3 June 2005

SR 520 Bridge Replacement and HOV Project Draft EIS

Appendix U

8-Lane Alternative Report

Washington State Department of Transportation

SoundTransit

U.S. Department of Transportation
Federal Highway Administration

SR 520 Bridge Replacement and HOV Project EIS

8-Lane Alternative Report

Prepared for

Washington State Department of Transportation
Federal Highway Administration
Sound Transit

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Contents

List of Exhibits

Acronyms and Abbreviations

ABO	average bus occupancy
AVO	average vehicle occupancy
CT	Community Transit
EIS	environmental impact statement
GP	general purpose
HOV	high occupancy vehicle
LOS	level of service
MOE	measure of effectiveness
mph	miles per hour
SR	State Route
ST	Sound Transit
V/C	volume/capacity
vph	vehicles per hour
WSDOT	Washington State Department of Transportation

Introduction

What is the history of the 8-Lane Alternative?

In July 1999 the Trans-Lake Study Committee recommended an array of alternatives to be carried forward into a formal NEPA/SEPA environmental review process. The 8-Lane Alternative was among the alternatives they recommended. During the summer of 2002, the Trans-Lake Washington Project Executive Committee adopted the 6-Lane Alternative as a Preliminary Preferred Alternative and agreed that further analysis of the 8-Lane Alternative would not be required.

Note to Reader

The 8-Lane Alternative is not being considered in the EIS. However, the 8-Lane Alternative, with improvements on I-5 as well as on SR 520, was one of a number of alternatives that were considered during the alternatives development phase of this project. This Appendix documents the transportation analysis for the 8-Lane Alternative. It was these results that led to the decision to discontinue analyzing the 8-Lane Alternative as part of the SR 520 Bridge Replacement and HOV Project.

The 8-Lane Alternative was dropped from further evaluation because the 8-Lane Alternative caused severe congestion along I-5 and would have required additional study about how to provide more capacity on I-5.

In 2003, the Washington State legislature successfully passed a nickel funding package that brought funding back to the project. Along with the funding, the legislature asked WSDOT to evaluate the I-5 corridor to determine what modifications would be required on I-5 to alleviate congestion caused by an 8-Lane Alternative. At the same time, the project was renamed the SR 520 Bridge Replacement and HOV Project, the project limits were redefined, and tolling was assumed to be an integral piece of the project alternatives.

The project team's 2002 planning level analyses (with no toll on SR 520) indicated that the I-5 corridor would require one additional lane in each direction between the SR 520 and Corson/Michigan interchanges with an 8-Lane SR 520. With the assumption of a toll on the Evergreen Point Bridge, the team's second assessment showed that one additional lane in each direction would be needed on the I-5 corridor from SR 520 south to I-90.

The project team then developed options that provided additional capacity along the I-5 corridor. They ultimately combined the various options and presented them as three distinct options for evaluation. The three options considered were a tunnel option, an aerial option, and a

frontage road option. The project team used a screening process to select one option that was carried into the next level of analysis (*SR 520 8-Lane Alternative I-5 Options Report,* Parametrix and CH2M HILL 2004). The frontage road option was selected because it provided the most reliable improvements with the lowest anticipated cost.

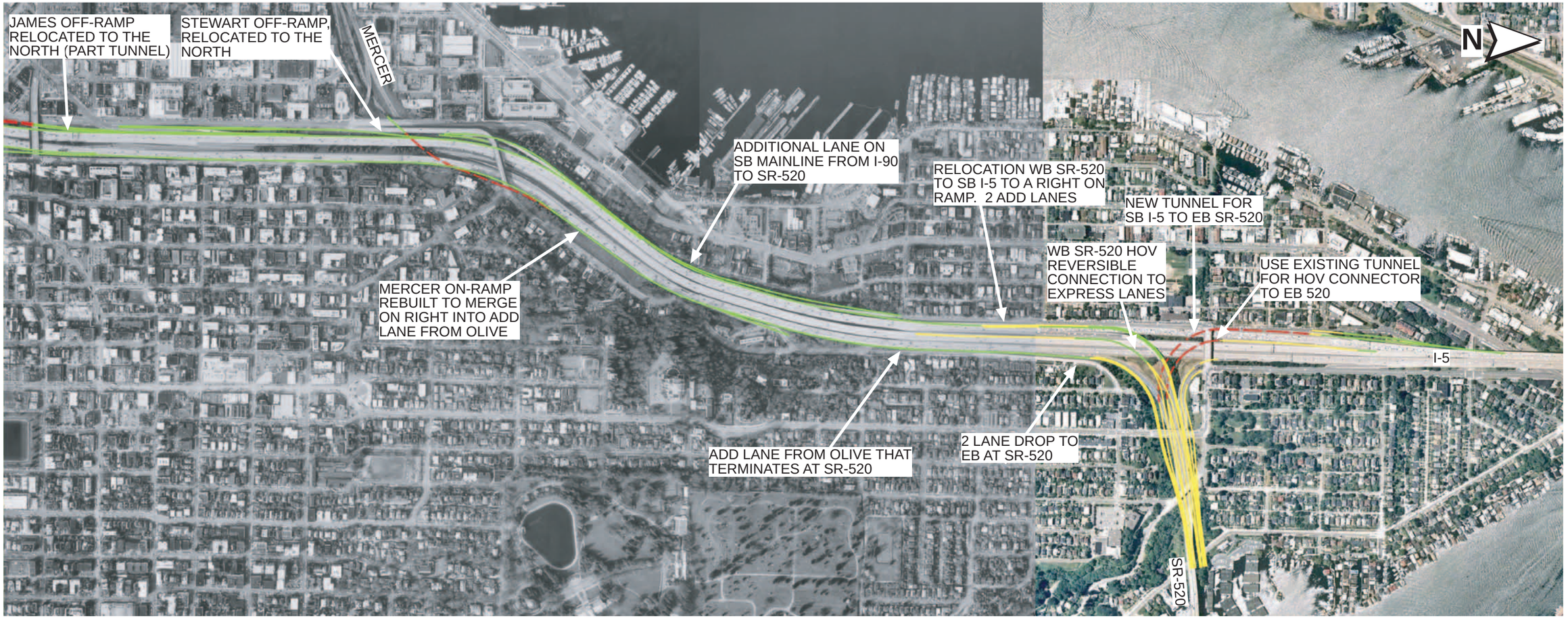
What improvements were included in the 8-Lane Alternative?

On SR 520, the 8-Lane Alternative would:

- Replace the roadway with standard design shoulders and lane widths.
- Add a general purpose (GP) lane in each direction (six GP lanes total).
- Complete the high occupancy vehicle (HOV) lane between I-405 and I-5.
- Relocate the existing HOV lane to the inside lane.
- Implement a toll across Lake Washington.

On I-5, the 8-Lane Alternative would include (Exhibits 1 and 2):

- A reversible HOV direct connection would be provided between the SR 520 mainline and the I-5 express lanes (operating westbound to southbound during the a.m. peak period and northbound to eastbound during the p.m. peak period).
- On I-5 beginning at the SR 520 interchange, an additional southbound lane would be added to I-5. This lane would originate from the two-lane westbound SR 520 on-ramp to southbound I-5 where both lanes would be added to the outside (that is, right side) of the roadway. This addition of two lanes would result in a six-lane southbound I-5 cross-section at this location. (Currently, there are only five lanes.)
- The outer-most lane would terminate at the Mercer Street off-ramp. The Boylston Avenue on-ramp and the Mercer Street off-ramps would retain the current configurations. The Stewart Street off-ramp would be relocated north to accommodate realignment of the James Street off-ramp. James Street traffic would exit just south of Stewart Street via a tunnel that would travel under the Convention



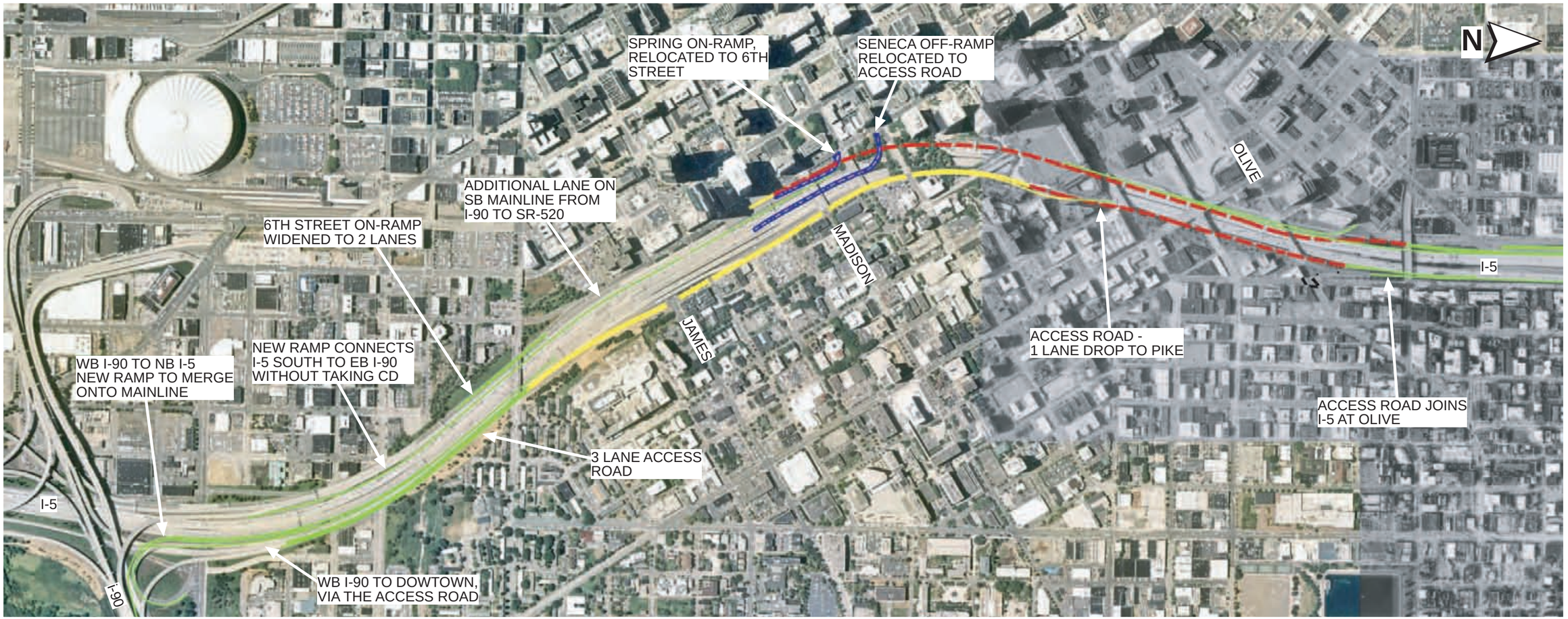
SOURCE: To be provided

LEGEND:

- New Tunnel
- New Structure
- At Grade

Exhibit 1. **Improvements on I-5 from SR 520 Interchange to James Street**

SR 520 Bridge Replacement and HOV Project



SOURCE: To be provided

LEGEND:

- New Tunnel
- New Structure
- At Grade
- Removed

Exhibit 2. **Improvements on I-5 from Olive Way to I-90 Interchange**

SR 520 Bridge Replacement and HOV Project

Center and connect with 6th Avenue near the location where it currently connects with 6th Avenue. This tunnel would effectively separate the James Street traffic from traffic associated with the Yale Avenue on-ramp and the Union Street off-ramp. (The Yale Avenue on-ramp and the Union Street off-ramp would remain in their existing configurations.)

- The Spring Street on-ramp to the collector-distributor would be closed. Traffic that had been using this ramp would use the 6th Avenue on-ramp to access I-5 and I-90. Widening and channelization improvements to 6th Avenue would accommodate the redistributed traffic.
- Northbound I-5 traffic destined for downtown Seattle via James or Madison Streets would exit from I-5 at the I-90 interchange area to access the collector/distributor. The frontage road option would modify northbound I-5 and eliminate the Seneca Street off-ramp. Therefore, the former Seneca Street off-ramp traffic would also need to use the collector/distributor off-ramp. A new on-ramp connecting directly to I-5 would be added to serve westbound and eastbound I-90 and Dearborn Street traffic. The new on-ramp would add an additional lane to the northbound I-5 corridor.
- The collector/distributor and Cherry Street on-ramps would be eliminated from the northbound I-5 corridor. Traffic originating from downtown Seattle that used the Cherry Street on-ramp would be required to access a new northbound frontage road along the 7th Avenue alignment. This one-way northbound frontage road would provide full access at each of the cross-streets between James Street and Pike Street. Traffic destined for northbound I-5 would use the two-lane on-ramp from the frontage road that would add one lane to I-5 north of Pike Street (that is, the two-lane ramp would enter I-5 as one merge lane and one additional lane).
- The Mercer Street on-ramp would be moved from the left side to the right side of the highway, to allow traffic to merge onto northbound I-5. No changes were proposed to the Lakeview Boulevard off-ramp, which would continue to be a one-lane exit. Two lanes would drop from I-5 to eastbound SR 520. I-5 would retain its current configuration north of the SR 520 off-ramp.

What information is in this report?

This report summarizes forecasts for the year 2030 related to travel demands and operations of the 8-Lane Alternative and compares them with 2030 forecasts for the No Build Alternative. These forecasts focus on I-5 and SR 520. Traffic volumes on the freeway and local streets differ under the No Build Alternative and the 8-Lane Alternative. Therefore, the effects of the change in traffic volumes on traffic operations were analyzed. The study area is shown in Exhibit 3.

This report consists of five sections:

- **Introduction**—This section provides a history and description of the 8-Lane Alternative, information about the structure of this report, and the key points from the analyses.
- **Freeway and Local Travel Demand Forecasts for the Year 2030**—This section describes forecasts of the freeway and local traffic demand.
- **Freeway Traffic Operations Forecasts for the Year 2030**—This section describes forecasts of freeway traffic operations for the SR 520 and I-5 corridors and discusses their interdependency.
- **Local Traffic Operations Forecasts for the Year 2030**—This section describes forecasts of local arterial intersection operations for the I-5 corridor between the Dearborn Street and Northeast 45th Street interchanges.
- **Transit Operations Forecasts for the Year 2030**—This section describes forecasts of transit service and ridership along the SR 520 corridor.

What are the key points?

Freeway Travel Demand Forecasts for the Year 2030

This section summarizes the key points from the forecasts of freeway travel demand in the year 2030 for the 8-Lane Alternative as compared to the No Build Alternative.

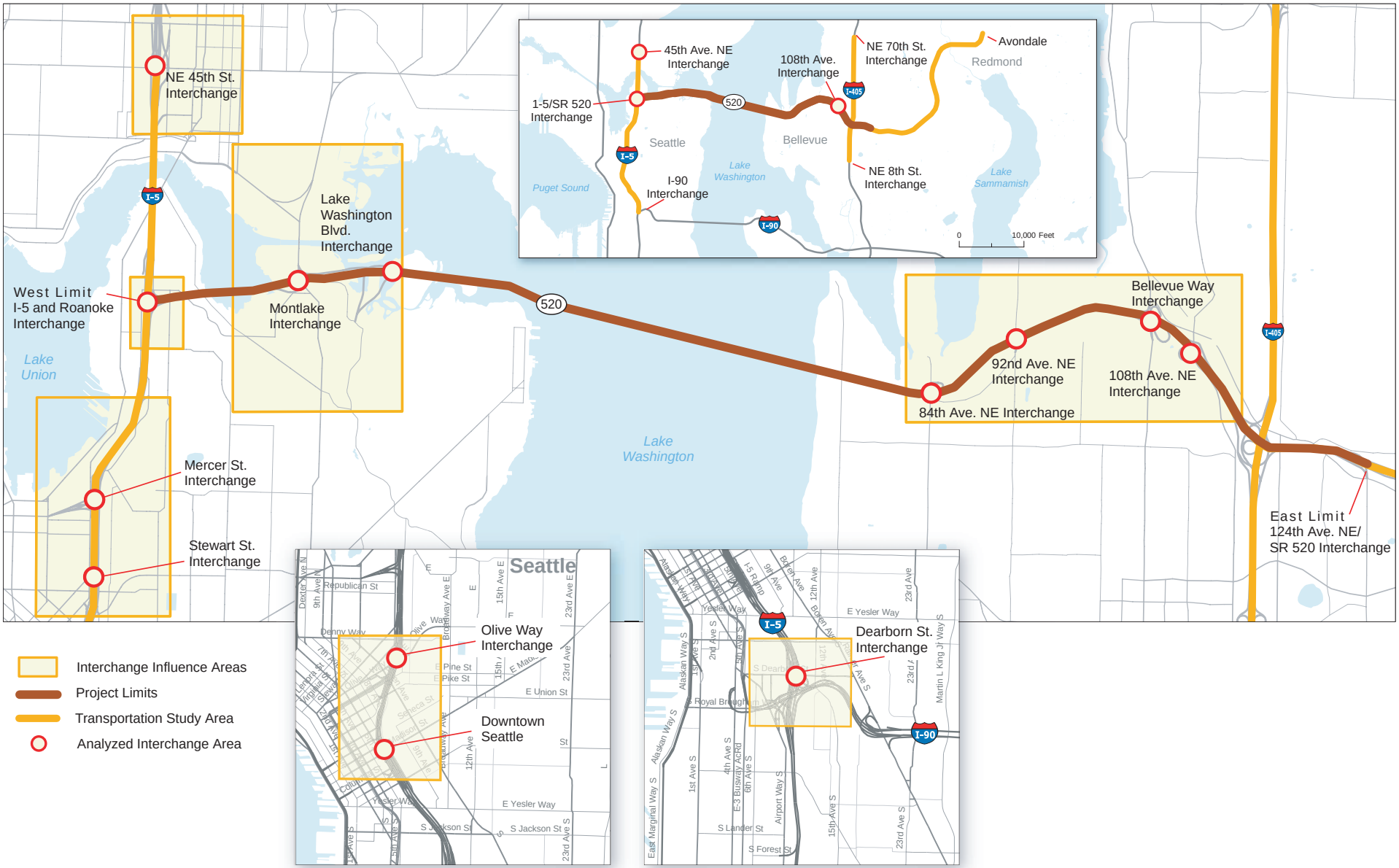


Exhibit 3. **Project Study Area**

SR520 Bridge Replacement and HOV Project

Additional Capacity

The 8-Lane Alternative would provide one additional GP lane in each direction on SR 520 and complete the HOV lane system (that is, the 8-Lane Alternative would provide one HOV lane in each direction on SR 520). In addition, the 8-Lane Alternative would add north and southbound capacity on I-5 equivalent to one lane in each direction.

The additional capacity under the 8-Lane Alternative would encourage traffic growth. By 2030, approximately 25 percent more traffic would approach the I-5 corridor on SR 520 under the 8-Lane Alternative than the No Build Alternative.

Traffic Volumes on I-5

With the addition of highway capacity, traffic forecasts for the year 2030 indicate that traffic volumes on I-5 would shift in the following ways:

- Traffic demand on I-5 southbound on the Ship Canal Bridge would be similar for both the No Build and 8-Lane Alternatives. The 8-Lane Alternative would encourage more growth on I-5 northbound on the Ship Canal Bridge than the No Build Alternative, with a 4 percent increase in the a.m. peak period and 10 percent increase in the p.m. peak period.
- Under the 8-Lane Alternative, southbound I-5 traffic destined to eastbound SR 520 would decrease while northbound I-5 traffic destined to eastbound SR 520 would increase.
- Under the 8-Lane Alternative, traffic on I-5 would use the new capacity through downtown Seattle to access areas farther south or to access the I-90 corridor.
- With the 8-Lane Alternative, traffic to and from SR 520 would also use the new I-5 capacity to access areas south of I-90.

Traffic Volumes on SR 520

SR 520 across Lake Washington

Traffic volumes on SR 520 across Lake Washington were evaluated in terms of peak period bi-directional average values. The peak period bi-directional average is a single value. This value is the a.m. and p.m. peak period average of the eastbound and westbound traffic volumes.

- Vehicle-trip demand across Lake Washington would increase by 14 percent more under the 8-Lane Alternative than the No Build Alternative.
- Increased traffic demand on SR 520 would be predominantly due to increased HOV traffic. The HOV volume would more than triple, while there would be only a 2 percent increase in GP vehicle demand. In 2030, HOV volume forecasts assume three or more persons per vehicle and GP forecasts assume two or fewer persons per vehicle.

SR 520 Corridor

- The person-trip demand under the No Build Alternative would be 16,380 persons per hour. The person-trip demand under the 8-Lane Alternative would be 21,350 persons per hour. The person-trip demand under the 8-Lane Alternative would be 30 percent greater than with the No Build Alternative because of the additional capacity and a shift to HOV modes of transportation across the SR 520 corridor.

Transit Demand on SR 520

- Transit demand for cross-lake travel under the 8-Lane Alternative would be similar to transit demand for cross-lake travel under the No Build Alternative. Under both the No Build and 8-Lane Alternatives, it is estimated that the demand for transit would account for over a quarter of the person-trip demand for cross-lake travel; they would be accommodated in just 1 percent of the vehicles.
- Current SR 520 transit service-hour forecasts would not serve the transit-person demand. Almost twice the number of buses than currently forecasted would be required along the SR 520 corridor to serve the future person demand in 2030.

Local Travel Demand Forecasts for the Year 2030

The traffic volume forecasts for the year 2030 show that overall local intersection traffic in the downtown area would be less under the 8-Lane Alternative than under the No Build Alternative. This is because, under the 8-Lane Alternative, it is assumed that there would be a shift from using single-occupancy vehicles on SR 520 to using transit and HOVs. This mode shift would be encouraged by the additional HOV lane and the toll on SR 520. Modifications to I-5 access

points and local traffic circulation under the 8-Lane Alternative would shift traffic volumes at several downtown intersections. This shift in traffic circulation would result in higher volumes at some local intersections than in the No Build Alternative.

Freeway Traffic Operations Forecasts for the Year 2030

This section summarizes the key points from the forecasted year 2030 freeway traffic operations for the 8-Lane Alternative as compared to the No Build Alternative.

I-5 Traffic Operations Forecasts

- Southbound I-5 traffic would operate at over capacity conditions in both the No Build and 8-Lane Alternatives. The additional capacity provided by the 8-Lane Alternative on southbound I-5 between SR 520 and the I-90 off-ramp would not serve the additional through traffic demand.
- Traffic on the northbound I-5 frontage road would operate over capacity with the 8-Lane Alternative. The frontage road would be designed for two lanes. However, the demand would be equivalent to up to four lanes of traffic.
- Congestion on mainline I-5 between I-90 and SR 520 interchanges under the No Build Alternative would be alleviated under the 8-Lane Alternative because of the upstream congestion.
- Congestion on southbound I-5 under the 8-Lane Alternative would limit the traffic volume served across westbound SR 520. The congestion on southbound I-5 would extend onto the SR 520 corridor as far back as the I-405 interchange. With more capacity added to I-5, it would attract non-SR 520 users (persons accessing I-5 from local arterials along I-5, not originating from local arterials along SR 520) and the capacity would soon be "filled."
- The congestion on I-5 would be due to both the additional SR 520 traffic and a redistribution of I-5 traffic. Therefore, WSDOT determined that during the I-5 Pavement Reconstruction Project they would explore opportunities to gain additional capacity and efficiency out of the existing corridor.

SR 520 Traffic Operations Forecasts

The key points related to SR 520 traffic operations are discussed in terms of peak period bi-directional average values. The peak period bi-directional average is a single value that is a summary of the a.m. and p.m. peak period averages for the eastbound and westbound traffic volumes.

- The 8-Lane Alternative would allow 21 percent more people to cross the SR 520 Evergreen Point Bridge in 3 percent more vehicles than in the No Build Alternative. This is a result of greater transit and HOV use along the SR 520 corridor under the 8-Lane Alternative than under the No Build Alternative.
- GP traffic demand under the 8-Lane Alternative would be greater than with the No Build Alternative. However, 11 percent fewer trips would be served under the 8-Lane Alternative.
- Under the 8-Lane Alternative, people in the GP lanes would need 41 minutes to travel between I-5 and 124th Avenue Northeast during the peak period. That trip would be 14 minutes longer than the same trip under the No Build Alternative.
- Under the 8-Lane Alternative, travel time between I-5 and 124th Avenue Northeast would be 21 minutes during the peak period for transit and HOV users which have a dedicated lane between I-5 and 124th Avenue Northeast. This would be 2 minutes less than the time needed for transit and HOV travel under the No Build Alternative (which has an HOV lane in the westbound direction between 124th Avenue Northeast and 76th Avenue).
- The average speed on the SR 520 corridor for the 8-Lane Alternative would be about 10 miles per hour (mph) for GP lanes and 21 mph for HOV lanes.
- A 3 percent increase in vehicles served across SR 520 is far less than the demand due to congestion spillback from I-5. Therefore, additional lanes in the 8-Lane Alternative would simply provide queue storage for much of the day.

Local Traffic Operations Forecasts for the Year 2030

This section summarizes the key points from the forecasted 2030 local traffic operations analyses of 48 study intersections for the 8-Lane Alternative as compared to the No Build Alternative.

Overall Local Traffic Operations Forecasts

- The 8-Lane Alternative greatly affects traffic operations on the local street network in the downtown Seattle and Stewart Street interchange areas. The other interchange areas experience a mix of effects during the various peaks.
- The greatest differences between the No Build Alternative and the 8-Lane Alternative related to local traffic volumes occur in downtown Seattle, where the existing interchange area would be reconfigured. The 8-Lane Alternative volumes would require extensive improvements to local streets in the downtown Seattle interchange area near the I-5 ramps.
- At 10 study intersections, level of service (LOS) improves to LOS D or better than No Build delay (for those at LOS D or worse under the No Build Alternative).
- At 11 study intersections, LOS degrades to LOS D or worse than the No Build Alternative delay (for those at LOS D or worse under the No Build Alternative).

Transit Operations Forecasts for the Year 2030

This section summarizes the key points from the forecasted 2030 transit service and ridership analyses for the 8-Lane Alternative as compared to the No Build Alternative.

- Average peak period passenger loads would be generally much higher than those provided for in the proposed bus operating plans. This is the case for the 8-Lane Alternative, and to a lesser extent, for the No Build Alternative.
- In order to bring bus operating plans in line with projected transit demand, additional buses would need to be added to those routes.
- The addition of dedicated HOV lanes under the 8-Lane Alternative would dramatically reduce travel times for westbound a.m. peak period HOVs compared to the No Build Alternative. In the

eastbound direction, the 8-Lane Alternative would result in 50 percent shorter HOV travel times during the a.m. peak period than under the No Build Alternative.

- The dedicated HOV facilities under the 8-Lane Alternative would increase HOV and transit ridership as compared to the No Build Alternative.
- Local traffic operations show an LOS degradation at the Stewart Street intersection with Denny Way. This intersection is heavily used by transit. Transit travel times would be adversely affected by the 8-Lane Alternative.

Freeway and Local Travel Demand Forecasts for the Year 2030

What is this section about?

This section presents the results of the 2030 freeway and local travel demand forecast analyses. It focuses on the SR 520 freeway mainline and ramps. It also summarizes the results of the I-5 and I-405 freeway mainline and ramp analyses. For a full description of the forecasting methodology, see Chapter 3 of Appendix R, *Transportation Discipline Report*. See *Final Submittal of Freeway and Local Traffic Forecasts and Operations* (Parametrix 2004) for traffic volumes. Exhibit 1 shows the project study area.

The project team completed 2030 traffic forecasts for the No Build and 8-Lane Alternatives covering the a.m. and p.m. peak periods. These forecasts include person-trip demand, vehicular demand, and mode choice.

Mode choice refers to how persons travel—in single-occupancy vehicles (using GP lanes), in HOVs, or in transit vehicles. Transit and HOV modes of transportation are the most efficient for moving people because they move more persons in fewer vehicles.

The a.m. and p.m. forecast results are divided into the following sections:

- Southbound I-5
- Northbound I-5
- Westbound SR 520
- Eastbound SR 520
- Adjacent travel routes

How would freeway travel demand and patterns change?

This section contains an analysis of travel demand and patterns along I-5, SR 520, and I-405 and traffic volumes during the a.m. and p.m. peak

periods, and compares the results of the No Build Alternative and the 8-Lane Alternative.

How would travel demand and patterns change during the a.m. peak period?

Southbound I-5

No Build Alternative

In 2030, traffic volumes would increase on southbound I-5 to:

- 7,220 vehicles per hour (vph) (6 percent growth compared to the present) at the Ship Canal Bridge
- 7,380 vph south of SR 520 (2 percent growth)
- 7,070 vph north of I-90 (37 percent growth)

Forecasts indicate that traffic volumes exiting from southbound I-5 to Seattle would decrease in the future. The decrease would be in vehicle trips, not person trips, resulting from people shifting to the use of transit and HOVs instead of single-occupancy vehicles. Forecasts indicate that traffic traveling from north of the Ship Canal Bridge to areas south of I-90 would increase. The decrease in traffic volume to Seattle, along with increases in freeway through trips, would increase traffic volumes on mainline I-5 approaching I-90 by 1,900 vph (equivalent to one lane of traffic).

8-Lane Alternative

Traffic volumes on the Ship Canal Bridge would be similar to those for the No Build Alternative (7,180 vph).

In 2030, the 8-Lane Alternative would have the following effects on SR 520:

- Traffic to SR 520 would be 160 vph less than under the No Build Alternative
- Traffic continuing on I-5 through the SR 520 interchange would be 200 vph greater than the No Build Alternative
- Traffic from SR 520 would be 690 vph more than the No Build Alternative (27 percent greater)
- South of SR 520, there would be 890 vph more than the No Build Alternative (12 percent greater)

Between SR 520 and north of I-90, I-5 would have one additional lane of capacity compared to the No Build Alternative. Through most of this section, the 8-Lane Alternative demand would be around 10 percent greater than demand under the No Build Alternative.

South of the I-90 collector-distributor, there would be one additional lane of capacity. This would yield 2,670 vph (one-and-a-quarter lanes of traffic) more than the No Build Alternative (71 percent greater). The volume increases because traffic from I-5 destined for the new eastbound I-90 direct ramp connection would not have exited the freeway yet. (With the No Build Alternative, the eastbound I-90 traffic would exit on the I-90 collector-distributor.)

Northbound I-5

No Build Alternative

In 2030, traffic volumes would increase on northbound I-5 to:

- 6,900 vph (13 percent growth compared to today) north of I-90
- 7,370 vph south of SR 520 (20 percent growth)
- 7,140 vph on the Ship Canal Bridge (20 percent growth)

Traffic demand into Seattle would decrease compared to today because people would likely shift from the use of single-occupancy vehicles to HOVs and transit.

8-Lane Alternative

The traffic volumes south of the I-90 interchange would be similar to those for the No Build Alternative. The 8-Lane Alternative includes a frontage road that would provide access to Seneca Street and remove the Seneca Street ramp connection. Therefore, the 8-Lane Alternative would have 40 percent less demand (approximately 2,370 vph or a full lane of traffic) between the frontage road off-ramp and the I-90 westbound on-ramp than the No Build Alternative at the same location. However, both the No Build and 8-Lane Alternatives would have the same number of lanes.

South of SR 520, traffic volume on northbound I-5 would be 500 vph more than the No Build Alternative (7 percent greater) due to the additional capacity on I-5 between I-90 and SR 520.

Traffic volume to SR 520 would be 170 vph more than the No Build Alternative (12 percent greater). Compared to the No Build Alternative, 320 vph more would remain on I-5. That is 6 percent greater than the

No Build Alternative. Traffic volumes from SR 520 to I-5 northbound would be similar to those for the No Build Alternative. The result would be 330 vph more on the Ship Canal Bridge than the No Build Alternative (4 percent greater).

Westbound SR 520

No Build Alternative

In 2030, the average person-trip demand across Lake Washington would be 8,980 persons per hour in 3,900 vehicles. This indicates that people would shift to using more transit options compared to the present.

8-Lane Alternative

The average person-trip demand across Lake Washington would be 37 percent greater than the No Build Alternative and the vehicle demand would be 24 percent greater (12,340 persons in 4,840 vph). This indicates that people would shift to using even more HOVs and transit options than the No Build Alternative.

The following bullets and Exhibit 4 summarize the vehicular growth and traffic flow pattern changes for the 8-Lane Alternative as compared with the No Build Alternative.

- Traffic volumes would be 11 percent greater west of the I-405 interchange. The growth would originate from I-405 and from an increase in through trips on SR 520 from east of I-405.
- Between I-405 and Evergreen Point, there would be less traffic exiting the freeway and more traffic entering the freeway.

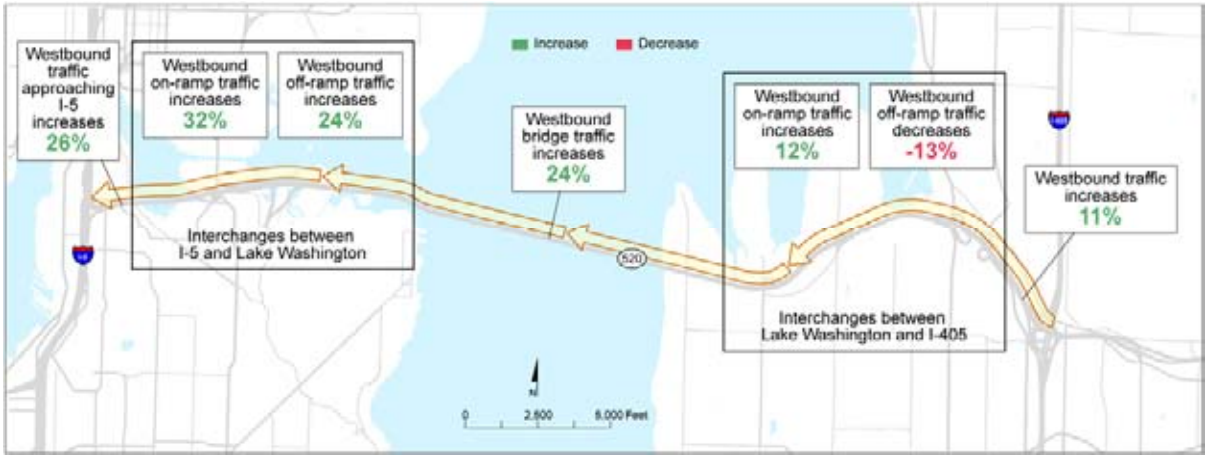


Exhibit 4. Westbound A.M. Peak Period Traffic Growth, 8-Lane Alternative Compared with the No Build Alternative

- Traffic volumes would be 24 percent greater across Lake Washington. Even though traffic volumes would be greater, persons would still be shifting to the use of HOV modes of transportation. GP vehicles would be 6 percent greater, but the HOV volume would be over three times greater than the No Build Alternative HOV volume.

- Westbound traffic exiting to Lake Washington Boulevard would be greater than the No Build Alternative. Traffic exiting to Montlake Boulevard would be less than the No Build Alternative due to the reconfiguration of this interchange area; however, the total traffic exiting to these interchanges would still be greater than the No Build Alternative. Traffic entering SR 520 at the Montlake Boulevard interchange would be greater than the No Build Alternative.

- Traffic volume would be 26 percent greater approaching I-5. The additional traffic volume would be destined for I-5 southbound. This is due to the additional capacity on I-5 between SR 520 and I-90. The traffic volume to I-5 northbound would be the same for both alternatives.

Did you know?

AVO: This term is used to describe the average number of persons per vehicle.

We made the following AVO assumptions for the forecasting analyses:

1.33 persons per GP vehicle

3.15 persons per HOV vehicle

Exhibit 5. **AVO Definition**

Mode Split

The mode split and average vehicle occupancy (AVO) across Lake Washington on SR 520 during the a.m. peak period are listed below. Exhibit 5 describes AVO. Exhibit 6 depicts the mode choice.

No Build Alternative

During the a.m. peak period, there would be a shift to transit by the 2030 that would increase the AVO across Lake Washington to 2.31.

- GP traffic would carry 52 percent of the people in 90 percent of the vehicles.

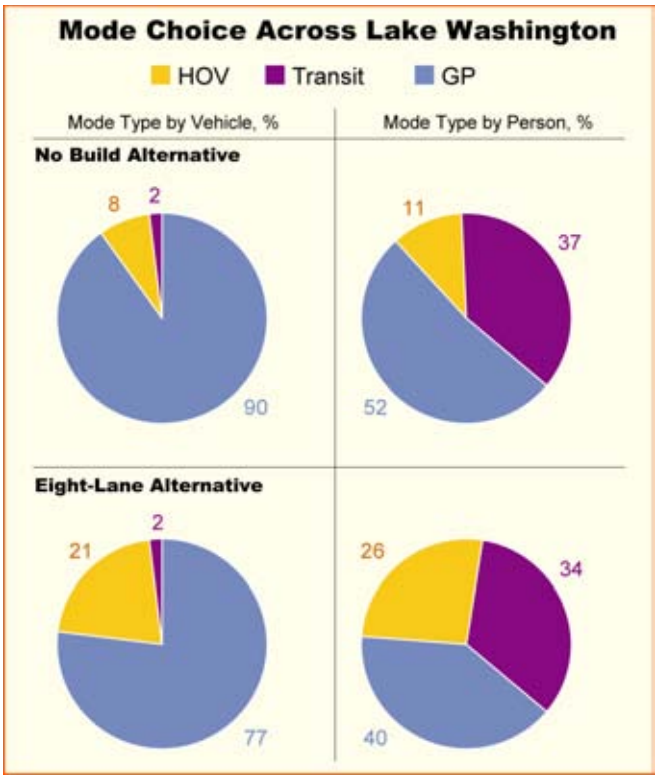


Exhibit 6. **Mode Choice, Westbound SR 520 A.M. Peak Period**

- Transit would carry 37 percent of the people in 2 percent of the vehicles.
- HOV traffic would carry 11 percent of the people in 8 percent of the vehicles.

8-Lane Alternative

- There is a greater shift to HOVs and transit than the No Build Alternative, increasing AVO across Lake Washington to 2.55.
- GP traffic would carry 40 percent of the people in 77 percent of the vehicles.
- Transit would carry 34 percent of the people in 2 percent of the vehicles.
- HOV traffic would carry 26 percent of the people in 21 percent of the vehicles.

Eastbound SR 520

No Build Alternative

The average person-trip demand across Lake Washington would be 7,210 persons per hour in 4,360 vehicles under the No Build Alternative.

8-Lane Alternative

The average person-trip demand would increase 15 percent and the vehicle demand would decrease 4 percent across Lake Washington, resulting in 8,300 persons in 4,210 vph. Traffic demand would decrease across Lake Washington compared to the No Build Alternative because a toll would be charged to cross Lake Washington and people would shift to use HOVs and transit.

The following bullets and Exhibit 7 summarize the vehicular growth and traffic flow pattern changes for the 8-Lane Alternative compared to the No Build Alternative.

- Traffic from I-5 would distribute to SR 520 in reverse proportions as the No Build Alternative with slightly more traffic coming from the south with the 8-Lane Alternative.
- The traffic exiting to the Montlake Boulevard area would increase 74 percent, while traffic entering the freeway from the Montlake Boulevard and Lake Washington Boulevard areas would increase by 14 percent. More vehicles would exit than enter the freeway; thus there would be a decrease in traffic across Lake Washington.

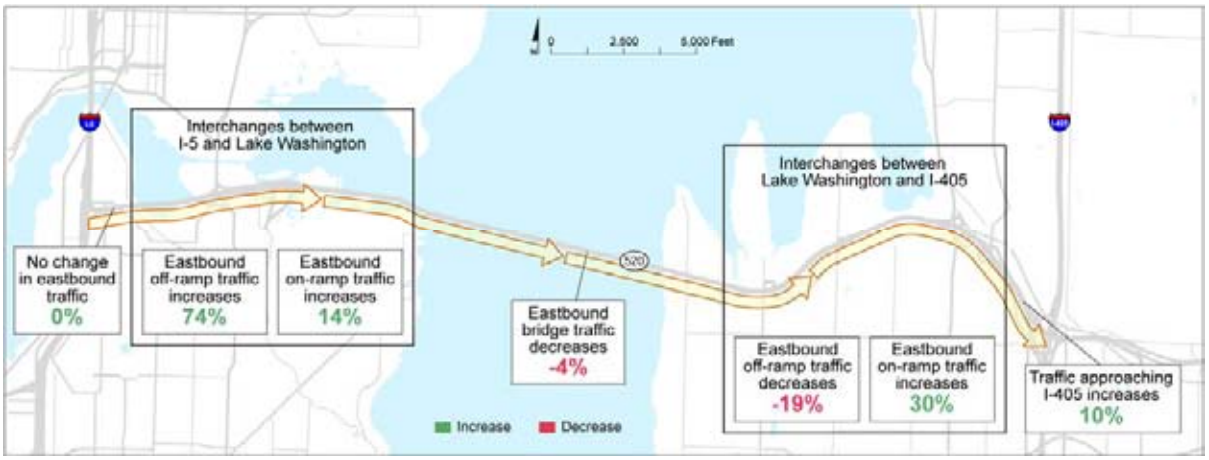


Exhibit 7. Eastbound A.M. Peak Period Traffic Growth, 8-Lane Alternative Compared with the No Build Alternative

- Traffic volumes would decrease 4 percent across Lake Washington because trips would divert to alternate routes or HOV/transit modes of transportation because of the toll. GP vehicles would decrease by 12 percent but the HOV volume would be over 2.5 times greater than the No Build Alternative HOV volume.
- The off-ramp volume exiting between Evergreen Point and I-405 would decrease but the on-ramp volume entering the freeway would increase.
- Approaching I-405, traffic volumes would increase 10 percent with most traffic growth destined to I-405. Traffic volumes east of I-405 would increase only 2 percent compared to the No Build Alternative.

Mode Split

The mode split and AVO across Lake Washington on SR 520 during the a.m. peak period are listed below. Exhibit 8 depicts the mode choice.

No Build Alternative

By the year 2030, there would be an increase in transit and GP traffic demand that would increase the AVO on eastbound SR 520 to 1.65 during the a.m. peak period.

- GP traffic would carry 76 percent of the people in 94 percent of the vehicles.
- Transit would carry 15 percent of the people in 1 percent of the vehicles.

- HOV traffic would carry 9 percent of the people in 5 percent of the vehicles.

8-Lane Alternative

There is a greater shift to HOVs and transit than the No Build Alternative, increasing AVO to 1.97.

- GP traffic would carry 58 percent of the people in 86 percent of the vehicles.
- Transit would carry 21 percent of the people in 1 percent of the vehicles.
- HOV traffic would carry 21 percent of the people in 13 percent of the vehicles.

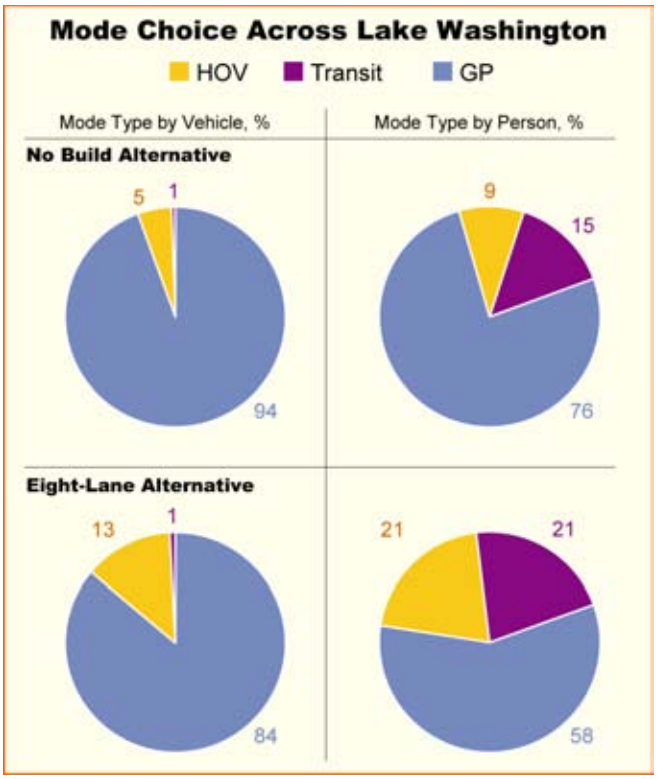


Exhibit 8. **Mode Choice, Westbound SR 520 A.M. Peak Period**

Adjacent travel routes

SR 520 East of I-405

No Build Alternative

In 2030, on SR 520 east of I-405, the demand would be 5,370 vph westbound and 6,540 vph eastbound.

8-Lane Alternative

The traffic demand on SR 520 east of I-405 would be 3 percent greater than the No Build Alternative westbound and 2 percent greater eastbound.

I-405

No Build Alternative

In 2030, the southbound I-405 traffic demand would be 11,350 vph north and south of the SR 520 interchange. The northbound I-405 traffic demand would be 7,850 vph south of the SR 520 interchange and 5,680 vph north of the SR 520 interchange.

8-Lane Alternative

The southbound I-405 traffic demand north and south of the SR 520 interchange would not differ from that for the No Build Alternative. The northbound I-405 traffic demand south of SR 520 would not differ from that under the No Build Alternative. However, the northbound I-405 traffic demand north of SR 520 would be 1 percent less than the No Build Alternative.

How would travel demand and patterns change during the p.m. peak period?

Southbound I-5

No Build Alternative

In 2030, traffic volumes would increase on southbound I-5 to:

- 8,550 vph (16 percent growth compared to today) at the Ship Canal Bridge
- 8,810 vph south of SR 520 (20 percent growth)
- 8,400 vph north of I-90 (22 percent growth)

Traffic demand into Seattle would decrease compared to today because of a shift from using single-occupancy vehicles to HOVs and transit.

8-Lane Alternative

The traffic pattern changes that would occur in the p.m. peak period are similar to the changes that would occur in the a.m. peak period.

Traffic volumes on the Ship Canal Bridge would be similar to those for the No Build Alternative (within 2 percent).

The effect of the 8-Lane Alternative on traffic volumes along SR 520 would be:

- Traffic to SR 520 would be 4 percent less than the No Build Alternative
- Traffic continuing on I-5 through the SR 520 interchange would be 3 percent greater than under the No Build Alternative
- Traffic from SR 520 would be 38 percent greater than under the No Build Alternative
- South of SR 520, traffic volume would be 10 percent greater than under the No Build Alternative

Between SR 520 and I-90, I-5 would have one additional lane of capacity southbound compared to the No Build Alternative. Through most of this section, the 8-Lane Alternative demand would be around 10 percent greater than the No Build Alternative.

North of the I-90 off-ramp, the 8-Lane Alternative would have one additional lane that drops to the eastbound I-90 direct ramp connection. Traffic volume in this section would be 35 percent greater than the No

Build Alternative. The volume increases because traffic from I-5 destined for the eastbound I-90 direct ramp connection.

South of the I-90 collector-distributor, there would be one additional lane of capacity. This would yield 2,160 vph (more than one lane of traffic) more than the No Build Alternative (35 percent greater). The volume increases because traffic from I-5 destined for the new eastbound I-90 direct ramp connection would not have exited the freeway yet. (With the No Build Alternative, the eastbound I-90 traffic would exit on the I-90 collector-distributor.)

Northbound I-5

No Build Alternative

In 2030, traffic volumes would increase on northbound I-5 to:

- 6,890 vph (17 percent growth compared to today) north of I-90
- 8,130 vph south of SR 520 (9 percent growth)
- 8,200 vph on the Ship Canal Bridge (8 percent growth)

Traffic demand into Seattle would increase 5 percent compared to today. However, traffic leaving Seattle to the north would decrease 18 percent because people would like shift from using single-occupancy vehicles to HOVs and transit.

8-Lane Alternative

The traffic volumes south of the I-90 interchange would be similar to those for the No Build Alternative. The 8-Lane Alternative includes a frontage road that would provide access to Seneca Street and remove the Seneca Street ramp connection. Therefore, the 8-Lane Alternative would have 20 percent less demand (approximately 1,200 vph or half a lane of traffic) between the frontage road off-ramp and the I-90 westbound on-ramp than the No Build Alternative would have at the same location. However, both the No Build and 8-Lane Alternatives would have the same number of lanes.

South of SR 520, traffic volume on northbound I-5 would be 10 percent greater than the No Build Alternative because the 8-Lane Alternative would provide additional lanes in this section.

Traffic volume to SR 520 is similar to that for the No Build Alternative. However, 880 vph more than the No Build Alternative would remain on I-5 as through traffic (15 percent greater). Traffic volumes from SR 520 to I-5 northbound would be slightly less than the No Build

Alternative. The result would be 830 vph more on the Ship Canal Bridge than the No Build Alternative (10 percent greater). This traffic would not be related to SR 520 but would be accessing I-5 due to the increased capacity between I-90 and SR 520.

Westbound SR 520

No Build Alternative

In 2030, the average person-trip demand across Lake Washington would be 7,900 persons per hour in 4,830 vehicles. This indicates that people would shift to using more transit options compared to the present.

8-Lane Alternative

The average person-trip demand across Lake Washington would be 33 percent greater than the No Build Alternative and the vehicle demand would be 20 percent greater (10,520 persons in 5,810 vph). This indicates that people would shift to using even more HOVs and transit options than the No Build Alternative.

The following bullets and Exhibit 9 summarize the vehicular growth and traffic flow pattern changes for the 8-Lane Alternative as compared to the No Build Alternative.

- Traffic volumes would be 14 percent greater west of the I-405 interchange. The growth would originate from I-405 and from an increase in through trips on SR 520 from east of I-405.
- Between I-405 and Evergreen Point, there would be more traffic exiting and entering the freeway.

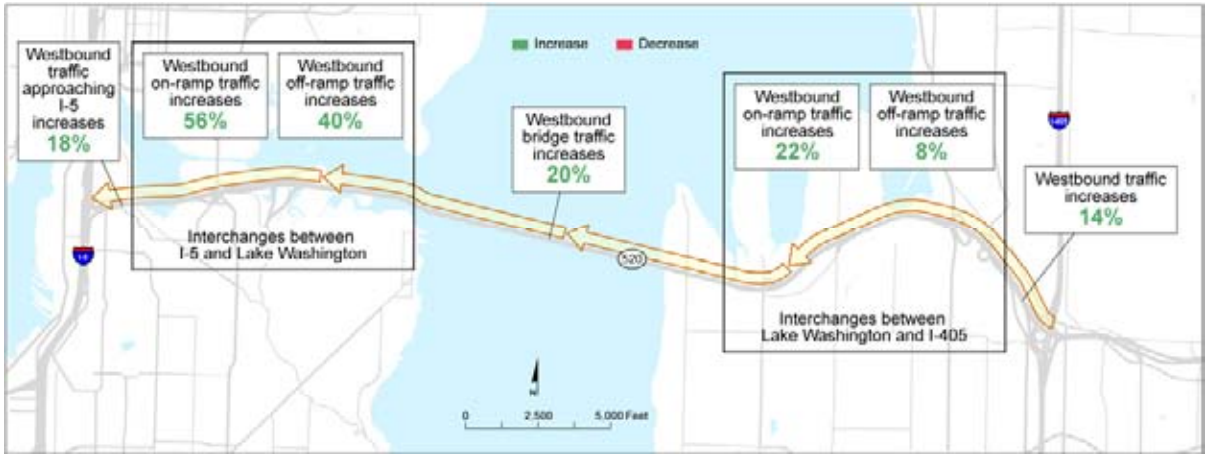


Exhibit 9. Westbound P.M. Peak Period Traffic Growth, 8-Lane Alternative Compared with the No Build Alternative

- Traffic volumes would be 20 percent greater across Lake Washington. Even though traffic would be greater, persons would still be shifting to the use of HOV modes of transportation. GP vehicles would be 14 percent greater, but the HOV volume would be over two times greater than the No Build Alternative HOV volume.
- The total traffic exiting to the Lake Washington Boulevard and Montlake Boulevard interchanges would be greater than the No Build Alternative. However, more traffic would exit at Lake Washington Boulevard (1,280 vph more than the No Build Alternative) and less traffic would exit at Montlake Boulevard (550 vph less than the No Build Alternative) due to the reconfiguration of the arterial connections at the interchanges.
- Traffic volume between Montlake Boulevard and I-5 would be 18 percent greater than the No Build Alternative. The traffic distribution from SR 520 to I-5 would shift to the south at the interchange as compared to the No Build Alternative. Traffic volume on the northbound ramp would be 4 percent less, while the traffic volume on the southbound ramp would be 38 percent greater than the No Build Alternative.

Mode Split

The mode split and AVO across Lake Washington on SR 520 during the p.m. peak period are listed below. Exhibit 10 depicts the mode choice.

No Build Alternative

During the p.m. peak period, there would be a shift to transit and GP demand by 2030 that would increase the AVO across Lake Washington to 1.64.

- GP traffic would carry 77 percent of the people in 95 percent of the vehicles.
- Transit would carry 13 percent of the people in less than 1 percent of the vehicles.
- HOV traffic would carry 10 percent of the people in 5 percent of the vehicles.

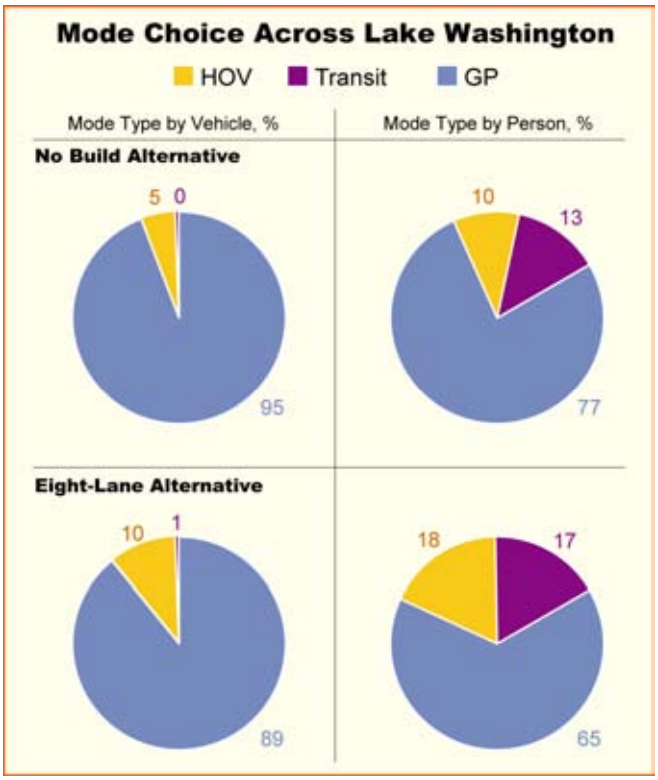


Exhibit 10. **Mode Choice, Westbound SR 520 P.M. Peak Period**

8-Lane Alternative

There is a greater shift to HOVs and transit than the No Build Alternative, increasing AVO across Lake Washington to 1.81.

- GP traffic would carry 65 percent of the people in 89 percent of the vehicles.
- Transit would carry 17 percent of the people in 1 percent of the vehicles.
- HOV traffic would carry 18 percent of the people in 10 percent of the vehicles.

Eastbound SR 520

No Build Alternative

Across Lake Washington, the average person-trip demand would be 8,670 persons per hour in 3,890. There would be a shift to transit compared to today.

8-Lane Alternative

The average person-trip demand would increase 33 percent and the vehicle demand would increase 17 percent across Lake Washington (compared to the No Build Alternative), resulting in 11,530 persons in 4,540 vph. There would be a shift to HOVs and transit compared to the No Build Alternative.

The following bullets and Exhibit 11 summarize the vehicular growth and traffic flow pattern changes for the 8-Lane Alternative compared to the No Build Alternative.

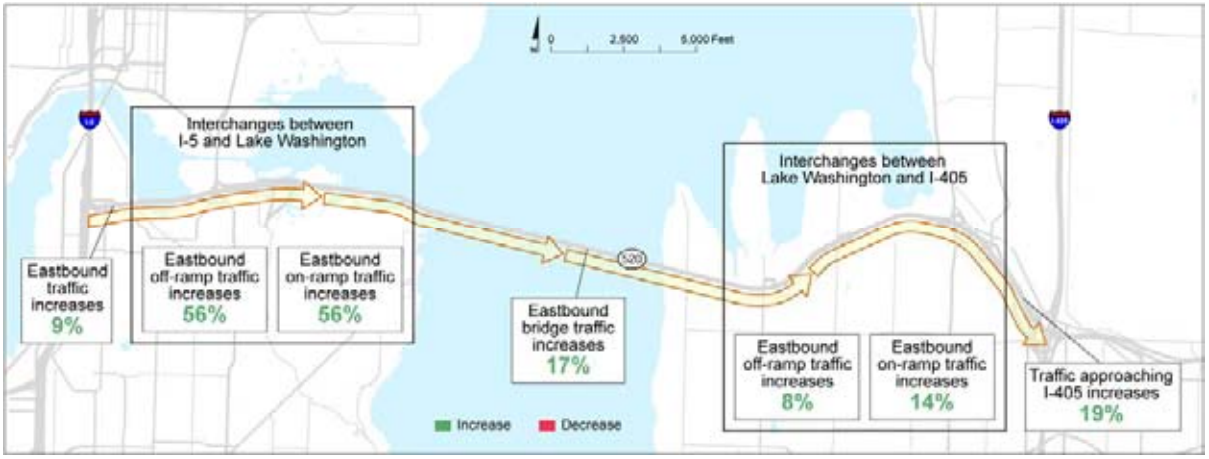


Exhibit 11. Eastbound P.M. Peak Period Traffic Growth, 8-Lane Alternative Compared with the No Build Alternative

- Traffic volumes would increase 9 percent on SR 520 east of I-5. Traffic from I-5 would distribute to SR 520 in similar proportions as the No Build Alternative (with 70 percent from northbound I-5 and 30 percent from southbound I-5).
- Traffic volumes entering and exiting the freeway would increase to and from the interchanges at Montlake Boulevard and Lake Washington Boulevard. Due to the reconfiguration of the ramp connection to the arterials, more traffic would access SR 520 via the Lake Washington Boulevard ramp and less on the Montlake Boulevard ramp.
- Traffic volumes would increase 17 percent across Lake Washington with trips diverting to HOV modes of transportation. GP vehicles would increase by 3 percent but the HOV volume would be over five times greater than the No Build Alternative HOV volume.
- The traffic exiting and entering to and from the local areas between Evergreen Point and I-405 would increase.
- Traffic volumes would increase 19 percent approaching I-405. Most of the traffic growth would be destined to I-405; forecasts indicate 3 percent growth east of the I-405 interchange.

Mode Split

The mode split and AVO across Lake Washington during the p.m. peak period are listed below. Exhibit 12 depicts the mode choice.

No Build Alternative

By 2030, there would be an increase in transit and GP traffic demand that increases the AVO on eastbound SR 520 to 2.25 during the p.m. peak period.

- GP traffic would carry 56 percent of the people in 94 percent of the vehicles.
- Transit would carry 38 percent of the people in 2 percent of the vehicles.
- HOV traffic would carry 6 percent of the people in 4 percent of the vehicles.

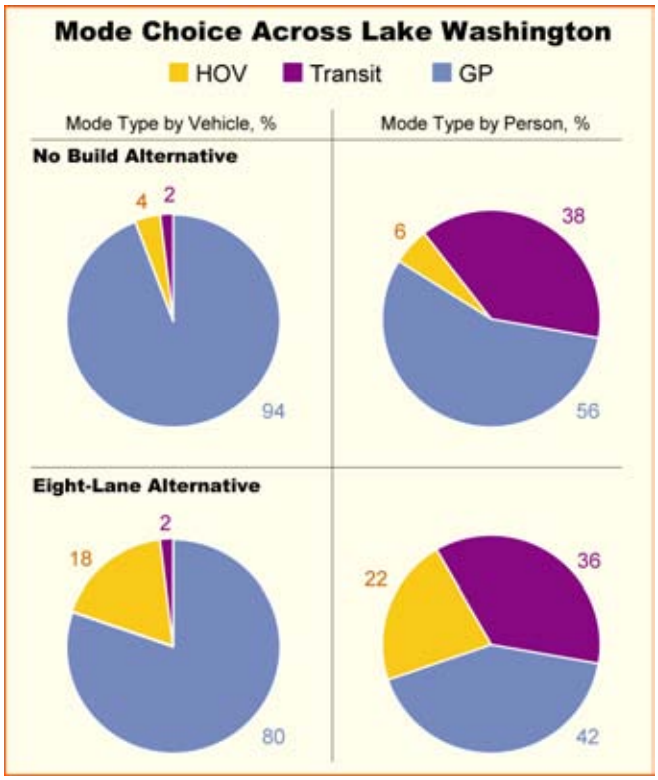


Exhibit 12. **Mode Choice, Eastbound SR 520 P.M. Peak Period**

8-Lane Alternative

There would be a greater shift to HOVs and transit than the No Build Alternative, increasing AVO to 2.54.

- GP traffic would carry 42 percent of the people in 80 percent of the vehicles.
- Transit would carry 36 percent of the people in 2 percent of the vehicles.
- HOV traffic would carry 22 percent of the people in 18 percent of the vehicles.

Adjacent travel routes

SR 520 East of I-405

No Build Alternative

In 2030, on SR 520 east of I-405, the demand would be 6,100 vph westbound and 5,630 vph eastbound.

8-Lane Alternative

The traffic demand on SR 520 east of I-405 would be 2 percent greater than the No Build Alternative westbound and 3 percent greater eastbound.

I-405

No Build Alternative

In 2030, the southbound I-405 traffic demand would be 7,710 vph north of SR 520 and 8,790 vph south of the SR 520 interchange. The northbound I-405 traffic demand would be 11,270 vph south of the SR 520 interchange and 10,600 vph north of the SR 520 interchange.

8-Lane Alternative

The southbound I-405 traffic demand would be 3 percent greater north of the SR 520 interchange than that for the No Build Alternative and 2 percent greater south of the SR 520 interchange. The northbound I-405 traffic demand would be 1 percent less south of SR 520 than the No Build Alternative and 1 percent more north of SR 520.

How would local travel demand and patterns change?

The 2030 forecasts show that, overall, local intersection traffic in downtown Seattle would be less under the 8-Lane Alternative than the No Build Alternative. The reason for this is a mode shift on SR 520 from

single-occupancy vehicles to transit and HOV. Tolling on SR 520 would encourage this shift away from single-occupancy vehicles.

The 8-Lane Alternative modifications to I-5 access points and local traffic circulation result in a shift in traffic volumes at several downtown intersections. This shift in traffic circulation results in higher volumes at some local intersections that would not be used in the No Build Alternative.

For detailed information on the methodology used to forecast local travel demand, see *Freeway and Local Traffic Forecasts* in Appendix R, *Transportation Discipline Report*.

Freeway Traffic Operations Forecasts for the Year 2030

What is this section about?

This section discusses general SR 520 traffic operations as well as a.m. and p.m. peak period traffic operations forecasted for the year 2030 under the No Build and 8-Lane Alternatives. Measures of effectiveness (MOEs) include queues, travel-time, speed, person and vehicle throughput, and total delay. A description of the MOEs and the methodology used for the freeway traffic operations analyses are provided in Chapter 4 of Appendix R, *Transportation Discipline Report*.

Traffic growth and operational issues differ throughout the day. The effects of the 8-Lane Alternative for the following traffic operations are discussed for the a.m. and p.m. peak periods:

- Overall SR 520
- Westbound SR 520
- Eastbound SR 520
- Southbound I-5
- Northbound I-5

How would the 8-Lane Alternative affect SR 520 traffic operations?

Exhibits 13 and 14 illustrate the SR 520 traffic operations forecasts for 2030 for the No Build and 8-Lane Alternatives during the a.m. and p.m. peak periods. These exhibits depict travel speeds, congestion, and travel time throughout the corridor. Exhibit 15 summarizes the SR 520 traffic operations forecasts for 2030 by direction (westbound and eastbound).

How would the 8-Lane Alternative affect freeway operations during the a.m. peak period?

Westbound SR 520

Where would the potential congestion points be?

The a.m. peak hour congestion points for westbound SR 520 today include:

- Weave section between 124th Avenue Northeast and I-405 interchange
- I-405 southbound at the ramp from westbound SR 520
- I-405 northbound at the ramp to eastbound SR 520
- Evergreen Point Bridge east approach and termination point for the HOV Lane
- I-5 southbound mainline through downtown Seattle
- I-5 southbound express lanes through downtown Seattle
- Exhibit 16 indicates the levels of congestion that are forecasted in these locations for 2030 under the No Build and 8-Lane Alternatives.

Weave Section between 124th Avenue Northeast and I-405 Interchange

Today, westbound traffic on SR 520 between 124th Avenue Northeast and I-405 operates with moderate congestion because SR 520 traffic must weave with traffic from 124th Avenue Northeast. Speeds on a portion of SR 520 are less than 50 mph for 3.5 hours during the a.m. peak period, and are reduced to 30 to 40 mph for 1.5 hours.

The 2030 traffic demand forecasts indicate that there would be a 21 percent increase in traffic at this location for the No Build Alternative and a 31 percent increase for the 8-Lane Alternative. This would increase congestion compared to the present. In 2030, traffic would queue (operate at speeds less than 30 mph) at this location for more than 3.5 hours for both the No Build and 8-Lane Alternatives. The congestion at this location would overlap with the downstream queues.

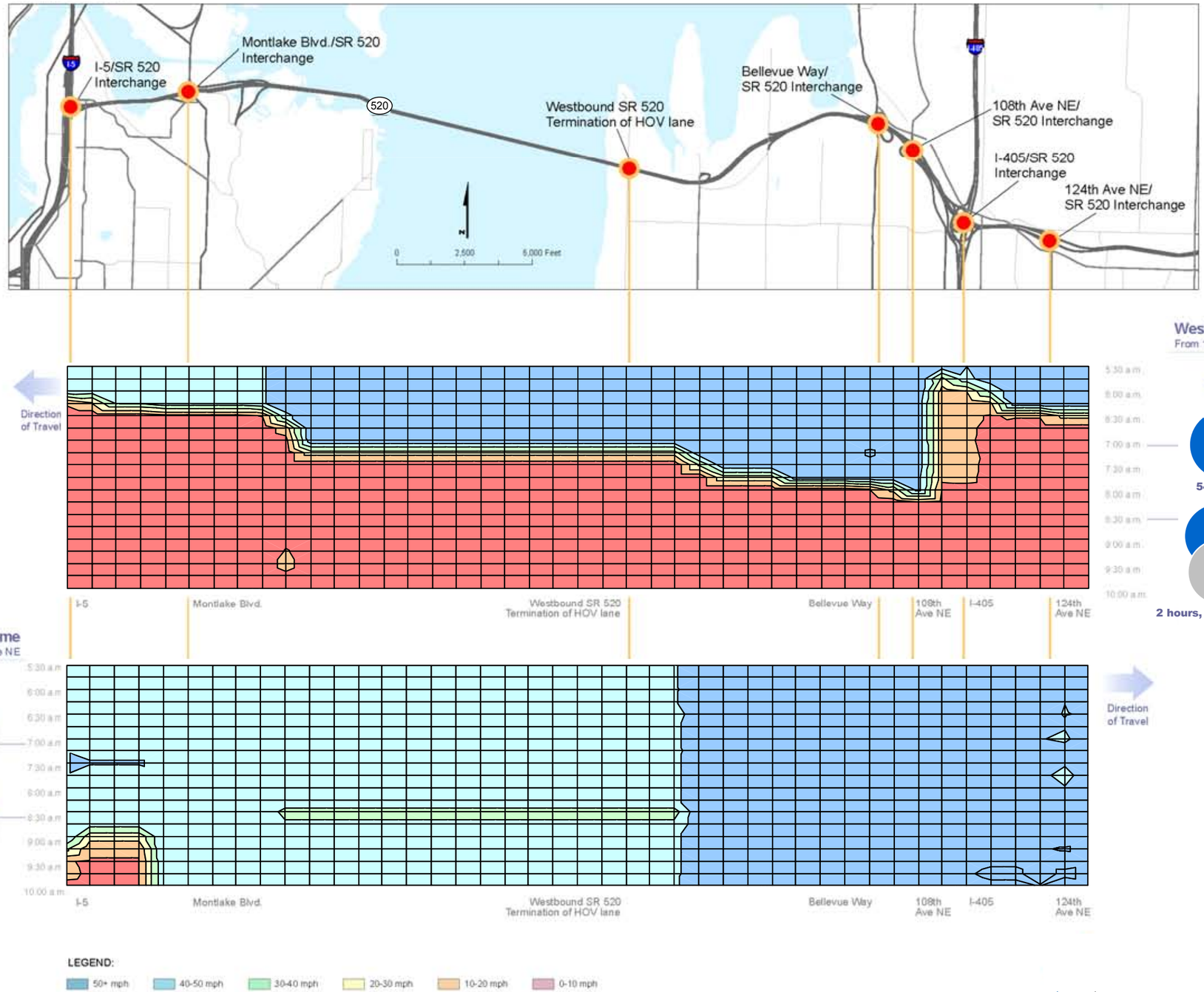
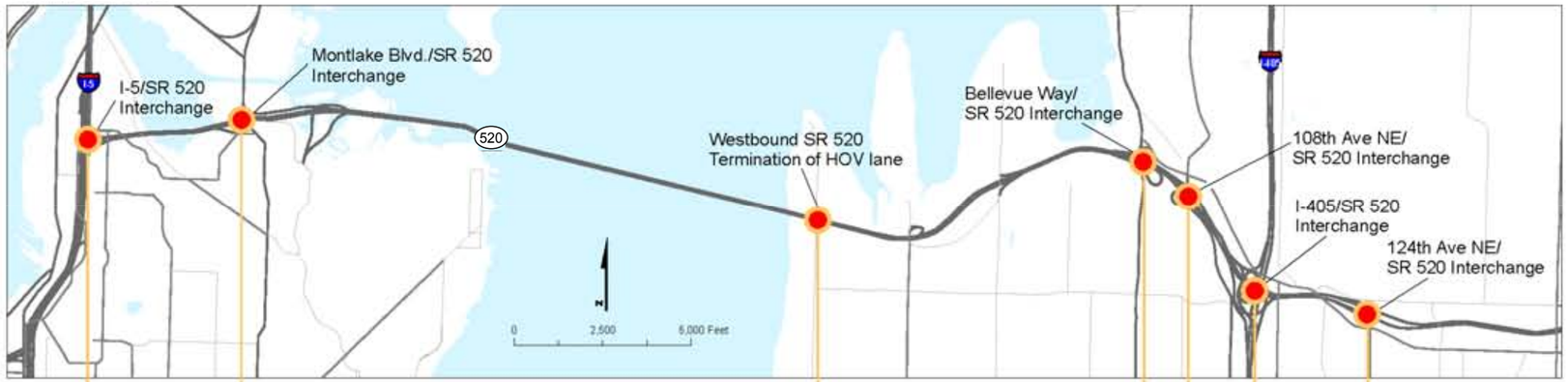


Exhibit 13. **A.M. Peak Period Traffic Operations, 8-Lane Alternative Conditions in 2030**
SR 520 Bridge Replacement and HOV Project



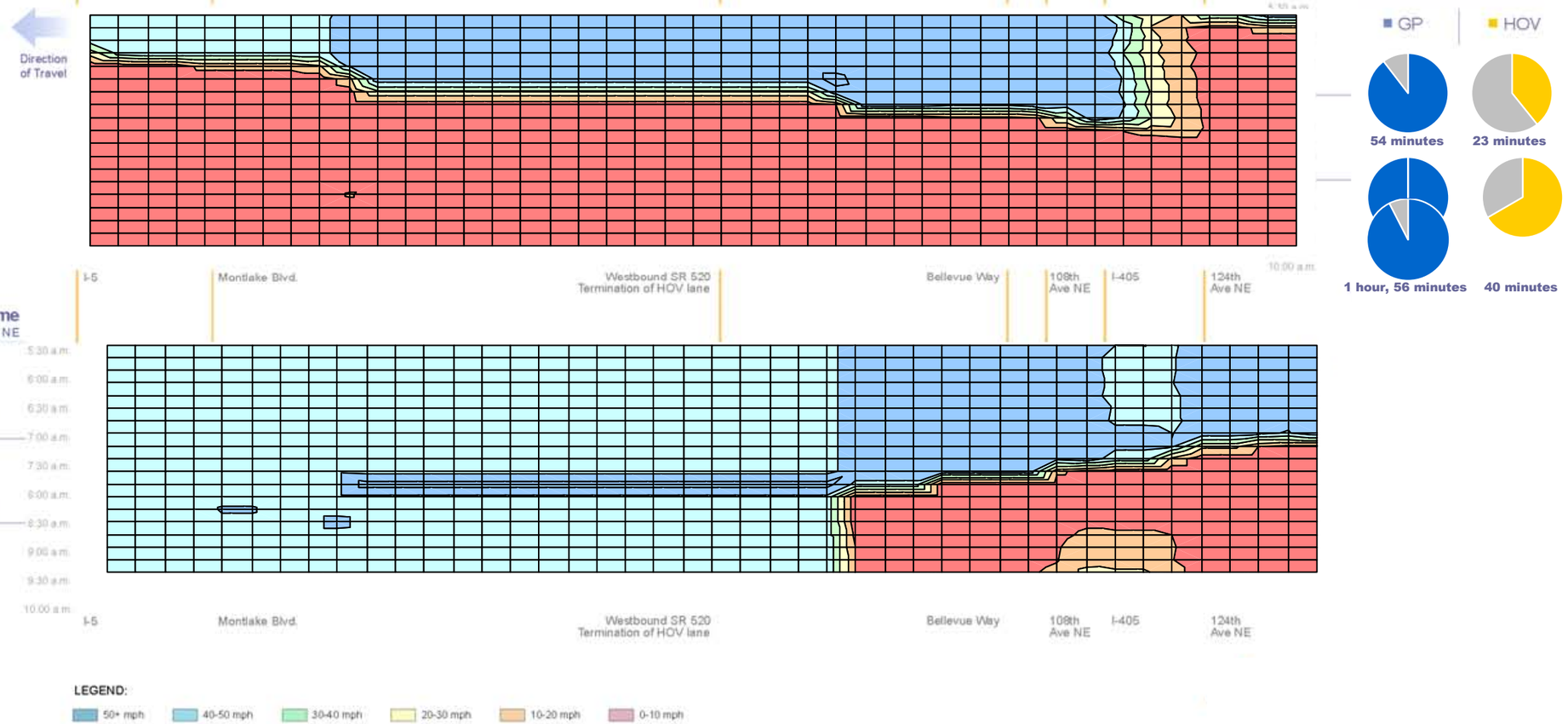


Exhibit 14. **P.M. Peak Period Traffic Operations, 8-Lane Alternative Conditions in 2030**
SR 520 Bridge Replacement and HOV Project

In other words, queues that begin farther to the west would trickle back to this location.

Exhibit 15. Summary of SR 520 Traffic Operations Forecasts for 2030

Measure of Effectiveness	A.M. Peak Period				P.M. Peak Period			
	No Build Alternative		8-Lane Alternative		No Build Alternative		8-Lane Alternative	
	WB	EB	WB	EB	WB	EB	WB	EB
Average Travel Time between I-5 and 124th Avenue Northeast								
General Purpose (GP)	49 min	19 min	1 hr, 18 min	8 min	30 min	10 min	1 hr, 4 min	15 min
High-Occupancy Vehicle (HOV)	39 min	19 min	45 min	8 min	24 min	9 min	22 min	8 min
Across Lake Washington								
Person Throughput (per hour)	6,320	6,100	7,200	7,410	6,640	7,170	7,260	9,790
Vehicle Throughput (per hour)	2,890	3,560	2,430	3,880	3,930	3,390	3,730	4,220

EB = eastbound SR 520
hr = hour
min = minute(s)
WB = westbound SR 520

Exhibit 16. Westbound SR 520 A.M. Peak Hour Congestion Points

Location	Year 2030	
	No Build Alternative	8-Lane Alternative
Weave section between 124th Avenue Northeast and I-405 interchange	X	X
I-405 southbound at ramp from westbound SR 520	X	X
I-405 northbound at ramp to eastbound SR 520	■	■
Evergreen Point Bridge east approach		●
I-5 southbound mainline through downtown Seattle	X	X
I-5 southbound express lanes through downtown Seattle	■	■

● No queuing at this location (speeds greater than 50 mph) and no effect on SR 520

◆ Moderate congestion at this location (speeds between 30 and 50 mph) and no effect on SR 520

■ Queuing at this location (speeds less than 30 mph) but no effect on SR 520

X Queuing at this location (speeds less than 30 mph) **and** affects SR 520

I-405 Southbound at Ramp from Westbound SR 520

Today, southbound I-405 is congested where westbound SR 520 ramp traffic merges onto I-405.

The 2030 No Build Alternative forecasts indicate a 45 percent growth in traffic volume compared to today on I-405 at the SR 520 interchange. The 8-Lane Alternative forecasts indicate traffic volume similar to the No Build Alternative. Operations would continue to degrade for both alternatives. This degradation would result in a queue that would extend from the SR 520 ramps to north of Northeast 70th Street that would last for most of the a.m. peak period.

Congestion on southbound I-405 near the SR 520 interchange would cause vehicles to back up through the ramp from westbound SR 520 onto the SR 520 mainline. This backup would cause a queue that would merge with congestion on SR 520. In addition, this congestion would reduce the volume of traffic able to reach the I-405 off-ramp to SR 520, which would reduce the traffic volume able to access SR 520.

I-405 Northbound at Ramp to Eastbound SR 520

Today, traffic on the northbound I-405 to SR 520 eastbound ramp operates near capacity. This means that the number of vehicles accessing this ramp is the maximum number that the ramp is designed to carry.

The 2030 No Build Alternative forecasts indicate a 27 percent growth in traffic volume on the northbound I-405 to SR 520 ramp compared to today.

The 2030 8-Lane Alternative forecasts indicate demand similar to that for the No Build Alternative. Traffic operations on the ramp and on I-405 approaching the ramp would continue to degrade for both alternatives. This would result in a queue that would extend from the SR 520 ramps to south of Northeast 4th Street that would last for most of the a.m. peak period. The effect on westbound SR 520 would be that the demand from I-405 to westbound SR 520 (or vehicles on I-405 wishing to access SR 520) would not be served since those vehicles would be trapped in congestion.

Evergreen Point Bridge East Approach and Termination Point for HOV Lane

Today, westbound SR 520 congestion occurs for a period of 1.5 hours approaching the HOV lane termination point and the Evergreen Point

Bridge. At the peak of congestion, vehicles queue back to 104th Avenue Northeast (Bellevue Way).

The 2030 No Build Alternative forecasts indicate that, because of capacity constraints near the I-405 interchange, the current morning congestion approaching the HOV lane termination point and the east bridge approach would not occur. Congestion at the I-405 interchange would decrease how much traffic could use the ramps by about 10 percent. That would reduce the amount of traffic that reached the Evergreen Point Bridge. However, it is predicted that congestion occurring on I-5 would spill back onto SR 520 and across the Evergreen Point Bridge.

With the 2030 8-Lane Alternative, congestion that occurs on SR 520 from I-5 to I-405 would be caused by constraints on southbound I-5. If the I-5 capacity constraints were removed, congestion at Evergreen Point would not occur with the improvements planned for the Evergreen Point Bridge.

I-5 Southbound Mainline through Downtown Seattle

Today, congestion occurs on southbound I-5 through the downtown Seattle area and extends north to the Ship Canal Bridge.

The 2030 No Build Alternative forecasts indicate a 37 percent increase in traffic on I-5 north of I-90. Therefore, I-5 traffic operations through downtown Seattle would continue to degrade. The resulting queue on southbound I-5 would extend from I-90 to north of Northeast 45th Street for most of the a.m. peak period. Congestion on southbound I-5 would cause vehicles to back up through the ramp from SR 520 onto the westbound SR 520 mainline. When the I-5/SR 520 interchange becomes congested, the SR 520 ramp to southbound I-5 would be limited to serving 1,650 vph. This is 50 percent less than the ramp's actual capacity. The congestion would cause a queue on SR 520 that would last for 3.5 hours or more. At its a.m. peak, the queue would extend beyond the SR 520/I-405 interchange and onto the I-405 mainline.

The 2030 8-Lane Alternative forecasts indicate that SR 520 congestion would begin on southbound I-5 near the newly configured I-90 eastbound off-ramp. As discussed in *Freeway and Local Travel Demand Forecasts for the Year 2030* above, traffic growth on I-5 between the express lanes and I-90 eastbound off-ramp would be nearly 71 percent (2,670 vph or demand equaling one-and-a-quarter lanes of traffic) more than the No Build Alternative. However, there would be only one

additional lane. Therefore, higher levels of congestion would occur through the entire a.m. peak period. Congestion on I-5 as part of the 8-Lane Alternative would affect SR 520 traffic more than I-5 through-traffic that originates north of SR 520. Under the 8-Lane Alternative, the SR 520 ramp would be located on the outside and traffic must merge into the weaving traffic destined for downtown Seattle. In the No Build Alternative, the SR 520 ramps are located on the inside as a single add lane. Therefore, traffic would access I-5 with less conflict than it would under the 8-Lane Alternative. Moving westbound SR 520 traffic to the southbound I-5 ramps on the outside would not eliminate the Mercer Street weave, but it would improve I-5 traffic operations.

With the 8-Lane Alternative, when the I-5/SR 520 interchange becomes congested, the SR 520 ramp to southbound I-5 would be limited to serving 600 vph. This is 20 percent of the actual ramp capacity.

Similar to the No Build Alternative, the 8-Lane Alternative would cause vehicles to back up on southbound I-5 through the ramp from SR 520 onto the westbound SR 520 mainline. This spillback would cause a queue that would last for 3.5 or more hours. At the a.m. peak period, this queue would extend beyond the I-405 interchange and onto the I-405 mainline.

I-5 Southbound Express Lanes through Downtown Seattle

Today and under the 2030 No Build Alternative, congestion would occur on the southbound I-5 express lanes. However, this congestion would not affect SR 520 since this alternative does not include a direct connection between SR 520 and the I-5 express lanes.

The 2030 8-Lane Alternative also forecasts congestion on the southbound I-5 express lanes, but this congestion would not affect the ramp from SR 520. The traffic destined for the express lanes from SR 520 would be caught in the congestion on westbound SR 520 approaching the I-5 interchange.

What would be the speeds and travel times in the general purpose (GP) lanes?

Under the No Build Alternative, traffic on westbound SR 520 would operate under congested conditions. If a GP vehicle accessed SR 520 at 7:00 a.m., it would take 27 minutes to travel westbound between 124th Avenue Northeast and I-5. The same trip would take 1 hour and 26 minutes if the GP vehicle accessed SR 520 at 8:30 a.m. The average travel time through the 4.5-hour a.m. peak period would be 49 minutes

at an average speed of 9 mph. This would be 38 minutes more travel time than today.

Under the 8-Lane Alternative, there would be more congestion on westbound SR 520 than the No Build Alternative. At 7:00 a.m., it would take 54 minutes to travel westbound in the GP lanes between 124th Avenue Northeast and I-5. The same trip would take 2 hours and 18 minutes at 8:30 a.m. The average travel time through the a.m. peak period would be 1 hour and 18 minutes at an average speed of 5 mph. The travel time would be 29 minutes more than the No Build Alternative.

What would be the speeds and travel times in the westbound HOV lane?

For the No Build Alternative, the HOV lane would be an outside lane (Eastside only). Therefore, it would operate under conditions similar to the GP lanes. The average travel time in the HOV lane through the a.m. peak period would be 39 minutes at an average speed of 11 mph. This would be 30 minutes more travel time than today.

With the 8-Lane Alternative, there would be less congestion in the HOV lane than in the GP lanes. The average travel time in the HOV lane would be 45 minutes between 124th Avenue Northeast and I-5. However, this would still be 6 minutes more than the No Build Alternative due to congestion on I-5 queuing onto the SR 520 HOV lane. At the termination point of the HOV lane near I-5, the HOV traffic would operate similar to the GP traffic. The average speed in the HOV lane would be 9 mph.

How many people and vehicles would be served on the corridor?

With the No Build Alternative, an average of 6,320 people would be served in 2,890 vph across Lake Washington during the a.m. peak period. This would be only about 74 percent of the vehicular demand, with 26 percent of the vehicular demand not served due to congestion.

With the 8-Lane Alternative, an average of 7,200 people would be served in 2,430 vph across Lake Washington during the westbound a.m. peak period. Forty-six percent of the GP vehicular demand would be served, while 66 percent of the HOV demand would be served.

Would freeway operations affect the local arterials?

In the westbound a.m. peak period with the No Build Alternative, freeway congestion would extend into the local arterial system and affect Montlake Boulevard for 2.5 hours. Freeway congestion would affect 84th Avenue Northeast, southbound 104th Avenue Northeast, 108th Avenue Northeast, and 124th Avenue Northeast for less than one hour.

With the 8-Lane Alternative, there would be more freeway congestion than with the No Build Alternative. Therefore, more traffic would queue onto the local arterial network for longer periods of time. Traffic would queue through the westbound on-ramps. The congestion would affect Montlake Boulevard for 4 hours or more and 84th Avenue Northeast for 3 hours or more. Freeway congestion would also queue through the on-ramps from northbound and southbound 104th Avenue Northeast, 108th Avenue Northeast, and 124th Avenue Northeast for two hours or more. Congestion on SR 520 would also limit vehicles from reaching their destination off-ramps.

Eastbound SR 520

Where would the potential congestion points be?

The a.m. peak hour congestion points for 2030 eastbound SR 520 include:

- I-5 southbound approaching the Ship Canal Bridge
- I-5 northbound approaching Spokane Street/Columbia Way off-ramp
- I-5 northbound approaching I-90 interchange/frontage road
- I-5 northbound approaching express lanes off-ramp
- I-5 northbound approaching ramp to eastbound SR 520
- Queue from signal at Montlake Boulevard
- Between Lake Washington Boulevard on-ramp merge and Evergreen Point Bridge
- I-405 southbound at ramp from westbound SR 520
- I-405 northbound at ramp to eastbound SR 520

Exhibit 17 indicates the levels of congestion that are forecasted for 2030 under the No Build and 8-Lane Alternatives.

Exhibit 17. Eastbound SR 520 A.M. Peak Hour Congestion Points

Location	Year 2030	
	No Build Alternative	8-Lane Alternative
I-5 southbound approaching the Ship Canal Bridge	■	■
I-5 northbound approaching Spokane Street/Columbia Way off-ramp	■	■
I-5 northbound approaching I-90 interchange/frontage road	●	■
I-5 northbound approaching express lanes off-ramp	■	●
I-5 northbound approaching ramp to eastbound SR 520	●	◆
Queue from signal at Montlake Boulevard	●	X
Between Lake Washington Boulevard on-ramp merge and Evergreen Point Bridge	X	●
I-405 southbound at ramp from westbound SR 520	■	■
I-405 northbound at ramp to eastbound SR 520	■	■

● No queuing at this location (speeds greater than 50 mph) and no effect on SR 520

◆ Moderate congestion at this location (speeds between 30 and 50 mph) and no effect on SR 520

■ Queuing at this location (speeds less than 30 mph) but no effect on SR 520

X Queuing at this location (speeds less than 30 mph) **and** affects SR 520

I-5 Southbound Approaching Ship Canal Bridge

Today, traffic on southbound I-5 at the Ship Canal Bridge operates over capacity, and traffic is congested for several hours during the a.m. peak period.

The 2030 No Build Alternative forecasts indicate that there would be a 6 percent increase in traffic across the Ship Canal Bridge.

The 2030 8-Lane Alternative forecasts indicate demand similar to that of the No Build Alternative across the Ship Canal Bridge. The congestion approaching the Ship Canal Bridge would continue to limit the traffic able to access SR 520, as it does today.

I-5 Northbound Approaching Spokane Street/Columbia Way Off-Ramp

Today, northbound I-5 traffic at the Spokane Street interchange operates over capacity and queues south of the project limits for 3 hours of the a.m. peak period.

The 2030 No Build Alternative forecasts indicate that northbound I-5 traffic at the Spokane Street interchange would grow by 19 percent. The 2030 8-Lane Alternative forecasts indicate demand similar to the No Build Alternative. In other words, the congestion at this location would increase compared to today, with approximately 20 percent of the demand not being served for both the No Build and 8-Lane Alternatives. Similar to today, this would limit the traffic able to access SR 520.

I-5 Northbound Approaching I-90 Interchange/Frontage Road

The 2030 No Build and 8-Lane Alternatives would have similar traffic demand south of the frontage road. The 8-Lane Alternative frontage road would provide access to Seneca Street in addition to I-90. Therefore, it would have 65 percent more traffic (2,300 vph more) than the No Build Alternative I-90 collector-distributor.

The two-lane frontage road off-ramp could serve between 3,400 and 4,000 vph per lane. However, the demand would exceed 4,000 vph during the entire 4.5-hour a.m. peak period. Four lanes would be required to serve the traffic demand. This congestion point would result in a queue that would extend south of the study area (Corson/Michigan interchange) for the entire a.m. peak period. Congestion on I-5 would limit the amount of traffic that could ultimately reach SR 520.

I-5 Northbound Approaching Express Lanes Off-Ramp

Today, northbound I-5 lanes are designed so that the inside lane feeds directly into the express lanes. This reduces the number of lanes on I-5 by one. In the morning, traffic in the express lanes operates in the southbound direction. Because the express lanes operate in the opposite direction, northbound I-5 traffic must exit the inside lane and travel with the mainline traffic. The next off-ramp on I-5 (Seneca Street) is also an exit-only lane. This forces through traffic to merge over two lanes. These complex traffic operations cause congestion.

The 2030 No Build Alternative traffic forecasts indicate there would be a 19 percent increase in traffic approaching the express lanes connection

compared to today. The congestion would increase compared to today, with approximately 20 percent of the demand not being served. Similar to today, this would limit the traffic able to access SR 520.

The 2030 8-Lane Alternative traffic forecasts do not indicate congestion at the express lanes off-ramp because traffic shifts to the frontage roads and there is a reduction in the amount of through traffic served because of the frontage road area congestion. With the 8-Lane Alternative, traffic destined for Seneca Street would have already exited the freeway onto the frontage road.

I-5 Northbound Approaching Ramp to Eastbound SR 520

For the 2030 No Build Alternative, there would be no congestion at the SR 520 interchange. This lack of congestion would not be due to improvements or a reduction in traffic but to the congestion to the south, which would severely limit the traffic able to access this location.

With the 2030 8-Lane Alternative, there would be congestion approaching the ramp to eastbound SR 520. This congestion would be due to both the drop lane from I-5 to SR 520 (where the number of lanes on I-5 decrease from five lanes south of SR 520 to three lanes after the ramp to SR 520) and the weave movements between the Mercer Street on-ramp and the SR 520 interchange. Traffic at this location would operate with speeds less than 30 mph for 3 hours and would extend south to the Mercer Street interchange.

Queue from Signal at Montlake Boulevard

The 2030 No Build Alternative forecasts that congestion at the Montlake Boulevard/SR 520 ramp intersection would not spill back onto the freeway.

With the 2030 8-Lane Alternative, traffic from the signal at the Montlake Boulevard/eastbound SR 520 ramp intersection would queue onto the SR 520 mainline. This situation will be discussed later in this report in *Local Traffic Operations Forecasts for the Year 2030*.

Between Lake Washington Boulevard On-Ramp Merge and Evergreen Point Bridge

The 2030 No Build Alternative forecasts indicate that congestion would occur at this location because of:

- Merging traffic from the Lake Washington Boulevard on-ramp
- The grade change between the ramp and the western highrise of the Evergreen Point Bridge

- Substandard shoulder widths

A queue would form at this location and would last for approximately 4 hours. At the a.m. peak of congestion, the queue would extend back to the I-5 interchange. Travel speeds would be reduced to below 10 mph.

The 2030 8-Lane Alternative forecasts indicate that congestion would not occur at this location because:

- The Evergreen Point Bridge would be improved (with widened lanes and shoulders)
- The conflict due to the Lake Washington Boulevard on-ramp merge would be eliminated because the ramp would be converted from a merge to an add lane
- The congestion that would occur on I-5 would limit the amount of traffic reaching the SR 520 corridor.

I-405 Southbound at Ramp from Westbound SR 520

At the present time, I-405 is congested where the westbound SR 520 traffic merges onto I-405.

The 2030 No Build Alternative forecasts indicate a 36 percent growth in traffic volume compared to the present on I-405 where the westbound SR 520 on-ramp merges.

The 2030 8-Lane Alternative forecasts indicate demand similar to that with the No Build Alternative. Because of the growth in traffic volume, operations would continue to degrade at this location and to the north for both alternatives. The result would be a queue extending from the SR 520 ramps to north of Northeast 70th Street that would last for most of the a.m. peak period. This congestion would limit traffic from reaching the I-405 off-ramp to SR 520 (which is located north of the congestion point).

I-405 Northbound at Ramp to Eastbound SR 520

At the present time, traffic on the northbound I-405 off-ramp to eastbound SR 520 operates at or near capacity. This means that the number of vehicles accessing this ramp are the maximum that the ramp is designed to carry.

The 2030 No Build Alternative traffic forecasts indicate a 27 percent growth in traffic volume on the off-ramp compared to today.

The 2030 8-Lane Alternative forecasts indicate demand similar to the No Build Alternative. Because of this increased traffic volume, operations on the ramp and on I-405 approaching the ramp would continue to degrade for both alternatives. A queue would extend from the SR 520 ramps to south of Northeast 4th Street that would last for most of the a.m. peak period. The effect on eastbound SR 520 would be that the demand from I-405 to eastbound SR 520 (or vehicles on I-405 wishing to access SR 520) would not be served since those vehicles would be in the queue.

What would be the speeds and travel times in the general purpose (GP) lanes?

The 2030 No Build Alternative forecasts indicate that traffic on eastbound SR 520 would operate under congested conditions. At 7:00 a.m., it would take 22 minutes for a vehicle in the GP lane to travel eastbound starting at I-5 and ending at 124th Avenue Northeast. The same trip would take 19 minutes if the vehicle in the GP lane accessed SR 520 at 8:30 a.m. The average travel time through the a.m. peak period would be 19 minutes at an average speed of 24 mph.

The 2030 8-Lane Alternative forecasts indicate that the corridor would operate under virtually free-flow conditions. These would result in 8 minutes of travel time between I-5 and 124th Avenue Northeast. The average speed during the a.m. peak period would be 53 mph. This indicates that there would be a significant improvement compared to the No Build Alternative, which would have an average speed of 24 mph. Less congestion would occur on eastbound SR 520 between the Lake Washington Boulevard interchange and the Evergreen Point Bridge because the Lake Washington Boulevard on-ramp would be an add lane and the bridge travel lanes and shoulders would meet Washington state design guidelines.

What would be the speeds and travel times in the HOV lanes?

An HOV lane does not exist for eastbound SR 520 between I–5 and I-405; therefore, new traffic would have the same speed and travel time as the GP traffic. The 2030 No Build Alternative forecasts indicate that the average travel time for HOV traffic through the a.m. peak period for the trip eastbound on SR 520 between I-5 and 124th Avenue Northeast would be 19 minutes at an average speed of 23 mph. This would be 5 minutes more travel time than today.

The 2030 8-Lane Alternative forecasts indicate that the HOV lane would operate at free-flow speeds, with a travel-time between I-5 and 124th Avenue Northeast of 8 minutes. This would be 11 minutes less than the No Build Alternative.

How many people and vehicles would be served on the corridor?

The 2030 No Build Alternative forecasts indicate an average of 6,100 people would be served in 3,560 vph across Lake Washington. This would meet 82 percent of the vehicular demand. (That is, 18 percent of the vehicles would not be served due to congestion.)

The 2030 8-Lane Alternative forecasts indicate an average of 7,410 people would be served in 3,880 vph across Lake Washington. This would serve 92 percent of the GP vehicular demand and virtually all the HOV demand. The unserved traffic would be in queue on I-5, I-405, or the Lake Washington Boulevard on-ramp.

Would freeway operations affect the local arterials?

The 2030 No Build Alternative forecasts indicate that the Montlake Boulevard on-ramp would not serve the demand at the ramp meter. Therefore, traffic would queue back into the local arterial network for over 1 hour. At the Lake Washington Boulevard on-ramp, traffic would queue back into the local arterial network for 2.5 hours.

With the 8-Lane Alternative, additional lanes would be provided at the Montlake Boulevard on-ramp to serve the traffic demand at this location. Therefore, the No Build Alternative congestion would be eliminated under the 8-Lane Alternative.

Southbound I-5

Because this report focuses on SR 520 and the effects of I-5 improvements and operations to SR 520, the congestion points on southbound I-5 were discussed in the *Westbound SR 520* and *Eastbound SR 520* sections above.

The 2030 No Build Alternative forecasts indicate that freeway congestion on I-5 would cause traffic to queue through the southbound on-ramps and affect the local arterial network at the Northeast 45th Street interchange for more than 3.5 hours and at the Boylston interchange for 2 hours.

The 2030 8-Lane Alternative forecasts indicate that freeway congestion on I-5 would affect the local arterial network at the Boylston interchange for 1.5 hours and at the Yale interchange for over 4 hours. The congestion at Northeast 45th Street that would occur under the No Build Alternative would be reduced under the 8-Lane Alternative when the ramps from SR 520 would be moved to the outside (or right side) of I-5.

Northbound I-5

Because this report focuses on SR 520 and the effects of I-5 improvements and operations to SR 520, the congestion points on northbound I-5 were discussed in the Westbound SR 520 and Eastbound SR 520 sections above.

The 2030 No Build and 8-Lane Alternatives forecasts indicate that freeway congestion would queue through the northbound on-ramps and affect the local arterial network at the Spokane Street/Columbian Way interchange for more than 4 hours.

How would the 8-Lane Alternative affect freeway operations during the p.m. peak period?

Westbound SR 520

Where would the potential congestion points be?

Today the p.m. peak hour congestion points for westbound SR 520 include:

- Weave section between 124th Avenue Northeast and I-405 interchange
- I-405 southbound at ramp from westbound SR 520
- I-405 northbound at ramp to eastbound SR 520
- Evergreen Point Bridge east approach and termination point for HOV Lane
- Weave section between Montlake Boulevard on-ramp and I-5 interchange
- I-5 southbound mainline through downtown Seattle

Exhibit 18 indicates the levels of congestion that are forecasted for 2030 under the No Build and 8-Lane Alternatives.

Exhibit 18. Westbound SR 520 P.M. Peak Hour Congestion Points

Location	Year 2030	
	No Build Alternative	8-Lane Alternative
Weave section between 124th Avenue Northeast and I-405 interchange	◆	X
I-405 southbound at ramp from westbound SR 520	■	■
I-405 northbound at ramp to eastbound SR 520	■	■
Evergreen Point Bridge east approach and termination point for HOV Lane	X	●
Weave section between Montlake Boulevard on-ramp and I-5 interchange	X	●
I-5 southbound mainline through downtown Seattle	X	X

● No queuing at this location (speeds greater than 50 mph) and no effect on SR 520

◆ Moderate congestion at this location (speeds between 30 and 50 mph) and no effect on SR 520

■ Queuing at this location (speeds less than 30 mph) but no effect on SR 520

X Queuing at this location (speeds less than 30 mph) **and** affects SR 520

Weave Section between 124th Avenue Northeast and I-405 Interchange

Today, westbound traffic on SR 520 between 124th Avenue Northeast and I-405 operates with moderate congestion because SR 520 traffic must weave with traffic from 124th Avenue Northeast. Speeds on a portion of SR 520 are less than 50 mph.

The 2030 No Build Alternative forecasts indicate that a queue would occur at the Evergreen Point Bridge and HOV lane termination point that would trickle back through this location. Therefore, the operations of this location independently would not be critical.

The 2030 8-Lane Alternative forecasts indicate that congestion would be caused by weaving between vehicles entering SR 520 via 124th Avenue Northeast and vehicles destined for I-405. This queue would last for 4.5 or more hours and would overlap with the downstream queue, causing it to extend east of the 124th Avenue Northeast interchange.

I-405 Southbound at Ramp from Westbound SR 520

The 2030 No Build Alternative forecasts indicate around a 37 percent growth in traffic volume compared to today on I-405 at the SR 520 interchange.

The 2030 8-Lane Alternative forecasts indicate demand similar to that for the No Build Alternative. Operations would continue to degrade for both alternatives. This degradation would result in a queue that would extend from the SR 520 ramps to north of Northeast 70th Street that would last for most of the peak period. This congestion would reduce the traffic able to reach the I-405 off-ramp to westbound SR 520.

I-405 Northbound at Ramp to Eastbound SR 520

Today, the northbound I-405 to SR 520 eastbound ramp is over capacity. This means that the number of vehicles accessing this ramp exceeds the volume that the ramp is designed to carry.

The 2030 No Build Alternative forecasts indicate a 23 percent growth in traffic volume on the northbound I-405 to SR 520 eastbound ramp compared to the present.

The 2030 8-Lane Alternative forecasts indicate demand similar to that for the No Build Alternative. Traffic operations on the ramp and on I-405 approaching the ramp would continue to degrade for both alternatives. This would result in a queue that would extend from the SR 520 ramps to south of Northeast 4th Street that would last for most of the p.m. peak period. The effect on westbound SR 520 would be that the demand from I-405 to westbound SR 520 (or vehicles on I-405 wishing to access SR 520) would not be served since those vehicles would be in queue.

Evergreen Point Bridge East Approach and Termination Point for HOV Lane

At the HOV lane termination point, HOVs must merge into the GP lanes. In addition, the freeway approaches the bridge, which has narrow shoulders.

The 2030 No Build Alternative forecasts indicate that these two factors would cause a queue that would last for approximately 4.5 hours or more and extend back to the I-405 interchange at the p.m. peak of congestion. Vehicle speeds would drop below 10 mph for 2 hours between the 84th Avenue Northeast and 92nd Avenue Northeast interchanges.

With the 2030 8-Lane Alternative, congestion would not occur because of improvements to the Evergreen Point Bridge (new lanes and shoulders). However, congestion that would occur on I-5 would extend across SR 520 through this location.

Weave Section between Montlake Boulevard On-Ramp and I-5 Interchange

Today, congestion occurs due to the Montlake Boulevard on-ramp merge.

The 2030 No Build Alternative forecasts indicate that the congestion due to the Montlake Boulevard on-ramp merge would not occur because congestion east of Lake Washington would reduce the volume of traffic that could reach the Montlake Boulevard interchange. This would reduce the congestion at this location. However, there would be some congestion approaching I-5 due to the reduction in posted speed on the ramps.

The 2030 8-Lane Alternative forecasts indicate that congestion on I-5 would extend back through this location, causing congestion on SR 520 between the I-5 and I-405 interchanges. Traffic operations at the 124th Avenue Northeast to I-405 weave are not critical since the congestion from I-5 impacts this location.

I-5 Southbound Mainline through Downtown Seattle

Today, I-5 is congested in the downtown Seattle area.

The 2030 No Build Alternative forecasts indicate a 22 percent growth in traffic north of I-90. Therefore, I-5 traffic operations through downtown Seattle would continue to degrade. The resulting queue on southbound I-5 would extend from I-90 to north of Northeast 45th Street for most of the p.m. peak period. Congestion on southbound I-5 would cause very slight queuing from the ramp from SR 520 onto the westbound SR 520 mainline. This spillback would cause a queue that would last approximately 1 hour. Vehicle speeds would drop to between 10 and 20 mph.

The 2030 8-Lane Alternative forecasts would be similar to the a.m. peak period operations. Congestion would begin on southbound I-5 near the newly configured I-90 eastbound off-ramp. As discussed in *Local and Travel Demand Forecasts*, traffic growth on I-5 between the express lanes and I-90 eastbound off-ramp would be 35 percent more than the No Build Alternative. However, there would be only one additional lane. This would result in congestion occurring through the entire p.m. peak period with congestion spilling back north of the SR 520 interchange and onto the SR 520 westbound mainline.

Similar to the a.m. peak period operations under the 8-Lane Alternative, the congestion on I-5 south of SR 520 would tend to affect

the SR 520 traffic worse than through traffic on I-5 coming from north of SR 520. The SR 520 ramp would be located on the outside and traffic would need to merge into the weaving traffic destined for downtown Seattle. However, the SR 520 ramps for the No Build Alternative would be located on the inside as a single add lane. Therefore, traffic would access I-5 with less conflict. The overall result of the 8-Lane Alternative with the ramp relocated to the outside would be that traffic on I-5 would operate slightly better. Compared to the No Build Alternative, delays would decrease for the I-5 through trips but increase for the SR 520 to I-5 traffic.

The spillback from I-5 under the 8-Lane Alternative would cause a larger queue on SR 520 than the No Build Alternative. This queue would last four hours or more and would extend east to the I-405 interchange and onto the I-405 mainline at the p.m. peak of congestion.

What would be the speeds and travel times in the general purpose (GP) lanes?

With the No Build Alternative, traffic on the westbound SR 520 corridor would operate under congested conditions. At 4:30 p.m., it would take a GP vehicle 38 minutes to travel westbound between 124th Avenue Northeast and I-5. The same trip would take 31 minutes at 6:00 p.m. The average travel time through the p.m. peak period would be 30 minutes at an average speed of 15 mph. This would be 12 minutes more travel time than today.

With the 8-Lane Alternative, there would be more congestion on westbound SR 520 than the No Build Alternative. If a GP vehicle accessed SR 520 at 4:30 p.m., it would take 54 minutes to travel westbound between 124th Avenue Northeast and I-5. The same trip would take 1 hour and 56 minutes at 6:00 p.m. The average travel time through the p.m. peak period would be 1 hour and 4 minutes at an average speed of 7 mph. This indicates that there would be more congestion than the No Build Alternative, which would have an average speed of 15 mph.

What would be the speeds and travel times in the HOV lanes?

For the No Build Alternative, the average travel time in the HOV lane through the p.m. peak period would be 24 minutes at an average speed of 18 mph.

With the 8-Lane Alternative, the HOV lane would operate under congested conditions near the I-5/SR 520 Interchange where the HOV lane merges into the GP lanes. The resulting travel time would be 22 minutes between 124th Avenue Northeast and I-5. This would be 2 minutes less than the No Build Alternative. With the 8-Lane Alternative, it would take 42 minutes less travel time using the HOV lane instead of the GP lanes.

How many people and vehicles would be served on the corridor?

With the No Build Alternative, an average of 6,640 people would be served in 3,930 vph across Lake Washington during the p.m. peak period. This would meet 81 percent of the vehicular demand, with 19 percent of the vehicular demand not served due to congestion.

With the 8-Lane Alternative, an average of 7,260 people would be served in 3,730 vph across Lake Washington during the p.m. peak period. Sixty-one percent of the GP vehicular demand would be served, while 95 percent of the HOV demand would be served.

Would freeway operations affect the local arterials?

Under the No Build Alternative, freeway congestion would not queue onto the on-ramps during the p.m. peak periods. Therefore, the local arterials would not be affected by the freeway operations.

With the 8-Lane Alternative, due to an increase in freeway congestion, traffic would queue onto:

- Montlake Boulevard on-ramp for over 3 hours
- 84th Avenue Northeast and northbound and southbound 104th Avenue Northeast for 1.5 hours
- 108th Avenue Northeast for 2 hours
- 124th Avenue Northeast for half an hour

Eastbound SR 520

The p.m. peak hour congestion points for eastbound SR 520 in 2030 include:

- I-5 southbound approaching Ship Canal Bridge
- I-5 northbound approaching Spokane Street/Columbia Way off-ramp

- I-5 northbound at I-90 interchange
- I-5 northbound approaching ramp to eastbound SR 520
- Between Lake Washington Boulevard on-ramp merge and Evergreen Point Bridge
- I-405 southbound at ramp from westbound SR 520
- I-405 northbound at ramp to eastbound SR 520
- Freeway terminus at Avondale

Exhibit 19 indicates the levels of congestion that are forecasted for 2030 under the No Build and 8-Lane Alternatives.

Exhibit 19. Eastbound SR 520 P.M. Peak Hour Congestion Points

Location	Year 2030	
	No Build Alternative	8-Lane Alternative
I-5 southbound approaching Ship Canal Bridge	■	■
I-5 northbound approaching Spokane Street/Columbia Way off-ramp	■	■
I-5 northbound at I-90 interchange	■	■
I-5 northbound approaching ramp to eastbound SR 520	◆	■
Between Lake Washington Boulevard on-ramp merge and Evergreen Point Bridge	●	●
I-405 southbound at ramp from westbound SR 520	■	■
I-405 northbound at ramp to eastbound SR 520	■	■
Freeway terminus at Avondale	X	

● No queuing at this location (speeds greater than 50 mph) and no effect on SR 520

◆ Moderate congestion at this location (speeds between 30 and 50 mph) and no effect on SR 520

■ Queuing at this location (speeds less than 30 mph) but no effect on SR 520

X Queuing at this location (speeds less than 30 mph) **and** affects SR 520

Where would the potential congestion points be?

I-5 Southbound Approaching Ship Canal Bridge

Today, traffic on southbound I-5 at the Ship Canal Bridge operates over capacity, and traffic is congested for several hours during the p.m. peak period.

The 2030 No Build and 8-Lane Alternative forecasts indicate that traffic will grow by 16 to 18 percent on the Ship Canal Bridge. This would increase congestion compared to today. This congestion would limit the traffic able to access SR 520.

I-5 Northbound Approaching Spokane Street/Columbia Way Off-Ramp

The 2030 No Build Alternative forecasts indicate a 27 percent growth in traffic approaching the Spokane Street/Columbia Way interchange.

The 2030 8-Lane Alternative forecasts indicate demand similar to that the No Build Alternative. Compared to today, congestion would increase. This would result in approximately 20 percent of the demand not being served with both the No Build and 8-Lane Alternatives. The congestion would also limit the traffic able to access SR 520.

I-5 Northbound at I-90 Interchange

Today, congestion occurs at the merge point of the I-90 collector-distributor on-ramp, with speeds less than 30 mph for at least 1 hour during the p.m. peak period.

The 2030 No Build Alternative forecasts indicate an approximately 40 percent growth in traffic approaching the I-90 collector-distributor on-ramp. The congestion would increase compared to today, with approximately 20 percent of the traffic demand not being served. The congestion would limit the traffic able to access SR 520.

The 2030 8-Lane Alternative forecasts for the p.m. peak period would be similar to those for the a.m. peak period. Congestion would occur on northbound I-5 through most of the p.m. peak period south of the frontage road off-ramp because the demand for the ramp would exceed the ramp capacity for several hours.

Congestion would not occur near the I-90 collector-distributor on-ramp under the 8-Lane Alternative. The 8-Lane Alternative would add capacity through this section but there would be a reduction in demand because the frontage road would draw traffic off the I-5 mainline.

Under the 8-Lane Alternative, traffic operations north of the frontage road off-ramp would be better than the No Build Alternative due to a reduction in demand. With the No Build Alternative, traffic destined for Seneca Street would exit I-5 farther north. With the 8-Lane Alternative, traffic destined for Seneca Street would exit at the frontage road.

I-5 Northbound Approaching Ramp to Eastbound SR 520

Today, congestion occurs approaching the ramp to eastbound SR 520. This congestion is due to:

- The drop lane from I-5 to SR 520 (I-5 reduces from five lanes south of SR 520 to three lanes after the ramp to SR 520)
- The weave movements between the Mercer Street on-ramp (located on the left side) and the SR 520 interchange

This location operates with speeds less than 30 mph for 3 hours and congestion extends south to the Olive Way interchange.

The year 2030 No Build and 8-Lane Alternatives forecasts indicate that congestion at the SR 520 interchange would be reduced compared to today because congestion to the south would severely limit the traffic able to access this location. In 2030, I-5 northbound between the Lakeview Boulevard off-ramp and the SR 520 interchange would operate with mild congestion with speeds around 30 mph for 2 hours.

The 2030 8-Lane Alternative forecasts indicate that congestion that occurs today at the weave from the Mercer Street on-ramp to SR 520 would occur for 2.5 hours of the p.m. peak period. Approaching the I-5/SR 520 interchange, there would be five lanes on I-5. Two lanes would drop to the ramp to SR 520. This would reduce I-5 north of the off-ramp to three lanes. The two drop lanes would force vehicles on I-5 to make up to two lane changes to exit the freeway.

Between Lake Washington Boulevard On-Ramp Merge and Evergreen Point Bridge

Today, congestion occurs at this location as a result of:

- Merging traffic from the Lake Washington Boulevard on-ramp
- The grade change between the ramp and the west highrise of the Evergreen Point Bridge
- Substandard shoulder and lane width along the Evergreen Point Bridge

The congestion at this location in the p.m. peak period lasts for 1.5 hours.

The 2030 No Build Alternative forecasts indicate an increase in traffic demand at this location compared to today. However, heavy congestion on northbound I-5 would limit the amount of traffic that could enter SR 520. Therefore, the number of vehicles actually arriving at this

location would decrease compared to today, and the congestion at this location would also decrease.

The 2030 8-Lane Alternative forecasts indicate that congestion would not occur at this location due to:

- Congestion on I-5 similar to congestion under the No Build Alternative
- Additional lanes and widened shoulders on the Evergreen Point Bridge.

I-405 Southbound at Ramp from Westbound SR 520

The 2030 No Build Alternative forecasts indicate about a 37 percent growth in traffic volume compared to today on I-405 where the westbound SR 520 on-ramp merges.

The 2030 8-Lane Alternative forecasts indicate demand similar to that of the No Build Alternative. Because of the growth in traffic volume, operations would degrade at this location and to the north for both alternatives. The result would be a queue extending from the SR 520 ramps to north of Northeast 70th Street that would last for most of the p.m. peak period. This congestion would reduce the volume of traffic able to reach the I-405 off-ramp to eastbound SR 520 (which is located north of the westbound SR 520 on-ramp).

I-405 Northbound at Ramp to Eastbound SR 520

The northbound I-405 off-ramp to eastbound SR 520 is over capacity today. This means that the vehicles accessing this ramp exceed the volume that the ramp is designed to carry.

The 2030 No Build Alternative traffic forecasts indicate a 23 percent growth in traffic volume on the northbound I-405 to SR 520 ramp compared to the present.

The 2030 8-Lane Alternative forecasts indicate demand similar to the No Build Alternative. Because of this increased traffic volume, operations on the ramp and on I-405 approaching the ramp would continue to degrade for both alternatives. A queue would extend from the SR 520 ramps to south of Northeast 4th Street that would last most of the p.m. peak period. The effect on eastbound SR 520 would be that the demand from I-405 to eastbound SR 520 (or vehicles on I-405 wishing to access SR 520) would not be served because those vehicles would be in the queue.

Freeway Terminus at Avondale

The 2030 No Build Alternative forecasts indicate that heavy queuing would occur at the signalized intersection at the Avondale interchange. This queue would extend to the I-405 interchange at the p.m. peak of congestion for more than 2 hours. Travel speeds would be reduced to 10 mph or less.

The 2030 8-Lane Alternative forecasts indicate that, similar to the No Build Alternative, congestion would also occur at the signalized intersection at the Avondale interchange. At the p.m. peak of congestion, this queue would extend back to 84th Avenue Northeast for more than 1.5 hours. The congestion that would occur with both alternatives would cause vehicles to back up through the ramp from I-405 and onto the I-405 northbound and southbound mainline.

The congestion under the No Build Alternative would terminate at I-405. However, under the 8-Lane Alternative, the queue would extend back to 84th Avenue Northeast. The queue would be longer than under the No Build Alternative because there would be 19 percent more demand approaching I-405. The additional traffic associated with the 8-Lane Alternative west of I-405 would stack at the back of this queue.

What would be the speeds and travel times in the general purpose (GP) lanes?

The 2030 No Build Alternative forecasts indicate that traffic on eastbound SR 520 would operate under congested conditions for a portion of the p.m. peak period. At 4:30 p.m., it would take nine minutes for a vehicle in the GP lane to travel eastbound between I-5 and 124th Avenue Northeast. The same trip would take 17 minutes in the GP lane if the vehicle accessed SR 520 at 6:00 p.m. The average travel time through the p.m. peak period would be 10 minutes at an average speed of 44 mph.

The 2030 8-Lane Alternative forecasts indicate that the corridor would operate under increased congestion compared to the No Build Alternative. If a GP vehicle accessed the corridor at 4:30 p.m., it would take 8 minutes to travel eastbound between I-5 and 124th Avenue Northeast. The same trip would take a GP vehicle 1 hour and 4 minutes at 6:00 p.m. The average travel time through the p.m. peak period would be 15 minutes at an average speed of 30 mph. This operating speed would be less than the No Build Alternative (which would operate at an average speed of 45 mph).

What would be the speeds and travel times in the HOV lane?

An HOV lane does not exist for eastbound SR 520 between I-5 and I-405; therefore, HOV traffic would have the same speed and travel time as the GP traffic.

The 2030 No Build Alternative forecasts indicate that the average travel time in the HOV lane for a trip between I-5 and 124th Avenue Northeast through the p.m. peak period would be 9 minutes at an average speed of 49 mph.

The 2030 8-Lane Alternative forecasts indicate that the HOV lane would operate under near free-flow speeds. These would result in a travel time of 8 minutes between I-5 and 124th Avenue Northeast. This would be 1 minute less than with the No Build Alternative. Traffic in the HOV lane would operate at an average speed of 53 mph.

How many people and vehicles would be served on the corridor?

The 2030 No Build Alternative forecasts indicate an average of 7,170 people would be served in 3,390 vph across Lake Washington. This would meet 87 percent of the vehicular demand (that is, 13 percent of the vehicles would not be served due to congestion).

The 2030 8-Lane Alternative forecasts indicate an average of 9,790 people would be served in 4,220 vph across Lake Washington. This would serve 93 percent of the GP vehicular demand. The unserved traffic would remain in the queue. All of the HOV demand would be served with no vehicles in a queue.

Would freeway operations affect the local arterials?

The 2030 No Build Alternative forecasts indicate that the Montlake Boulevard on-ramp would not serve the demand at the ramp meter. Therefore, traffic would queue back into Montlake Boulevard throughout the entire p.m. peak period.

With the 8-Lane Alternative, additional lanes would be provided at the Montlake Boulevard on-ramp to serve the traffic demand at this location. Therefore, the congestion indicated for the No Build Alternative would be eliminated.

Southbound I-5

Because this report focuses on SR 520 and the effects of I-5 improvements and operations to SR 520, the congestion points on southbound I-5 were discussed in the *Westbound SR 520* and *Eastbound SR 520* sections above.

The 2030 No Build Alternative forecasts indicate that freeway congestion on I-5 would cause traffic to queue:

- Through the Northeast 45th Street on-ramp for 4 hours
- Through the Mercer Street on-ramp for 2 hours
- Through the Yale interchange for 5 hours, but not extend north to the Northeast 45th Street interchange

Northbound I-5

Because this report focuses on SR 520 and the effects of I-5 improvements and operations to SR 520, the congestion points on northbound I-5 were discussed in the *Westbound SR 520* and *Eastbound SR 520* sections above.

With the No Build Alternative, the on-ramp at Spokane Street/Columbian Way would be two lanes, which would merge to a single add lane. The No Build Alternative forecasts indicate that the demand at this ramp would exceed the capacity of a single lane. Therefore, congestion would occur where the lane drops and vehicles would queue on the ramp for 1.5 hours. Congestion would occur at the I-90 collector-distributor and the Cherry on-ramp. Vehicles would queue on the ramp for 1 hour. The ramp meter at the Olive Way on-ramp would not serve the traffic demand. Therefore, vehicles would queue into the local arterial network for 4 hours.

With the 8-Lane Alternative, the on-ramp at Spokane Street/Columbian Way would be two lanes, which would merge to a single add lane. The year 2030 8-Lane Alternative forecasts indicate that the demand at this ramp would exceed the capacity of a single lane. Therefore, congestion would occur where the lane drops and vehicles would queue on the ramp for 1.5 hours. The ramp meter at the Olive Way on-ramp would not serve the traffic demand. Therefore, vehicles would queue into the local arterial network for 4 hours.

Local Traffic Operations Forecasts for the Year 2030

What is this section about?

This section describes adjacent intersection operations near the I-5 corridor and how those intersection operations would be affected by the No Build and 8-Lane Alternatives as forecasted for 2030. The primary focus was on the downtown Seattle area, which is described in detail. After review of the freeway operations and local intersection operations along the I-5 corridor, WSDOT decided not to continue the study of the 8-Lane Alternative. Therefore, discussion of the 8-Lane Alternative local intersection traffic operations along the SR 520 corridor is not included in this section.

The local intersection traffic operations analyses focused on intersections in the following I-5 interchange areas:

- Dearborn Street
- Downtown Seattle (defined as those interchanges between Pine and James Street)
- Olive Way
- Stewart Street/Yale Avenue
- Mercer Street
- Roanoke Street
- Northeast 45th Street

The above list of interchange areas is organized from south to north beginning at the south side of downtown Seattle and ending a short distance north of Lake Union and Portage Bay.

The project engineers provided additional detail at study intersections when one of the following situations applied:

- The intersection would be modified in the 8-Lane Alternative with physical improvements such as additional lanes or turn restrictions
- The intersection would operate at LOS D or worse under the 8-Lane Alternative and the intersection delay would be worse than under the No Build Alternative.

Using this threshold, project engineers were able to focus the analysis at locations where traffic operations were at, or getting closer to, failure as a result of the 8-Lane Alternative and where the 8-Lane Alternative would physically change the intersection configuration.

The methodology used for the local traffic operations analyses is described in more detail in Chapter 5 of Appendix R, *Transportation Discipline Report*.

What local intersections would the 8-Lane Alternative modify and how?

As mentioned previously, the 8-Lane Alternative analyses focused on the following seven interchange areas:

- Dearborn Street
- Downtown Seattle (defined as those interchanges between Pine and James Street)
- Olive Way
- Stewart Street/Yale Avenue
- Mercer Street
- Roanoke Street
- Northeast 45th Street

Of these seven interchange areas, the 8-Lane Alternative would modify local intersections and access to mainline I-5 at the downtown Seattle interchange area. At the other six interchange areas, local intersections and access to mainline I-5 would remain unchanged. Access to the I-5 express lanes would not change at any of the interchange areas.

For the downtown Seattle interchange area, the 8-Lane Alternative would change how motorists on I-5 access downtown Seattle and how I-5 is accessed from downtown Seattle. As a result, the 8-Lane Alternative would modify several intersections in the downtown Seattle area to respond to changes in the freeway ramp connections.

This is a first-glance analysis. As a result, the improvements assumed for the downtown Seattle intersections have not been reviewed or endorsed by the city of Seattle. The project team would coordinate with Seattle on the specific intersection improvements if the 8-Lane Alternative were at some later date determined to be a viable alternative.

What freeway and local street system modifications would be made in the downtown Seattle interchange area?

Northbound I-5

- The existing collector-distributor roadway would be removed.
- The northbound I-5 exit ramps at Seneca and Madison Streets would be removed.
- The northbound I-5 on-ramp at Cherry Street would be removed.
- These improvements would force vehicles wanting to access downtown via northbound I-5 to use the northbound I-5 off-ramp at James Street and 7th Avenue.
- These improvements would force traffic wanting to access northbound I-5 from downtown Seattle to travel northbound on 7th Avenue. To do so, 7th Avenue would be converted into a collector-distributor to provide access to northbound I-5 north of Pike Street.
- The high volume intersections on 7th Avenue would be changed to signalized intersections and would allow only one-way traffic in the northbound direction, except for the short link between Seneca Street and the Washington State Convention Center. This link would allow two-way travel for truck/freight access to and from the Convention Center.

Southbound I-5

- The southbound I-5 off-ramp at Marion Street and 6th Avenue would be realigned to access 6th Avenue south of Columbia Street. This would eliminate the southbound I-5 on-ramp at Spring Street.
- Traffic wishing to access southbound I-5 would be required to use the on-ramps at either the Yale Avenue/Stewart Street interchange area (which requires back-tracking and is unlikely) or would have to travel to the south end of the downtown area and access southbound I-5 at James Street.
- Some local street rerouting would be necessary. Madison Street would operate with two-way traffic east of 5th Avenue and 6th Avenue would operate one-way in the southbound direction south of Madison Street.

What modifications would be made to intersections in the downtown Seattle interchange area?

In conjunction with the freeway and local street system changes described in the previous paragraphs, the 8-Lane Alternative would modify various intersections. The assumptions related to modifications at these intersections are discussed in detail below.

James Street/6th Avenue Intersection

- Add a southbound left/through lane on 6th Avenue at this intersection.

James Street/7th Avenue Intersection

- Add five northbound through lanes and one northbound right-turn lane on 7th Avenue at this intersection.

Cherry Street/5th Avenue Intersection

- Allow left-turns onto Cherry Street from the southbound left-turn lane that currently allows left-turns only onto the I-5 express lanes.

Cherry Street/6th Avenue Intersection

- Remove the right-turn option from the existing outside southbound lane and add a southbound right-turn lane.

Cherry Street/7th Avenue Intersection

- Add one eastbound left-turn lane on Cherry Street.
- Add five northbound through lanes on 7th Avenue.
- Replace the two existing northbound lanes on 7th Avenue with northbound through-only lanes.
- Add one northbound right-turn lane on 7th Avenue.

Cherry Street/I-5 Northbound On-Ramp Intersection

- Eliminate intersection because the northbound I-5 on-ramp is removed.

Columbia Street/5th Avenue Intersection

- Remove one of the northwestbound I-5 express lane approach lanes.

Columbia Street/6th Avenue Intersection

- Remove the right-turn option from the existing outside southbound lane on 6th Avenue and add a southbound right-turn lane for improved southbound flow.

Columbia Street/7th Avenue Intersection

- For lane continuity between Cherry Street/7th Avenue and Madison Street/7th Avenue, add six northbound through lanes and convert the existing outside through/right lane to through only to provide a total of seven northbound through lanes.
- Add one northbound right-turn lane to improve flow for the northbound through movement.

Marion Street/7th Avenue Intersection

- For lane continuity between Cherry Street/7th Avenue and Madison Street/7th Avenue, add five northbound through lanes and convert the existing outside through/right lane to through only to provide a total of seven northbound through lanes.
- Add one northbound right-turn lane to improve flow for the northbound through movement.

Madison Street/7th Avenue Intersection

- Convert southbound lanes to northbound lanes.
- Change the northbound left/through lane to left-turn only and add another left-turn lane to make a triple northbound left-turn lane and widen Madison Street as necessary to provide three receiving lanes.
- Add five northbound through lanes.

Spring Street/6th Avenue Intersection

- Remove the southbound I-5 on-ramp leg.
- Convert the eastbound left/through option lane to left-turn only.
- Convert the eastbound through/right option lane to through only.
- Remove the northbound right-turn only lane.

Spring Street/7th Avenue Intersection

- Signalize the intersection.

- Remove the southbound lane and provide a northbound lane instead.
- Add three more northbound through lanes.
- Remove the right-turn option from the outside eastbound lane because 7th Avenue would be changed to one-way northbound.

Seneca Street/6th Avenue Intersection

- Remove the northbound I-5 off-ramp leg and the signal phase for it.

Seneca Street/7th Avenue Intersection

- Signalize the intersection.
- Remove one westbound lane and allow through movements only on the remaining lane.
- On the northbound approach, replace the single lane with two left-turn lanes, two through lanes, and a right-turn lane.
- On the southbound approach, restrict the single lane southbound right-turn to right-turn only.

University Street/7th Avenue Intersection

- Add a northbound through/right lane.

Hubbell Place/9th Avenue Intersection

- Convert the southwestbound lane on Hubbell Place to northeastbound, which removes southwestbound movement on Hubbell Place at this intersection.
- Restrict the 9th Avenue approach to right-turn only.

Pike Street/Terry Avenue Intersection

- Signalize the intersection.
- Add a westbound left-turn lane on Pike Street for movements to Terry Avenue and remove the left-turn option from the inside through lane.
- Add an eastbound right-turn lane on Pike Street for movements to Terry Avenue and remove the right-turn option from the outside through lane.

- Disallow left-turns from Terry Avenue onto Hubbell Place because Hubbell Place is now one-way northeastbound.
- Convert the southwestbound lane on Hubbell Place to a northeastbound left-turn lane and mark the existing northeastbound lane for right-turns onto Pike Street and Terry Avenue only.

Which intersections in the downtown Seattle interchange area would not be modified?

- University Street/6th Avenue
- Union Street/7th Avenue
- Pike Street/9th Avenue

Would freeway traffic spill back onto the local streets?

Exhibit 20 summarizes the locations where year 2030 forecasts indicate that freeway congestion would spill back onto the local arterials. Interchange locations that would not experience freeway congestion spillback for either alternative or peak period were not listed. Further discussion related to freeway congestion can be found in the *Freeway Traffic Operations Forecasts for the Year 2030* section above.

Exhibit 20. Summary of Locations Where Freeway Traffic Would Spill Back onto Local Streets

Interchange Area	A.M. Peak Period				P.M. Peak Period			
	No Build Alternative		8-Lane Alternative		No Build Alternative		8-Lane Alternative	
	SB	NB	SB	NB	SB	NB	SB	NB
Downtown Seattle (Cherry on-ramp)						1 hour		
Olive Way						4 hours		4 hours
Stewart Street/Yale Avenue			> 4 hours				5 hours	
Mercer Street							2 hours	
Roanoke Street (Boylston on-ramp)	2 hours		1.5 hours					
Northeast 45th Street	> 3.5 hours				4 hours			

> denotes greater than.
NB denotes northbound I-5.
SB denotes southbound I-5.

Would local street operations affect freeway operations?

The answer to this question can be found in the discussions for each of the interchange areas.

Individual intersection analysis results are discussed, including queue information, if the intersection would operate at LOS D or worse under the 8-Lane Alternative or would be modified by the 8-Lane Alternative.

Dearborn Street Interchange Area

Three intersections were analyzed at the Dearborn Street Interchange Area:

- I-5 southbound off-ramp/Dearborn Street
- I-5 northbound off-ramp/Dearborn Street
- I-5 northbound on slip-ramp/Dearborn Street

The I-5 northbound off-ramp and Dearborn Street intersection form a five-legged signalized intersection. This intersection also includes 10th Avenue South as well as the I-5 northbound on loop-ramp. Traffic traveling southbound on 10th Avenue South can only turn right upon reaching Dearborn Street. Eastbound vehicles on Dearborn Street destined for northbound I-5 use the outside eastbound lane. The movement of these eastbound vehicles conflicts with the movement of vehicles on the northbound I-5 off-ramp since the loop ramp to access northbound I-5 begins east of the intersection.

Located approximately 100 feet east is the signalized intersection of the I-5 northbound on slip-ramp and Dearborn Street. The 8-Lane Alternative design removes the westbound Dearborn Street traffic wishing to access northbound I-5 from the five-legged intersection.

Exhibit 21 summarizes the LOS for the Dearborn Street interchange area intersections under both the No Build and 8-Lane Alternatives for the a.m. and p.m. peak hours. Exhibit 22 graphically displays the LOS results.