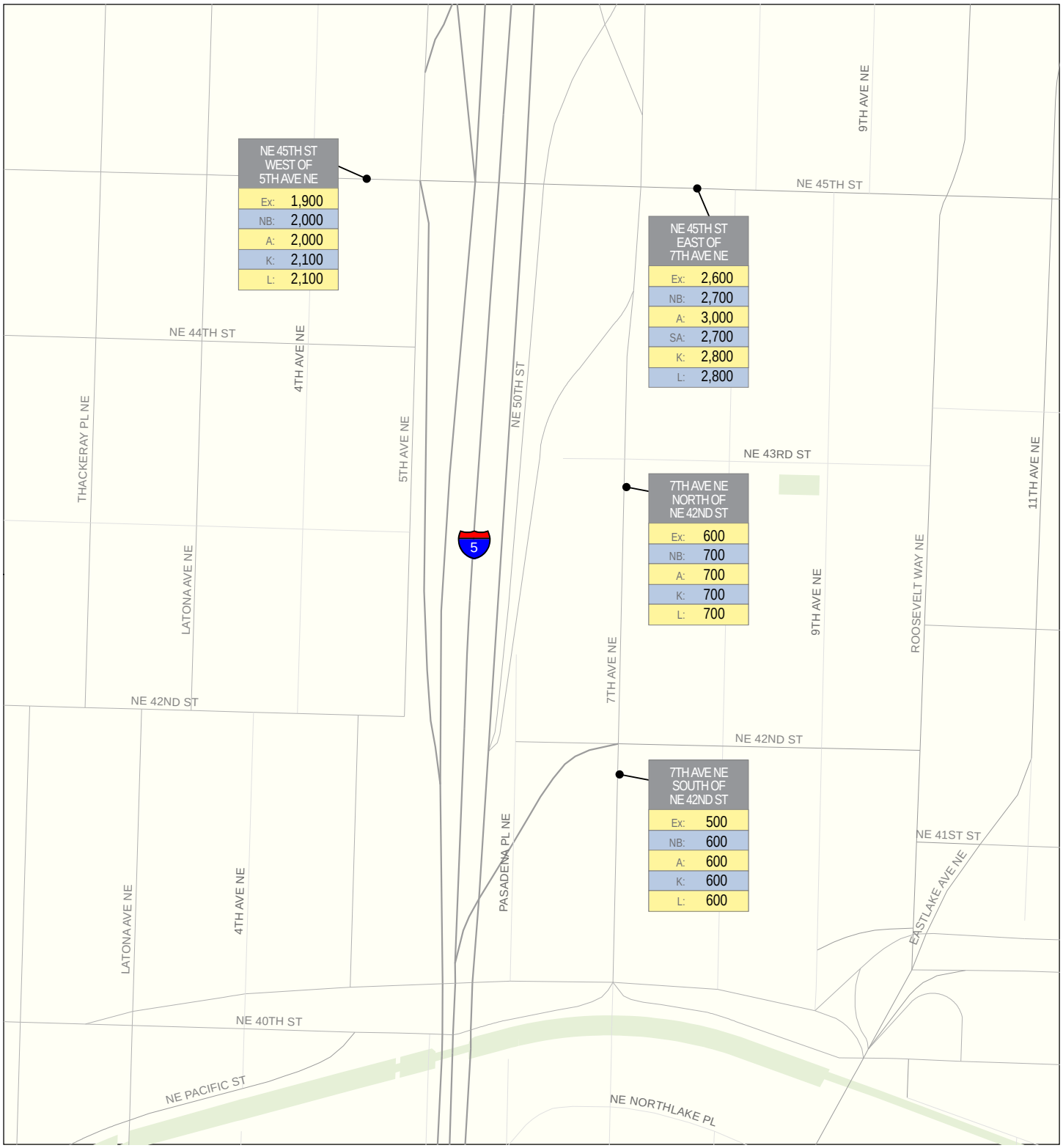
N

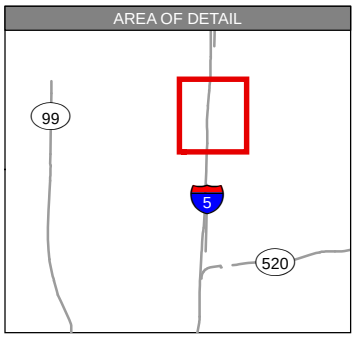
0 100 200 400 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-8. **I-5/Northeast 45th Street Interchange Area – A.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project





LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

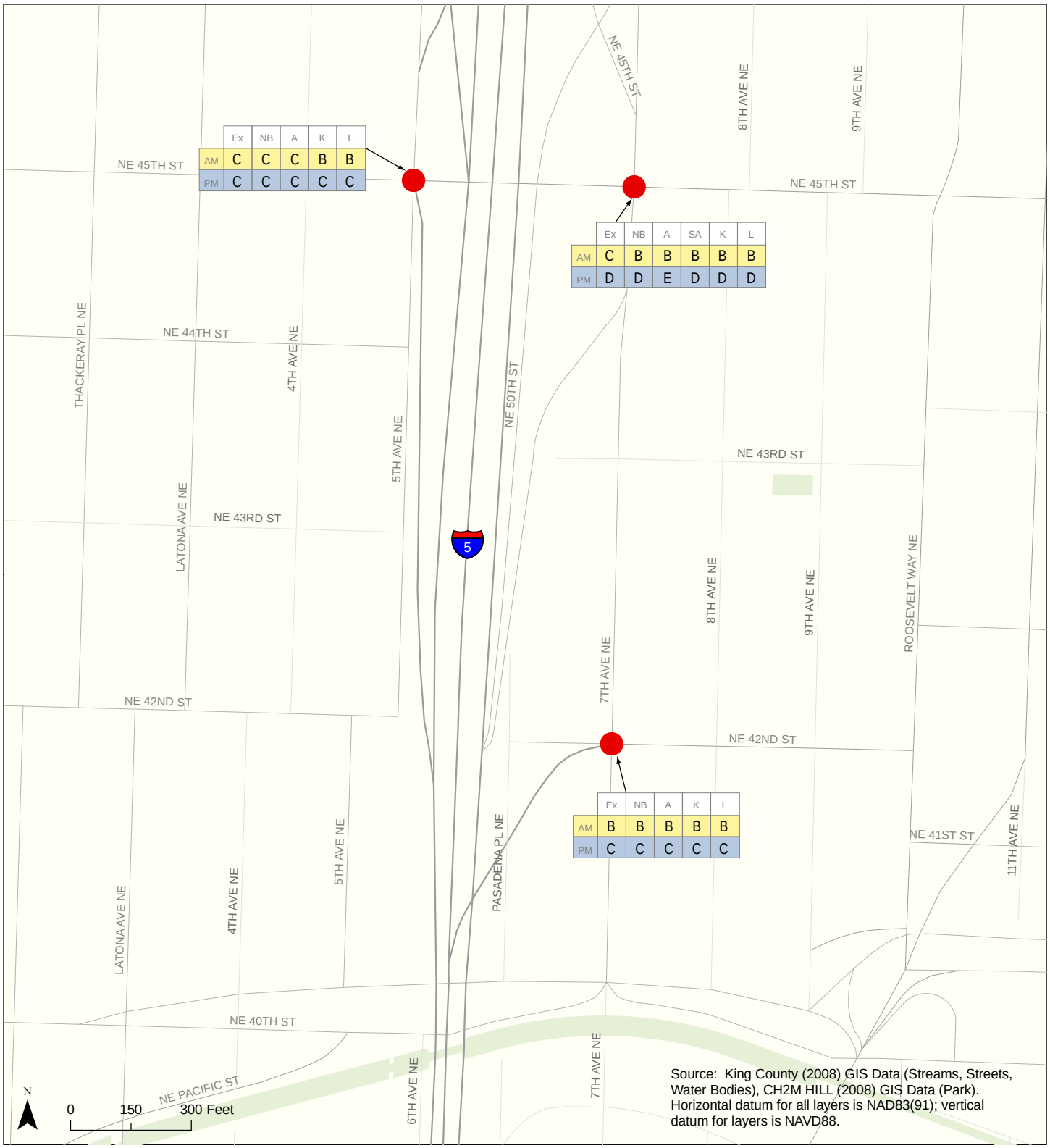
N

0 100 200 400 Feet

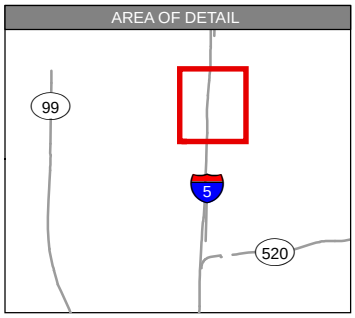
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-9. **I-5/Northeast 45th Street Interchange Area – P.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



AREA OF DETAIL



No Build — Existing — Option A — Option K — Option L

		Ex	NB	A	K	L
A.M. Peak Hour	AM	B	C	B	B	C
P.M. Peak Hour	PM	C	E	C	C	D

Alternatives
Year 2030

Signalized Intersection

LEVEL OF SERVICE

A-C	No/Little Congestion
D	Moderate Congestion
E	Heavy Congestion
F	Severe Congestion/Over Capacity

Exhibit 6-10. **I-5/Northeast 45th Street Interchange Area LOS**

I-5 to Medina: Bridge Replacement and HOV Project

I-5/Mercer Street Interchange Area

The I-5/Mercer Street interchange area provides access to and from I-5 and the I-5 express lanes, and Mercer Street connects the Seattle Center area, Queen Anne, South Lake Union, and Elliott Avenue with I-5. Morning and afternoon peak-hour traffic volumes on streets within the I-5/Mercer Street interchange area are shown in Exhibits 6-11 and 6-12. As shown in Exhibit 6-13, the Mercer Street/I-5 ramps/Fairview Avenue intersection operates at LOS F today during both peak hours because the intersection is over capacity.

I-5/Stewart Street Interchange Area

The I-5/Stewart Street interchange area provides access to and from southbound I-5 and the I-5 express lanes for downtown Seattle. Travel on city streets is influenced by freeway access and the connection that Denny Way provides between Capitol Hill and the north end of downtown Seattle and South Lake Union. Stewart Street is also a primary bus corridor into the north end of downtown Seattle, which affects traffic operations in the far right lane because drivers want to avoid being delayed behind buses serving the bus stops.

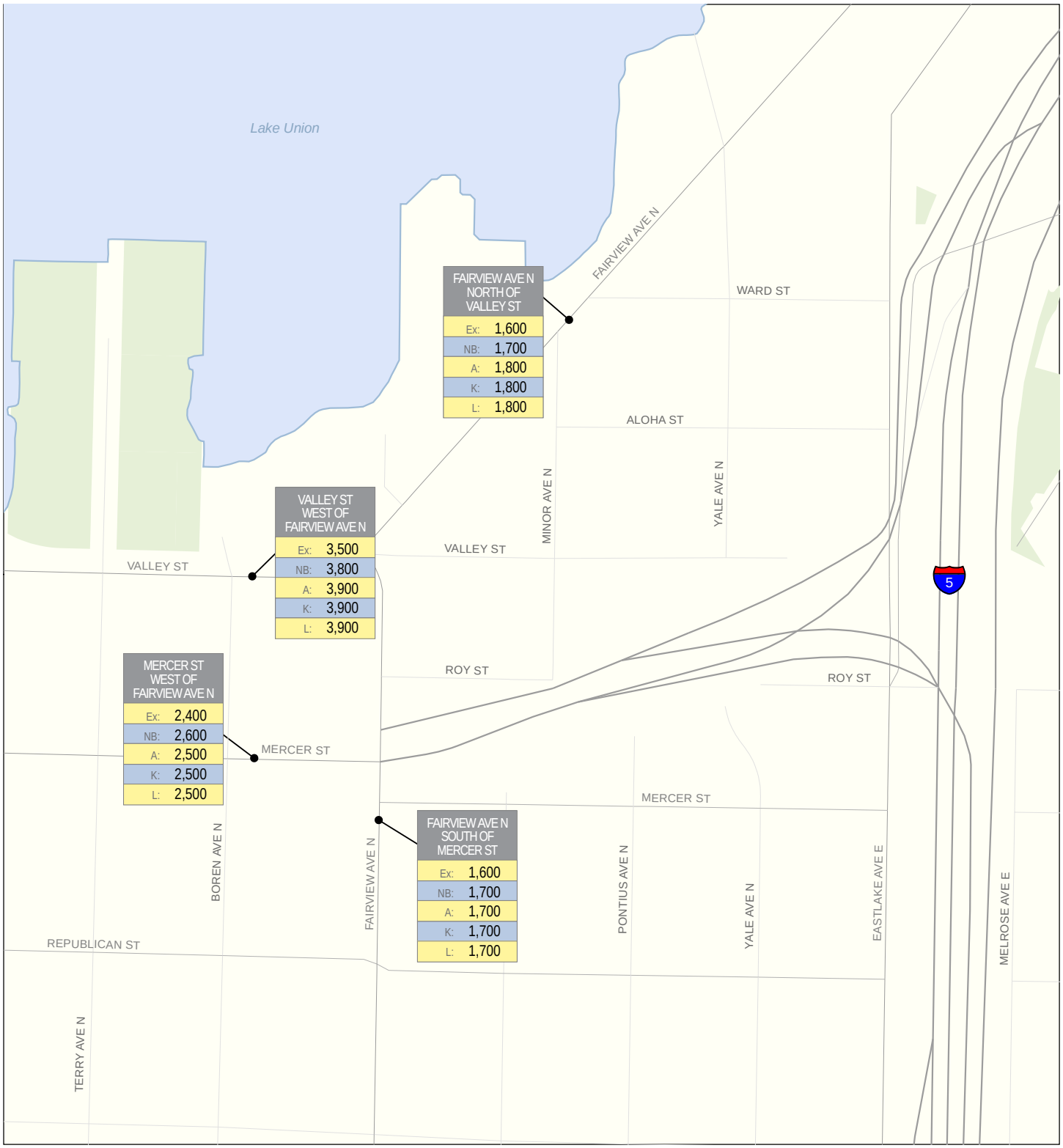
During the morning and afternoon peak hours, travelers encounter congestion in the area, which is partly related to the freeway access and the associated traffic volumes. Morning and afternoon peak-hour traffic volumes on streets within the I-5/Stewart Street interchange area are shown in Exhibits 6-14 and 6-15.

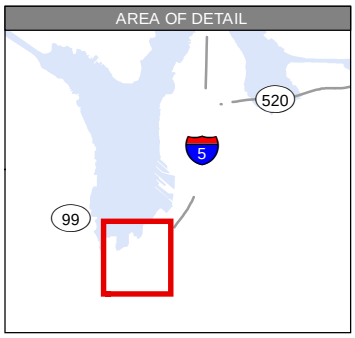
Signal timing and coordination is complex in this area because of the closely spaced and “irregular” intersections (more than four approaches) of the Stewart Street/Denny Way and Stewart Street/Yale Avenue. These intersections are located approximately 100 feet apart and share a traffic controller that operates with “clustered signal phasing” to ensure coordinated signal timing. However, substantial differences in traffic volumes at the two intersections make it difficult to serve traffic volumes and maintain signal coordination.

As shown in Exhibit 6-16, two intersections currently operate worse than LOS D during the peak hours.

Stewart Street/Denny Way

During the morning peak hour, this intersection operates at LOS E because the eastbound left-turn, westbound left-turn, and southwest





LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

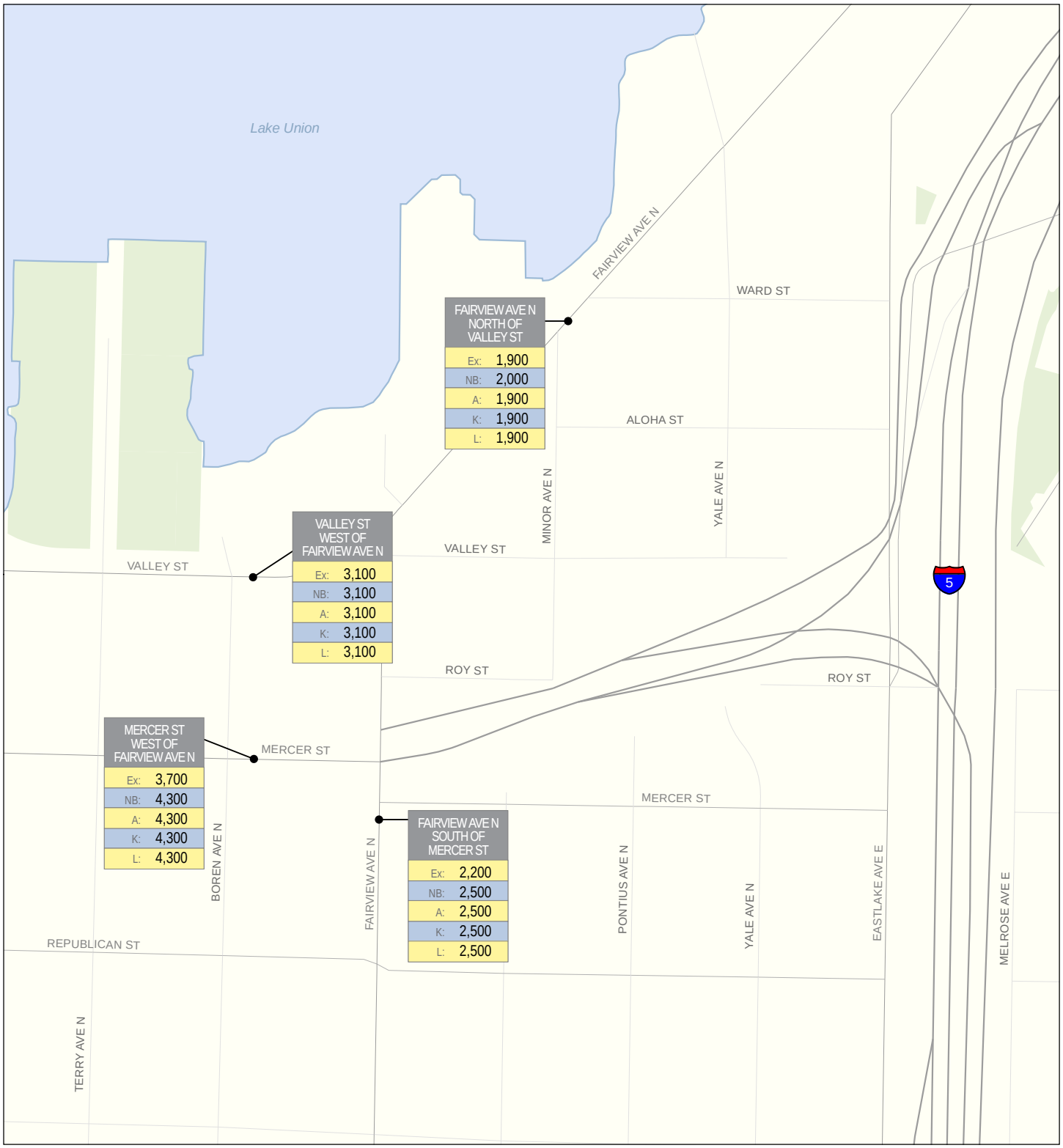
N

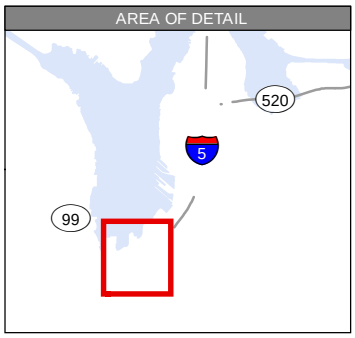
0 100 200 400 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-11. **I-5/Mercer Street Interchange Area – A.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project





LOCATION	
Existing — Ex:	Volume
No Build — NB:	Volume
6L Option — A:	Volume
6L Suboption — SA:	Volume

Volumes are totals for both directions

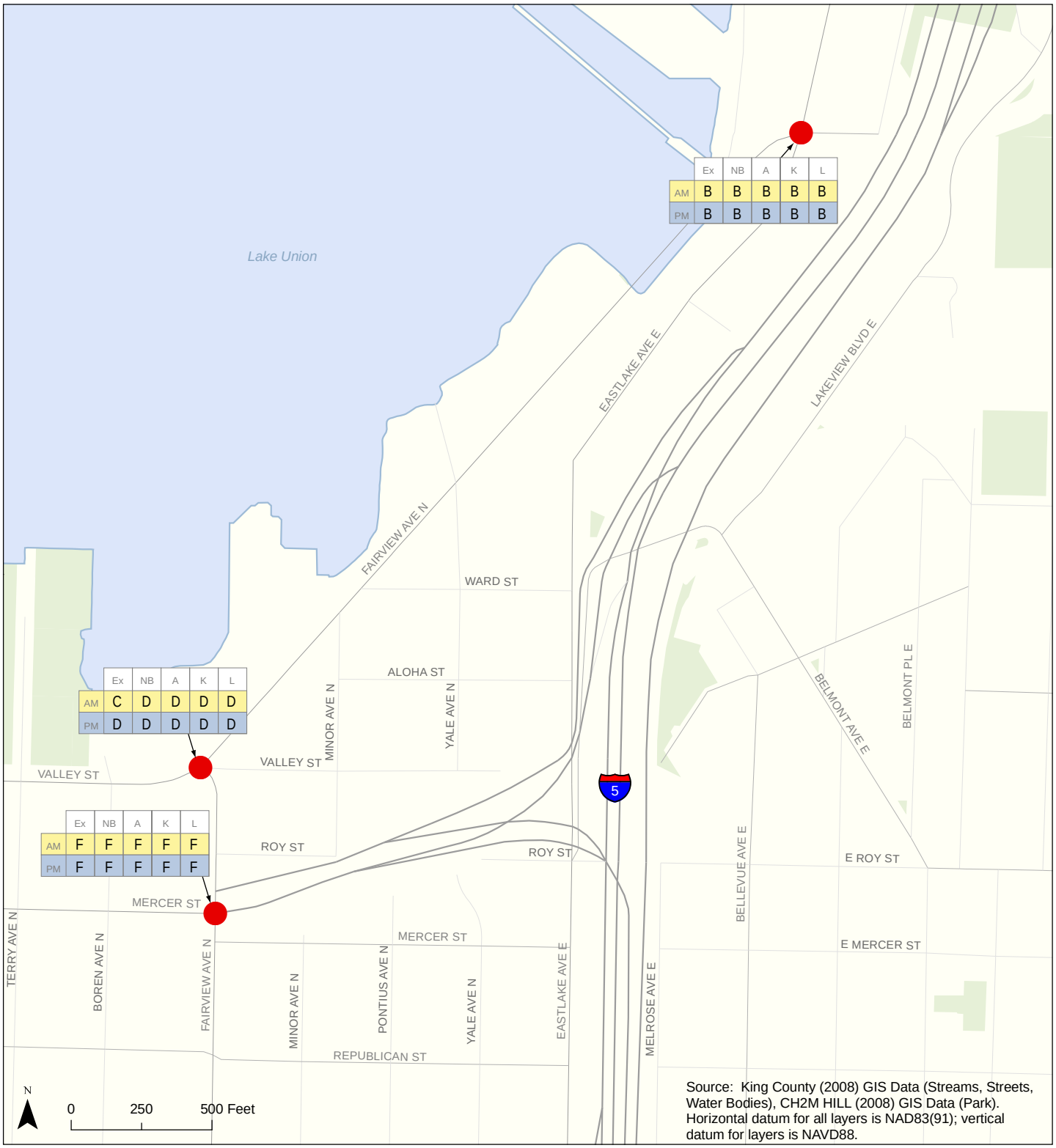
N

0 100 200 400 Feet

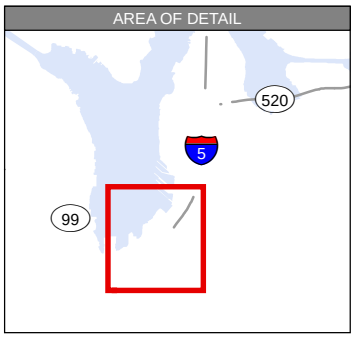
Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-12. **I-5/Mercer Street Interchange Area – P.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.



		No Build Existing		Option A	Option K	Option L
		Ex	NB	A	K	L
A.M. Peak Hour	AM	B	C	B	B	C
P.M. Peak Hour	PM	C	E	C	C	D

Alternatives
Year 2030

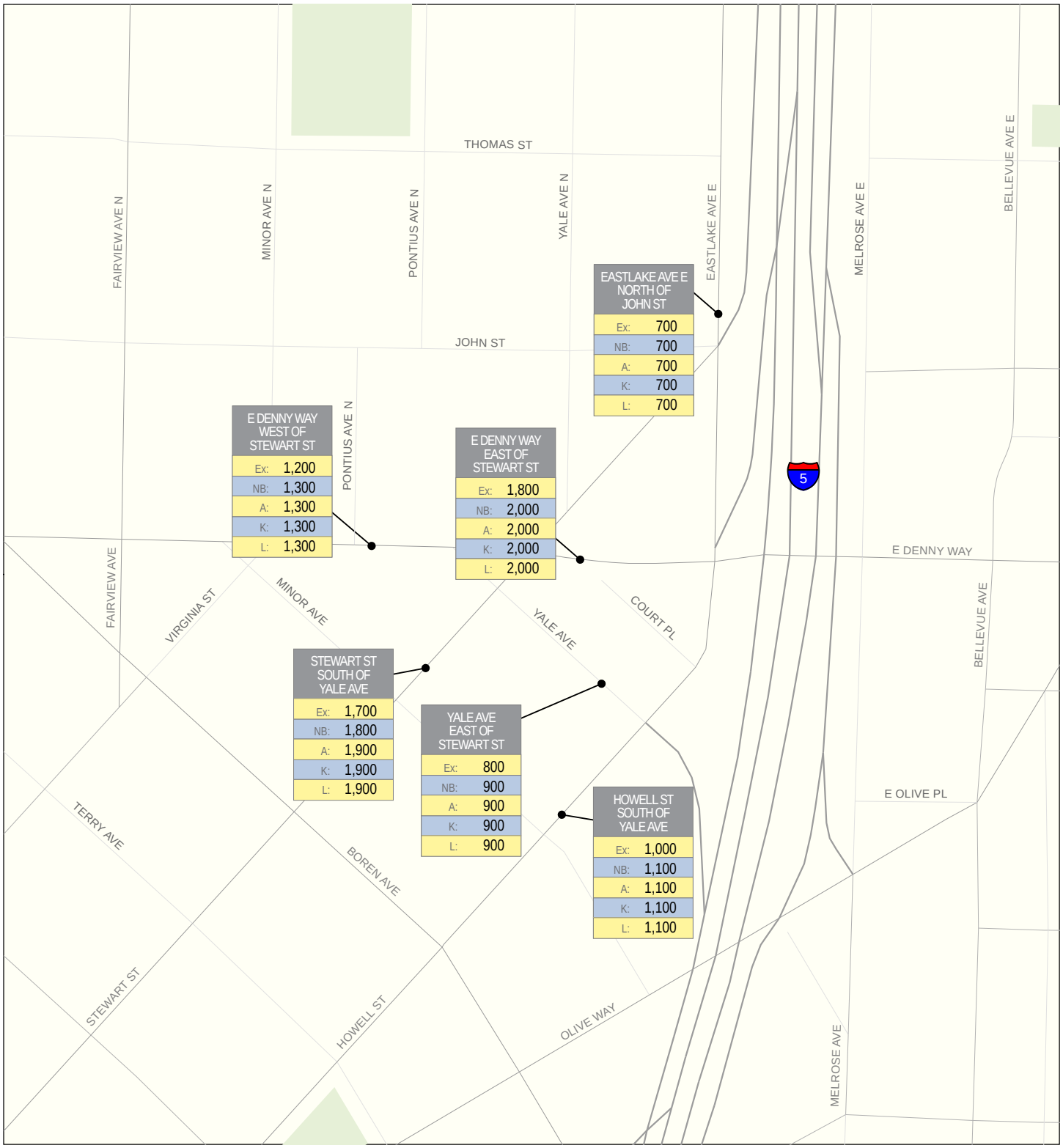
Signalized Intersection

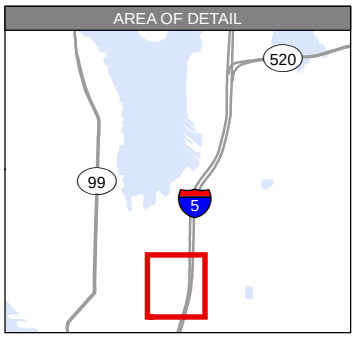
LEVEL OF SERVICE

A-C	No/Little Congestion
D	Moderate Congestion
E	Heavy Congestion
F	Severe Congestion/Over Capacity

Exhibit 6-13. **I-5/Mercer Street Interchange Area LOS**

I-5 to Medina: Bridge Replacement and HOV Project





LOCATION
Ex: Volume
NB: Volume
A: Volume
SA: Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

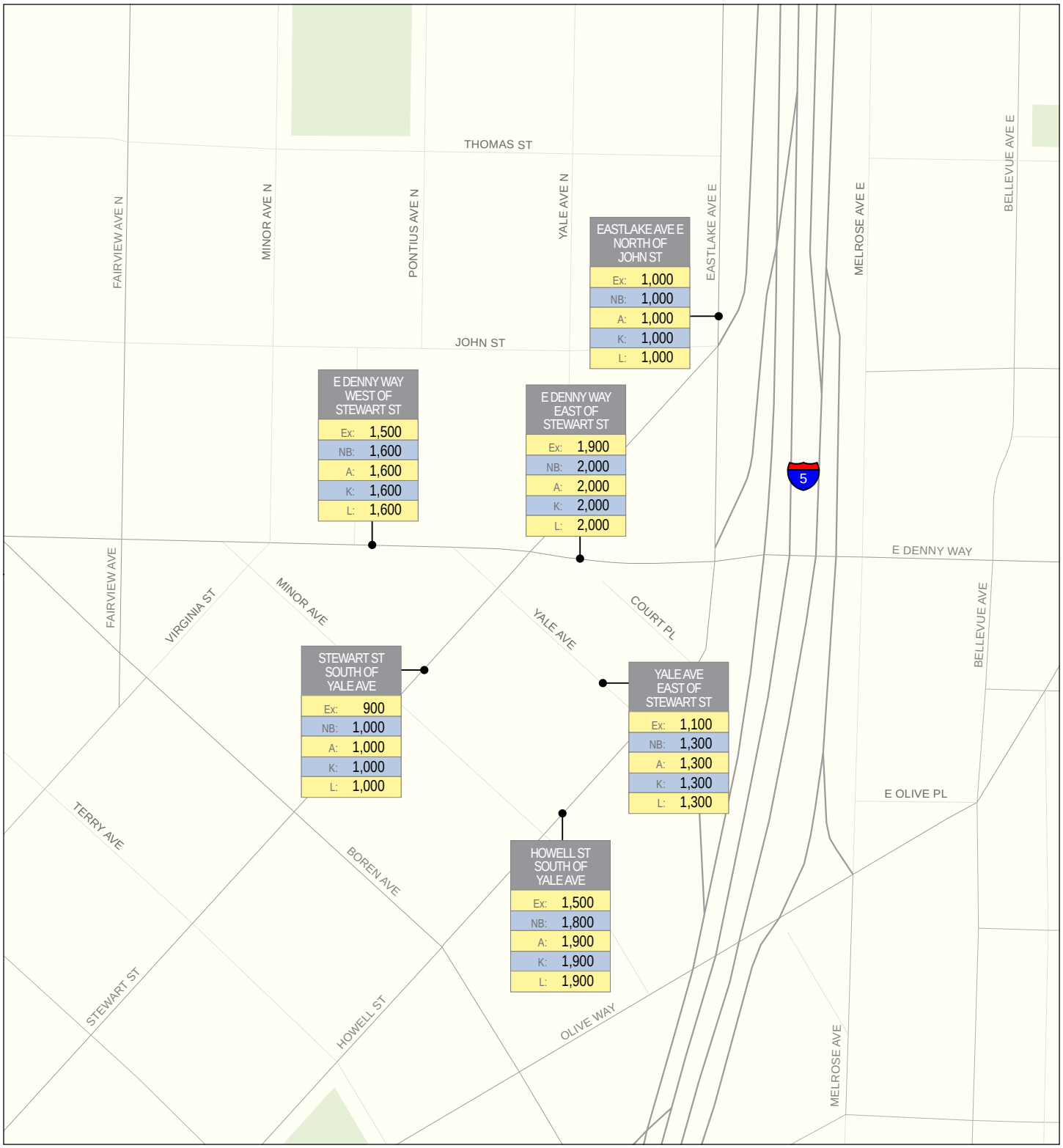
N

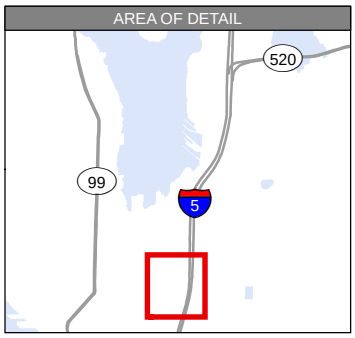
0 100 200 400 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-14. **I-5/Stewart Street Interchange Area – A.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project





LOCATION	
Ex:	Volume
NB:	Volume
A:	Volume
SA:	Volume

Existing
No Build
6L Option
6L Suboption

Volumes are totals for both directions

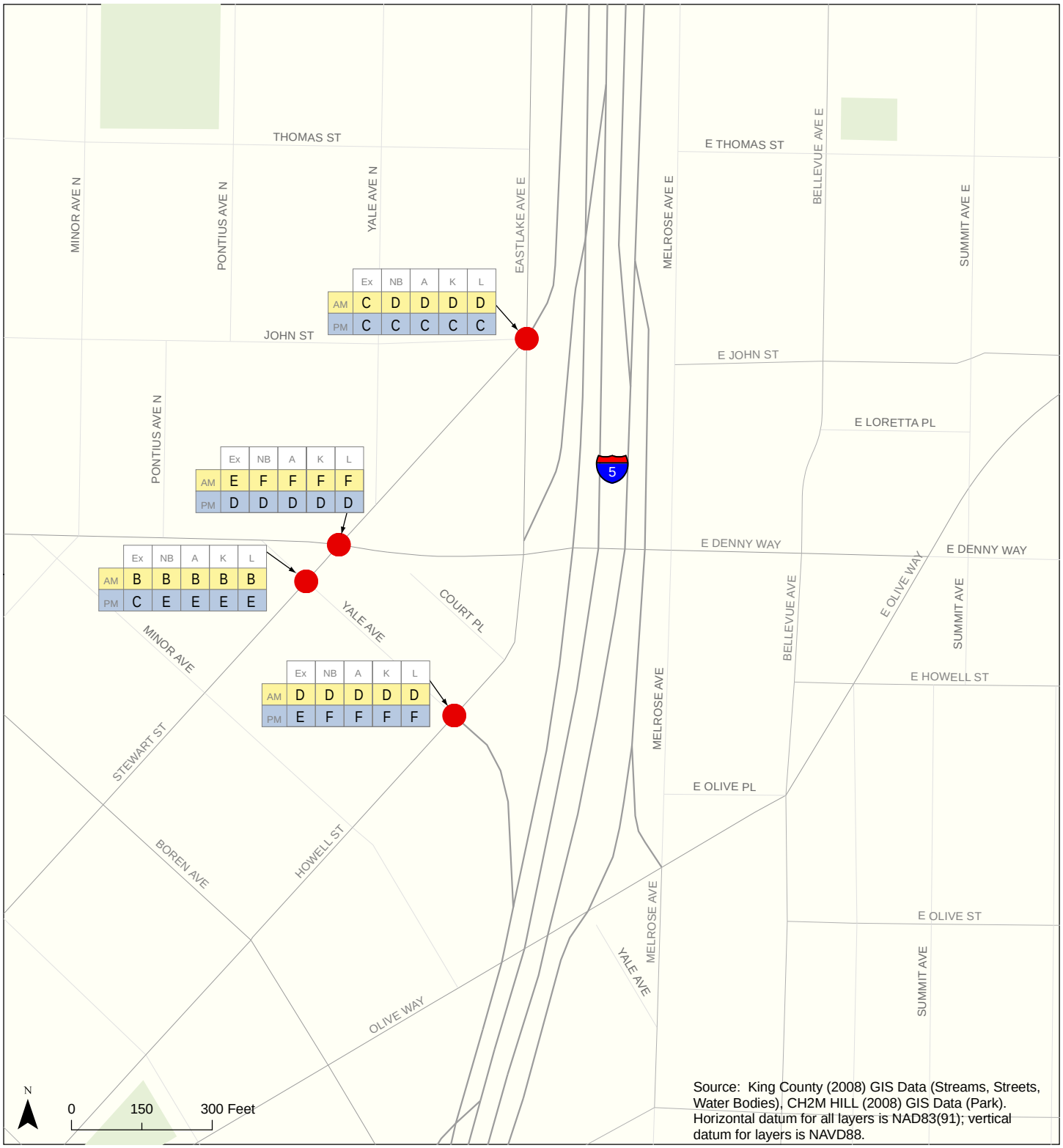
N

0 100 200 400 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-15. **I-5/Stewart Street Interchange Area – P.M. Peak Hour Vehicle Volumes**

I-5 to Medina: Bridge Replacement and HOV Project



	Ex	NB	A	K	L
AM	C	D	D	D	D
PM	C	C	C	C	C

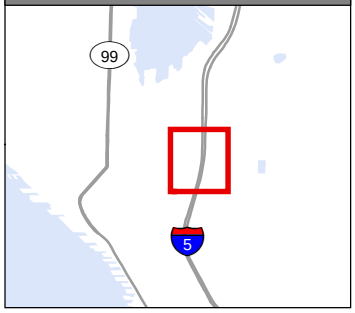
	Ex	NB	A	K	L
AM	E	F	F	F	F
PM	D	D	D	D	D

	Ex	NB	A	K	L
AM	B	B	B	B	B
PM	C	E	E	E	E

	Ex	NB	A	K	L
AM	D	D	D	D	D
PM	E	F	F	F	F

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

AREA OF DETAIL



No Build
Existing
Option A
Option K
Option L

		Ex	NB	A	K	L
A.M. Peak Hour	AM	B	C	B	B	C
P.M. Peak Hour	PM	C	E	C	C	D

Alternatives
Year 2030

Signalized Intersection

LEVEL OF SERVICE

A-C No/Little Congestion
D Moderate Congestion
E Heavy Congestion
F Severe Congestion/Over Capacity

Exhibit 6-16. **I-5/Stewart Street Interchange Area LOS**

I-5 to Medina: Bridge Replacement and HOV Project

through lanes are over capacity. Congestion can back up through the Stewart Street/Eastlake Avenue East intersection.

Howell Street/Yale Avenue/I-5 Southbound On-Ramp

During the afternoon peak hour, this intersection operates at LOS E. The northeast through lane and southeast through/right-turn lanes are over capacity (all other lanes have capacity remaining). Congestion can back up through the Stewart Street/Yale Avenue intersection.

The primary congestion point in this area is along Howell Street approaching the Howell Street/Yale Avenue/southbound I-5 on-ramp during the afternoon commute. This area experiences high volumes in the afternoon because it provides access to the southbound I-5 mainline as well as the I-5 express lane on-ramp on Eastlake Avenue.

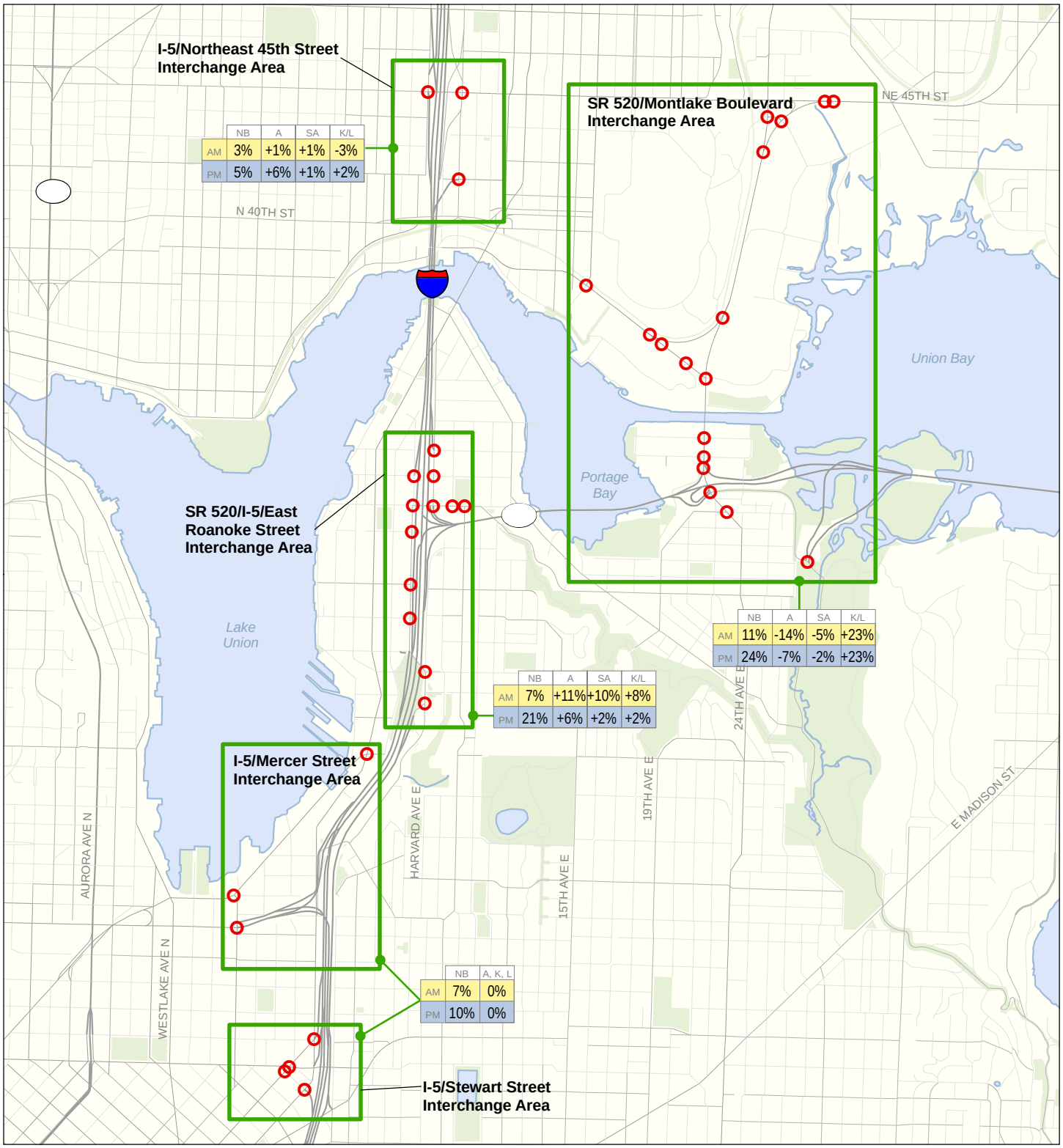
What would traffic be like at the study area interchanges in 2030 without the project?

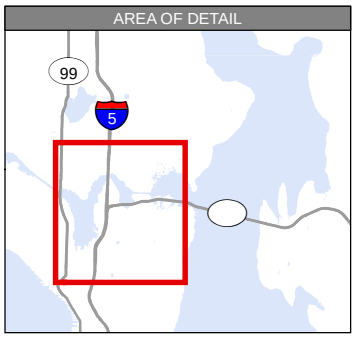
As discussed in Chapter 5, Freeway Volumes and Operations, the region will grow by an additional 1.1 million people by 2030, add over 850,000 new jobs, and need to accommodate close to 50 percent more traffic (PSRC 2007). In Seattle, the largest increases in population and employment are forecast for the South Lake Union, Denny Regrade/Triangle, and downtown Seattle areas. Chapter 5 summarizes population and employment changes between now and the year 2030. Because of these increases, traffic volumes at the study area interchange areas are forecasted to increase between 3 and 24 percent, depending on the time of day and interchange area. Exhibit 6-17 shows growth rates by interchange area and alternative.

The following sections describe how traffic operations in each of the study area interchanges would change by the year 2030 if the project were not built.

SR 520/Montlake Boulevard Interchange Area

The travel demand model forecasted that by the year 2030, traffic demand in the Montlake and Lake Washington Boulevard neighborhood areas (from north of the Montlake Boulevard/Pacific Street intersection to south of the SR 520/Montlake Boulevard





Study Intersection

Year 2030 No Build — ±% Change vs. No Build

		NB	A	SA	K/L
A.M. Peak Hour	AM	3%	+1%	+1%	-3%
P.M. Peak Hour	PM	5%	+6%	+1%	+2%

% Change vs. Existing

N

0 500 1,000 2,000 Feet

Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Park). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 6-17. **Future Traffic Volume Changes**

I-5 to Medina: Bridge Replacement and HOV Project

interchange) would increase by approximately 11 percent during the morning peak hour and 24 percent during the afternoon peak hour. The growth in traffic volumes occurs from a mix of land use changes and travel mode choice shifts, which also affect travel patterns. The peak-hour volumes shown in Exhibits 6-1 and 6-2 for the SR 520/Montlake Boulevard interchange area show how traffic volume changes within the larger interchange area would affect specific streets.

With these increases, congestion is expected to worsen compared to today's conditions. Intersections in the SR 520/Montlake Boulevard interchange area where traffic operations would degrade to worse than LOS D under the No Build Alternative are described in detail below. Exhibits 6-3 and 6-4 show intersection LOS designations.

Montlake Boulevard/Lake Washington Boulevard/SR 520 Eastbound Ramps

As discussed in Chapter 5, eastbound SR 520 is congested for approximately 3 hours during the morning peak period. As a result, congestion backs up through the Montlake Boulevard/Lake Washington Boulevard/SR 520 ramps intersection and onto adjacent arterials. Congestion on Montlake Boulevard southbound traffic can extend as far back as NE 45th Street.

During the morning peak hour, this intersection would operate at LOS E as it does today, with the eastbound off-ramp operating over capacity. Congestion on all approaches would worsen compared to today's conditions. Northbound congestion would affect the Montlake Boulevard/Roanoke Street intersection, and southbound congestion would affect the westbound SR 520 on-ramp intersection. Congestion on the eastbound off-ramp would not affect SR 520 mainline operations.

During the afternoon peak hour, intersection operations would worsen from LOS E today to LOS F in 2030 under the No Build Alternative, with all lanes operating over capacity. At its worst, congestion on the eastbound SR 520 off-ramp would extend back onto the eastbound SR 520 mainline. Large queues would occur on all approaches and affect adjacent intersections. Montlake Boulevard southbound would often be congested as far back as NE 45th Street.

Montlake Boulevard/NE Pacific Street

During the afternoon peak hour, intersection operations would worsen to LOS F with the No Build Alternative because of increases in traffic volumes expected between now and the year 2030. This intersection,

which is currently at capacity, would be 26 percent over capacity in 2030 with the No Build Alternative. Congestion at this intersection would continue to affect adjacent intersections, with congestion extending as far north as 25th Avenue NE during the afternoon peak hour.

NE Pacific Street/15th Avenue NE

In the afternoon peak hour, intersection operations would worsen from LOS D today to LOS E in 2030 under the No Build Alternative. Increased traffic volumes on NE Pacific Street eastbound, as well as on both directions of 15th Avenue NE, would cause longer delays at this intersection. In particular, the southbound left-turn lane would be slightly over capacity and the eastbound through movement would be at capacity.

Lake Washington Boulevard/SR 520 Ramps

In the afternoon peak hour, intersection operations would worsen from LOS C today to LOS E in 2030 under the No Build Alternative. With all-way stop control and the forecasted increase in traffic volumes between now and the year 2030, delays would increase at the SR 520 westbound off-ramp and on Lake Washington Boulevard eastbound. The increased congestion on the SR 520 westbound off-ramp would not affect SR 520 mainline operations.

Montlake Boulevard/East Shelby Street

During the afternoon peak hour, operations at this intersection would worsen from LOS D today to LOS F under the No Build Alternative because of increased traffic on Montlake Boulevard forecasted between now and the year 2030. Congestion at this intersection would extend into adjacent intersections to the north and south.

SR 520/I-5/East Roanoke Street Interchange Area

The travel demand model forecasted that traffic demand in the SR 520/I-5/East Roanoke Street interchange area would increase by approximately 7 percent during the morning peak hour and 21 percent during the afternoon peak hour by the year 2030 (see Exhibit 6-17). The growth in traffic demand occurs because of the mix of land use changes and travel mode choice shifts, which affect traffic patterns. The greatest changes in volume occur at the on- and off-ramps to and from I-5.

Exhibits 6-5 and 6-6 show traffic volumes on local streets under the No Build Alternative. With the forecasted increases in traffic volumes between now and the year 2030, congestion would worsen in the SR 520/I-5/East Roanoke Street interchange area, increasing delays at both signaled and stop-controlled intersections. Intersections that would operate at LOS E or F are discussed more fully below (see Exhibit 6-7 for LOS designations).

East Roanoke Street/Harvard Avenue/SR 520 Westbound Off-Ramp

Under the No Build Alternative in the year 2030, this intersection would be at capacity in the morning peak hour and would increase to 39 percent over capacity during the afternoon peak hour compared to 15 percent today. Congestion on the SR 520 off-ramp would increase and could extend beyond the ramp, affecting traffic in the I-5 northbound exit lane from SR 520 during both the morning and afternoon peak hours.

Boylston Avenue East/East Lynn Street

With the forecasted increases in traffic volumes between now and the year 2030, operations at this intersection worsen from LOS D today during both peak hours to LOS E in the morning peak hour and LOS F in the afternoon peak hour under the No Build Alternative.

Two-Way Stop-Controlled Intersections

The increase in traffic volumes would worsen operations for side-street traffic trying to access primary arterials. Two two-way stop-controlled intersections within the Roanoke Street interchange area would be affected:

- Lakeview Boulevard East/I-5 northbound off–ramp
- Harvard Avenue East/I-5 northbound on–ramp

These two intersections are unsignalized, with stop signs on the side streets. Vehicles entering from side streets can be delayed because they must find a gap in traffic on the primary arterial before entering the traffic stream. The delay is typically longer for vehicles wanting to turn left because they must wait for gaps in traffic in both directions. With the increase in traffic demand expected between now and the year 2030, drivers would have to wait even longer to find a gap in traffic.

I-5/NE 45th Street Interchange Area

The project travel demand model forecasted that traffic demand between now and the year 2030 would increase by approximately 3 percent during the morning peak period and 5 percent in the afternoon peak period (see Exhibit 6-17). Even with these increases, intersection operations would be the same in 2030 under the No Build Alternative as they are today.

Exhibit 6-8 and 6-9 show traffic volumes in the intersections in this interchange area under the No Build Alternative; Exhibit 6-10 shows the LOS designations.

I-5/Mercer Street Interchange Area

The project travel demand model forecasted that traffic demand between now and the year 2030 would increase by approximately 7 percent during the morning peak period and 10 percent during the afternoon peak period (see Exhibit 6-17). Without any major improvements to these intersections, traffic operations and congestion would continue to worsen. The Mercer Corridor Project planned by the City of Seattle is expected to reduce backups onto I-5 at Mercer Street. This project is included in the results of the transportation cumulative effects analysis in Chapter 11.

Exhibit 6-11 and 6-12 show traffic volumes in the intersections in this interchange area under the No Build Alternative; Exhibit 6-13 shows the LOS designations.

I-5/Stewart Street Interchange Area

The project travel demand model forecasted that traffic volumes would increase by roughly 7 percent during the morning peak period and 10 percent in the afternoon peak period between now and the year 2030 (see Exhibit 6-17). With no roadway improvements and increased traffic volumes, operations would worsen to LOS E or F at three intersections (discussed below). Traffic volumes at these three intersections are shown in Exhibits 6-14 and 6-15; LOS changes are shown in Exhibit 6-16.

Stewart Street/Denny Way

During the morning peak hour, traffic operations at this intersection would degrade from LOS E today to LOS F in 2030 under the No Build Alternative. Congestion backups in the outside lane of the I-5 express

lanes would increase from approximately 200 feet today to 470 feet by 2030.

Howell Street/Yale Avenue/I-5 Southbound On-Ramp

Under the No Build Alternative, operations at this intersection would degrade from LOS E today to LOS F during the afternoon peak hour.

Stewart Street/Yale Avenue

Under the No Build Alternative, operations at this intersection during the afternoon peak hour would degrade from LOS C today to LOS E in the year 2030.

What would traffic be like at the study area interchanges in 2030 with the project?

Overview

The 6-Lane Alternative options would not generate more regional traffic, but would change traffic circulation patterns to and from SR 520 in Seattle. With the 6-Lane Alternative, the SR 520 corridor would be tolled, which would cause some drivers to change their routes, modes of travel, or time of day traveled to avoid the toll. Some SR 520 traffic would shift to the SR 520/I-5/East Roanoke Street interchange area regardless of which build option is selected. Traffic volumes would increase at the Lakeview/I-5 northbound off-ramp and the Boylston/Lynn and East Roanoke/Harvard/SR 520 westbound off-ramps.

The 6-Lane Alternative options would not affect overall traffic volumes at the I-5/Stewart and Mercer Street interchange areas. However, some localized change in traffic circulation would result as people modify their routes to access the I-5 express lanes (which would include a new connection to SR 520) rather than the I-5 general-purpose lane.

Exhibit 6-17 shows the percent change in traffic volumes within each of the interchange areas studied for the transportation analysis. The exhibit compares the percent change for the 6-Lane Alternative options to the No Build Alternative. The most substantial changes in traffic volumes, both increases and decreases, would occur in the Montlake interchange area as result of the capacity and access improvements in

that area. Therefore, the greatest effects would occur on the local streets in the SR 520/Montlake Boulevard interchange area and on SR 520 across the Portage Bay Bridge.

Changes in traffic volumes and intersection operations are summarized by interchange area below. For the 6-Lane Alternative options, the traffic volumes and intersection operations (LOS) are compared to the No Build Alternative and include only intersections that would operate worse than LOS D, which is considered to be the threshold for acceptable peak period operations.

Montlake Boulevard Interchange Area

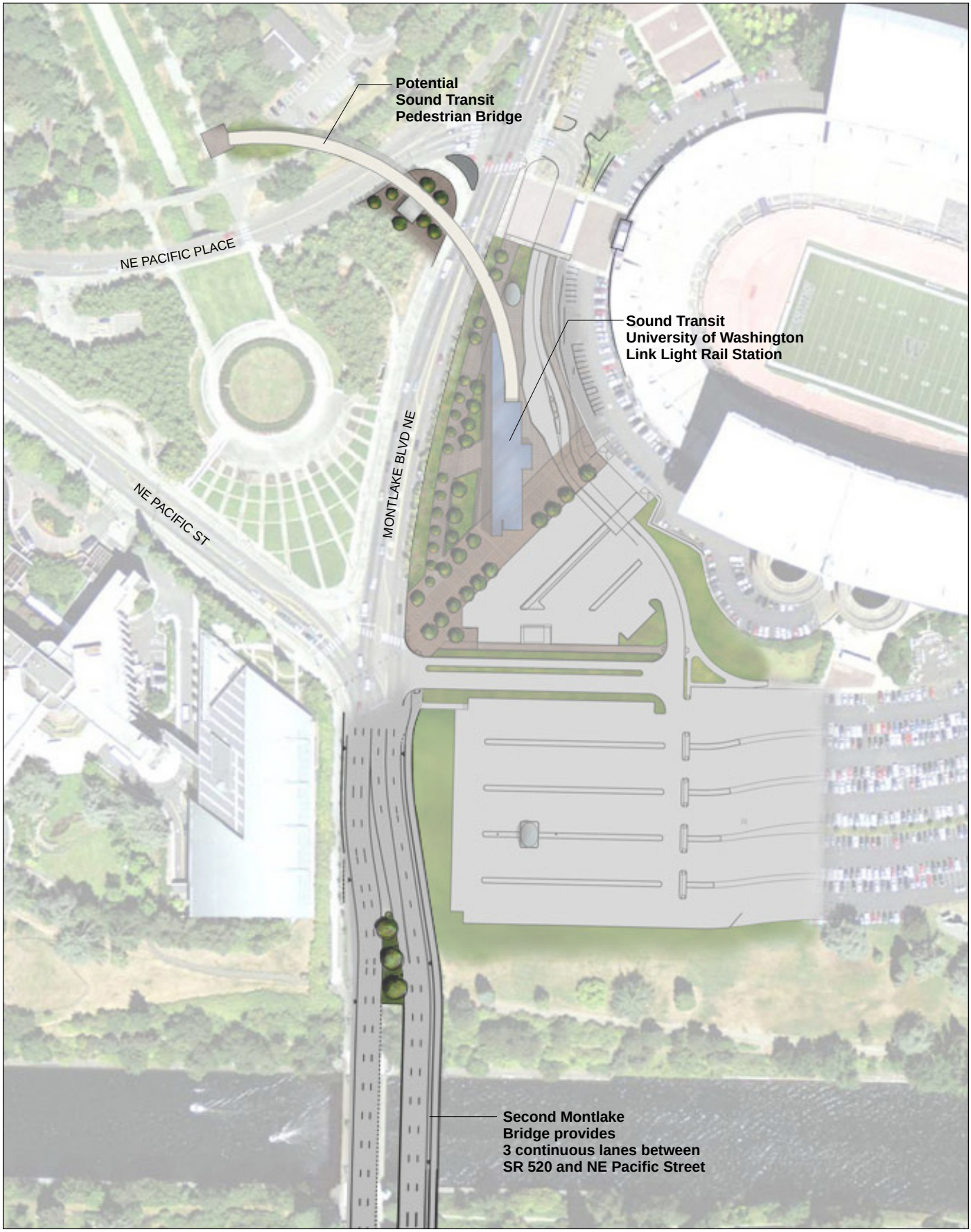
The SR 520/Montlake Boulevard interchange area would be the most affected—both positively and negatively—by the different options. Each option both addresses and creates different traffic issues within the Montlake Boulevard interchange area. For all the 6-Lane Alternative options, some of the intersections and ramps in the SR 520/Montlake Boulevard interchange area would be reconfigured, which—along with changes in traffic volumes and patterns—would improve operations at some intersections and degrade operations at others.

Option A

Option A would remove the Lake Washington Boulevard ramps that exist today, provide direct transit access from the westbound SR 520 HOV lane, and add a second Montlake bridge. It would result in arterial traffic operations that are better than the No Build Alternative.

Option A would make the following changes to the transportation network within the Montlake Boulevard interchange area (see Exhibits 6-18 and 6-19):

- Add a new bascule bridge parallel to the existing Montlake Bridge that would add two lanes across the Montlake Cut and connect with the existing lanes on either side.
- Add a transit-only direct access off-ramp to Montlake Boulevard from westbound SR 520.
- Add a second general-purpose lane to the Montlake Boulevard westbound and eastbound on-ramps.



N

Exhibit 6-18. **Option A – Montlake Boulevard NE/NE Pacific Street Intersection**

I-5 to Medina: Bridge Replacement and HOV Project

N

SR 520 Regional Bicycle/Pedestrian Path

Exhibit 6-19. **Option A – Montlake Interchange**

I-5 to Medina: Bridge Replacement and HOV Project

- Widen and reconfigure the Montlake Boulevard structure over SR 520 to the include:
  - A new signalized intersection at the westbound SR 520 ramps with northbound and westbound left-turn lanes
  - A second left-turn lane from Montlake Boulevard southbound to Lake Washington Boulevard eastbound
  - A second lane on Lake Washington Boulevard eastbound between Montlake Boulevard and 24th Avenue North

A third through lane on Montlake Boulevard southbound between Lake Washington Boulevard and just south of East Roanoke Street

With these changes, traffic operations would improve at the following intersections (compared with No Build Alternative):

- Montlake Boulevard/Lake Washington Boulevard/SR 520 eastbound ramps (LOS E to D in the morning peak hour and LOS F to E in the afternoon peak hour)
- Montlake Boulevard/NE Pacific Street (LOS F to E in the afternoon peak hour)
- NE Pacific Street/15th Avenue NE (LOS E to D in the afternoon peak hour)

Exhibits 6-3 and 6-4 summarize LOS results for all SR 520/Montlake Boulevard interchange area intersections. Operations at each of these intersections are described in detail below. Option A would not degrade intersection operations during either peak hour compared to the No Build Alternative.

With removal of the Lake Washington Boulevard ramps, traffic volumes would increase at the Montlake Boulevard interchange compared to the No Build Alternative. Traffic volumes on Lake Washington Boulevard south of the SR 520/Arboretum ramps would decrease up to 900 vehicles per hour (vph)—total both directions—in the morning peak hour and 600 vph—total both directions—in the afternoon peak hour.

Some of these volumes would shift to the SR 520 ramps at Montlake Boulevard (see Exhibits 6-1, 6-2, 6-5, and 6-6 for traffic volume information). It is also expected that some Montlake ramp trips from areas north of SR 520 would divert to the I-5/NE 45th Street and I-5/SR 520/East Roanoke interchanges in the afternoon peak hour because of

the additional traffic shifting to the Montlake Boulevard ramps from the Lake Washington Boulevard ramps. This shift would decrease traffic volumes at intersections north of the SR 520/Montlake Boulevard interchange area, including Montlake Boulevard NE/NE Pacific Street and NE Pacific Street/15th Avenue NE.

Montlake Boulevard/Lake Washington Boulevard/SR 520 Eastbound Ramps

During the afternoon peak hour, operations would improve to LOS E from LOS F with the No Build Alternative because the proposed intersection improvements would increase capacity and therefore reduce congestion on all legs of the intersection. With the improvements to the SR 520 mainline and the addition of a second general-purpose lane on the on ramp, congestion on the eastbound on-ramp would be reduced and would no longer back up onto Montlake Boulevard, substantially reducing the congestion on Montlake Boulevard southbound. However, there would still be congestion on the northbound, southbound, and westbound approaches of the intersection because of an increase in traffic volume associated with the removal of the Lake Washington Boulevard ramps. Northbound congestion would affect the Montlake Boulevard/Roanoke Street intersection, and southbound congestion would affect the westbound SR 520 on-ramp intersection.

Montlake Boulevard NE/NE Pacific Street

During the afternoon peak hour, intersection operations would improve to LOS E from LOS F under the No Build Alternative. Removal of the Lake Washington Boulevard ramps would reduce the amount of traffic traveling through this intersection as drivers divert to other interchanges; therefore, drivers would experience less congestion.

NE Pacific Street/15th Avenue NE

Intersection operations would improve from LOS E under the No Build Alternative to LOS D with Option A. Removing the Lake Washington Boulevard ramps would result in less traffic traveling through this intersection and, thus, less delay for drivers.

Suboption A (With Lake Washington Boulevard Ramps)

Suboption A would retain the SR 520 westbound off-ramp and eastbound on-ramp connections to Lake Washington Boulevard. These ramps would be redesigned to connect to Lake Washington Boulevard northwest of the current location (see Exhibit 6-19). Traffic volumes and

patterns would be similar to the No Build Alternative because overall capacity to SR 520 would be similar without the project. Suboption A would also include a transit direct-access on-ramp from Montlake Boulevard NE to eastbound SR 520.

Suboption A would also differ from Option A for drivers using the Montlake westbound off-ramp. With the access the Lake Washington Boulevard ramps would provide to Montlake Boulevard, the Montlake westbound off-ramp would be restricted to right turns only onto Montlake Boulevard. Drivers destined for areas south of SR 520 would need to use the Lake Washington Boulevard westbound off-ramp to travel southbound on Montlake Boulevard rather than using the U-turn movement as they do today.

Suboption A also includes a southbound-to-eastbound transit and HOV direct access on-ramp. This ramp complements Option A's transit-only westbound direct access off-ramp by providing freeway access in the opposite (eastbound) direction. Increases in traffic volumes at the SR 520/I-5/East Roanoke Street interchange area would degrade operations at four intersections to LOS D or worse.

As with Option A, this suboption's design would improve intersection operations compared to the No Build Alternative. During the morning peak hour, all intersections within the SR 520/Montlake Boulevard interchange area would operate at LOS D or better, similar to the No Build Alternative. During the afternoon peak hour, traffic operations would improve at the same intersections as Option A.

With the improvements to the SR 520 mainline, the Lake Washington Boulevard eastbound on-ramp merges would improve, allowing the ramp meters to serve more traffic. This would substantially reduce congestion that spills back onto Lake Washington Boulevard compared to the No Build Alternative.

Option K

Option K would include a new lowered single-point urban interchange (SPUI) that combines the functions of the existing SR 520/Montlake Boulevard and SR /520 Lake Washington Boulevard interchanges to the east. Option K would make the following changes to the transportation network within the Montlake Boulevard interchange area (see Exhibits 6-20 and 6-21):

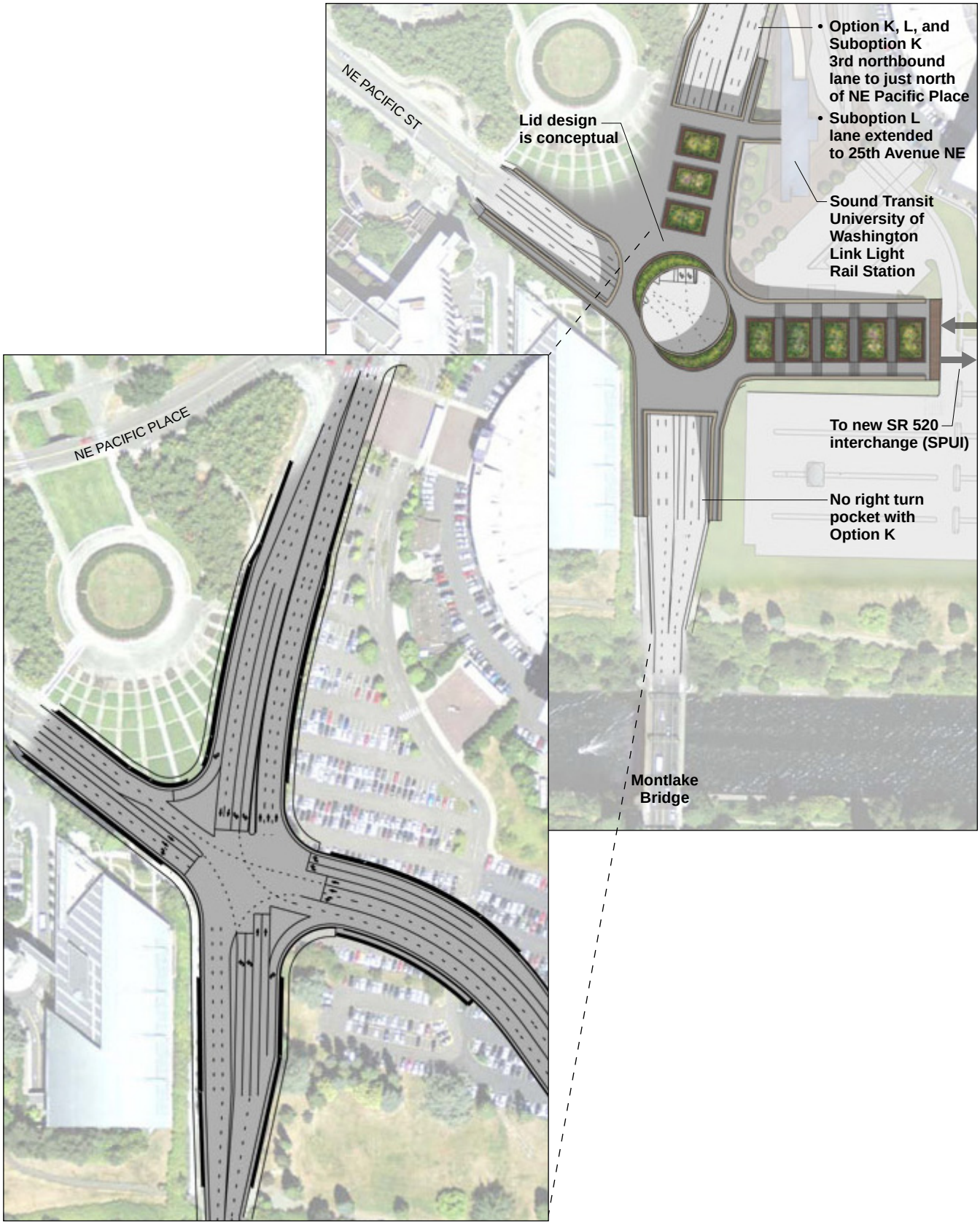


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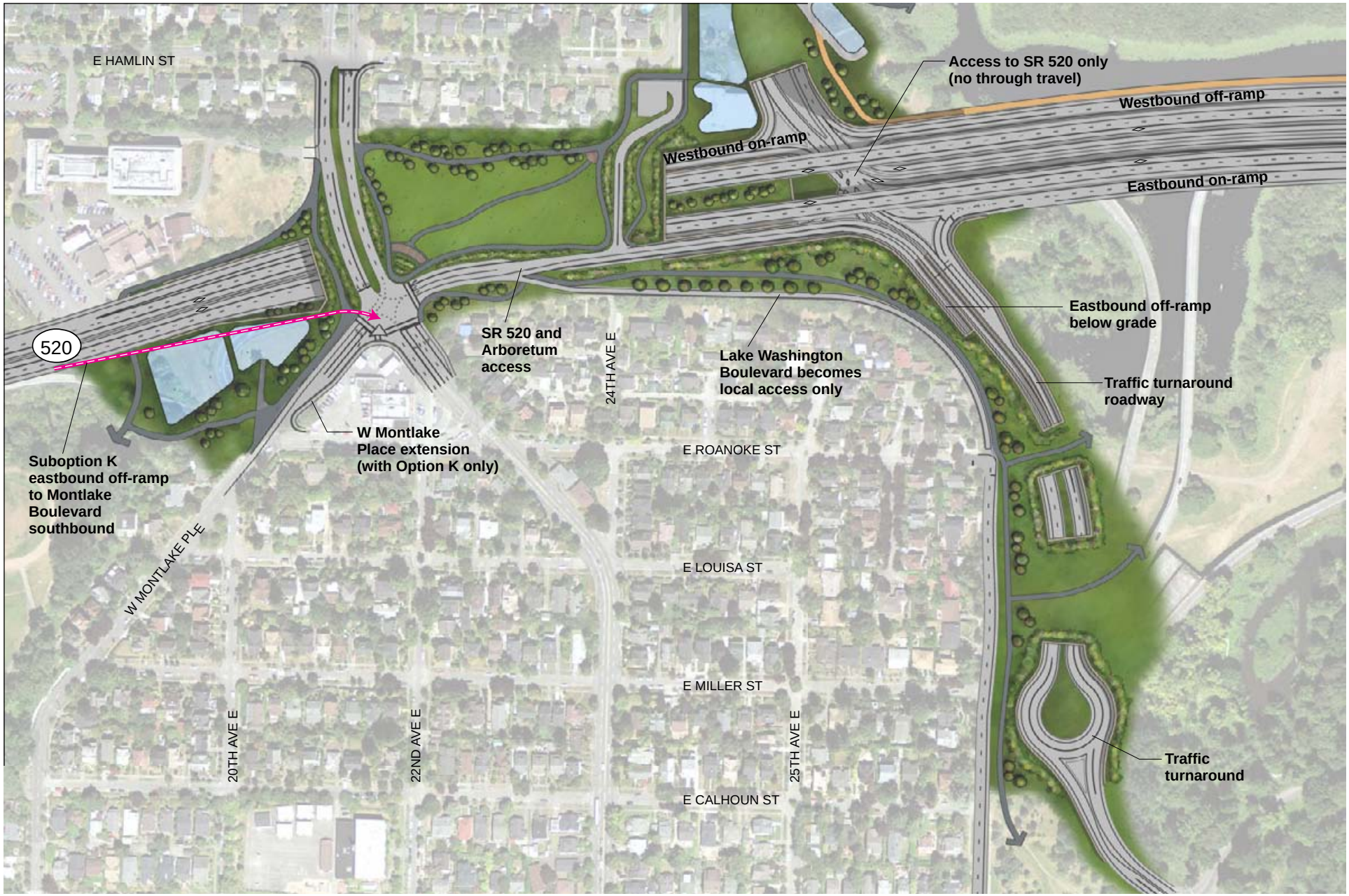
Exhibit 6-20. **Options K and L – Montlake Boulevard NE/ NE Pacific Street Intersection**

I-5 to Medina: Bridge Replacement and HOV Project



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SR 520 Regional Bicycle/Pedestrian Path

Exhibit 6-21. **Option K – Montlake/ Lake Washington Boulevard Area**

I-5 to Medina: Bridge Replacement and HOV Project

- Revision of the Montlake Boulevard/NE Pacific Street intersection to include a new approach to and from the east. The following lanes would be added to this intersection:
  - Two westbound through lanes to NE Pacific Street
  - A two-lane westbound right-turn pocket to northbound Montlake Boulevard
  - A one-lane westbound left-turn pocket to southbound Montlake Boulevard
  - A two-lane southbound left-turn pocket to the new tunnel
- New HOV and transit access ramps at the SPUI to and from the north and east.
- Restriction of through traffic at the new SPUI interchange.
- Addition of a third northbound through lane on Montlake Boulevard between NE Pacific Street and the pedestrian bridge north of NE Pacific Place.
- Access to and from SR 520 and the Washington Park Arboretum provided via a reconfigured roadway parallel to the existing Lake Washington Boulevard with a modified traffic turnaround near the existing Lake Washington Boulevard/SR 520 ramp intersection. The turnaround would allow trips from Montlake Boulevard to access SR 520 south of the Cut.
- A grade-separated pedestrian crossing of the Montlake Boulevard/NE Pacific Street intersection.
- Closure of the west leg of the Montlake Boulevard/East Roanoke Street intersection. Traffic would be re-routed to a new extension of Montlake Place East that will connect with Montlake Boulevard near the previous location of the SR 520 eastbound ramps.

With Option K, traffic volumes in the overall SR 520/Montlake Boulevard interchange area would increase by 23 percent compared to the No Build Alternative because of the new capacity associated with the new interchange and crossing of the Montlake Cut. By shifting SR 520 freeway traffic to the SPUI, drivers would choose to take advantage of the capacity made available on Montlake Boulevard.

As a result of Option K's interchange design and traffic turnaround, traffic patterns and operations through the SR 520/Montlake Boulevard interchange area would change as follows:

- Drivers coming from the west and south (e.g., Capitol Hill) could access the new interchange (SPUI) via Lake Washington Boulevard (see Exhibit 6-21).
- The new tunnel and traffic turnaround would allow freeway traffic to bypass the Montlake bridge, reducing traffic volumes on Montlake Boulevard by approximately 1,400 vph in the morning peak hour and 2,200 vph in the afternoon peak hour compared to the No Build Alternative.
- Traffic volumes on Lake Washington Boulevard south of the traffic turnaround would increase by approximately 220 vph in the morning peak hour and 300 vph in the afternoon peak hour because the traffic turnaround would allow access to the SPUI from both directions on Lake Washington Boulevard.
- No trips would be allowed to travel through the SPUI between Lake Washington Boulevard and the Montlake Boulevard/NE Pacific Street intersection. This would not only maintain 23rd Street/Montlake Boulevard as the primary arterial between neighborhoods, but also provide a smaller structure footprint for the interchange.
- The pedestrian lid at the Montlake Boulevard/NE Pacific Street intersection would improve pedestrian travel (no signal delays) and traffic operations (more signal green time available).

As shown in Exhibits 6-1 and 6-2, some local streets would experience greater traffic increases than others, with the greatest increase on Montlake Boulevard north of NE Pacific Street. However, because of roadway improvements associated with the project, Option K would not degrade operations at any intersections during the morning peak hour and one intersection (Montlake Boulevard/NE Pacific Street) during the afternoon peak hour (see Exhibits 6-3 and 6-4). Traffic operations for this intersection as well as other elements of this option are discussed below.

SR 520/SPUI Operations

The intersection of the SPUI ramps would operate acceptably at LOS B during both the morning and afternoon peak hours. At times, SR 520

freeway congestion on the Portage Bay Bridge would affect the westbound on-ramp, causing congestion to spill back into the street system surrounding the SR 520/SPUI. As discussed in Chapter 5, the freeway congestion is associated with Portage Bay Bridge traffic volumes and bridge design. Option K would not have an auxiliary lane on the Portage Bay Bridge, affecting the capacity of the merge point with the westbound on-ramp.

The eastbound off-ramp would also operate over capacity at times during the afternoon peak hour. Congestion would back up onto the SR 520 mainline, requiring exiting drivers to slow down before leaving the SR 520 mainline.

Because the SPUI is located farther away from the local street system, congestion associated with on-ramps would be relocated away from the Montlake neighborhood, improving access and mobility through this area, especially south of the Montlake Cut.

Traffic Turnaround Operations

Drivers traveling through the traffic turnaround south of the SPUI would experience congested conditions during the afternoon peak hour because of high traffic volumes and lane changes approaching the turnaround (see Exhibit 6-21). The traffic turnaround roadway was designed for slow speeds (25 mph), which was an outcome of the mediation process. Given these conditions, both the southbound and northbound sections of the roadway would operate at low speeds with restricted maneuverability in the afternoon peak hour. Vehicles heading north through the traffic turnaround would see similar conditions in the morning peak hour.

Montlake Boulevard/Lake Washington Boulevard Intersection (Formerly SR 520 Eastbound Ramps)

Under Option K, operations at this intersection would improve to LOS E from LOS F under the No Build Alternative. Traffic volumes would decrease as a result of the change in access to SR 520, which would shift traffic to the new tunnel. The west leg of the existing intersection, which serves the SR 520 eastbound on- and off-ramps, would be replaced by the extension of West Montlake Place to form a four-legged intersection (see Exhibit 6-21). By removing the connection to SR 520, northbound and southbound traffic operations would improve because the need to keep off-ramp traffic from backing onto the SR 520 mainline would no longer exist.

Montlake Boulevard/NE Pacific Street Intersection

Under Option K, this intersection would operate acceptably at LOS D during the morning peak hour. During the afternoon peak hour, it would continue to operate at LOS F under Option K. With Option K, this intersection would serve as the primary access from the University District to SR 520, accommodating the majority of trips destined to SR 520. Traffic volumes would increase through this intersection, causing it to be 38 percent over capacity (compared to 26 percent over capacity with the No Build Alternative).

Congestion would increase under Option K compared to the No Build Alternative. The increased congestion would affect adjacent intersection operations to the north, south, and west.

Suboption K

Suboption K would include an eastbound right-only off-ramp to Montlake Boulevard to allow drivers to head directly south on Montlake Boulevard without having to use the new interchange and traffic turnaround (see Exhibit 6-21). Traffic volumes on this ramp would be 110 vph in the morning peak hour and 240 vph during the afternoon peak hour, which would reduce traffic at the SR 520/SPUI and on the traffic turnaround roadway by the same amount. Maneuverability and travel speed on the traffic turnaround roadway would improve compared to Option K, reducing delay for drivers during both the morning and afternoon peak hours.

Suboption K would not include extension of West Montlake Place. Therefore, traffic operations at the Montlake Boulevard/Lake Washington Boulevard/SR 520 eastbound off-ramp would improve compared to Option K. The East Roanoke Street/Montlake Boulevard NE intersection would be the same as with the No Build Alternative, retaining the closely spaced intersections of Lake Washington Boulevard and East Roanoke Street along Montlake Boulevard. The closely spaced intersections (approximately 300 feet) would still operate better than the No Build Alternative configuration.

The Montlake Boulevard/NE Pacific Street intersection would operate the same (LOS F) as Option K, but with an additional northbound through lane, it would be 20 percent over capacity. This would be an improvement over Option K and similar to the No Build Alternative.

Option L

Option L differs from Option K, resulting in slightly different traffic patterns, volumes, and intersection operations. These differences are illustrated in Exhibit 6-22 and described below.

- Replaces the tunnel in Option K with an elevated bascule bridge crossing of the Montlake Cut and results in traffic operations similar to Option K
- Maintains the Lake Washington Boulevard/SR 520 ramp intersection in a similar configuration to the No Build Alternative except that it would be signalized to minimize local queues through the Arboretum
- Results in no access to the SR 520/SPUI from Lake Washington Boulevard southbound due to the left-turn restriction (similar to No Build Alternative). Drivers would continue north on Montlake Boulevard to the Montlake Boulevard/NE Pacific Street intersection and turn right onto the new bridge that connects to the SR 520/SPUI (see Exhibit 6-21)
- Adds a northbound right-turn lane at the Montlake Boulevard/NE Pacific Street intersection (otherwise the same as Option K) to accommodate additional trips from the south

Traffic volumes on Montlake Boulevard between Lake Washington Boulevard and NE Pacific Street would be greater than with Option K, but still less than the No Build Alternative. The Montlake Boulevard/Lake Washington Boulevard intersection would operate at LOS F, as it would with the No Build Alternative. The Montlake Boulevard/NE Pacific Street intersection would operate the same as with Option K.

Exhibits 6-1 and 6-2 illustrate specific traffic volume changes on streets in the SR 520/Montlake Boulevard interchange area.

Suboption L

Suboption L differs from Option L in that it allows drivers south of the Cut on Montlake Boulevard to access the SR 520/SPUI via Lake Washington Boulevard and a new left-turn access to SR 520 (see Exhibit 6-22). This results in a shift away from the Montlake Bridge to Lake Washington Boulevard of 710 vph in the morning peak hour and 490 vph during the afternoon peak hour.

N

SR 520 Regional Bicycle/Pedestrian Path

Exhibit 6-22. **Option L – Montlake/ Lake Washington Boulevard Area**

I-5 to Medina: Bridge Replacement and HOV Project

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These changes would worsen operations at the SR 520 ramps/Lake Washington Boulevard intersection from LOS C to D in the morning peak hour and from LOS E to F in the afternoon peak hour (compared to the No Build Alternative). Suboption L operations at this intersection would also be worse than with Option L (see Exhibits 6-3 and 6-4). At the SR 520/SPUI intersection, operations would degrade from LOS D to E in the morning peak hour (compared to Option L).

The Montlake Boulevard/East Roanoke Street intersection would improve from LOS F to E in the afternoon peak hour and from LOS E to C in the morning peak hour compared to the No Build Alternative. Operations would improve at this intersection due to channelization changes to the northbound approach, which increases capacity for the northbound through traffic movement.

At the Montlake Boulevard/NE Pacific Street intersection, Suboption L's additional northbound through lane would result in the intersection being 16 percent over capacity, which is an improvement over Option L and the No Build Alternative. However because it is still over capacity, it would continue to operate at LOS F.

Suboption L would also add a third northbound lane on Montlake Boulevard NE between NE Pacific Place and 25th Avenue NE. Traffic volumes would be the same as Options K and L.

SR 520/I-5/East Roanoke Street Interchange Area

Under all of the 6-Lane Alternative options, the SR 520 corridor would be tolled, which would cause some drivers to change their routes or time of day traveled. As a result, freeway ramp volumes would change, which would affect traffic volumes and intersection operations on the local streets.

Option A would result in the largest increase in traffic volumes because the Lake Washington Boulevard ramps would be removed. Without the ramps, traffic patterns between the SR 520/Montlake Boulevard and I-5/East Roanoke Street interchange areas would change. Increases in traffic volumes under Options K or L would be less than Option A, but more than the No Build Alternative.

Increases in traffic volumes at the SR 520/I-5/East Roanoke Street interchange area would degrade operations at four intersections to LOS D or worse. Exhibits 6-5 and 6-6 depict traffic volumes in the SR 520/I-5/East Roanoke interchange area; Exhibit 6-7 shows the LOS designations

at intersections within this area. These intersections are described below.

Boylston Avenue East/East Lynn Street

Morning peak-hour operation at this intersection would be worse with all of the 6-Lane Alternative options (LOS F) compared to the No Build Alternative (LOS E). Larger delays would result because of an additional 150 vph on Boylston Avenue East, associated with changes in traffic patterns due to the toll or the different interchange configurations in the Montlake area. This increase in volume would put the intersection above capacity, causing it to operate at LOS F. Congestion at this intersection would continue to affect adjacent intersections.

East Roanoke Street/Harvard Avenue/SR 520 Westbound Off-Ramp

With the No Build Alternative, this intersection would operate at LOS F during both the morning and afternoon peak hours. This intersection would be at capacity in the morning and 40 percent over capacity in the afternoon (compared to 15 percent today). As a result, congestion on the SR 520 westbound off-ramp would extend back beyond the split from the I-5 northbound exit lane.

With Option A, the intersection would continue to operate at LOS F, but exceed capacity by 9 percent during the morning peak hour. During the afternoon peak hour, the intersection would also continue to operate at LOS F, but gradually worsen to nearly 60 percent over capacity (compared to 40 percent with the No Build Alternative). Traffic volumes would increase slightly at this intersection because Option A would remove the Lake Washington Boulevard ramps.

Congestion on the SR 520 westbound off-ramp would back up to a greater extent with Option A—by approximately 350 feet more than the No Build Alternative—because of increased traffic volumes (240 vph) at the off-ramp. The queue is long enough to affect operations of the vehicles heading to I-5 north.

With Suboption A or Options K or L, traffic operations at this intersection would worsen slightly compared to the No Build Alternative because of changes in traffic patterns associated with the toll, completion of the HOV lanes system, the new Montlake area interchange configuration, and addition of two crosswalks at this intersection. The proposed improvements would add crosswalks on the

north and west legs, which would reduce the amount of signal green time available for vehicles and increase delays.

Two-Way Stop Controlled Intersections

Similar to the No Build Alternative, operations at the Lakeview Boulevard East/I-5 northbound off–ramp and Harvard Avenue East/I-5 northbound on–ramp intersections would worsen slightly with the 6-Lane Alternative. The increase in traffic volumes associated with shifts in traffic patterns due to the toll and changes in access to SR 520 would worsen operations for side-street traffic trying to access primary arterials.

I-5/NE 45th Street Interchange Area

With the 6-Lane Alternative, the project travel demand model forecasted that traffic demand would increase by approximately 1 percent during the morning peak period and 6 percent during the afternoon peak period by the year 2030 (compared to the No Build Alternative). These increases are associated with the toll and the closure of the SR 520 Lake Washington Boulevard ramps under Option A. With Option A, traffic would shift from the SR 520/Montlake Boulevard interchange area to the I-5/NE 45th Street interchange area, resulting in an increase of approximately 120 vph using the I-5/NE 45th Street northbound off-ramp and 100 vph using the NE 45th Street/I-5 southbound on-ramp.

With these increases, intersection operations would degrade to LOS E at the NE 45th Street/7th Avenue NE intersection during the afternoon peak hour. Congestion on the NE 45th Street off-ramp would not back up onto the I-5 mainline.

Under Options K and L, traffic volumes would not change substantially at this interchange. Operations at the NE 45th Street/7th Avenue NE intersection would remain the same as No Build and the NE 45th Street/southbound on-ramp would improve during the morning peak.

Exhibits 6-8 and 6-9 show traffic volumes in the I-5/NE 45th Street interchange area; Exhibit 6-10 shows the LOS designations for all 6-Lane Alternative options.

I-5/Mercer Street Interchange Area

Under the 6-Lane Alternative options, traffic volumes in the I-5/Mercer Street interchange area would be nearly identical to the No Build

Alternative for all options, showing an increase of approximately 1 percent during the morning peak hour and no change during the afternoon peak hour. The largest change in volume would be approximately 90 vehicles per hour on Mercer Street during the morning commute. Intersection operations would be about the same as under the No Build Alternative.

Exhibits 6-11 and 6-12 show traffic volumes in the I-5/Mercer Street interchange area; Exhibit 6-13 shows the LOS designations for all 6-Lane Alternative options.

I-5/Stewart Street Interchange Area

Traffic volumes in the I-5/Stewart Street interchange area under all the 6-Lane Alternative options would be nearly identical to the No Build Alternative, increasing approximately 1 percent during the morning peak hour and experiencing no change during the afternoon peak hour. Exhibits 6-14 and 6-15 show the morning and afternoon peak hour vehicle volumes by direction for the I-5/Stewart Street interchange area. The largest change in volume would be approximately 100 vehicles per hour on Stewart Street during the morning commute because of the new connection between the SR 520 westbound HOV lane and the I-5 express lanes.

As shown in Exhibit 6-16, the 6-Lane Alternative options would not affect intersection operations at this interchange. However, with the I-5 express lanes connection to SR 520, freeway traffic volumes exiting to Stewart Street would increase by 100 vph in the morning peak hour, increasing congestion in the outside lane of the express lanes from 470 feet under the No Build Alternative to approximately 800 feet.