

Exhibit 3-10. P.M. Peak Volume and Mode Choice

SR 520 Bridge Replacement and HOV Project

How do travel patterns change on westbound SR 520?

Existing Conditions

Today, the average vehicle demand on westbound SR 520 through the a.m. peak period does not vary greatly between I-405 and I-5. The average demand west of I-405, across Lake Washington, and approaching I-5 is between 3,500 and 3,900 vph.

No Build Alternative

The following bullets and Exhibit 3-12 summarize the vehicle-trip growth and traffic flow pattern changes under the No Build Alternative in 2030 compared to existing conditions.

- Compared with today, there would be a 24 percent increase in traffic west of I-405. This growth would originate from both I-405 and SR 520 east of I-405.
- The growth on the corridor west of I-405 would be destined to the local areas between I-405 and Lake Washington. The increase in traffic would be larger on the Eastside (between Lake Washington and I-405) than in Seattle, as indicated by the planning-level model that incorporates changes in land use. There would be little to no growth from the local areas between I-405 and Lake Washington across the lake (compared to today).

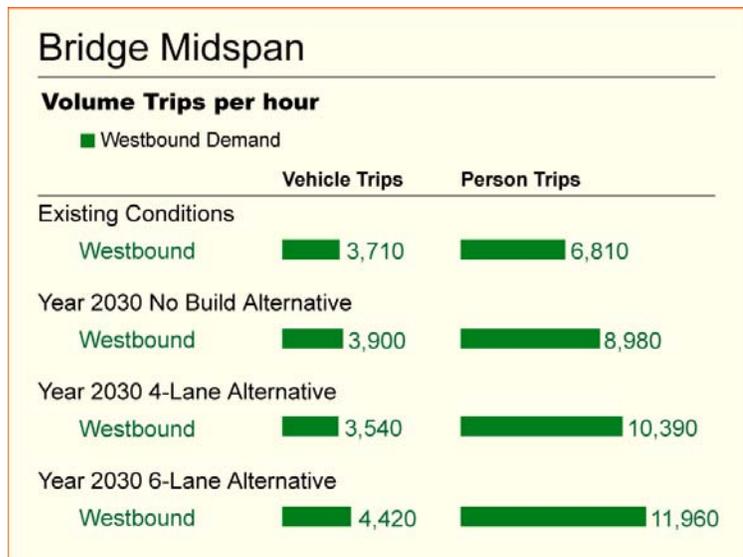


Exhibit 3-11. Westbound A.M. Peak Period Person and Vehicle Demand per Hour

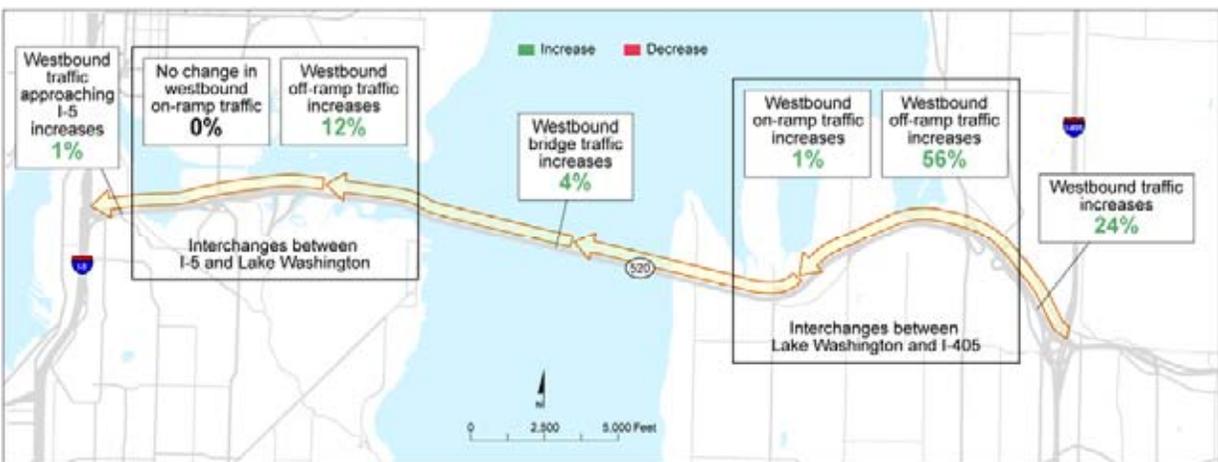


Exhibit 3-12. No Build Alternative, A.M. Peak Period Westbound Vehicle Demand Compared to Existing Conditions



- Compared with today, traffic volumes across Lake Washington would increase by only 4 percent. This growth would primarily be due to an increase in GP traffic coupled with a 33 percent growth in bus demand.
- The Lake Washington Boulevard and Montlake Boulevard off-ramp volumes would increase by 12 percent compared with existing conditions. There would be no growth from the Montlake Boulevard on-ramp.
- Traffic would increase 1 percent between Montlake Boulevard and I-5, with the additional traffic destined for northbound I-5. The traffic distribution at the I-5/SR 520 Interchange would be similar to today (with 23 percent to northbound I-5 and 77 percent to southbound I-5).

4-Lane Alternative

The following bullets and Exhibit 3-13 summarize the vehicle-trip growth and traffic flow pattern changes in 2030 with the 4-Lane Alternative compared to the No Build Alternative.

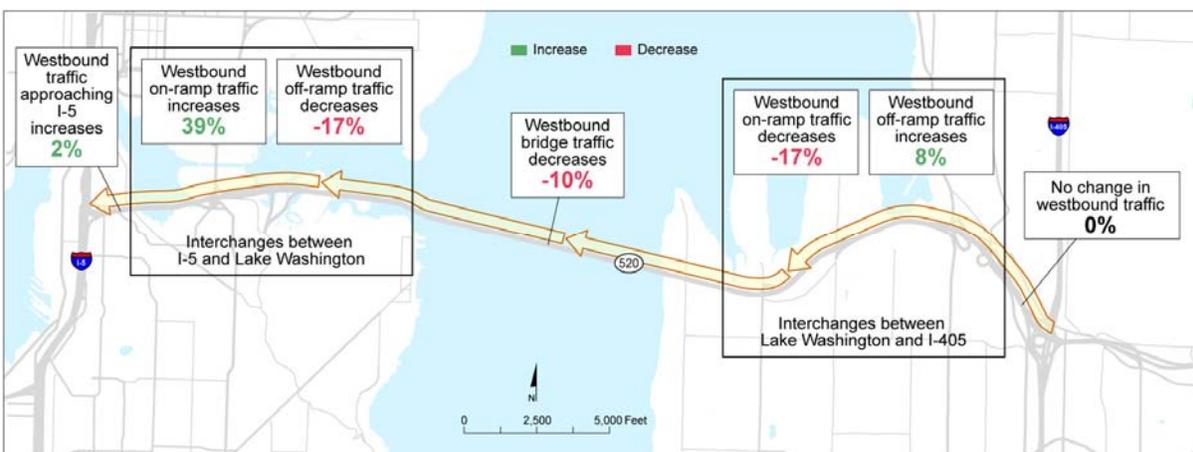


Exhibit 3-13. 4-Lane Alternative, A.M. Peak Period Westbound Vehicle Demand Compared to No Build Alternative

- There would be no increase in traffic west of the I 405 interchange.
- Between I-405 and Lake Washington, traffic exiting to local areas via off-ramps would increase, while traffic entering SR 520 from these local areas via the on-ramps would decrease.
- Traffic volumes across Lake Washington would decrease 10 percent compared to the No Build Alternative because tolls on the corridor would make this a less desirable trip. Trips would divert to alternate routes or to buses and carpools. GP traffic would decrease,



but the carpool volume would be three times greater than carpool volumes forecast for the No Build Alternative.

- The volume of traffic exiting SR 520 to Lake Washington Boulevard and Montlake Boulevard would decrease, while the volume entering SR 520 from Montlake Boulevard would increase (compared to the No Build Alternative).
- Compared with No Build Alternative conditions, traffic would increase by 2 percent between Montlake Boulevard and I-5. The traffic distribution from SR 520 to I-5 would shift to the north. Traffic on the northbound ramp would increase 4 percent, while traffic on the southbound ramp would decrease 8 percent (compared to the No Build Alternative).

6-Lane Alternative

The following bullets and Exhibit 3-14 summarize vehicle-trip growth and traffic flow pattern changes for the 6-Lane Alternative in 2030 compared to the No Build Alternative.

- Compared with the No Build Alternative, traffic would increase 12 percent west of the I-405 interchange. Over three-quarters of the growth would originate from I-405.

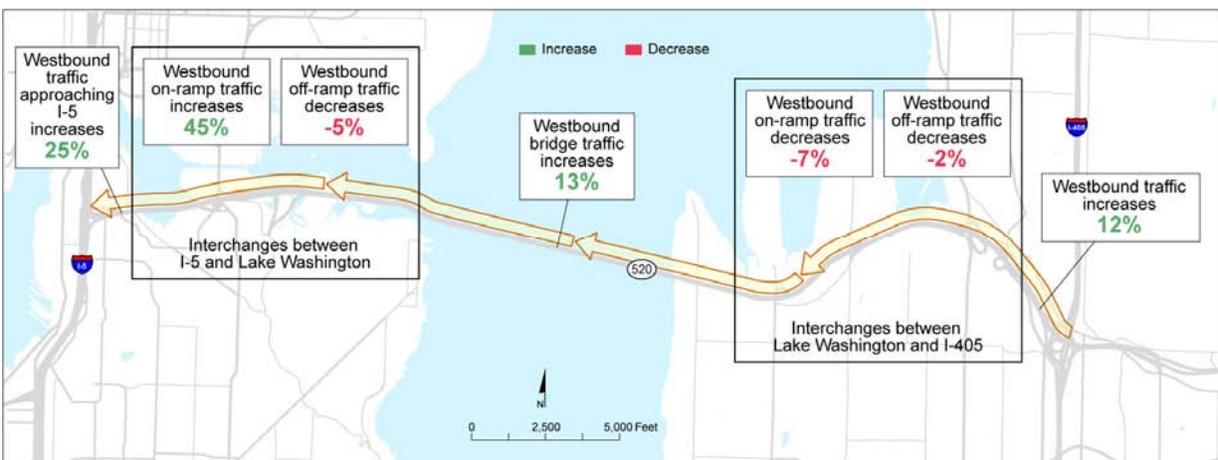


Exhibit 3-14. 6-Lane Alternative, A.M. Peak Period Westbound Vehicle Demand Compared to No Build Alternative

- Between I-405 and Lake Washington, traffic would decrease to and from the local areas.
- Traffic volumes would increase 13 percent across Lake Washington. Despite this increase, trips would still divert to buses and carpools. GP vehicles would decrease by 9 percent, while the carpool volume



would be over three and one-half times greater than the No Build Alternative carpool volume.

- Compared with the No Build Alternative, the Lake Washington Boulevard and Montlake Boulevard off-ramp volumes would decrease, while the Montlake Boulevard on-ramp volume would increase.
- Traffic volumes would increase 25 percent between Montlake Boulevard and I-5. The traffic distribution from SR 520 would be similar to that described for the No Build Alternative.

What is the mode split on westbound SR 520?

Bus and carpool modes of transportation are the most efficient for moving people because they carry more persons in fewer vehicles. The following sections list, by alternative, the mode split and average vehicle occupancy (AVO) across Lake Washington. AVO is defined in Exhibit 3-15. The following information is also illustrated in pie charts in Exhibit 3-9. Exhibit 3-16 explains how readers can connect what is discussed in the text with information shown in the pie charts in Exhibit 3-9.

Existing Conditions

SR 520 traffic across Lake Washington has the following mode split, which results in an AVO of 1.84.

- GP traffic carries 63 percent of the people in 88 percent of the vehicles.
- Bus traffic carries 18 percent of the people 1 percent of the vehicles.
- Carpool traffic carries 19 percent of the people in 11 percent of the vehicles.

No Build Alternative

Traffic shifts to buses by 2030 would result in an increase in the AVO across Lake Washington from 1.84 today to 2.31 under the No Build Alternative.

- General purpose traffic would carry 52 percent of the people in 90 percent of the vehicles. Compared to existing conditions, the

Did you know?

AVO is a term that is used to describe the average number of persons per vehicle (average vehicle occupancy).

The following AVO assumptions were made for the forecasting analyses:

- 1.33 persons per GP vehicle
- 3.15 persons per HOV vehicle

Exhibit 3-15. Average Vehicle Occupancy Definition

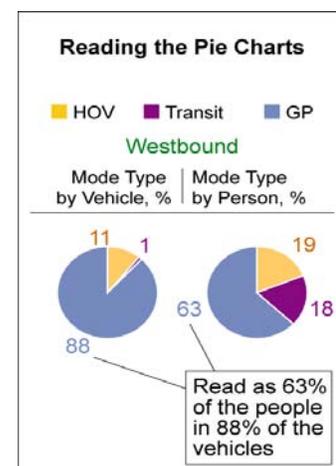


Exhibit 3-16. How to Interpret the Pie Charts in Exhibit 3-9



number of GP vehicle-trips increases but the percentage of person-trips *decreases*.

- Bus traffic would carry 37 percent of the people in 2 percent of the vehicles. This is a 19 percent increase in bus person-trips over existing conditions, with a small increase in the number of buses on the roadway.
- Carpool traffic would carry 11 percent of the people in 8 percent of the vehicles. The number of carpool person-trips would decrease compared to existing conditions because increased congestion on the roadway would make buses a more attractive travel option.

4-Lane Alternative

Under the 4-Lane Alternative in 2030, carpool traffic would increase and GP traffic would decrease compared to the No Build Alternative; therefore, the AVO would shift from 2.31 under the No Build Alternative to 2.96 under the 4-Lane Alternative.

- GP traffic would carry 32 percent of the people in 71 percent of the vehicles. The number of GP person-trips would decrease because of the shift to buses and carpools.
- Bus traffic would carry 40 percent of the people in less than 3 percent of the vehicles.
- Carpool traffic would carry 28 percent of the people in 26 percent of the vehicles. Bus and carpool vehicles share one lane, while GP vehicles share two lanes; therefore, the HOV lane would carry approximately 70 percent (39 percent+28 percent) of the people using SR 520 in a *single* lane, while it would take *two* GP lanes to carry only 33 percent of the people.

6-Lane Alternative

Under the 6-Lane Alternative in 2030, carpool traffic would increase and the GP traffic would decrease compared to the No Build Alternative. Therefore, the AVO would shift from 2.31 under the No Build Alternative to 2.72 under the 6-Lane Alternative.

- General purpose traffic would carry 36 percent of the people in 73 percent of the vehicles.
- Bus traffic would carry 35 percent of the people in 2 percent of the vehicles. While this would appear to be a decrease in bus person-trips compared to the No Build Alternative, it is actually an increase



because the total number of person-trips on SR 520 has increased (see Exhibit 3-9). At 37 percent, the No Build Alternative would carry approximately 3,330 people on buses, while the 6-Lane Alternative would carry approximately 4,190 people on buses.

- Carpool traffic would carry 29 percent of the people in 25 percent of the vehicles. This is an 18 percent increase in carpool person-trips compared to the No Build Alternative. The 6-Lane Alternative would complete the HOV lane to I-5, thus providing more mobility options to the traveling public.

Westbound SR 520, P.M. Peak Period

This section summarizes travel forecasts for westbound SR 520 during the p.m. peak period. The average represents the average hourly volume that occurs throughout the peak period.

What is the person and vehicle-trip demand?

Exhibit 3-17 depicts the vehicle- and person-trip demand for westbound SR 520 across Lake Washington during the p.m. peak period.

Existing Conditions

The average person-trip demand is 6,390 persons westbound across Lake Washington during the p.m. peak period.

No Build Alternative

In 2030, the average person-trip demand would be 7,900 persons per hour (an increase of more than 24 percent over today) in 20 percent more vehicles. The person-trip demand would increase at a greater rate than the vehicle-trip demand due to an increase in bus trips. The No Build Alternative vehicle demand would be 4,830 vph across Lake Washington.

4-Lane Alternative

In 2030, the average person-trip demand would be 8,300 persons per hour (over a 5 percent increase) in 11 percent fewer vehicles. This

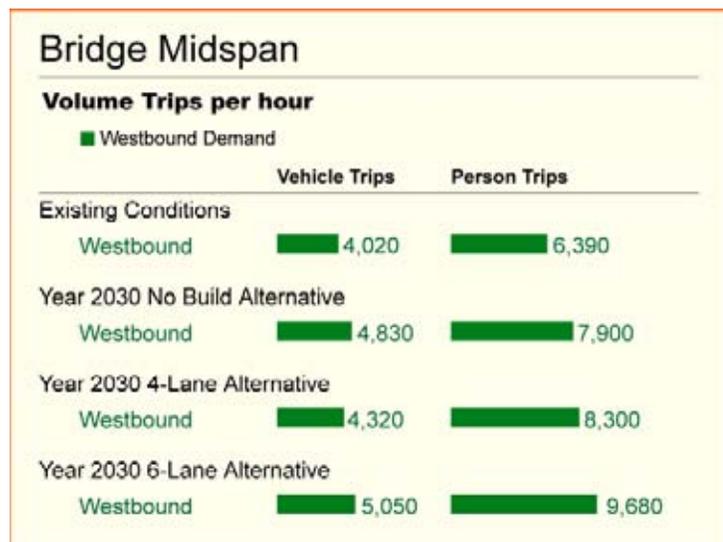


Exhibit 3-17. Westbound P.M. Peak Period Vehicle and Person Demand per Hour



indicates a substantial shift to carpools and buses. The vehicle demand would be 4,320 vph across Lake Washington.

6-Lane Alternative

In 2030, the average person-trip demand would be 9,680 persons per hour (over a 23 percent increase) in 4 percent more vehicles. As with the 4-Lane Alternative, this indicates a shift to carpools and buses. The vehicle demand would be 5,050 vph across Lake Washington.

How do travel patterns change on westbound SR 520?

Existing Conditions

The vehicle demand today is 3,830 vph at I-405, 4,020 vph across Lake Washington, and 3,460 vph east of I-5. Traffic is heavier on the Eastside and crossing Lake Washington and declines approaching I-5.

No Build Alternative

The following bullets and Exhibit 3-18 summarize the vehicle-trip growth and traffic flow pattern changes in 2030 compared to existing conditions.

- There would be an 8 percent increase in traffic over existing conditions west of I-405. This growth would originate from both I-405 and SR 520 east of I-405.
- The on- and off-ramp traffic volumes between I-405 and Lake Washington would increase.
- Traffic volumes would increase by 20 percent across Lake Washington due to a 7 percent increase in GP traffic and a 21 percent growth in transit demand.
- The Lake Washington Boulevard and Montlake Boulevard off-ramp volumes would increase; there would be no growth from the Montlake Boulevard on-ramp.
- Traffic would increase 9 percent between Montlake Boulevard and I-5. The traffic distribution from SR 520 to I-5 would shift to the south at the interchange compared to existing conditions, with 56 percent going to southbound I-5 and 44 percent to northbound I-5. (The distribution under existing conditions is 51 percent southbound and 49 percent northbound).



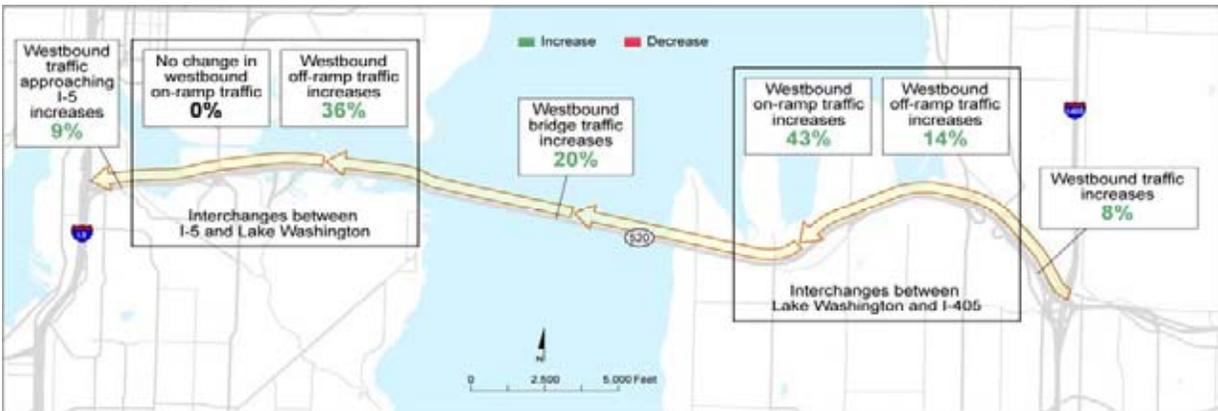


Exhibit 3-18. No Build Alternative, P.M. Peak Period Westbound Vehicle Demand Compared to Existing Conditions

4-Lane Alternative

The following bullets and Exhibit 3-19 summarize the 4-Lane Alternative vehicle-trip growth and traffic flow pattern changes on westbound SR 520 during the p.m. peak period in 2030, compared to the No Build Alternative.

- There would be a slight decrease in traffic (1 percent) west of I-405.
- Traffic volumes to and from the local areas between I-405 and Lake Washington would all decrease.
- Traffic volumes across Lake Washington would decrease 11 percent because tolling would make this a less desirable trip. Trips would divert to alternate routes or to buses and carpools.
- GP traffic would decrease by 17 percent, while carpool volume would be more than 2.5 times greater than carpool volume for the No Build Alternative.
- Lake Washington Boulevard and Montlake Boulevard off-ramp volumes would decrease, while Montlake Boulevard on-ramp traffic would increase.
- Traffic would increase by 1 percent between Montlake Boulevard and I-5. The traffic distribution from SR 520 to I-5 would shift to the north at the interchange compared to the No Build Alternative. Traffic on the northbound ramp would increase by 10 percent, while traffic on the southbound ramp would decrease by 6 percent.



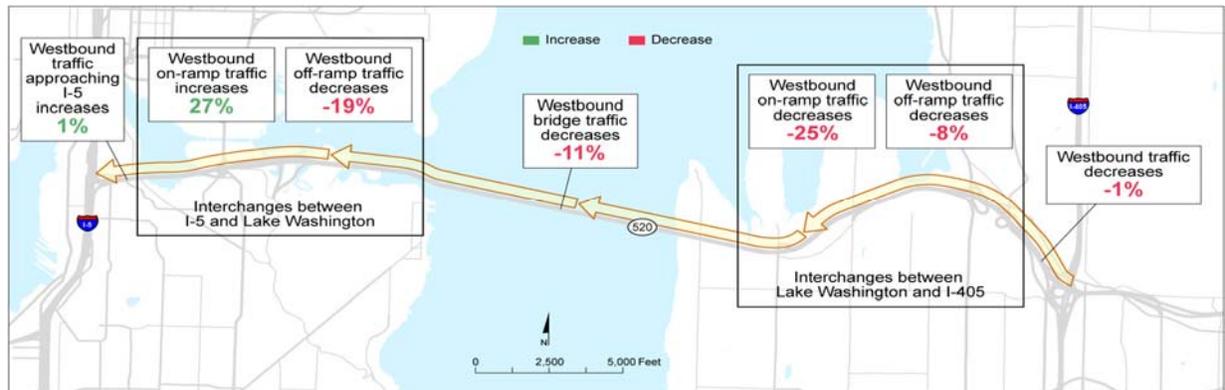


Exhibit 3-19. 4-Lane Alternative, P.M. Peak Period Westbound Vehicle Demand Compared to No Build Alternative

6-Lane Alternative

The following bullets and Exhibit 3-20 summarize the 6-Lane Alternative vehicle-trip growth and traffic flow pattern changes on westbound SR 520 during the p.m. peak period in 2030, compared to No Build conditions.

- Traffic volumes would increase by 6 percent west of the I-405 interchange. This increase in traffic would originate from both I-405 and SR 520 east of the interchange.
- Between I-405 and Lake Washington, traffic would decrease to and from the local areas.
- Traffic volumes would increase by 4 percent across Lake Washington; however, trips would still divert to buses and carpools. GP vehicular demand would decrease by 5 percent, while the carpool volume would be over 2.5 times greater than under the No Build Alternative.
- The Lake Washington Boulevard and Montlake Boulevard off-ramp volumes would decrease, while the Montlake Boulevard on-ramp volume would increase.
- Traffic would increase by 11 percent between Montlake Boulevard and I-5. The traffic distribution from SR 520 to I-5 would shift to the north at the interchange compared to the No Build Alternative. Traffic on the northbound ramp would increase by 22 percent, while the southbound ramp would increase by only 2 percent.



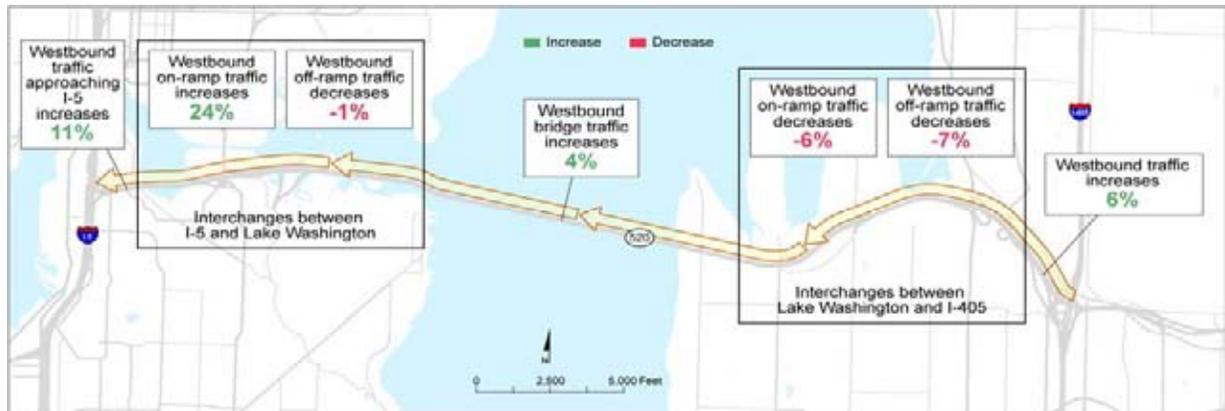


Exhibit 3-20. 6-Lane Alternative, P.M. Peak Period Westbound Vehicle Demand Compared to No Build Alternative

What is the mode split on westbound SR 520 in the p.m. peak period?

Existing Conditions

SR 520 traffic across Lake Washington has the following mode split, which results in an AVO of 1.59.

- GP traffic carries 73 percent of the people in 88 percent of the vehicles.
- Bus traffic carries 2 percent of the people in less than 1 percent of the vehicles.
- Carpool traffic carries 25 percent of the people in 12 percent of the vehicles.

No Build Alternative

On westbound SR 520 during the p.m. peak period under the No Build Alternative, there would be an increase in bus and GP demand by 2030 (compared to today), which would result in an AVO of 1.64.

- GP traffic would carry 77 percent of the people in 95 percent of the vehicles.
- Bus traffic would carry 13 percent of the people in less than 1 percent of the vehicles.
- Carpool traffic would carry 10 percent of the people in 5 percent of the vehicles. The decrease in carpool demand would be due to an increase in bus demand.



4-Lane Alternative

In 2030, the 4-Lane Alternative would increase both bus and carpool demand and decrease GP traffic (compared to the No Build Alternative), which would result in an increased AVO of 1.93. The bridge toll associated with the 4-Lane Alternative would cause a shift in mode choice, resulting in increased demand for bus and carpool.

- GP traffic would carry 61 percent of the people in 87 percent of the vehicles.
- Bus traffic would carry 20 percent of the people in 1 percent of the vehicles.
- Carpool traffic would carry 19 percent of the people in 12 percent of the vehicles.

6-Lane Alternative

In 2030, the 6-Lane Alternative would increase carpool and bus demand and decrease GP demand compared to the No Build Alternative, resulting in an AVO of 2.27. Under the 6-Lane Alternative, the HOV lane on SR 520 would be completed to I-5 with a direct connection to the I-5 express lanes. The additional mobility and capacity provided by this connection would serve to further increase the bus and carpool demand.

- GP traffic would carry 59 percent of the people in 86 percent of the vehicles.
- Bus traffic would carry 19 percent of the people in 1 percent of the vehicles.
- Carpools would carry 22 percent of the people in 13 percent of the vehicles. The HOV lane would carry 41 percent of the people in 14 percent of the vehicles in a single lane, while each GP lane would carry an average of 30 percent of the people in 43 percent of the vehicles.

Eastbound SR 520, A.M. Peak Period

This section summarizes travel forecasts for eastbound SR 520 during the a.m. peak period. The average represents the average hourly volume that occurs throughout the peak period.

What is the person and vehicle-trip demand?

Exhibit 3-21 depicts the vehicle- and person-trip demand for eastbound SR 520 across Lake Washington during the a.m. peak period.



Existing Conditions

The average person-trip demand is 5,850 persons eastbound across Lake Washington in the a.m. peak period. The vehicle demand is 3,830 vph.

No Build Alternative

In 2030, the average person-trip demand would be 7,210 persons per hour (a 23 percent increase) in 14 percent more vehicles. This indicates that there would be a shift to buses by the year 2030. The No Build Alternative vehicle demand eastbound across Lake Washington would be 4,360 vph.

4-Lane Alternative

In 2030, the average person-trip demand would be 7,140 persons per hour (a 1 percent decrease) in 24 percent fewer vehicles. This indicates a substantial shift to buses and carpools. The vehicle demand across Lake Washington would be 3,330 vph.

6-Lane Alternative

In 2030, the average person-trip demand would be 8,250 persons per hour (over a 14 percent increase) in 8 percent fewer vehicles. This indicates a shift to buses and carpools and a decrease in GP demand. The vehicle demand across Lake Washington would be 4,010 vph.

How do travel patterns change on eastbound SR 520?

Existing Conditions

During the a.m. peak period, the vehicle demand is 2,840 vph east of I-5, 3,830 vph across Lake Washington, and 3,620 vph west of I-405.

No Build Alternative

The following bullets and Exhibit 3-22 summarize the vehicle-trip growth and traffic flow pattern changes in 2030 compared to existing conditions.



Exhibit 3-21. Eastbound A.M. Peak Period Person and Vehicle Demand per Hour





Exhibit 3-22. No Build Alternative, A.M. Peak Period Eastbound Vehicle Demand in 2030 Compared to Existing Conditions

- Traffic volumes would increase 10 percent over existing conditions on SR 520 east of I-5. Traffic from I-5 would distribute to SR 520 in similar proportions as today (with 48 percent from northbound I-5 and 52 percent from southbound I-5).
- Traffic volumes on the Montlake Boulevard off-ramp would not change from existing conditions; however, the Montlake Boulevard and Lake Washington Boulevard on-ramp volumes would increase.
- Traffic volumes across Lake Washington would increase by 14 percent over existing conditions. The increase would primarily be due to an increase in GP traffic with 21 percent growth in bus demand.
- The off-ramps between Lake Washington and I-405 would increase in volume, but the on-ramps would show no change. The increase in traffic would be larger on the Eastside (between Lake Washington and I-405) than in Seattle, as indicated by the planning-level model that incorporates changes in land use.
- There would be 3 percent growth approaching I-405; growth east of the interchange would originate from I-405.

4-Lane Alternative

The following bullets and Exhibit 3-23 summarize the vehicle-trip growth and traffic flow pattern changes on eastbound SR 520 during the a.m. peak period in 2030 compared to 2030 No Build conditions.

- Fewer vehicle-trips would access SR 520 from I-5 and more trips would exit to the Montlake Boulevard interchange area. The





Exhibit 3-23. 4-Lane Alternative, A.M. Peak Period Eastbound Vehicle Demand in 2030 Compared to No Build Alternative

increase in eastbound off-ramp traffic corresponds with a decrease in the westbound off-ramp, and the total number of trips to the local area would be similar to the No Build Alternative. This represents a shift in travel patterns related to traveler mode choice and route choice associated with the tolls.

- Traffic volumes would decrease by 16 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 49 percent from northbound I-5 and 51 percent from southbound I-5).
- Traffic on the Montlake Boulevard off-ramp would increase, while the Montlake Boulevard and Lake Washington Boulevard on-ramp volumes would decrease.
- Traffic volumes would decrease 24 percent across Lake Washington because tolling would make this a less desirable trip. Trips would divert to alternate routes or to buses and carpools. GP traffic would decrease by 34 percent, while the carpool volume would be more than 2.5 times greater than carpool volume forecast for the No Build Alternative.
- Traffic exiting to local areas between Lake Washington and I-405 would decrease, but traffic entering SR 520 from these areas would increase.
- There would be no growth approaching I-405.



6-Lane Alternative

The following bullets and Exhibit 3-24 summarize vehicle-trip growth and traffic flow pattern changes on eastbound SR 520 during the a.m. peak period in 2030 compared to 2030 No Build conditions.

- Traffic volumes would decrease by 7 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, but with slightly more traffic coming from the north.
- Traffic exiting to the Montlake area would increase, while traffic entering the corridor from the Montlake Boulevard and Lake Washington Boulevard areas would decrease.
- Traffic volumes would decrease by 9 percent across Lake Washington as a result of tolling. Trips would divert to alternate routes or buses and carpools. GP vehicles would decrease by 19 percent, while the carpool volume would be over 2.5 times greater than the No Build Alternative.
- The off-ramp volumes between Lake Washington and I-405 would decrease, but the on-ramp volumes would increase.
- Approaching I-405, traffic volumes would increase by 7 percent, with the increased traffic destined to I-405. Traffic volumes east of I-405 would be similar to the No Build Alternative.



Exhibit 3-24. 6-Lane Alternative, A.M. Peak Period Eastbound Vehicle Demand in 2030 Compared to No Build Alternative



What is the mode split on eastbound SR 520 in the a.m. peak period?

Existing Conditions

SR 520 traffic across Lake Washington has the following mode split, which results in an AVO of 1.53.

- GP traffic carries 79 percent of the people in 91 percent of the vehicles.
- Bus traffic carries 3 percent of the people in less than 1 percent of the vehicles.
- Carpool traffic carries 18 percent of the people in 9 percent of the vehicles.

No Build Alternative

By 2030, there would be an increase in bus and GP vehicle demand, resulting in an increase in AVO to 1.65 on eastbound SR 520 during the a.m. peak period.

- GP traffic would carry 76 percent of the people in 94 percent of the vehicles.
- Bus traffic would carry 15 percent of the people in less than 1 percent of the vehicles.
- Carpool traffic would carry 9 percent of the people in 5 percent of the vehicles. Carpool demand would decrease because of a corresponding increase in bus demand.

4-Lane Alternative

On eastbound SR 520 during the a.m. peak period in 2030, carpool and bus demand would increase and GP demand would decrease (in terms of both people and vehicle-trips) compared to the No Build Alternative, resulting in an AVO of 2.15.

- GP traffic would carry 50 percent of the people in 81 percent of the vehicles. GP vehicle demand would decrease because of the toll on the Evergreen Point Bridge. The decrease in GP demand corresponds with the increase in bus and carpool demand.
- Bus traffic would carry 24 percent of the people in 1 percent of the vehicles.



- Carpool traffic would carry 26 percent of the people in 18 percent of the vehicles. Under the 4-Lane Alternative, the westbound HOV lane would carry 50 percent of the people in 19 percent of the vehicles, while each GP lane would average 25 percent of the people in just over 40 percent of the vehicles.

6-Lane Alternative

Similar to the 4-Lane Alternative, carpool and bus demand would increase and GP demand would decrease in 2030, which would result in an AVO of 2.06.

- General purpose traffic would carry 54 percent of the people in 83 percent of the vehicles.
- Bus traffic would carry 22 percent of the people in 1 percent of the vehicles. While this would appear to be a decrease in bus person-trips compared to the No Build Alternative, it is an increase because the total number of person-trips has increased (see Exhibit 3-21). The No Build Alternative would carry approximately 1,082 people on buses, while the 6-Lane Alternative would carry approximately 1,815 people on buses.
- Carpool traffic would carry 24 percent of the people in 16 percent of the vehicles.

Eastbound SR 520, P.M. Peak Period

This section summarizes travel forecasts for eastbound SR 520 during the p.m. peak period. The average represents the average hourly volume that occurs throughout the peak period.

What is the person and vehicle-trip demand?

Exhibit 3-25 depicts the vehicle- and person-trip demand for eastbound SR 520 across Lake Washington during the p.m. peak period.



Exhibit 3-25. Eastbound P.M. Peak Period Person and Vehicle Demand per Hour



Existing Conditions

The average person-trip demand eastbound across Lake Washington in the p.m. peak is 6,440. The corresponding vehicle demand is 3,580 vph.

No Build Alternative

In 2030, the average person-trip demand would be 8,670 persons per hour (a 34 percent increase) in 8 percent more vehicles. Vehicle demand for the No Build Alternative would be 3,890 vph across Lake Washington.

4-Lane Alternative

In 2030, the average person-trip demand would be 8,740 persons per hour (a 1 percent increase from the No Build Alternative) in 21 percent fewer vehicles. This indicates a substantial shift to buses and carpools. The vehicle demand across Lake Washington would be 3,090 vph.

6-Lane Alternative

In 2030, the average person-trip demand would be 10,710 persons per hour (over a 24 percent increase) in 2 percent more vehicles. This indicates a shift to buses and carpools. The vehicle demand across Lake Washington would be 3,980 vph.

How would travel patterns change on eastbound SR 520?

Existing Conditions

During the p.m. peak period, vehicle demand is 3,160 vph east of I-5, 3,580 vph across Lake Washington, and 3,630 vph west of I-405.

No Build Alternative

The following bullets and Exhibit 3-26 summarize the changes in vehicle-trip growth and traffic flow patterns compared to existing conditions.

- Traffic volumes would increase by 1 percent over existing conditions on SR 520 east of I-5. Northbound and southbound traffic from I-5 would distribute to SR 520 with the same proportions as today (with 69 percent from northbound I-5 and 31 percent from southbound I-5).
- Traffic exiting to Montlake Boulevard would not change over existing conditions, while traffic from Montlake Boulevard and Lake Washington Boulevard to the corridor would increase.



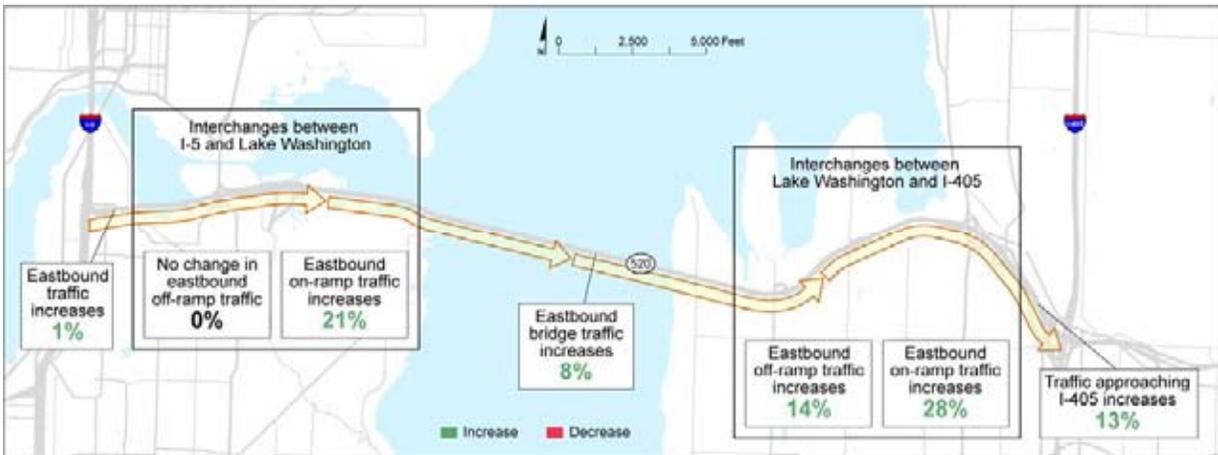


Exhibit 3-26. No Build Alternative, P.M. Peak Hour Eastbound Vehicle Demand in 2030 Compared to Existing Conditions

- Traffic volumes across Lake Washington would increase by 8 percent over existing conditions. The increase would be due primarily to an increase in GP traffic with 33 percent growth in bus demand.
- Traffic volumes on the on- and off-ramps between Lake Washington and I-405 would all increase.
- Traffic approaching I-405 would increase by 13 percent; most of the increased traffic on SR 520 would exit to I-405, and growth east of the interchange would originate from I-405.

4-Lane Alternative

The following bullets and Exhibit 3-27 summarize the growth in vehicle-trips and changes in traffic flow patterns on eastbound SR 520 during the p.m. peak period in 2030 compared to No Build conditions.

- Traffic volumes would decrease by 12 percent on SR 520 east of I-5. Traffic from I-5 would distribute to SR 520 in similar proportions to the No Build Alternative (with 79 percent from northbound I-5 and 21 percent from southbound I-5).
- Montlake Boulevard off-ramp traffic volumes would increase, while Montlake Boulevard and Lake Washington Boulevard on-ramp volumes would decrease.
- Traffic volumes across Lake Washington would decrease by 21 percent as a result of trips diverting to alternate routes or to buses and carpools. GP traffic would decrease by 27 percent, while



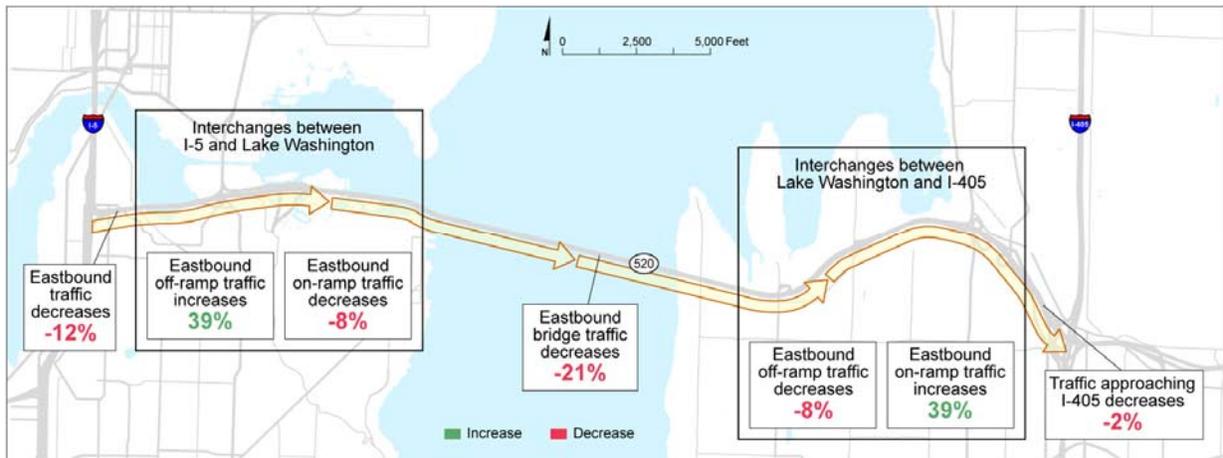


Exhibit 3-27. 4-Lane Alternative, P.M. Peak Period Eastbound Vehicle Demand in 2030 Compared to No Build Alternative

the carpool volume would be more than two times greater than carpool volume forecast for the No Build Alternative.

- Traffic exiting to the local areas between Lake Washington and I-405 would decrease, but entering traffic from the local areas would increase.
- Approaching I-405, traffic volumes would decrease by 2 percent; this decrease would occur throughout the I-405 interchange ramps.

6-Lane Alternative

The following bullets and Exhibit 3-28 summarize the growth in vehicle-trips and changes in traffic flow patterns on eastbound SR 520 during the p.m. peak period compared to No Build conditions.

- Traffic volumes would increase by 1 percent on SR 520 east of I-5. Traffic from I-5 would distribute to SR 520 in similar proportions to the No Build Alternative (with 71 percent from northbound I-5 and 29 percent from southbound I-5).
- Traffic volumes would increase on the ramps to and from Montlake Boulevard and Lake Washington Boulevard.
- Traffic volumes would increase by 2 percent across Lake Washington, with trips diverting to buses and carpools. GP vehicles would decrease by 14 percent, while the carpool volume would be over 4.5 times greater than under the No Build Alternative.



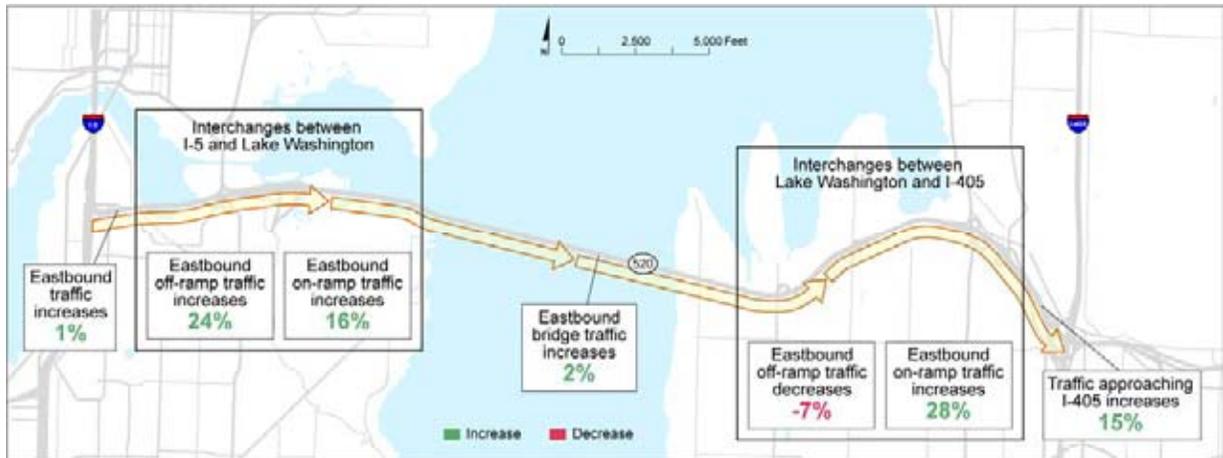


Exhibit 3-28. 6-Lane Alternative, P.M. Peak Period Eastbound Vehicle Demand in 2030 Compared to No Build Alternative

- Off-ramp volumes between Lake Washington and I-405 would decrease, but on-ramp volumes would increase.
- Traffic volumes approaching I-405 would increase by 15 percent. Most of the traffic growth would be destined to I-405; forecasts indicate 1 percent growth east of the I-405 interchange.

What is the mode split on eastbound SR 520 in the p.m. peak period?

Existing Conditions

SR 520 traffic across Lake Washington has the following mode split, which results in an AVO of 1.80.

- GP traffic carries 66 percent of the people in 91 percent of the vehicles.
- Bus traffic carries 19 percent of the people in 1 percent of the vehicles.
- Carpools carry 15 percent of the people in 8 percent of the vehicles.

No Build Alternative

On eastbound SR 520 during the p.m. peak period, there would be a shift to buses by 2030 and an increase in GP traffic, resulting in an increased AVO of 2.25.

- GP traffic would carry 56 percent of the people in 95 percent of the vehicles.



- Bus traffic would carry 38 percent of the people in 2 percent of the vehicles.
- Bus traffic would carry 38 percent of the people in 2 percent of the vehicles.
- Carpools would carry 6 percent of the people in 4 percent of the vehicles.

4-Lane Alternative

In 2030, bus and carpool demand would increase with the 4-Lane Alternative (compared to the No Build Alternative), and GP demand would decrease, resulting in an AVO of 2.85.

- GP traffic would carry 40 percent of the people in 86 percent of the vehicles.
- Bus traffic would carry 47 percent of the people in 3 percent of the vehicles.
- Carpools would carry 13 percent of the people in 11 percent of the vehicles.

6-Lane Alternative

Under the 6-Lane alternative by 2030, bus and carpool traffic would increase and GP demand would decrease as compared to the No Build Alternative, resulting in an AVO of 1.92.

- GP traffic would carry 39 percent of the people in 79 percent of the vehicles.
- Bus traffic would carry 39 percent of the people in less than 2 percent of the vehicles.
- Carpool traffic would carry 22 percent of the people in 19 percent of the vehicles.

Adjacent Freeways

This section provides some additional insight into how traffic forecasts for the various alternatives affect the adjacent freeway systems. The SR 520 corridor provides a critical link between communities on the east and west sides of Lake Washington. It also crosses the two primary north/south interstate freeways (I-405 and I-5) in the Puget Sound region. The I-90 corridor provides a similar link across Lake Washington and is parallel to the SR 520 corridor.



Detailed traffic volume forecasts were not developed for the I-90 corridor; however, results from the travel demand model for the I-90 bridge during the p.m. peak period are discussed below to provide information about possible future traffic patterns.

During the p.m. peak period, vehicle volumes on I-90 would increase between 0.6 percent and 1.5 percent for the 6-Lane and 4-Lane Alternatives, respectively. This equates to an increase of between 300 and 800 vph during the peak period (or 900 to 2,400 over the entire 3-hour period). Conversely, the person-trips using the I-90 corridor would decrease between 5 percent and 2.7 percent for the 6-Lane and 4-Lane Alternatives, respectively. These data suggest a corridor shift for non-HOV vehicles away from SR 520 to I-90, while the carpool and bus trips shift from I-90 to the SR 520 corridor. Carpool and bus trips would shift from I-90 to SR 520 under the 6-Lane Alternative because the SR 520 corridor would have the completed HOV lane and SR 520 would be a more centrally located corridor across Lake Washington.

A.M. Peak Period

How does vehicle demand change on I-5?

The vehicle demand discussion below is summarized in tabular format at the end of this section in Exhibit 3-29.

Existing Conditions

Today on southbound I-5 on the Ship Canal Bridge, vehicle demand is 6,810 vph. South of the I-5/ SR 520 Interchange, demand is 7,210 vph. On northbound I-5 south of the I-5/SR 520 Interchange, northbound demand is 6,160 vph. On the Ship Canal Bridge, vehicle demand is 5,970 vph.

No Build Alternative

On I-5 southbound, vehicle demand would increase in 2030 by 6 percent on the Ship Canal Bridge and by 2 percent south of the SR 520 interchange compared to today. On I-5 northbound, vehicle demand would increase by 20 percent south of the SR 520 interchange and on the Ship Canal Bridge.

Forecast traffic volumes exiting from north- and southbound I-5 to Seattle are predicted to decrease in the future. This would result in a substantial volume increase on the I-5 mainline. North of the I-90 collector-distributor, traffic volumes would increase by 37 percent over existing conditions.



Exhibit 3-29. A.M. Peak Period Vehicle Demand Forecasts for Adjacent Freeways (I-5, SR 520 east of I-405, I-405)

	Existing Conditions	Year 2030		
		No Build Alternative ^a	4-Lane Alternative ^b	6-Lane Alternative ^b
I-5 Southbound				
Ship Canal Bridge	6,810 vph	↑ 6%	↓ 4%	↓ 2%
South of I-5/SR 520 Interchange	7,210 vph	↑ 2%	↓ 2%	↑ 5%
I-5 Northbound				
Ship Canal Bridge	5,970 vph	↑ 20%	No change	↑ 3%
South of I-5/SR 520 Interchange	6,160 vph	↑ 20%	↓ 3%	↓ 1%
SR 520 (east of I-405)				
Westbound	4,440 vph	↑ 21%	No Change	↑ 5%
Eastbound	3,610 vph	↑ 20%	↓ 3%	↓ 1%
I-405 Southbound				
North of SR 520	7,670 vph	↑ 48%	↓ 1%	↓ 1%
South of SR 520	8,040 vph	↑ 41%	No Change	No Change
I-405 Northbound				
North of SR 520	4,500 vph	↑ 26%	↓ 1%	No Change
South of SR 520	6,040 vph	↑ 30%	↓ 2%	↑ 1%

Source: Post-processing of information contained within Final Submittal of Freeway and Local Traffic Forecasts and Operations (SR 520 Project Team 2004b).

vph = vehicles per hour

^aNo Build Alternative changes in vehicle demand are compared with existing conditions.

^b4-Lane and 6-Lane Alternative changes in vehicle demand are compared with the No Build Alternative.

4-Lane Alternative

During the a.m. peak period on I-5 southbound, vehicle demand would decrease by 4 percent on the Ship Canal Bridge and by 2 percent south of the SR 520 interchange in 2030 (as compared to the No Build Alternative).

Southbound traffic would decrease on I-5 and on the I-5 ramps through downtown Seattle until the I-90 interchange. Traffic would increase on the I-90 collector-distributor ramp, likely due to a diversion from SR 520 to I-90. South of the I-90 collector-distributor, the I-5 corridor would carry traffic volumes similar to the No Build Alternative.

On I-5 northbound, vehicle demand would decrease by 3 percent south of the SR 520 interchange, with no change occurring on the Ship Canal Bridge.

6-Lane Alternative

In the a.m. peak period on southbound I-5, vehicle demand would decrease by 2 percent on the Ship Canal Bridge and increase by



5 percent south of the SR 520 interchange in 2030 (compared with the No Build Alternative). On I-5 northbound, vehicle demand would decrease by 1 percent south of the SR 520 interchange and increase by 3 percent on the Ship Canal Bridge.

How does vehicle demand change on SR 520 east of I-405?

Existing Conditions

Today, the vehicle demand westbound on SR 520 east of I-405 is 4,440 vph. Eastbound demand is 3,610 vph.

No Build Alternative

The vehicle demand on SR 520 east of I-405 would increase by 21 percent westbound and 20 percent eastbound in 2030 (compared to today).

4-Lane Alternative

In 2030, westbound vehicle demand east of I-405 under the 4-Lane Alternative would not change compared to the No Build Alternative, but eastbound vehicle demand would decrease by 3 percent.

6-Lane Alternative

Under the 6-Lane Alternative, vehicle demand would increase in 2030 by 5 percent westbound compared to the No Build Alternative and would decrease by 1 percent eastbound.

How does vehicle demand change on I-405?

Existing Conditions

On I-405 southbound, vehicle demand during the a.m. peak period is 7,670 vph north of SR 520 and 8,040 vph south of SR 520. On I-405 northbound, vehicle demand is 6,040 vph south of SR 520 and 4,500 vph north of SR 520.

No Build Alternative

On I-405 southbound, vehicle demand would increase in 2030 (compared to today) by 48 percent north of SR 520 and by 41 percent south of the SR 520. On I-405 northbound, vehicle demand would increase by 30 percent south of SR 520 and 26 percent north of SR 520.

4-Lane Alternative

On I-405 southbound, vehicle demand would decrease in 2030 by 1 percent north of SR 520 and would not change south of SR 520



(compared to the No Build Alternative). On I-405 northbound, vehicle demand would decrease by 2 percent south of SR 520 and by 1 percent north of SR 520.

6-Lane Alternative

During the a.m. peak period on I-405 southbound, vehicle demand would decrease in 2030 by 1 percent north of the SR 520 interchange, but would not change south of the SR 520 interchange (compared to the No Build Alternative). On I-405 northbound, vehicle demand would increase by 1 percent south of SR 520 and would not change north of SR 520.

P.M. Peak Period

How does vehicle demand change on I-5?

The vehicle demand discussion below is summarized in tabular format at the end of this section in Exhibit 3-30.

Existing Conditions

On I-5 southbound, vehicle demand is 7,370 vph on the Ship Canal Bridge and 7,320 vph south of the SR 520 interchange. On I-5 northbound, vehicle demand is 7,490 vph south of the SR 520 interchange and 7,580 vph on the Ship Canal Bridge.

No Build Alternative

On I-5 southbound, vehicle demand would increase in 2030 by 16 percent on the Ship Canal Bridge and by 20 percent south of the SR 520 interchange (compared to today). On I-5 northbound, vehicle demand would increase by 9 percent south of the SR 520 interchange and by 8 percent on the Ship Canal Bridge. Traffic volumes to and from Seattle are predicted to decrease.

4-Lane Alternative

On I-5 southbound, vehicle demand would increase in 2030 by 2 percent on the Ship Canal Bridge and south of the SR 520 interchange during the p.m. peak period (compared to the No Build Alternative). On I-5 northbound, vehicle demand would decrease by 5 percent south of the SR 520 interchange, with no change in volume on the Ship Canal Bridge.

6-Lane Alternative

During the p.m. peak period on I-5 southbound, vehicle demand would increase in 2030 by 3 percent on the Ship Canal Bridge and south of the



SR 520 interchange compared to the No Build Alternative. On I-5 northbound, vehicle demand would decrease by 3 percent south of the SR 520 interchange and increase by 5 percent on the Ship Canal Bridge.

Exhibit 3-30. P.M. Peak Period Vehicle Demand Forecasts on Adjacent Freeways (I-5, SR 520 east of I-405, I-405)

	Existing Conditions	Year 2030		
		No Build Alternative ^a	4-Lane Alternative ^b	6-Lane Alternative ^b
Southbound I-5				
Ship Canal Bridge	7,370 vph	↑ 16%	↑ 2%	↑ 3%
South of I-5/SR 520 Interchange	7,320 vph	↑ 20%	↑ 2%	↑ 3%
Northbound I-5				
Ship Canal Bridge	7,580 vph	↑ 8%	No change	↑ 5%
South of I-5/SR 520 Interchange	7,490 vph	↑ 9%	↓ 5%	↓ 3%
SR 520 (east of I-405)				
Westbound	5,160 vph	↑ 18%	↑ 1%	↑ 3%
Eastbound	3,590 vph	↑ 14%	↓ 2%	↑ 1%
I-405 Southbound				
North of SR 520	5,880 vph	↑ 31%	↓ 1%	No Change
South of SR 520	6,530 vph	↑ 35%	No Change	↑ 2%
I-405 Northbound				
North of SR 520	7,490 vph	↑ 42%	No Change	↑ 1%
South of SR 520	8,110 vph	↑ 39%	↓ 1%	↓ 1%

Source: Post-processing of information contained within Final Submittal of Freeway and Local Traffic Forecasts and Operations (SR 520 Project Team 2004b).

vph = vehicles per hour

^aNo Build Alternative changes in vehicle demand are compared with existing conditions.

^b4-Lane and 6-Lane Alternative changes in vehicle demand are compared with No Build Alternative.

How does vehicle demand change on SR 520 east of I-405?

Existing Conditions

Today, the vehicle demand westbound on SR 520 east of I-405 is 5,160 vph. Eastbound demand is 3,590 vph.

No Build Alternative

The vehicle demand on SR 520 east of I-405 would increase by 18 percent westbound and 14 percent eastbound in 2030 (compared to today).



4-Lane Alternative

Vehicle demand for the 4-Lane Alternative would increase in 2030 by 1 percent (compared to the No Build Alternative) in the westbound direction and would decrease by 2 percent in the eastbound direction.

6-Lane Alternative

Vehicle demand during the p.m. peak period under the 6-Lane Alternative would increase in 2030 by 3 percent westbound (compared to the No Build Alternative) and by 1 percent eastbound.

How does vehicle demand change on I-405?

Existing Conditions

During the p.m. peak period on I-405 southbound, vehicle demand is 5,880 vph north of SR 520 and 6,530 vph south of SR 520. On I-405 northbound, vehicle demand is 7,490 vph north of SR 520 and 8,110 vph south of SR 520.

No Build Alternative

On I-405 southbound, vehicle demand would increase in 2030 by 31 percent north of SR 520 and by 35 percent south of SR 520 (compared to today). On I-405 northbound, vehicle demand would increase by 42 percent north of SR 520 and by 39 percent south of SR 520.

4-Lane Alternative

On I-405 southbound, vehicle demand would decrease in 2030 by 1 percent north of SR 520 and would not change south of SR 520 (compared to the No Build Alternative). On I-405 northbound, vehicle demand would decrease by 1 percent south of SR 520, with no change north of SR 520.

6-Lane Alternative

During the p.m. peak period on I-405 southbound, vehicle demand would not change north of SR 520 and would increase by 2 percent south of SR 520 in 2030 (compared to the No Build Alternative). On I-405 northbound, vehicle demand would increase by 1 percent north of SR 520 and decrease by 1 percent south of SR 520.

What percentage of traffic consists of heavy vehicles?

Traffic in the SR 520 corridor includes 3 percent heavy vehicles under existing conditions (a.m. and p.m. peak periods, both eastbound and westbound), with 75 to 80 percent of the trucks being single-unit



vehicles. Volumes of heavy vehicles are expected to grow in the same proportion as other vehicle types, resulting in the same percentage of heavy vehicles under the future 2030 scenarios (No Build, 4-Lane, and 6-Lane Alternatives).

Local Travel Forecasts

Year 2030 vehicle-trip forecasts were completed for the study area for the a.m. and p.m. peak hours. These forecasts cover existing conditions and the 2030 No Build, 4-Lane, and 6-Lane Alternatives.

How were travel forecasts and patterns determined?

What time periods were evaluated and why?

The transportation discipline team evaluated local traffic operations during single a.m. and p.m. peak hours within the peak period identified for the freeway. Freeway ramps and arterials have unique peaking characteristics, which were combined to assess the future operational efficiency of each interchange area. The peak hour for each interchange peak was defined as the time when the combined traffic volume of all ramps located within the interchange study area reached their peak.

The peak hour was allowed to vary between various interchange study areas to preserve their individual peaking characteristics. For instance, one interchange may peak at 4:00 p.m., while another interchange peaks at 5:30 p.m. We studied the peak hour for each interchange.

In addition, the arterial volumes (traffic on the arterials not accessing the freeway) used in the forecasts were based on arterial peaking characteristics. For instance, the ramps to an interchange area may peak at 4:00 p.m., while the arterial volumes at that interchange may peak at 5:00 p.m. The arterial peak-hour volumes and freeway ramp peak-hour volumes were added for conservative traffic volume forecasts.

How were existing data compiled?

The transportation discipline team compiled existing arterial turn movement counts conducted over the past 3 years. Local jurisdictions or a traffic volume counting agency provided the count data.

We identified traffic patterns for freeway and nonfreeway traffic on the local network. Nonfreeway-related traffic was assumed to follow



patterns similar to those seen today. For example, if today at a given intersection 10 percent of vehicles turn left, 60 percent head straight through, and the remaining 30 percent turn right, it was assumed that the same distribution would apply to nonfreeway-related traffic for the year 2030. This assumption was used because there are no proposed project changes to the local roadway networks that would result in new trip distributions at the ramp termini. On- and off-ramp traffic volume forecasts may change due to the project; however, their distribution in the local network would be relatively similar to the existing conditions.

Freeway-related trips were also characterized as following turn movement patterns at an intersection similar to those that occur today. However, we eliminated illogical movements, such as freeway traffic exiting and reentering the freeway by making a series of right or left turns.

How were arterials grouped together to form interchange influence areas?

We calculated local rates of traffic growth using an areawide growth rate that encompassed many local roads within an interchange influence area.

Interchange influence areas are those areas throughout which similar growth in traffic was expected. Each influence area includes one or more interchanges. The locations of the interchange influence areas were discussed in the section above titled *How was traffic forecast for the screenline and influence areas?* at the beginning of this chapter.

How was travel demand forecast for local streets?

Arterial travel demand forecasts are based on growth in traffic volumes on local arterials in the interchange area, combined with freeway on- and off-ramp volumes (as described in the freeway forecast section of this report). The study area for the local forecasts is shown in *Chapter 1: Introduction and Overview* (Exhibit 1-5) and includes arterial interchanges on SR 520 between I-5 and 108th Avenue Northeast, I-5 between Northeast 45th Street and Stewart Street, and the I-5 express lanes between Northeast 42nd Street and 5th Avenue Northeast. Forecasting of local traffic ended at Bellevue Way/108th Avenue Northeast because the traffic forecasts on SR 520 east of 108th Avenue Northeast did not show substantial growth in traffic volumes over the No Build Alternative.



We identified local traffic patterns for freeway-related and nonfreeway-related traffic. We distributed freeway ramp traffic through the local roadway system by applying existing intersection turning movement ratios.

After ramp traffic was distributed through the system, local traffic volumes not associated with the freeway ramps were adjusted to ensure that the overall interchange influence area growth rate equaled the rate identified in the travel demand model.

How were adjustments made to account for future changes in travel patterns?

Travel patterns for forecast volumes were based on existing travel patterns, except where adjustments were necessary to account for new road connections and facilities. Detailed information about turn movement volumes are provided in the technical memorandum entitled *Final Submittal of Freeway and Local Traffic Forecasts and Operations* (SR 520 Project Team 2004b).

How were transit and pedestrian volumes on local streets estimated?

Bus and pedestrian mode choices were included in the local traffic volume forecasts. Bus volumes were estimated using a 1 percent growth rate per year. This is different than the 2 percent per year growth rate forecast in regional service hours. Bus volumes were forecast so that bus blockages and their effect on the local street traffic operations could be included in the operations analysis. Bus blockages occur when buses that are stopped to board and deboard passengers block an arterial travel lane.

Future pedestrian volumes were assumed to remain consistent with existing volumes; where pedestrian counts were unavailable, estimates were based on data provided in the Highway Capacity Manual for central business district (CBD) and non-CBD areas.

Local Travel Demand Forecast Results

This section discusses the a.m. and p.m. peak period travel demand forecast results for existing conditions and the 2030 No Build, 4-Lane, and 6-Lane Alternatives. The forecasts are summarized in terms of vehicle demand in Exhibits 3-31 and 3-32.

Existing conditions are described first to provide a basis for understanding the future forecasts. The No Build Alternative is the



baseline year 2030 scenario and describes the growth that is expected between now and the year 2030. The 4-Lane and 6-Lane Alternatives are the year 2030 build scenarios and are compared to the No Build Alternative to answer the question: “How does travel demand change if we improve the corridor by the year 2030?”

Exhibit 3-31. A.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Change Between									
		Total 2-Way Peak Hour Volume				No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
Stewart Street	Eastlake Avenue north of Stewart Street	640	620	590	630	-20	-3%	-30	-5%	10	2%
	John Street west of Stewart Street/ Eastlake Avenue	80	60	60	60	-20	-25%	0	0%	0	0%
	Denny Way west of Stewart Street	1250	1170	1150	1220	-80	-6%	-20	-2%	50	4%
	Denny Way east of Stewart Street	1880	1800	1770	1850	-80	-4%	-30	-2%	50	3%
	Yale Avenue northwest of Stewart Street	250	260	260	250	10	4%	0	0%	-10	-4%
	Stewart Street southwest of Yale Avenue	2040	1890	1960	2000	-150	-7%	70	4%	110	6%
	Howell Street southwest of Yale Avenue	1050	1100	1110	1110	50	5%	10	1%	10	1%
	Total of Locations	7190	6900	6900	7120	-290	-4%	0	0%	220	3%
Mercer Street	Mercer Street west of Fairview Avenue	2200	2350	2270	2350	150	7%	-80	-3%	0	0%
	Fairview Avenue north of Mercer Street	2970	2640	2710	2770	-330	-11%	70	3%	130	5%
	Fairview Avenue south of Mercer Street	1870	1790	1810	1870	-80	-4%	20	1%	80	4%
	Total of Locations	7040	6780	6790	6990	-260	-4%	10	0%	210	3%
Roanoke Street	Harvard Avenue north of East Hamlin Street	840	930	960	960	90	11%	30	3%	30	3%
	East Edgar Street east of Harvard Avenue	20	30	30	30	10	50%	0	0%	0	0%
	East Roanoke Street east of Harvard Avenue	1930	2120	2140	2140	190	10%	20	1%	20	1%



Exhibit 3-31. A.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Change Between									
		Total 2-Way Peak Hour Volume				No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
	Boylston Avenue north of East Edgar Street	30	30	30	30	0	0%	0	0%	0	0%
	East Edgar Street west of Boylston Avenue	70	80	80	80	10	14%	0	0%	0	0%
	East Roanoke Street west of Boylston Avenue	400	440	440	440	40	10%	0	0%	0	0%
	East Louisa Street west of Boylston Avenue	100	120	120	120	20	20%	0	0%	0	0%
	East Lynn Street west of Boylston Avenue	800	870	860	860	70	9%	-10	-1%	-10	-1%
	East Boston Street west of Boylston Avenue	70	80	70	70	10	14%	-10	-13%	-10	-13%
	East Newton Street west of Boylston Avenue	20	30	20	20	10	50%	-10	-33%	-10	-33%
	Harvard Avenue north of East Newton Street	240	270	280	280	30	13%	10	4%	10	4%
	Lakeview Blvd south of I-5 northbound ramp	430	500	510	510	70	16%	10	2%	10	2%
	Total of Locations	4950	5500	5540	5540	550	11%	40	1%	40	1%
Northeast 45th Street	5th Avenue Northeast north of Northeast 45th Street	880	900	880	910	20	2%	-20	-2%	10	1%
	7th Avenue Northeast north of Northeast 45th Street	550	560	550	580	10	2%	-10	-2%	20	4%
	Northeast 45th Street west of 5th Avenue Northeast	1370	1390	1370	1410	20	1%	-20	-1%	20	1%
	Northeast 45th Street east of Northeast 7th Avenue	2160	2190	2160	2230	30	1%	-30	-1%	40	2%
	5th Avenue Northeast south of I-5 southbound on-ramp	190	200	190	190	10	5%	-10	-5%	-10	-5%
	Northeast 42nd Street west of 7th Avenue Northeast	20	20	20	20	0	0%	0	0%	0	0%



Exhibit 3-31. A.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Change Between									
		Total 2-Way Peak Hour Volume				No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
	7th Avenue Northeast south of Northeast 42nd Street	420	420	420	410	0	0%	0	0%	-10	-2%
	Northeast 42nd Street east of 7th Avenue Northeast	340	340	340	320	0	0%	0	0%	-20	-6%
	Total of Locations	5930	6020	5930	6070	90	2%	-90	-1%	50	1%
Montlake Boulevard and Lake Washington Boulevard	Montlake Boulevard north of SR 520 westbound ramps	5290	5380	5310	5550	90	2%	-70	-1%	170	3%
	Montlake Boulevard south of SR 520 eastbound ramps	2530	2600	2540	2670	70	3%	-60	-2%	70	3%
	Lake Washington Boulevard east of SR 520 ramps	2370	2520	2250	2480	150	6%	-270	-11%	-40	-2%
	Total of Locations	10190	10500	10100	10700	310	3%	-400	-4%	200	2%
84th Avenue and 92nd Avenues Northeast	84th Avenue Northeast north of westbound on-ramp	170	180	160	190	10	6%	-20	-11%	10	6%
	92nd Avenue Northeast north of westbound off-ramp	340	380	370	400	40	12%	-10	-3%	20	5%
	Hunts Point west of 84th Avenue Northeast	20	20	20	20	0	0%	0	0%	0	0%
	Transit Stop Access west of 92nd Avenue Northeast	50	50	60	60	0	0%	10	20%	10	20%
	Northeast 28th Street east of 84th Avenue Northeast	630	740	630	680	110	17%	-110	-15%	-60	-8%
	84th Avenue Northeast south of eastbound off-ramp	1120	1290	1070	1150	170	15%	-220	-17%	-140	-11%
	92nd Avenue Northeast south of eastbound on-ramp	940	1130	1300	1200	190	20%	170	15%	70	6%
	Total of Locations	3270	3790	3610	3700	520	16%	-180	-5%	-90	-2%
104th and 108th Avenues Northeast	104th Avenue Northeast north of SR 520 westbound ramps	2580	2930	2370	2680	350	14%	-560	-19%	-250	-9%



Exhibit 3-31. A.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Change Between									
		Total 2-Way Peak Hour Volume				No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
	108th Avenue North-east north of SR 520 westbound ramps	2350	2870	3160	2950	520	22%	290	10%	80	3%
	104th Avenue North-east south of SR 520 eastbound ramps	1890	2110	1840	2000	220	12%	-270	-13%	-110	-5%
	108th Avenue North-east south of SR 520 eastbound on-ramp	1110	1350	1450	1410	240	22%	100	7%	60	4%
	Total of Locations	7930	9260	8820	9040	1330	17%	-440	-5%	-220	-2%

Note: No Build, 4-Lane, and 6-Lane Alternatives are forecast for the year 2030.



Exhibit 3-32. P.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Total 2-Way Peak Hour Volume				Change Between					
						No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
Stewart Street	Eastlake Avenue north of Stewart Street	780	970	940	950	190	24%	-30	-3%	-20	-2%
	John Street west of Stewart Street/ Eastlake Avenue	130	130	130	130	0	0%	0	0%	0	0%
	Denny Way west of Stewart Street	1350	1410	1430	1460	60	4%	20	1%	50	4%
	Denny Way east of Stewart Street	1880	1940	1950	2000	60	3%	10	1%	60	3%
	Yale Avenue northwest of Stewart Street	420	410	390	400	-10	-2%	-20	-5%	-10	-2%
	Stewart Street south-west of Yale Avenue	960	960	950	1000	0	0%	-10	-1%	40	4%
	Howell Street south-west of Yale Avenue	1680	1850	1850	1910	170	10%	0	0%	60	3%
	Total of Locations	7200	7670	7640	7850	470	7%	-30	0%	180	2%
Mercer Street	Mercer Street west of Fairview Avenue	4070	4410	4360	4510	340	8%	-50	-1%	100	2%
	Fairview Avenue north of Mercer Street	2440	2420	2450	2530	-20	-1%	30	1%	110	5%
	Fairview Avenue south of Mercer Street	2240	2470	2480	2570	230	10%	10	0%	100	4%
		Total of Locations	8750	9300	9290	9610	550	6%	-10	0%	310
Roanoke Street	Harvard Avenue north of East Hamlin Street	1130	1250	1250	1280	120	11%	0	0%	30	2%
	East Edgar Street east of Harvard Avenue	60	60	70	70	0	0%	10	17%	10	17%
	East Roanoke Street east of Harvard Avenue	2040	2180	2190	2290	140	7%	10	0%	110	5%
	Boylston Avenue north of East Edgar Street	100	100	110	110	0	0%	10	10%	10	10%
	East Edgar Street west of Boylston Avenue	70	80	70	80	10	14%	-10	-13%	0	0%
	East Roanoke Street west of Boylston Avenue	390	410	430	430	20	5%	20	5%	20	5%



Exhibit 3-32. P.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Total 2-Way Peak Hour Volume				Change Between					
						No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
	East Louisa Street west of Boylston Avenue	120	140	120	120	20	17%	-20	-14%	-20	-14%
	East Lynn Street west of Boylston Avenue	790	840	850	880	50	6%	10	1%	40	5%
	East Boston Street west of Boylston Avenue	110	130	130	130	20	18%	0	0%	0	0%
	East Newton Street west of Boylston Avenue	20	30	30	30	10	50%	0	0%	0	0%
	Harvard Avenue north of East Newton Street	200	240	240	240	40	20%	0	0%	0	0%
	Lakeview Blvd south of I-5 northbound ramp	630	680	680	710	50	8%	0	0%	30	4%
	Total of Locations	5660	6140	6170	6370	480	8%	30	0%	230	4%
Northeast 45th Street	5th Avenue Northeast north of Northeast 45th Street	710	780	780	780	70	10%	0	0%	0	0%
	7th Avenue Northeast north of Northeast 45th Street	940	1020	1020	1030	80	9%	0	0%	10	1%
	Northeast 45th Street west of 5th Avenue Northeast	1730	1880	1860	1900	150	9%	-20	-1%	20	1%
	Northeast 45th Street east of Northeast 7th Avenue	2530	2730	2710	2810	200	8%	-20	-1%	80	3%
	5th Ave Northeast south of I-5 southbound on-ramp	210	220	220	230	10	5%	0	0%	10	5%
	Northeast 42nd Street west of 7th Avenue Northeast	10	10	10	10	0	0%	0	0%	0	0%
	7th Avenue Northeast south of Northeast 42nd Street	530	580	590	590	50	9%	10	2%	10	2%
	Northeast 42nd Street east of 7th Avenue Northeast	390	430	450	440	40	10%	20	5%	10	2%
	Total of Locations	7050	7650	7640	7790	600	9%	-10	0%	140	2%



Exhibit 3-32. P.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Total 2-Way Peak Hour Volume				Change Between					
						No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
Montlake Boulevard and Lake Washington Boulevard	Montlake Boulevard north of SR 520 westbound ramps	5300	5660	5570	5760	360	7%	-90	-2%	100	2%
	Montlake Boulevard south of SR 520 eastbound ramps	2320	2360	2310	2230	40	2%	-50	-2%	-130	-6%
	Lake Washington Boulevard east of SR 520 ramps	1600	1770	1640	1780	170	11%	-130	-7%	10	1%
Total of Locations		9220	9790	9520	9770	570	6%	-270	-3%	-20	0%
84th Avenue and 92nd Avenues Northeast	84th Avenue Northeast north of westbound on-ramp	160	240	230	250	80	50%	-10	-4%	10	4%
	92nd Avenue Northeast north of westbound off-ramp	320	410	460	440	90	28%	50	12%	30	7%
	Hunts Point west of 84th Avenue Northeast	20	100	90	100	80	400%	-10	-10%	0	0%
	Transit Stop Access west of 92nd Avenue Northeast	40	80	100	90	40	100%	20	25%	10	13%
	Northeast 28th Street east of 84th Avenue Northeast	650	530	480	530	-120	-18%	-50	-9%	0	0%
	84th Avenue Northeast south of eastbound off-ramp	1210	1210	1000	1160	0	0%	-210	-17%	-50	-4%
	92nd Avenue Northeast south of eastbound on-ramp	760	840	940	890	80	11%	100	12%	50	6%
Total of Locations		3160	3410	3300	3460	250	8%	-110	-3%	50	1%
104th and 108th Avenues Northeast	104th Avenue Northeast north of SR 520 westbound ramps	3220	4340	3660	4120	1120	35%	-680	-16%	-220	-5%
	108th Avenue Northeast north of SR 520 westbound ramps	2460	3030	3200	3200	570	23%	170	6%	170	6%
	104th Avenue Northeast south of SR 520 eastbound ramps	2360	3010	2800	2960	650	28%	-210	-7%	-50	-2%



Exhibit 3-32. P.M. Street Vehicle Volume Forecasts

Interchange Area	Location	Total 2-Way Peak Hour Volume				Change Between					
						No Build and Existing		4-Lane and No Build		6-Lane and No Build	
		Existing	No Build	4-Lane	6-Lane	(vph)	(%)	(vph)	(%)	(vph)	(%)
	108th Avenue North-east south of SR 520 eastbound on-ramp	1470	1850	1920	1940	380	26%	70	4%	90	5%
Total of Locations		9510	12230	11580	12220	2720	29%	-650	-5%	-10	0%

Note: No Build, 4-Lane, and 6-Lane Alternatives are forecast for the year 2030

What local street improvements are included in this alternative?

No Build Alternative

The No Build Alternative includes the local 6-year Transportation Improvement Plan projects, but does not include any improvements related to the SR 520 Bridge Replacement and HOV Project. A full description of the No Build Alternative can be found in the *Final Year 2030 No-Action Definition* memorandum dated July 9, 2003.

4-Lane Alternative

In addition to the local 6-year Transportation Improvement Plan projects included in the No Build Alternative, the 4-Lane Alternative includes improvements at the Montlake Boulevard interchange, which are discussed in detail in Chapter 5. One of the interchange improvements signalizes the Montlake Boulevard/SR 520 westbound ramps intersection, which removes the northbound u-turn movement from the Montlake Boulevard/Hamlin Street intersection.

6-Lane Alternative

This alternative includes the same improvements at the Montlake Boulevard interchange that are described above for the 4-Lane Alternative.

How does travel change during the a.m. peak hour?

Existing Conditions

Exhibit 3-31 shows today’s traffic volumes during the a.m. peak hour. The traffic volumes shown on Exhibit 3-31 represent the total traffic at



that location (including traffic on both sides of the street). For instance, volumes listed for a location north of an intersection are the sum of the northbound traffic leaving the intersection and southbound traffic approaching the intersection.

No Build Alternative

Traffic volumes would increase throughout the study area in 2030 except in downtown Seattle, where volumes would decrease. The interchanges where traffic would decrease include:

- Mercer Street
- Stewart Street

Vehicle-trip volume would decrease in these locations as a result of more people using buses and carpools for trips into and out of Seattle.

4-Lane Alternative

Traffic volumes would decrease by 2030 compared to the No Build Alternative in the following interchange areas:

- Northeast 45th Street
- Montlake Boulevard and Lake Washington Boulevard
- 84th Avenue Northeast
- 92nd Avenue Northeast
- Bellevue Way Northeast
- 108th Avenue Northeast

Traffic volumes would decrease due to changes in mode (carpool and bus), the elimination of some trips, and the availability of other corridors (I-405, I-90, SR 522) as alternate routes.

The Mercer Street and Stewart Street interchange areas would experience no increase in volume. The Roanoke Street interchange would experience a 1 percent increase.

6-Lane Alternative

The forecast volumes for the 6-Lane Alternative would increase in 2030 by at least 1 percent west of Lake Washington compared to the No Build Alternative. Traffic volumes would decrease east of Lake Washington in the following interchange areas:

- 84th Avenue Northeast
- 92nd Avenue Northeast
- Bellevue Way Northeast
- 108th Avenue Northeast



At the listed interchanges, the area volume would decrease due to origin and destination changes, mode shifts to carpools and buses, and diversions to alternate travel routes.

How does travel change in the p.m. peak hour?

Existing Conditions

Exhibit 3-32 shows existing traffic volumes during the p.m. peak hour. These volumes represent the total traffic at that location (including traffic on both sides of the street).

No Build Alternative

In 2030, traffic volumes would increase throughout the interchange influence areas; however, travel patterns would remain consistent between existing and future traffic forecasts.

4-Lane Alternative

In 2030, traffic volumes would decrease in the following interchange areas:

- Montlake Boulevard and Lake Washington Boulevard
- 84th Avenue Northeast
- 92nd Avenue Northeast
- Bellevue Way Northeast
- 108th Avenue Northeast

There would be no change in the overall interchange area volumes along the I-5 corridor at Stewart Street, Mercer Street, Roanoke Street, and Northeast 45th Street. Traffic patterns would shift within the areas due to a shift from freeway-related trips to nonfreeway-related trips (which have different travel patterns).

6-Lane Alternative

The traffic forecasts would increase by 1 percent or more for the interchange influence areas in 2030, except at the following locations:

- Montlake Boulevard and Lake Washington Boulevard
- Bellevue Way Northeast
- 108th Avenue Northeast

What conclusions can be drawn?

The No Build Alternative is forecast to have more vehicles and persons on SR 520, I-5, and I-405 in the year 2030 than there are today. The vehicle demand on the local arterials in the study area increases from 3



percent up to 26 percent (compared to today) under the No Build Alternative.

The 4-Lane Alternative is forecast to have fewer vehicles on SR 520 in the year 2030 than the No Build Alternative. There is a higher person demand for the SR 520 corridor, primarily in buses and carpools. The vehicle demand on the local arterials decreases compared to the No Build Alternative (similar to the pattern on the freeway).

The 6-Lane Alternative is forecast to have slightly more vehicles on SR 520 and more persons than the No Build Alternative. Completion of the HOV lane system on SR 520 would result in the highest person demand, with a small increase in traffic demand. The vehicle demand on the local arterials ranges between decreasing 2 percent and increasing 2 percent compared to the No Build Alternative. The minimal growth is similar to the freeway forecasts.



Chapter 4: Freeway Traffic Operations

What is in this chapter?

This chapter describes how traffic on the SR 520 freeway mainline and ramps operates during the a.m. and p.m. peak periods for existing conditions and how it would operate in the future for each of the alternatives studied. As shown in Exhibit 1-5, the project study area limits are SR 520 between the I-5 and 124th Avenue Northeast interchanges. However, to account for interactions between SR 520 traffic and traffic on adjacent freeways, several other freeway sections were also included in the analyses. The resulting transportation study area, which is also shown in Exhibit 1-5, encompasses:

- SR 520 between the I-5 interchange and Avondale Road
- I-5 (mainline and express lanes) between Northeast 45th Street and Stewart Street
- I-405 between Northeast 70th Street and Northeast 8th Street/Northeast 4th Street

How were the alternatives analyzed?

The transportation discipline team used the CORSIM computer program, a micro-simulation package developed and supported by the Federal Highway Administration (FHWA), to simulate traffic operations on the SR 520 corridor. CORSIM provides detailed simulation output, including animation and performance data, for freeway, ramp, and HOV operations. This information was used to evaluate the operational differences among the various project alternatives.

Exhibit 4-1 shows an example of the CORSIM model animation screen.

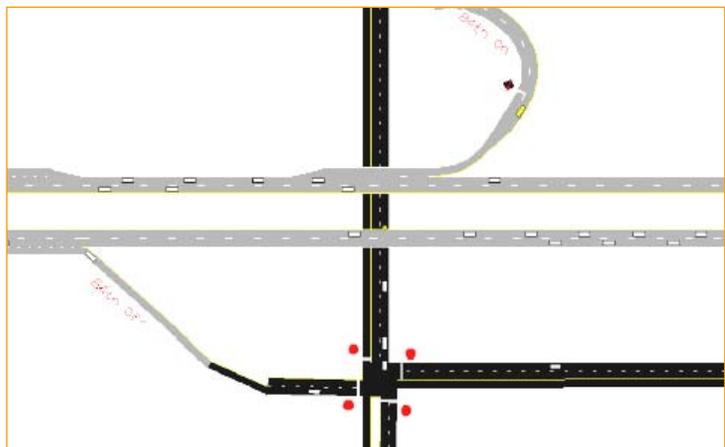


Exhibit 4-1. CORSIM Micro-Simulation Model Animation Screen



Exhibit 4-2 outlines the process used to analyze the alternatives. The first step in the process was to verify that the simulation model correctly represented existing freeway operations – a process known as calibration. The team calibrated the CORSIM model to ensure that the model’s output for the a.m. and p.m. peak periods closely matched existing traffic volumes for the freeway mainline and ramps. Model output within 10 percent of actual existing volumes was considered reasonable for purposes of the analysis; most locations were within 5 percent

of actual volumes. The team also verified information on queuing and traffic speeds from the model to verify that it reasonably matched field observations and operations data from WSDOT’s archives.

We used ramp lengths, acceleration and deceleration lengths, and car-following sensitivity as variables for the calibration. The team set the ramp, acceleration, and deceleration lengths to closely match existing conditions, with some modifications to achieve the proper vehicle responses at the merge points. The car-following sensitivity variable allows for different car spacing (the distance drivers typically allow between their vehicles and the vehicles in front of them). This factor was modified for locations where drivers typically behave with more caution and allow additional spacing, such as roadway sections with substandard shoulder widths or bridges. When the car-following sensitivity factor is adjusted to allow additional spacing, the result is congestion in the area approaching the roadway section where vehicles behave more cautiously. For example, the car-following sensitivity factor was adjusted for the current substandard shoulders of the Evergreen Point Bridge, which has been observed to cause congestion approaching the bridge.

After completing the calibration process, the project team coded the alternatives into the simulation model. The team adjusted the length of ramps and acceleration and deceleration lanes to reflect design changes

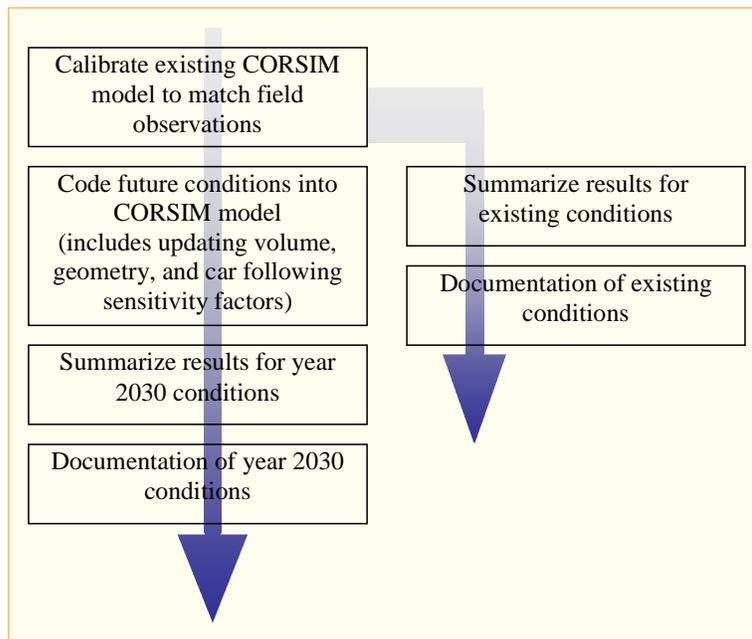


Exhibit 4-2. Alternatives Analysis Process



that would be made under future conditions. They also set back the car-following sensitivity factors to default values for existing substandard sections that would be upgraded to design standards.

The last step of the simulation process was to summarize the simulation output data and provide recommendations for design modifications. Each of the alternatives is summarized using six basic measures of effectiveness, which are described in the following section.

What are the measures of effectiveness?

The transportation discipline team, together with WSDOT, developed the following list of measures of effectiveness (MOEs) – vehicular queuing, travel time, speed, and demand, as well as throughput for both vehicles and person-trips. The MOEs were used to evaluate and compare traffic operations among the alternatives. Exhibit 4-3 shows

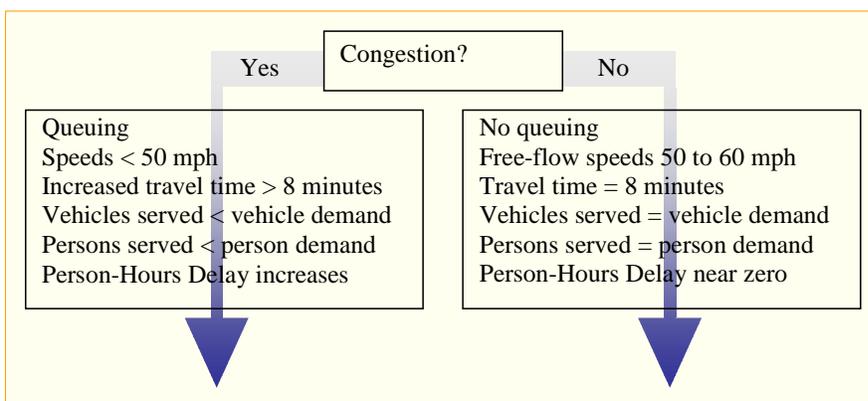


Exhibit 4-3. Understanding Congestion and Measures of Effectiveness

how the MOEs were used to define thresholds for identifying freeway congestion. Each MOE is described in greater detail below.

Vehicle Queues

Vehicles queues occur at locations where traffic demand exceeds the capacity of the roadway. Queuing is defined as taking place in a freeway section that operates at speeds of less than 30 miles per hour (mph). Queues may occur at on-ramps or off-ramps because of weaving activity or a change in the number of lanes, lane width, grade, or other physical characteristics. A queue is measured by its duration and its length (i.e., the distance upstream where traffic is affected). Queuing locations were identified for each alternative based on CORSIM model results.



Travel Time

The team calculated travel time for the various alternatives and freeway corridors to measure the delay that drivers would experience on the corridor. Travel time is directly related to corridor speed, which was calculated using the corridor speed data described in the next section.

Speed

Travel speeds are a function of congestion and driver comfort. Freeway traffic operating at speeds exceeding 50 mph is considered a free-flow condition. Traffic operating at speeds between 30 and 50 mph indicates moderate congestion, while speeds below 30 mph indicate a highly congested condition. Traffic operations along the freeways are summarized in 10-mph intervals between zero and 50+ mph.

The CORSIM model provided speed data in 15-minute intervals at each location along the SR 520 corridor. The data were then plotted on charts at various locations along the corridor to provide a three-dimensional perspective of corridor operations. The three dimensions included in the charts are time, space, and speed. The results of the CORSIM analysis are provided later in this report.

Vehicle-trips (Demand and Throughput)

Estimating future traffic volumes for a freeway facility already operating at or over capacity during the peak hour – or throughout the peak period – is a challenge. Because over-capacity conditions already exist along the SR 520, I-5, and I-405 corridors, the team selected a methodology for traffic volume forecasting and analysis that would account for these conditions throughout multiple hours.

Two types of traffic volumes are discussed throughout this section – demand and throughput. They can be defined as follows:

- *Demand* refers to the number of vehicles that want to use the freeway during a given time period.
- *Throughput* refers to the number of vehicles that are moving beyond a point of reference during a given time period. For uncongested locations, demand equals throughput. For congested locations, demand is always higher than the throughput because of over-capacity conditions. Demand that is not served because of over-capacity conditions queues up but is eventually served during later time periods.



Exhibit 4-4 shows a funnel analogy for the relationship between traffic demand and throughput.

Person-Trips (Demand and Throughput)

The purpose and need statement for the SR 520 Bridge Replacement and HOV Project states that the “proposed action is to improve mobility of people.”¹ The best way to measure the improvement of mobility is first to assess the person demand associated with any action on the corridor, and then to measure how many of those people are actually served in a specified time period.

The project team calculated person-trip demand based on the HOV (carpool and bus) and general purpose (GP) vehicle demand and throughput, and assumed vehicle occupancy consistent with the transportation-planning model. Exhibit 4-5 describes average vehicle occupancy and the assumptions used.

What time periods were evaluated and why?

Five-hour peak periods were analyzed for both the a.m. and p.m. peak periods. For a discussion of the peak periods and the benefit of using peak periods instead of a peak hour in the freeway forecast and operations analyses, refer to *Chapter 3: Freeway and Local Traffic Forecasts*.

What are the freeway traffic operations results?

This section discusses a.m. and p.m. peak period traffic operations for existing conditions and the 2030 No Build, 4-Lane, and 6-Lane Alternatives. MOEs included queues, travel time, speed, and person and vehicle throughput.

Traffic operations are discussed in detail for each direction, since traffic growth and operational issues differ between westbound and eastbound SR 520 during the a.m. and p.m. peak periods. The detailed discussion identifies:

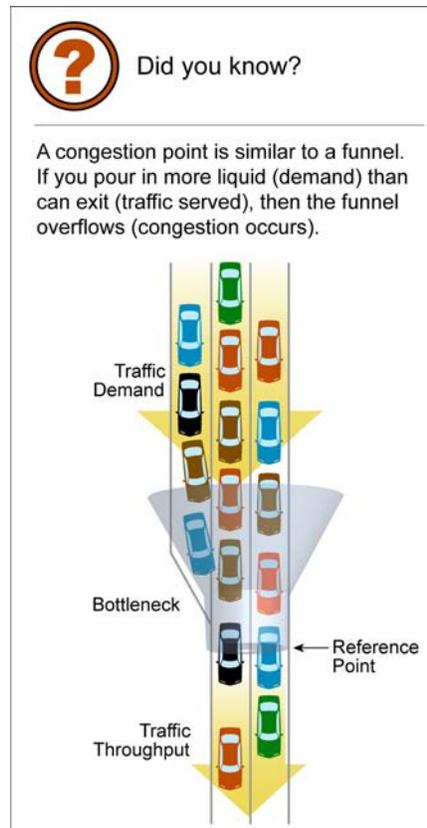


Exhibit 4-4. Funnel Analogy

Did you know?

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

The following AVO assumptions were made for the operations analyses:

- 1.33 persons per GP vehicle
- 3.15 persons per HOV vehicle
- 65 persons per bus

Exhibit 4-5. Average Vehicle Occupancy Definition and Assumptions

¹ Purpose of and Need for the Action, Trans-Lake Washington Project, June 14, 2000.



- Traffic demand
- Congestion points and queuing within the study area
- Speeds and travel time for the GP and HOV lanes
- Vehicle and person throughput
- Arterials potentially affected by spillback from freeway congestion

Existing conditions are described first to provide a basis for understanding future operations. The No Build Alternative is the baseline 2030 scenario and describes the changes that are expected to occur without the project between now and the year 2030. The 4-Lane and 6-Lane Alternatives are the 2030 build scenarios and are compared to the No Build Alternative to answer the question: “How would traffic operations change if we improve the corridor by the year 2030?”

The following sections summarize the vehicle- and person-trip demand and throughput, and mode choice for the a.m. and p.m. peak periods under existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. Following this discussion, exhibits show the traffic forecasts and operations for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives.

How do traffic operations compare for the alternatives?

Exhibits 4-6 and 4-7 summarize the results for each alternative in terms of travel time and vehicle and person throughput. The following sections discuss these results in detail.



Exhibit 4-6. A.M. Peak Period Traffic Operations on SR 520

Measure of Effectiveness	Year 2030								
	Existing Conditions		No Build Alternative		4-Lane Alternative		6-Lane Alternative		
	WB	EB	WB	EB	WB	EB	WB	EB	
Average Travel Time (in minutes between I-5 and 124th Avenue Northeast)									
GP	11	14	49	19	57	8	55	8	
Carpool and Bus	9	14	39	19	46	8	14	8	
Vehicle Throughput (per hour across Lake Washington)	3,710	3,550	2,890	3,560	2,700	2,840	3,080	3,380	
Person Throughput (per hour across Lake Washington)	6,810	5,430	6,320	6,100	7,020	5,790	8,720	6,900	

EB = eastbound travel

GP = general purpose traffic

WB = westbound travel

Exhibit 4-7. P.M. Peak Period Traffic Operations on SR 520

Measure of Effectiveness	Year 2030								
	Existing Conditions		No Build Alternative		4-Lane Alternative		6-Lane Alternative		
	WB	EB	WB	EB	WB	EB	WB	EB	
Average Travel Time (in minutes between I-5 and 124th Avenue Northeast)									
GP	18	9	30	9	10	8	12	9	
Carpool and Bus	13	9	24	9	9	8	11	8	
Vehicle Throughput (per hour across Lake Washington)	3,930	3,530	3,930	3,400	4,120	2,790	4,600	3,500	
Person Throughput (per hour across Lake Washington)	6,250	6,380	6,640	7,190	7,570	6,810	8,590	8,760	

EB = eastbound travel

GP = general purpose traffic

WB = westbound travel

The information presented in Exhibits 4-6 and 4-7 is also shown graphically in Exhibits 4-25 and 4-26 later in this chapter.

Exhibit 4-8 provides information on what traffic operations conditions would be like under free-flow conditions for the 2030 alternatives.





Did you know?

Congestion on SR-520, I-5, and I-405 negatively affects traffic operations within the study area. Here is how SR 520 would operate under free-flow conditions:

- The travel time would be 8 minutes for all alternatives between I-5 and 124th Avenue Northeast.
- The No Build Alternative would serve 8,000 vehicles and 15,200 persons per hour across Lake Washington.
- The 4-Lane Alternative would serve 8,800 vehicles and 21,120 persons per hour across Lake Washington.
- The 6-Lane Alternative would serve 11,800 vehicles and 27,140 persons per hour across Lake Washington.

Exhibit 4-8. SR 520 Free-Flow Traffic Operations

What improvements are included in this alternative?

No Build Alternative

The No Build Alternative includes development of the Nickel Projects (Exhibit 4-9) on freeways adjacent to SR 520 and an eastbound auxiliary lane on SR 520 between the Northeast 51st Street on-ramp and the West Lake Sammamish off-ramp. It evaluates the growth in travel demand expected for the year 2030 with no additional improvements to SR 520. A full description of the No Build Alternative can be found in the Final Year 2030 No-Action Definition Memorandum (SR 520 Project Team 2003b).

4-Lane and 6-Lane Alternatives

The 4-Lane and 6-Lane Alternatives include all of the improvements assumed for the No Build Alternative, as well as the improvements proposed for each of the alternatives. See *What are the project alternatives?* in Chapter 1.

Westbound SR 520, A.M. Peak Period

The following section discusses westbound SR 520 operations during the a.m. peak period. The exhibits showing traffic operations for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives (including a.m. and p.m. peak volume and mode choice, as well as exhibits showing westbound and



Did you know?

The **Nickel Projects** are Washington State Department of Transportation projects adopted in 2003. The name Nickel Projects comes from the funding source, which is the five-cent gas tax increase.

Projects on adjacent freeways include:

- *I-405 - Congestion Relief & Bus Rapid Transit (BRT) Projects.* The Bellevue project constructs one lane each direction between SE 8th and I-90 and replaces the Wilburton Tunnel. The Kirkland project constructs one lane northbound from Northeast 70th to Northeast 124th and southbound from SR 522 to SR 520.
- *SR 520 - W Lake Sammamish Parkway to SR 202 - Add Lanes.* Constructs one HOV lane and one auxiliary lane in each direction between West Lake Sammamish Parkway and SR 202, and completes the interchanges at SR 202 and West Lake Sammamish Parkway. Improves safety and relieves congestion on SR 520, SR 202, and Avondale Road. There are currently four lanes. There will be eight lanes (which includes an HOV lane in each direction) when this project is completed.

Exhibit 4-9. Nickel Projects



eastbound, a.m. and p.m. peak period person and vehicle demand) are grouped together for convenience at the end of this section. An instructional exhibit explaining how to read these traffic operations exhibits is also provided.

The reported average values represent the average hourly value that occurs throughout the peak period.

How does traffic demand change for westbound SR 520?

The following discussion can be found in more detail in *Chapter 3: Freeway and Local Traffic Forecasts*. This summary is provided as an aid to understanding the traffic operations results.

Existing Conditions

Today, the average demand on westbound SR 520 between I-405 and I-5 does not vary greatly during the a.m. peak period. The average demand west of I-405, across Lake Washington, and approaching I-5 is between 3,500 and 3,900 vph.

No Build Alternative

Compared to today, westbound traffic demand in 2030 would increase by 24 percent west of the I-405 interchange, by 4 percent across Lake Washington, and by 2 percent just east of I-5. Traffic would be heavier on the east side of Lake Washington.

4-Lane Alternative

In 2030, westbound traffic demand as compared to the No Build Alternative would increase by 1 percent west of the I-405 interchange, decrease by 10 percent across Lake Washington, and increase by 3 percent just east of I-5.

6-Lane Alternative

In 2030, westbound traffic demand as compared to the No Build Alternative would increase by 12 percent west of the I-405 interchange, by 13 percent across Lake Washington, and by 26 percent just east of I-5.

What congestion points are there on westbound SR 520 between I-5 and 124th Avenue Northeast? What is the resulting queue?

Exhibit 4-10 lists the westbound a.m. peak hour congestion points in the transportation study area (including I-5, I-405, and SR 520). Exhibit 4-10 includes the following symbols:



- If a location operates at speeds greater than 50 mph, there is no congestion and the location is marked with a green circle.
- If a location operates at speeds between 30 and 50 mph, it operates under mild congestion and is marked with a yellow diamond.
- If a location operates at speeds less than 30 mph, it operates under heavy congestion with potential queuing. If the speeds are below 30 mph but the congestion does not cause speeds to drop below 30 mph on SR 520 between I-5 and 124th Avenue Northeast, that location is marked with a red square. For example, congestion occurs on the I-5 southbound mainline through downtown Seattle today, but this congestion affects the operations on SR 520 only for the year 2030 alternatives. Therefore, the box is marked with a red square for existing conditions and an X (see next bullet) for the year 2030 alternatives.
- If a location operates at speeds less than 30 mph AND causes speeds to drop below 30 mph on SR 520 between I-5 and 124th Avenue Northeast, that location is marked with an X.

Traffic operations at each congestion point location shown in Exhibit 4-10 are discussed by alternative below.

Exhibit 4-10. Westbound SR 520 A.M. Peak Hour Congestion Points

Location	Existing Conditions	Year 2030		
		No Build Alternative	4-Lane Alternative	6-Lane Alternative
Weave section between 124th Avenue Northeast and I-405 interchange	◆	X	X	X
I-405 southbound at the ramp from westbound SR 520	■	X	X	X
I-405 northbound at the ramp to eastbound SR 520	◆	■	■	■
Evergreen Point Bridge approach and termination point for the HOV Lane	X	●	●	●
I-5 southbound mainline through Downtown Seattle	■	X	X	X
I-5 southbound express lanes through downtown Seattle	■	■	■	X

- = No queuing at this location (speeds > 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 < 30 mph) but no effect on SR 520
- X = Queuing at this location (speeds < 30 mph) AND speeds on SR 520 < 30 mph



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

Existing Conditions

SR 520 between 124th Avenue Northeast and I-405 operates under moderate congestion today because of weaving between vehicles entering SR 520 via 124th Avenue Northeast and vehicles destined for I-405. Speeds 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.

No Build Alternative

Traffic demand forecasts indicate that there would be a 21 percent increase in traffic at this location in 2030, which would increase congestion as compared to today. Traffic would queue (operate at speeds less than 30 mph) at this location for more than 3.5 hours. The congestion at this location would overlap with the downstream queues (in other words, queues that begin farther to the west would extend back to this location).

4-Lane Alternative

Similar to the No Build Alternative, SR 520 (between 124th Avenue Northeast and I-405) would operate under congested conditions for more than 3.5 hours in 2030.

6-Lane Alternative

The 6-Lane Alternative would operate with congestion similar to the No Build and 4-Lane Alternatives in 2030, with queues that last for more than 4 hours.

I-405 Southbound at the Ramp from Westbound SR 520

Existing Conditions

Under existing conditions, I-405 is congested at the point where the ramps from SR 520 merge onto I-405. However, this congestion does not affect the operations of SR 520.

No Build Alternative

Forecasts indicate a 45 percent growth in traffic volume by 2030 compared to today on I-405 at the SR 520 interchange. As a result, operations would continue to degrade, resulting in a queue that would extend from the SR 520 ramps to north of Northeast 70th Street and would last for most of the peak period.



Congestion on I-405 southbound 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 able to access SR 520. In essence, I-405 meters the amount of traffic that reaches SR 520.

4-Lane Alternative

Forecasts indicate similar growth and operations at this location in 2030 as under the No Build Alternative, resulting in a queue on I-405 that would back up through the ramp from westbound SR 520 onto the SR 520 mainline and 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 volume of traffic able to access SR 520.

6-Lane Alternative

As with the No Build and 4-Lane Alternatives, congestion on I-405 in 2030 would cause congestion on westbound SR 520 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 volume of traffic able to access SR 520.

I-405 Northbound at the Ramps to Eastbound SR 520

Existing Conditions

The I-405 northbound to SR 520 eastbound ramp is near capacity today (the amount of vehicles accessing this ramp is the maximum that the ramp can carry). However, all traffic is served and this ramp operates with minor congestion but there is less congestion on I-405 approaching the ramp system.

No Build, 4-Lane, and 6-Lane Alternatives

Forecasts indicate a 25 to 36 percent growth in traffic volume in 2030 on the I-405 northbound to SR 520 eastbound ramp compared to today. As a result, operations on the ramp and on I-405 approaching the ramp would continue to degrade. This would result in a queue that would extend from the SR 520 ramps to south of Northeast 4th Street and would last for most of the peak period. The effect on westbound SR 520 is that the demand from I-405 to westbound SR 520 (or vehicles on I-405 wishing to access SR 520) would not be served because those vehicles would be stuck in congestion.



Evergreen Point Bridge Approach and Termination Point for the HOV Lane

Existing Conditions

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 the 104th Avenue Northeast/Bellevue Way interchange.

No Build Alternative

Congestion that occurs today approaching the HOV lane termination point and the east bridge approach is not expected to occur at this location in 2030 because of capacity constraints near the I-405 interchange. Congestion at the I-405 interchange would decrease traffic flow by approximately 10 percent, reducing the amount of traffic that reaches the existing congestion point at the Evergreen Point Bridge. However, congestion occurring downstream from I-5 is predicted to spill back across the Evergreen Point Bridge through this location, which therefore would still experience congestion.

4-Lane Alternative

Similar to the No Build Alternative, congestion would not occur at this location in 2030 because congestion approaching the I-405 interchange would limit the traffic flow. In addition, this alternative includes widened lanes and shoulders on the Evergreen Point Bridge, which would improve traffic flow approaching the Evergreen Point Bridge.

6-Lane Alternative

The 6-Lane Alternative also would not experience congestion at the bridge approach in 2030. As with the 4-Lane Alternative, congestion approaching I-405 would reduce traffic flow at this location and wider lanes and shoulders would eliminate the visual distraction. In addition, the HOV lane would no longer terminate at this location, resulting in increased traffic capacity.

I-5 Southbound Mainline Through Downtown Seattle

Existing Conditions

Congestion occurs today on I-5 southbound near Mercer Street and extends from the SR 520 interchange to the Ship Canal Bridge. However, this congestion does not cause queuing on SR 520.

No Build Alternative

Forecasts indicate a 37 percent increase in traffic on I-5 north of I-90 in 2030; therefore, I-5 operations through downtown Seattle would continue to degrade, resulting in a queue on southbound I-5 that would extend from I-90 to north of Northeast 45th Street for most of the 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 vehicles per hour, which 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 and, at its peak, would extend beyond the SR 520/I-405 interchange and onto the I-405 mainline.

4-Lane Alternative

Forecasts indicate a 6 percent increase in traffic in 2030 from the I-90 collector-distributor on-ramp as compared to the No Build Alternative, resulting in slightly more congestion on I-5 than the No Build Alternative. This congestion would extend north to the ramp from SR 520 and affect SR 520 operations, similar to the No Build Alternative operations, but with longer duration.

When congestion on I-5 backs up into the I-5/SR 520 interchange, the SR 520 ramp to southbound I-5 would be limited to serving 1,500 vehicles per hour, which is a 50 percent reduction in the capacity of this location. The resulting spillback from I-5 onto SR 520 would last for 3.5 hours or more and, at its peak, would extend beyond the I-405 interchange, causing vehicles to back up through the ramp from I-405 onto the I-405 mainline. This, in turn, would result in an increase in travel time for the 4-Lane Alternative as compared to the No Build Alternative.

6-Lane Alternative

Congestion on I-5 would have a similar effect on SR 520 in 2030, as is discussed for the No Build Alternative. The queue on SR 520 would last for 3.5 hours or more and, at its peak, would extend beyond the I-405 interchange. This queue also would cause vehicles to back up through the ramp from I-405 and onto the I-405 mainline.

I-5 Southbound Express Lanes Through Downtown Seattle

Existing Conditions and No Build Alternative

Congestion occurs on the southbound I-5 express lanes; however, this would not affect SR 520 because there is no direct connection between SR 520 and the I-5 express lanes planned for the No Build Alternative.

4-Lane and 6-Lane Alternatives

Congestion on the southbound I-5 express lanes in 2030 would cause vehicles to back up through the SR 520 HOV ramp connection onto the



HOV lane on SR 520. This spillback would compound with the congestion on SR 520 described above for the I-5 mainline.

What are the speeds and travel times for the GP lanes?

The following section summarizes the average travel time through the a.m. peak period and the 7:00 a.m. and 8:30 a.m. travel times for GP traffic for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. The westbound travel times for 7:00 a.m. and 8:30 a.m. are shown in Exhibit 4-11.

Existing Conditions

The GP lanes currently experience relatively low levels of congestion. At 7:00 a.m., it takes 12 minutes to travel westbound between 124th Avenue Northeast and I-5. The same travel route takes 9 minutes at 8:30 a.m. The average travel time through the peak period is 11 minutes, averaging 40 mph.

No Build Alternative

In 2030, the corridor would operate under congested conditions. At 7:00 a.m., it would take 27 minutes to travel westbound between 124th Avenue Northeast and I-5. The same travel route would take 1 hour and 26 minutes at 8:30 a.m.

The average travel time through the peak period would be 49 minutes, averaging 9 mph. This is an increase in travel time of 38 minutes compared to existing conditions.

4-Lane Alternative

For the 4-Lane Alternative, the corridor would operate under slightly more congestion than under the No Build Alternative in 2030 due to the increased congestion on I-5 extending back onto SR 520. At 7:00 a.m., it would take 37 minutes to travel westbound between 124th Avenue Northeast and I-5. The same travel route would take 1 hour and 35 minutes at 8:30 a.m.

The average travel time through the peak period would be 57 minutes, averaging 8 mph. This is an increase in travel time of 8 minutes compared to the No Build Alternative.

6-Lane Alternative

The 6-Lane Alternative would operate with more congestion than the No Build Alternative in 2030 due to an increase in traffic demand. At 7:00 a.m., it would take 34 minutes to travel westbound

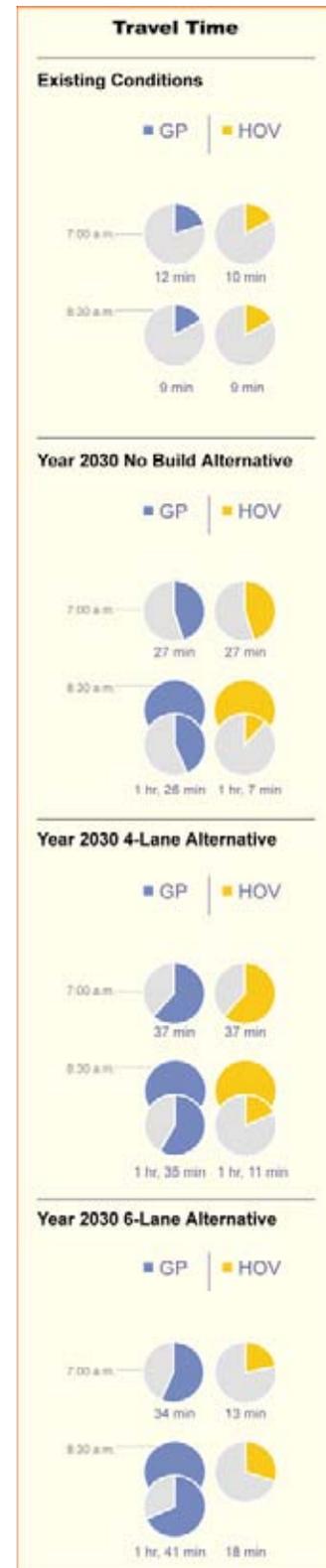


Exhibit 4-11. Westbound A.M. Travel Time on SR 520 between 124th Avenue Northeast and I-5



between 124th Avenue Northeast and I-5. The same travel route would take 1 hour and 41 minutes at 8:30 a.m.

The average travel time through the peak period would be 55 minutes, averaging 8 mph. This is an increase in travel time of 6 minutes compared to the No Build Alternative.

What are the speeds and travel times for the HOV lane?

Exhibit 4-11 summarizes the HOV lane travel times for 7:00 a.m. and 8:30 a.m. for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. The following section provides a summary discussion of the average travel time through the peak period.

Existing Conditions

The HOV lane currently operates at near free-flow conditions, with some congestion occurring at the termination point where it merges into the GP lanes. The average travel time through the peak period is 9 minutes, averaging 49 mph.

No Build Alternative

The HOV lane operates similarly to the GP lanes through the I-405 interchange because the lane is located on the outside where traffic weaves between on- and off-ramps. To the west of the 104th Avenue Northeast interchange, the HOV lane operates as a queue bypass for the congestion that occurs in the GP lanes approaching the Evergreen Point Bridge.

The average travel time through the peak period under the No Build Alternative in 2030 would be 39 minutes, averaging 11 mph. This would be an increase in travel time of 30 minutes as compared to existing conditions; however, it would be a 10-minute decrease in travel time compared to the No Build Alternative GP lanes.

4-Lane Alternative

The HOV lane for the 4-Lane Alternative would operate with some congestion through the I-405 interchange in 2030, similar to the HOV lane for the No Build Alternative. Since the HOV lane in this alternative would still terminate east of Lake Washington, the carpool and bus traffic would travel in the GP lanes for the remainder of the corridor as they do today. The GP lanes between the lake and I-5 would remain congested through most of the morning.



The average travel time through the peak period would be 46 minutes, averaging 9 mph. This would be an increase in travel time of 7 minutes compared to the No Build Alternative; however, it would be an 11-minute time savings compared to the 4-Lane Alternative GP lanes.

6-Lane Alternative

In 2030, the HOV lane would operate at near free-flow conditions until the SR 520/I-5 interchange. At this interchange, congestion would occur as buses and carpools destined to northbound I-5 exit the HOV lane and merge into the congested GP lanes.

The average travel time would be 14 minutes between 124th Avenue Northeast and I-5 (a savings of 25 minutes compared to the No Build Alternative HOV lane). The HOV lane would provide a travel-time savings of 41 minutes over the 6-Lane Alternative GP lanes. The average speed in the HOV lane would be 32 mph.

How many people and vehicles are served on the corridor?

Exhibit 4-12 summarizes the westbound a.m. peak period vehicle and person demand and throughput for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. This summary differs from Chapter 3, which summarizes the traffic demand. The following discussion summarizes vehicle and person throughput. Throughput is the vehicle and person traffic that is actually served on the corridor and is not in the queue at the end of the time period. The information provided in the following bulleted lists is also shown graphically in Exhibit 4-25 later in this chapter.

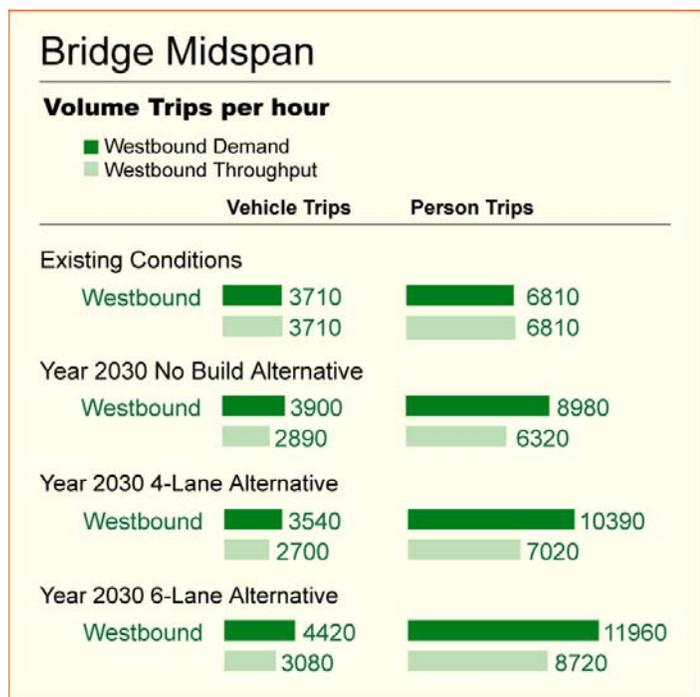


Exhibit 4-12. Westbound A.M. Peak Period Vehicle and Person Demand and Throughput per Hour

Existing Conditions

An average of 6,810 people are served in 3,710 vehicles per hour during the peak period.

- GP traffic carries 64 percent of the people in 88 percent of the vehicles.



- Bus traffic carries 17 percent of the people in 1 percent of the vehicles.
- Carpools carry 19 percent of the people in 11 percent of the vehicles.

No Build Alternative

An average of 6,320 people would be served in 2,890 vehicles per hour during the peak period in 2030. This represents only about 74 percent of the vehicle-trip demand; 26 percent of vehicles would not be served due to congestion.

- GP traffic would carry 55 percent of the people in 91 percent of the vehicles.
- Bus traffic would carry 33 percent of the people in 1 percent of the vehicles.
- Carpools would carry 12 percent of the people in 8 percent of the vehicles.

4-Lane Alternative

In 2030, an average of 7,020 people would be served in 2,700 vehicles per hour across Lake Washington, meeting 76 percent of the vehicle-trip demand. Twenty-four percent of vehicle demand would not be served due to congestion.

- GP traffic would carry 37 percent of the people in 72 percent of the vehicles.
- Bus traffic would carry 31 percent of the people in 1 percent of the vehicles.
- Carpools would carry 32 percent of the people in 27 percent of the vehicles.

6-Lane Alternative

An average of 8,720 people would be served in 3,080 vehicles per hour across Lake Washington in 2030. Sixty-two percent of the GP vehicle demand would be served and 38 percent would not be served, while 93 percent of the carpool demand would be served with 7 percent not served due to congestion.

- GP traffic would carry 30 percent of the people in 65 percent of the vehicles.



- Bus traffic would carry 32 percent of the people in 1 percent of the vehicles.
- Carpools would carry 38 percent of the people in 34 percent of the vehicles.

Do freeway operations affect the local arterials?

Freeway operations can affect the local arterials in two ways: (1) by freeway congestion backing up onto the on-ramp, or (2) by traffic demand at the ramp meter increasing beyond the level that the meter can serve and causing vehicles to queue onto local arterials.

Existing Conditions

Freeway congestion currently does not queue onto the on-ramps, and traffic demand is served at the ramp meters. Therefore, local arterials are not affected by freeway operations.

No Build Alternative

Freeway congestion would queue through the westbound on-ramps in 2030, affecting Montlake Boulevard for 2.5 hours and the local arterial network at 84th Avenue Northeast, southbound 104th Avenue Northeast, 108th Avenue Northeast, and 124th Avenue Northeast for less than 1 hour.

4-Lane Alternative

Freeway congestion would queue through the westbound on-ramps in 2030 and would affect Montlake Boulevard for less than 2 hours and 84th Avenue Northeast for 2.5 hours or more. Even though congestion on SR 520 for the 4-Lane Alternative would be similar to conditions under the No Build Alternative, there would be less congestion at the on-ramps between Lake Washington and I-405 because vehicle demand on these ramps would be lower.

6-Lane Alternative

Similar to the No Build Alternative, freeway congestion under the 6-Lane Alternative would queue through the westbound on-ramps in 2030, affecting Montlake Boulevard for 3 hours and 84th Avenue Northeast for 2 hours or more. Freeway congestion would also queue through the on-ramps from southbound 104th Avenue Northeast, 108th Avenue Northeast, and 124th Avenue Northeast for up to 1 hour.



Westbound SR 520, P.M. Peak Period

The following section discusses westbound SR 520 operations during the p.m. peak period. The exhibits showing traffic operations for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives are grouped together for convenience at the end of this section. An instructional exhibit explaining how to read these traffic operations exhibits is also provided.

The reported average values represent the average hourly value that occurs throughout the peak period.

How does traffic demand change for westbound SR 520?

The following discussion can be found in more detail in *Chapter 3: Freeway and Local Traffic Forecasts*. A summary is provided below as an aid to understanding the operations results.

Existing Conditions

Today, vehicle demand is 3,830 vph at I-405, 4,020 vph across Lake Washington, and 3,460 vph east of I-5. Traffic is heavier on the Eastside and crossing Lake Washington, and declines approaching I-5.

No Build Alternative

In 2030, traffic demand westbound would increase by 8 percent west of the I-405 interchange, 20 percent across Lake Washington, and 9 percent just east of I-5 as compared to existing conditions.

4-Lane Alternative

Traffic demand westbound would decrease by 2 percent west of the I-405 interchange and 11 percent across Lake Washington, and increase by 1 percent just east of I-5 as compared to the No Build Alternative in 2030.

6-Lane Alternative

In 2030, traffic demand westbound would increase by 6 percent west of the I-405 interchange, 4 percent across Lake Washington, and 11 percent just east of I-5 as compared to the No Build Alternative.

Where are the congestion points on westbound SR 520 between 124th Avenue Northeast and I-5? What is the resulting queue?

Exhibit 4-13 lists the westbound p.m. peak hour congestion points in the transportation study area (including I-5, I-405, and SR 520). The



bullet list preceding Exhibit 4-10 explains how the symbols were marked for each location.

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

Existing Conditions

Queuing does not occur at this location across all lanes. Congestion may occur in the outside lane, where there is weaving traffic between the on- and off-ramps.

Exhibit 4-13. Westbound SR 520 P.M. Peak Hour Congestion Points

Location	Existing Conditions	Year 2030		
		No Build Alternative	4-Lane Alternative	6-Lane Alternative
Weave section between 124th Avenue Northeast and I-405 interchange	◆	◆	X	X
I-405 southbound at the ramp from westbound SR 520	●	■	■	■
I-405 northbound at the ramp to eastbound SR 520	■	■	■	■
Evergreen Point Bridge approach and termination point for the HOV Lane	X	X	◆	●
Weave section between the Montlake Boulevard on-ramp and the I-5 interchange	X	X	X	X
I-5 southbound mainline through Downtown Seattle	■	X	X	X

● = No queuing at this location (speeds > 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 < 30 mph) but no effect on SR 520

X = Queuing at this location (speeds < 30 mph) AND speeds on SR 520 < 30 mph

No Build Alternative

Under future conditions in 2030, a queue would occur at the Evergreen Point Bridge and HOV termination point and would extend back through the weave section, so the operations of this location independently are not critical.

4-Lane Alternative

A queue would occur at this location in 2030 because of the weave condition caused by vehicles entering SR 520 via 124th Avenue Northeast and vehicles destined for I-405. More vehicles would travel through this weave with the 4-Lane Alternative than with the No Build Alternative. This queue would last for 4.5 hours or more and would overlap with the downstream queue, causing it to extend east of the



124th Avenue Northeast interchange. Vehicles would travel at speeds below 10 mph for 1 hour or more.

6-Lane Alternative

Congestion under the 6-Lane Alternative in 2030 would be similar to that described for the 4-Lane Alternative in terms of duration and length.

I-405 Southbound at the Ramp from Westbound SR 520

Existing Conditions

No congestion occurs on I-405 southbound at the SR 520 interchange in the evening peak period.

No Build, 4-Lane, and 6-Lane Alternatives

Forecasts indicate a 37 percent growth in traffic volume by 2030 compared to today on I-405 at the SR 520 interchange. As a result, operations would degrade, resulting in a queue that would extend from the SR 520 ramps to north of Northeast 70th Street and 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 the Ramps to Eastbound SR 520

Existing Conditions

The I-405 northbound to SR 520 eastbound ramp is over capacity today (meaning the vehicles accessing this ramp exceed the volume that the ramp can carry). This results in congestion on northbound I-405 from the ramps to SR 520 south to Northeast 4th Street. The congestion on I-405 likely reduces traffic able to access SR 520.

No Build, 4-Lane, and 6-Lane Alternatives

Forecasts indicate a 19 to 23 percent growth in traffic volume on the I-405 northbound to SR 520 eastbound ramp in 2030 compared to today. As a result, operations on the ramp and on I-405 approaching the ramp would continue to degrade. This would result in a queue that would extend from the SR 520 ramps to south of Northeast 4th Street and would last most of the peak period. The effect on westbound SR 520 is that the demand from I-405 to westbound SR 520 (or vehicles on I-405 wishing to access SR 520) would not be served because those vehicles are in queue.



Evergreen Point Bridge Approach and Termination Point for the HOV Lane

Existing Conditions

Carpools and buses must merge into the GP lanes, causing a queue that lasts for approximately 3.5 hours and extends back to the I-405 interchange at the peak of congestion.

No Build Alternative

In the No Build scenario, drivers in 2030 would experience a queue similar to existing conditions, extending back to the I-405 interchange at the peak of congestion. However, this queue would last for 4.5 hours or more. Vehicle speeds would drop below 10 mph for 2 hours between the 84th Avenue Northeast and 92nd Avenue Northeast interchanges.

4-Lane Alternative

Minor congestion would occur at this location at the termination point of the HOV lane in 2030; however, due to the widened lanes and shoulders on the Evergreen Point Bridge, operations would be substantially improved compared to the No Build Alternative.

6-Lane Alternative

With the completion of the HOV lane across the bridge, traffic operations at the eastern bridge approach would improve substantially because buses and carpools would not have to merge into the GP lanes. Additionally, improving the roadway to design standards (widened lanes and shoulders) would allow all vehicles to maintain higher speeds and therefore improve traffic operations.

Weave Section Between the Montlake Boulevard On-Ramp and I-5 Interchange

Existing Conditions

Congestion currently occurs near Montlake Boulevard and I-5 due to the short acceleration lane and merging activity at the Montlake Boulevard on-ramp and the reduction in posted speed on the ramp to northbound I-5. In addition, traffic on SR 520 is changing lanes to access the north or southbound I-5 ramps.

No Build Alternative

The congestion that occurs today due to the Montlake Boulevard on-ramp merge would not occur. This is because congestion east of Lake Washington would reduce the volume of traffic that can reach the Montlake Boulevard interchange, thereby reducing the congestion at this location.



The No Build Alternative would continue to experience some congestion approaching I-5 due the reduction in posted speed on the ramps.

4-Lane Alternative

Similar to the No Build Alternative operations, congestion would occur on SR 520 approaching the I-5 interchange in 2030 because the traffic speeds decrease on the interchange ramps.

6-Lane Alternative

This location would operate with more congestion with the 6-Lane Alternative than the No Build Alternative due to an increase in traffic throughput from the Eastside.

The congestion that would occur between the Montlake Boulevard and I-5 interchanges would merge with congestion that would extend back from mainline I-5 through downtown Seattle.

I-5 Southbound Mainline Through Downtown Seattle

Existing Conditions

Congestion occurs under existing conditions on I-5 through downtown Seattle with speeds less than 30 mph for 2.5 hours or more, but does not extend onto SR 520.

No Build Alternative

Forecasts indicate a 22 percent growth in traffic north of I-90 in 2030; therefore, traffic operations on I-5 southbound would continue to degrade. This would result in a queue that would extend from I-90 to north of Northeast 45th Street and would last for most of the peak period under the No Build Alternative.

Congestion on southbound I-5 would cause 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.

4-Lane Alternative

In 2030, congestion on I-5 southbound would cause slight queuing on the ramp from SR 520 onto the westbound SR 520 mainline. This spillback would cause a queue that would last approximately 1 hour on the SR 520 mainline. Vehicle speeds would drop to between 10 and 20 mph.

6-Lane Alternative

Congestion on I-5 southbound would cause queuing on the ramp from SR 520 and onto the westbound SR 520 mainline in 2030. This queue



would last approximately 1.5 hours and would extend east to the Lake Washington Boulevard interchange at the peak of congestion. Vehicle speeds would drop below 10 mph. The congestion would increase with the 6-Lane Alternative as compared to the No Build Alternative because of increased demand at this location.

What are the speeds and travel times for the GP lanes?

The following summarizes the average travel time through the peak period and the 4:30 p.m. and 6 p.m. travel times for GP traffic for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. The westbound travel times for 4:30 p.m. and 6 p.m. are indicated in Exhibit 4-14.

Existing Conditions

At 4:30 p.m., it takes 20 minutes to travel westbound between 124th Avenue Northeast and I-5. The same travel route takes 17 minutes at 6:00 p.m. The average travel time through the peak period is 18 minutes, averaging 24 mph.

No Build Alternative

The corridor would operate under congested conditions in 2030. At 4:30 p.m., it would take 38 minutes to travel westbound between 124th Avenue Northeast and I-5. The same travel route would take 32 minutes at 6:00 p.m.

The average travel time through the peak period would be 30 minutes, averaging 15 mph. This would be an increase in travel time of 12 minutes compared to existing conditions.

4-Lane Alternative

The corridor would operate under minor levels of congestion in 2030. The travel time through most of the peak period would be 10 minutes, as compared to existing conditions. This is a reduction in travel time of 20 minutes compared to the No Build Alternative. The average speed during the p.m. peak period would be 44 mph, which is a substantial improvement compared to the No Build Alternative, which would operate at 15 mph.

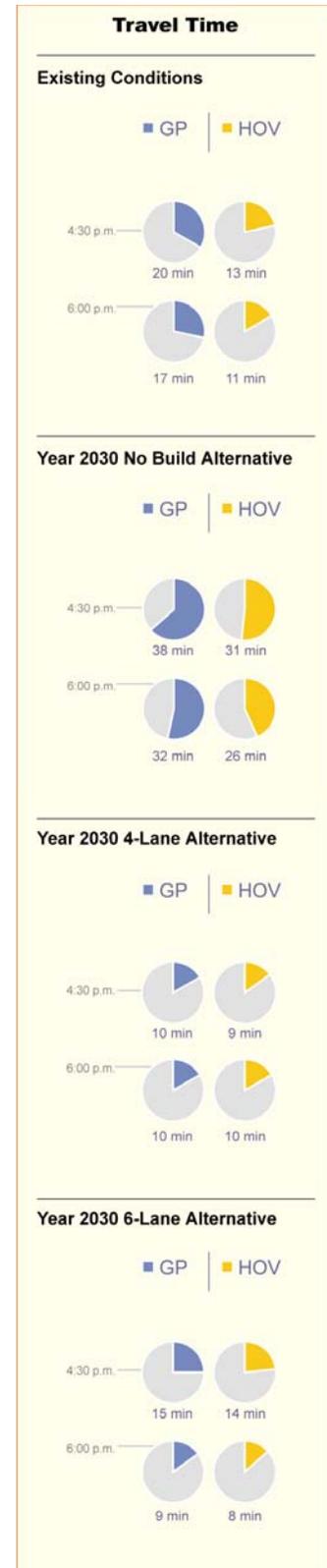


Exhibit 4-14. Westbound P.M. Travel Time on SR 520 between 124th Avenue Northeast and I-5



6-Lane Alternative

The corridor would operate under minor levels of congestion in 2030. At 4:30 p.m., it would take 15 minutes to travel westbound between 124th Avenue Northeast and I-5. The same travel route would take 9 minutes at 6:00 p.m.

The average travel time through the peak period would be 12 minutes, with an average speed of 38 mph. This is a substantial improvement compared to the No Build Alternative, which would operate at an average speed of 15 mph.

What are the speeds and travel times for the HOV lane?

Exhibit 4-14 summarizes the HOV lane westbound travel times for 4:30 p.m. and 6:00 p.m. for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. The following sections provide a summary discussion of the average travel time through the peak period.

Existing Conditions

The average travel time along the SR 520 corridor between 124th Avenue Northeast and I-5 through the peak period is 13 minutes, averaging 34 mph.

No Build Alternative

The average travel time through the peak period would be 24 minutes in 2030, averaging 18 mph. This would be an increase in travel time of 11 minutes compared to the HOV lane existing conditions.

4-Lane Alternative

With the 4-Lane Alternative, the HOV lane would operate under near free-flow conditions in 2030. The average travel time through the peak period would be 9 minutes, averaging 47 mph. This would be a travel-time savings of 15 minutes compared to the No Build Alternative.

6-Lane Alternative

In 2030, the HOV lane would operate under free-flow speeds except near the I-5/SR 520 interchange. Here, the HOV lane would terminate and traffic would merge into the GP lanes, resulting in a total travel time of 11 minutes between 124th Avenue Northeast and I-5 (a savings of 13 minutes compared to the No Build Alternative).



How many people and vehicles are served on the corridor?

Exhibit 4-15 summarizes the westbound p.m. peak-period vehicle and person demand and throughput for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. This summary differs from Chapter 3, which summarizes the traffic demand. The following discussion summarizes vehicle and person throughput, which is the vehicle and person traffic that is actually served on the corridor. For instance, if the HOV lane provides better service than the GP lane, then more of the HOV traffic demand would be served than the GP traffic demand. The information provided in the following bulleted lists is also shown graphically in Exhibit 4-26 toward the end of this chapter.



Exhibit 4-15. Westbound P.M. Peak Period Vehicle and Person Demand per Hour

Existing Conditions

An average of 6,250 people are currently served in 3,930 vehicles per hour across Lake Washington.

- GP traffic carries 73 percent of the people in 88 percent of the vehicles.
- Bus traffic carries 2 percent of the people in less than 1 percent of the vehicles.
- Carpools carry 25 percent of the people in 12 percent of the vehicles.

No Build Alternative

In 2030, an average of 6,640 people would be served in 3,930 vehicles per hour across Lake Washington, meeting 81 percent of the vehicle-trip demand with 19 percent not served due to congestion.

- GP traffic would carry 74 percent of the people in 94 percent of the vehicles.
- Bus traffic would carry 16 percent of the people in less than 1 percent of the vehicles.



- Carpools would carry 10 percent of the people in 5 percent of the vehicles.

4-Lane Alternative

An average of 7,570 people would be served in 4,120 vehicles per hour across Lake Washington in 2030, meeting 95 percent of the vehicular demand with 5 percent not served due to congestion.

- GP traffic would carry 64 percent of the people in 88 percent of the vehicles.
- Bus traffic would carry 16 percent of the people in less than 1 percent of the vehicles.
- Carpools would carry 20 percent of the people in 12 percent of the vehicles.

6-Lane Alternative

An average of 8,590 people would be served in 4,600 vehicles per hour across Lake Washington in 2030. Ninety percent of the GP vehicle-trip demand would be served with 10 percent remaining unserved, while virtually all of the carpool demand would be served.

- GP traffic would carry 61 percent of the people in 85 percent of the vehicles.
- Bus traffic would carry 15 percent of the people in less than 1 percent of the vehicles.
- Carpools would carry 24 percent of the people in 14 percent of the vehicles.

Do freeway operations affect the local arterials?

Existing Conditions

Freeway congestion between the Montlake Boulevard on-ramp and I-5 occasionally queues through the on-ramp to Montlake Boulevard.

No Build, 4-Lane, and 6-Lane Alternatives

In 2030, freeway congestion would not queue onto the on-ramps and traffic demand would be served at the ramp meters; therefore, the local arterials would not be affected by freeway operations.

Eastbound SR 520, A.M. Peak Period

This section discusses eastbound SR 520 operations during the a.m. peak period. The exhibits showing traffic operations for existing



conditions and the No Build, 4-Lane, and 6-Lane Alternatives are grouped together for convenience at the end of this section. An instructional exhibit explaining how to read these traffic operations exhibits is also provided.

The reported average values represent the average hourly value that occurs throughout the peak period.

How does traffic demand change for eastbound SR 520?

The following discussion can be found in more detail in *Chapter 3: Freeway and Local Traffic Forecasts*. The summary below is provided as an aid in understanding the operations results.

Existing Conditions

Vehicle demand today is 2,840 vph east of I-5, 3,840 vph across Lake Washington, and 3,620 vph west of I-405.

No Build Alternative

Traffic demand eastbound would increase by 10 percent just east of I-5, 14 percent across Lake Washington, and 3 percent west of the I-405 interchange in 2030, as compared to existing conditions.

4-Lane Alternative

In 2030, traffic demand eastbound would decrease by 16 percent just east of I-5, 25 percent across Lake Washington, and 1 percent west of the I-405 interchange as compared to the No Build Alternative.

6-Lane Alternative

Traffic demand eastbound would decrease by 7 percent just east of I-5 and 9 percent across Lake Washington, and would increase by 7 percent west of the I-405 interchange in 2030, as compared to the No Build Alternative.

What congestion points are there on the SR 520 corridor and what is the resulting queue?

Exhibit 4-16 lists the eastbound a.m. peak hour congestion points in the transportation study area (including I-5, I-405, and SR 520). The bullet list immediately preceding Exhibit 4-10 explains how the symbols were marked for each location.



Exhibit 4-16. Eastbound SR 520 A.M. Peak Hour Congestion Points

Location	Existing Conditions	Year 2030		
		No Build Alternative	4-Lane Alternative	6-Lane Alternative
I-5 southbound approaching the Ship Canal Bridge	■	■	■	■
I-5 northbound approaching Spokane Street/Columbia Way off ramp	■	■	■	■
I-5 northbound between Express Lanes off ramp	■	■	■	■
Between Lake Washington Boulevard on-ramp merge and the Evergreen Point Bridge	X	X	●	●
I-405 southbound at the ramp from westbound SR 520	■	■	■	■
I-405 northbound at the ramp to eastbound SR 520	◆	■	■	■

● = No queuing at this location (speeds > 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 < 30 mph) but no effect on SR 520

X = Queuing at this location (speeds < 30 mph) AND speeds on SR 520 < 30 mph

I-5 Southbound Approaching the Ship Canal Bridge

Existing Conditions

The I-5 southbound approaching the Ship Canal Bridge is over capacity today, and traffic is congested for several hours in the morning. This congestion limits the ability of traffic to access SR 520.

No Build, 4-Lane, and 6-Lane Alternatives

Traffic forecasts indicate between 2 and 5 percent growth approaching the Ship Canal Bridge by 2030. Similar to today, the congestion approaching the Ship Canal Bridge would limit the traffic able to access SR 520 in 2030.

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

Existing Conditions

This location is over capacity today, and queues south of the project study area limits traffic for 3 hours of the morning peak period.

No Build, 4-Lane, and 6-Lane Alternatives

Traffic forecasts indicate a 19 percent growth approaching the Spokane Street/Columbia Way interchange by 2030. The congestion would increase compared to today, with approximately 20 percent of the demand not being served. This would limit the amount of traffic that could access SR 520 in 2030, similar to today.



I-5 Northbound Approaching the Express Lanes Off-Ramp

Existing Conditions

In the morning, the express lanes run in the southbound direction. The lane that accesses the express lanes terminates and the vehicles must merge to the right. This location operates under congestion for 1.5 hours during the morning peak period.

No Build, 4-Lane, and 6-Lane Alternatives

Traffic forecasts indicate between an 18 and 20 percent growth approaching the express lanes connection by 2030. The congestion would increase compared to today, with approximately 20 percent of the demand not being served. This limits the traffic able to access SR 520 in 2030, similar to today.

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

Existing Conditions

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 western highrise of the Evergreen Point Bridge, and visual distractions associated with the lake and substandard shoulder widths. The queue at this location lasts for approximately 3 hours and extends back to the I-5 interchange. Travel speeds are reduced to below 10 mph.

No Build Alternative

Operations approaching the Evergreen Point Bridge in 2030 would be similar to those discussed for Existing Conditions. For the No Build Alternative, however, the queue at this location would last for approximately 4 hours and would extend back to the I-5 interchange. Travel speeds would be reduced to below 10 mph.

4-Lane and 6-Lane Alternatives

Due to widened lanes and shoulders on the Evergreen Point Bridge, congestion would not occur at this location in 2030.

I-405 Southbound at the Ramp from Westbound SR 520

Existing Conditions

Under existing conditions, I-405 is congested at the point where the ramp from westbound SR 520 merges onto I-405. However, this congestion does not affect the operations of eastbound SR 520.

No Build, 4-Lane, and 6-Lane Alternatives

Forecasts indicate a 45 percent growth in traffic volume by 2030 compared to today on I-405 where the westbound SR 520 on ramp



merges. This congestion would reduce the volume able to reach the I-405 off-ramp to eastbound SR 520 (which is located north of the westbound SR 520 on-ramp). Operations would continue to degrade at this location and to the north, resulting in a queue that would extend from the SR 520 ramps to north of Northeast 70th Street and last for most of the peak period.

I-405 Northbound at the Ramps to Eastbound SR 520

Existing Conditions

The I-405 northbound to SR 520 eastbound ramp is near capacity today (meaning the amount of vehicles accessing this ramp are the maximum that the ramp can carry); however, all traffic is served and this ramp operates under minor congestion.

No Build, 4-Lane, and 6-Lane Alternatives

Forecasts indicate a 25 to 36 percent growth in traffic volume on the I-405 northbound to SR 520 eastbound ramp by 2030, as compared to today. As a result, operations on the ramp and on I-405 approaching the ramp would continue to degrade. This would result in a queue that would extend from the SR 520 ramps to south of Northeast 4th Street and would last for most of the peak period. The effect on eastbound SR 520 is 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 are in queue.

What are the speeds and travel times for the GP lanes?

The following section summarizes the average travel time through the peak period and the travel times for 7:00 and 8:30 a.m. for GP traffic for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. Exhibit 4-17 shows the eastbound travel times for 7:00 and 8:30 a.m.

Existing Conditions

The corridor currently operates under semi-congested conditions. At 7:00 a.m., it takes 18 minutes to travel eastbound between I-5 and 124th Avenue Northeast. The same route takes 13 minutes at 8:30 a.m. The average travel time through the peak period is 14 minutes, averaging 31 mph.

No Build Alternative

The corridor would operate under semi-congested conditions for the No Build Alternative in 2030. At 7:00 a.m., it would take

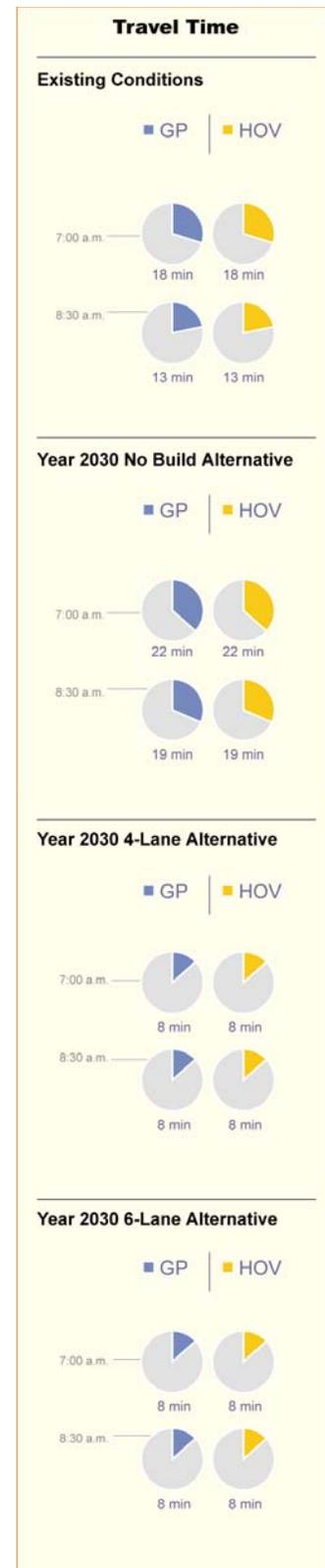


Exhibit 4-17. Eastbound A.M. Travel Time on SR 520 between I-5 and 124th Avenue Northeast



22 minutes to travel eastbound between I-5 and 124th Avenue Northeast. The same route would take 19 minutes at 8:30 a.m.

The average travel time through the peak period would be 19 minutes, averaging 23 mph. This would be an increase in travel time of 5 minutes as compared to existing conditions.

4-Lane Alternative

The corridor would operate under virtually free-flow conditions during the a.m. peak period in 2030, resulting in a travel time of 8 minutes between I-5 and 124th Avenue Northeast.

The average speed during the a.m. peak period would be 54 mph. This is a substantial improvement compared to the No Build Alternative, which would operate at an average speed of 23 mph.

6-Lane Alternative

Similar to the 4-Lane Alternative, the SR 520 corridor would operate under virtually free-flow conditions in 2030, resulting in 8 minutes of travel time between I-5 and 124th Avenue Northeast. The average speed for this alternative during the a.m. peak period would also be 54 mph.

What are the speeds and travel times for the HOV lane?

Exhibit 4-17 summarizes the HOV lane travel times for 7:00 a.m. and 8:30 a.m. for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. The following section provides a summary discussion of the average eastbound a.m. travel time through the peak period.

Existing Conditions

The HOV lane has similar operations as the GP lanes, with an average travel time through the peak period of 14 minutes and an average speed of 31 mph.

No Build Alternative

The average travel time through the peak period would be 19 minutes in 2030, averaging 23 mph. This is an increase in travel time of 5 minutes compared to existing conditions.

4-Lane Alternative

The HOV lane would operate under virtually free-flow conditions in 2030. The average travel time through the peak period would be 8 minutes, averaging 55 mph. This is a travel-time savings of 11 minutes compared to the No Build Alternative.



6-Lane Alternative

The HOV lane would operate at free-flow speeds in 2030, with a travel time between 124th Avenue Northeast and I-5 of 8 minutes (a savings of 11 minutes compared to the No Build Alternative).

How many people and vehicles are served on the corridor?

Exhibit 4-18 summarizes the eastbound a.m. vehicle and person demand and throughput for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. This summary differs from Chapter 3, which summarizes the traffic demand. The following discussion summarizes vehicle and person throughput, which is the vehicle and person traffic that is actually served on the corridor. For example, if the HOV lane provides better service than the GP lane, then more of the HOV traffic demand would be served than the GP traffic demand. The information provided in the following bulleted lists is also graphically depicted in Exhibit 4-25 toward the end of this chapter.



Exhibit 4-18. Eastbound A.M. Peak Period Vehicle and Person Demand Per Hour

Existing Conditions

An average of 5,430 people are served in 3,550 vehicles per hour across Lake Washington, meeting 93 percent of the vehicle demand with 7 percent not served due to congestion.

- GP traffic carries 79 percent of the people in 91 percent of the vehicles.
- Bus traffic carries 3 percent of the people in less than 1 percent of the vehicles.
- Carpools carry 18 percent of the people in 9 percent of the vehicles.

No Build Alternative

An average of 6,100 people would be served in 3,560 vehicles per hour across Lake Washington in 2030, meeting 82 percent of the vehicle demand with 18 percent not served due to congestion.



- GP traffic would carry 74 percent of the people in 95 percent of the vehicles.
- Bus traffic would carry 17 percent of the people in less than 1 percent of the vehicles.
- Carpools would carry 9 percent of the people in 5 percent of the vehicles.

4-Lane Alternative

An average of 5,790 people would be served in 2,840 vehicles per hour across Lake Washington in 2030, meeting 85 percent of the vehicle demand with 15 percent not served due to congestion.

- GP traffic would carry 54 percent of the people in 81 percent of the vehicles.
- Bus traffic would carry 19 percent of the people in less than 1 percent of the vehicles.
- Carpools would carry 27 percent of the people in 18 percent of the vehicles.

6-Lane Alternative

An average of 6,900 people would be served in 3,380 vehicles per hour across Lake Washington in 2030. Eighty-two percent of the GP vehicle demand would be served with 18 percent remaining unserved; 97 percent of the carpool demand would be served, with 3 percent not served due to congestion.

- GP traffic would carry 53 percent of the people in 81 percent of the vehicles.
- Bus traffic would carry 19 percent of the people in 1 percent of the vehicles.
- Carpools would carry 28 percent of the people in 18 percent of the vehicles.

Do freeway operations affect local intersections?

Existing Conditions

The Montlake Boulevard on-ramp currently does not serve the demand at the ramp meter; therefore, traffic queues back into the local arterial network for 2 hours. Queuing also occurs at the Lake Washington Boulevard on-ramp for 2.5 hours.



No Build Alternative

Similar to existing conditions, the Montlake Boulevard on-ramp would not serve the demand at the ramp meter in 2030; therefore, traffic would queue back into the local arterial network for over 1 hour. The queue would last for a shorter time than under existing conditions because the ramp meter would be set at an increased rate for the year 2030. Congestion would occur through the Lake Washington Boulevard on-ramp for 2.5 hours.

4-Lane Alternative

The congestion at the Montlake Boulevard on-ramp that occurs in the No Build Alternative would not occur under the 4-Lane Alternative, due to a decrease in traffic demand at this location.

The Lake Washington Boulevard on-ramp would not serve the demand at the meter; therefore, traffic would queue back into the local arterial network for up to 1 hour at the interchange in 2030.

6-Lane Alternative

The congestion at the Montlake Boulevard on-ramp that occurs in the No Build Alternative would not occur under the 6-Lane Alternative due to a decrease in traffic demand at this location and the addition of a second metered GP lane on the ramp (as needed based on vehicle demand). Therefore, queuing on the local arterials in the Montlake Interchange area would be reduced, improving overall traffic operation on the local street network.

Like the 4-Lane and No Build Alternatives, the Lake Washington Boulevard on-ramp would not serve the demand at the meter; therefore, traffic would queue back into the local arterial network for over 2 hours in 2030.

Eastbound SR 520, P.M. Peak Period

This section discusses operations on eastbound SR 520 during the p.m. peak period. The exhibits showing traffic operations for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives are grouped together for convenience at the end of this section. An instructional exhibit explaining how to read these traffic operations exhibits is also provided.

The reported average values represent the average hourly value that occurs throughout the peak period.



How does traffic demand change for eastbound SR 520?

The following discussion can be found in more detail in *Chapter 3: Freeway and Local Traffic Forecasts*. The summary below is provided as an aid to understanding the operations results.

Existing Conditions

The current vehicle demand is 3,160 vph east of I-5, 3,580 vph across Lake Washington, and 3,630 vph west of I-405.

No Build Alternative

Traffic demand eastbound would increase by 1 percent just east of I-5, 8 percent across Lake Washington, and 13 percent west of the I-405 interchange in 2030 as compared to existing conditions.

4-Lane Alternative

Traffic demand eastbound would decrease by 12 percent just east of I-5, 21 percent across Lake Washington, and 2 percent west of the I-405 interchange in 2030 as compared to the No Build Alternative.

6-Lane Alternative

Eastbound traffic demand would increase by 1 percent just east of I-5, 2 percent across Lake Washington, and 15 percent west of the I-405 interchange in 2030 as compared to the No Build Alternative.

Where are the congestion points on eastbound SR 520 between I-5 and 124th Avenue Northeast? What is the resulting queue?

Exhibit 4-19 lists the eastbound p.m. peak hour congestion points in the transportation study area (including I-5, I-405, and SR 520). The bullet list preceding Exhibit 4-10 explains how the symbols were marked for each location.

I-5 Southbound Approaching the Ship Canal Bridge

Existing Conditions

The I-5 southbound approaching the Ship Canal Bridge is over capacity today, and traffic is congested for several hours of the evening. This congestion limits the traffic able to access SR 520.

No Build, 4-Lane, and 6-Lane Alternatives

Traffic forecasts indicate a 16 to 19 percent growth in traffic volumes approaching the Ship Canal by 2030, which would increase congestion compared to today. This congestion would limit the traffic able to access SR 520 in 2030.



Exhibit 4-19. Eastbound SR 520 P.M. Peak Hour Congestion Points

Location	Existing Conditions	Year 2030		
		No Build Alternative	4-Lane Alternative	6-Lane Alternative
I-5 southbound approaching the Ship Canal Bridge	■	■	■	■
I-5 northbound approaching Spokane Street/Columbia Way off-ramp	●	■	■	■
I-5 northbound approaching the I-90 collector-distributor on-ramp	■	■	■	■
I-5 northbound approaching the ramp to eastbound SR 520	■	◆	◆	◆
Between Lake Washington Boulevard on-ramp merge and the Evergreen Point Bridge	●	●	●	●
I-405 southbound at the ramp from westbound SR 520	■	■	■	■
I-405 northbound at the ramp to eastbound SR 520	■	■	■	■
Freeway termination at Avondale	■	X	X	X

● = No queuing at this location (speeds > 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 < 30 mph) but no effect on SR 520

X = Queuing at this location (speeds < 30 mph) AND speeds on SR 520 < 30 mph

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

Existing Conditions

This location operates without congestion today.

No Build, 4-Lane, and 6-Lane Alternatives

Traffic forecasts indicate a 27 percent growth in traffic volumes approaching the Spokane Street/Columbia Way interchange by 2030. The congestion would increase compared to today, which results in approximately 20 percent of the demand not being served. The congestion would also limit the traffic able to access SR 520 in 2030.

I-5 Northbound Approaching the I-90 Collector-Distributor On-Ramp

Existing Conditions

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 evening commute period.

No Build, 4-Lane, and 6-Lane Alternatives

Traffic forecasts indicate an approximately 40 percent growth in traffic volumes approaching the I-90 collector-distributor on-ramp by 2030.



The congestion increases compared to today, with approximately 20 percent of the demand not being served. The congestion limits the traffic able to access SR 520 in 2030.

I-5 Northbound Approaching the Ramp to Eastbound SR 520

Existing Conditions

Congestion occurs approaching the ramp to eastbound SR 520. This congestion is due to both the drop lane from I-5 to SR 520 (I-5 reduces from four lanes south of SR 520 to three lanes after the ramp to SR 520) and 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 extends south to the Olive Way interchange.

No Build, 4-Lane, and 6-Lane Alternatives

Congestion at the SR 520 interchange would reduce in 2030 not because of improvements or reduction in traffic, but because congestion to the south severely limits the traffic able to access this location. In 2030, I-5 northbound between the Lakeview off-ramp and the SR 520 interchange would operate with mild congestion with speeds around 30 mph for 2 hours during the evening commute.

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

Existing Conditions

Congestion occurs today at this location as a result of merging traffic from the Lake Washington Boulevard on-ramp, changes in grade differences between the ramp and the western highrise of the Evergreen Point Bridge, and visual distractions associated with the lake and substandard shoulder widths. The congestion at this location lasts for 1.5 hours.

No Build Alternative

Traffic forecasts indicate an increase in 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, traffic actually arriving at this location would decrease for the No Build Alternative (compared to today), and the congestion at this location would also decrease.

4-Lane and 6-Lane Alternatives

Due to congestion on I-5 (similar to the No Build Alternative) and widened lanes and shoulders on the Evergreen Point Bridge, congestion would not occur at this location in 2030.



I-405 Southbound at the Ramp from Westbound SR 520

Existing Conditions

Congestion does not occur today on I-405 southbound where the ramp from westbound SR 520 joins I-405.

No Build, 4-Lane, and 6-Lane Alternatives

Forecasts indicate a 37 percent growth in traffic volume by 2030 compared to today on I-405 where the westbound SR 520 on-ramp merges. As a result, operations on I-405 would degrade at this location and to the north, resulting in a queue that would extend from the SR 520 ramps to north of Northeast 70th Street and last for most of the 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 the Ramps to Eastbound SR 520

Existing Conditions

The I-405 northbound to SR 520 eastbound ramp is over capacity today (meaning the vehicles accessing this ramp exceed the volume that the ramp can carry). This results in congestion on northbound I-405 from the ramps to SR 520 south to Northeast 4th Street. The congestion on I-405 likely reduces traffic able to access SR 520.

No Build, 4-Lane, and 6-Lane Alternatives

By 2030, forecasts indicate a 19 to 23 percent growth in traffic volume on the I-405 northbound to SR 520 eastbound ramp compared to today. As a result, operations on the ramp and on I-405 approaching the ramp would continue to degrade. This would result in a queue that would extend from the SR 520 ramps to south of Northeast 4th Street and last most of the peak period. The effect on eastbound SR 520 is 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 are in queue.

Freeway Terminus at Avondale

Existing Conditions

Congestion occurs under existing conditions at the east end of the corridor but does not extend into the project limits (between I-5 and 124th Avenue Northeast). The congestion from Avondale lasts for 2.5 hours and queues to the Northeast 40th Street/Northeast 51st Street interchange at the peak of congestion.



No Build Alternative

Heavy queuing would occur at the signalized intersection at the Avondale interchange. This queue would extend to 124th Avenue Northeast for 1 hour. Travel speeds would be reduced to 10 mph or less.

4-Lane Alternative

The same queue (in terms of length and duration) as discussed for the No Build Alternative would occur with the 4-Lane Alternative in 2030.

6-Lane Alternative

Congestion would occur at the signalized intersection at the Avondale interchange in 2030. This queue would extend to 108th Avenue Northeast for 1 hour. The queue would extend back to the Bellevue Way interchange at the peak of congestion. This queue 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 124th Avenue Northeast; however, with the 6-Lane Alternative, this queue would extend back to Bellevue Way. The length of the queue would increase due to the increase in demand between Lake Washington and I-405, compared to the No Build Alternative. The 6-Lane and No Build Alternatives would have similar demand crossing the lake and east of 124th Avenue Northeast; however, west of I-405, the 6-Lane Alternative would have a 15 percent increase in traffic over No Build, and directly east of I-405, the 6-Lane Alternative would have a 2 percent increase in traffic over the No Build Alternative. Traffic volumes on the ramps to SR 520 eastbound from local areas between Lake Washington and I-405 would grow by 28 percent as compared to the No Build Alternative. The additional traffic associated with the 6-Lane Alternative between Lake Washington and I-405 would stack at the back of the queue and extend the queue to Bellevue Way.

What are the speeds and travel times for the GP lanes?

Exhibit 4-20 shows the SR 520 eastbound travel times for 4:30 p.m. and 6 p.m. The following section discusses the average GP traffic travel time through the peak period and the 4:30 p.m. and 6 p.m. travel times for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives.



Exhibit 4-20. Eastbound P.M. Travel Time on SR 520 between I-5 and 124th Avenue Northeast



Existing Conditions

The corridor (SR 520 between I-5 and 124th Avenue Northeast) operates under near free-flow conditions. The average travel time through the p.m. peak period is 9 minutes, averaging 49 mph.

No Build Alternative

The corridor would operate under minor congestion levels in 2030. The average travel time through the peak period would be 9 minutes, averaging 49 mph. This would be a decrease in travel time of 1 minute compared to existing conditions. Travel time would decrease due to the addition of the auxiliary lane between Northeast 51st Street and West Lake Sammamish, which would reduce the congestion on eastbound SR 520.

4-Lane Alternative

The corridor would operate under minor levels of congestion in 2030. The average travel time through the p.m. peak period under the 4-Lane Alternative would be 8 minutes, averaging 54 mph.

6-Lane Alternative

The corridor would operate under slightly congested conditions during the later evening hours in 2030. At 4:30 p.m., it would take 8 minutes to travel eastbound between I-5 and 124th Avenue Northeast; however, the same travel route would take 20 minutes at 6:00 p.m.

The average travel time through the 5-hour p.m. peak period would be 9 minutes, with an average speed of 47 mph. Speed would be similar to the No Build Alternative, operating at an average speed of 49 mph.

What are the speeds and travel times for the HOV lane?

Exhibit 4-20 summarizes the HOV lane travel times for 4:30 and 6:00 p.m. for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. The following section provides a summary discussion of the average travel time through the peak period.

Existing Conditions

Similar to the GP lanes, the HOV lane operates under near free-flow conditions. The average travel time through the peak period is 9 minutes, averaging 49 mph.

No Build Alternative

In 2030, the average travel time through the peak period would be 9 minutes, averaging 49 mph, similar to today.



4-Lane Alternative

In 2030, the HOV lane would operate under near free-flow speeds, resulting in a travel time of 8 minutes between 124th Avenue Northeast and I-5 (a savings of 1 minute compared to the No Build Alternative).

6-Lane Alternative

Similar to the 4-Lane Alternative, the HOV lane would operate under near free-flow speeds in 2030, resulting in a travel time of 8 minutes between 124th Avenue Northeast and I-5 (a savings of 1 minute compared to the No Build Alternative).

How many people and vehicles are served on the corridor?

Exhibit 4-21 summarizes the eastbound p.m. peak-period vehicle and person demand and throughput for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. This summary differs from Chapter 3, which summarizes the traffic demand. The following discussion summarizes vehicle and person throughput, which is the vehicle and person traffic that is actually served on the corridor. The information provided in the bulleted lists below is also shown graphically in Exhibit 4-26 later in this chapter.

Existing Conditions

An average of 6,380 people are currently served in 3,530 vehicles per hour across Lake Washington.

- GP traffic carries 66 percent of the people in 91 percent of the vehicles.
- Bus traffic carries 19 percent of the people in 1 percent of the vehicles.
- Carpools carry 15 percent of the people in 8 percent of the vehicles.



Exhibit 4-21. Eastbound P.M. Peak Period Vehicle and Person Demand per Hour



No Build Alternative

An average of 7,190 people would be served in 3,400 vehicles per hour across Lake Washington in 2030, meeting 88 percent of the demand with 12 percent not served because of congestion.

- GP traffic would carry 60 percent of the people in 95 percent of the vehicles.
- Bus traffic would carry 34 percent of the people in 1 percent of the vehicles.
- Carpools would carry 6 percent of the people in 4 percent of the vehicles.

4-Lane Alternative

An average of 6,810 people would be served in 2,790 vehicles per hour across Lake Washington in 2030, meeting 90 percent of the vehicular demand with 10 percent not served due to congestion.

- GP traffic would carry 47 percent of the people in 87 percent of the vehicles.
- Bus traffic would carry 38 percent of the people in 1 percent of the vehicles.
- Carpools would carry 15 percent of the people in 12 percent of the vehicles.

6-Lane Alternative

In 2030, an average of 8,760 people would be served in 3,500 vehicles per hour across Lake Washington. Eighty-six percent of the GP vehicular demand would be served with 14 percent remaining unserved, while virtually all of the carpool demand would be served with no queuing.

- GP traffic would carry 41 percent of the people in 78 percent of the vehicles.
- Bus traffic would carry 32 percent of the people in 1 percent of the vehicles.
- Carpools would carry 27 percent of the people in 21 percent of the vehicles.



Do freeway operations affect the local arterials?

Montlake Boulevard Interchange

Existing Conditions

The Montlake Boulevard on-ramp does not currently serve the demand at the meter; therefore, traffic queues back into Montlake Boulevard for 1.5 hours.

No Build Alternative

Similar to today, the Montlake Boulevard on-ramp would not serve the demand at the ramp meter in 2030. Traffic would queue back into Montlake Boulevard throughout the entire 5-hour peak period.

4-Lane Alternative

Demand at the Montlake Boulevard on-ramp would decrease under the 4-Lane Alternative in 2030 as compared to the No Build Alternative, so traffic demand would be served at this ramp.

6-Lane Alternative

Demand at the Montlake Boulevard on-ramp would increase under the 6-Lane Alternative in 2030 as compared to the No Build Alternative. However, an additional lane would be provided at this on-ramp to serve traffic demand, so traffic would not queue onto Montlake Boulevard. This additional ramp would provide queue storage and increase the ramp meter capacity. Traffic would not back up onto Montlake Boulevard.

What do the following exhibits show?

Exhibits 4-22 and 4-23 show the congestion points within the project area for the a.m. and p.m. peak periods, respectively.

Exhibit 4-24 explains how to read the traffic operations exhibits. Exhibits 4-25 and 4-26 show the a.m. and p.m. peak volume and mode choice for existing conditions and the No Build, 4-Lane, and 6-Lane Alternatives. Exhibits 4-27 through 4-30 provide westbound and eastbound, a.m. and p.m. peak-period travel speeds, congestion, travel time, and persons served across the bridge for the No Build, 4-Lane, and 6-Lane Alternatives.

What would be the effects on traffic of the No Build Catastrophic Failure Scenario?

This scenario assumes that catastrophic failure of the Evergreen Point Bridge and the Portage Bay Bridge would occur simultaneously, leaving the SR 520 corridor inaccessible between I-5 and 84th Avenue Northeast. Traffic that typically uses the SR 520 corridor to cross Lake

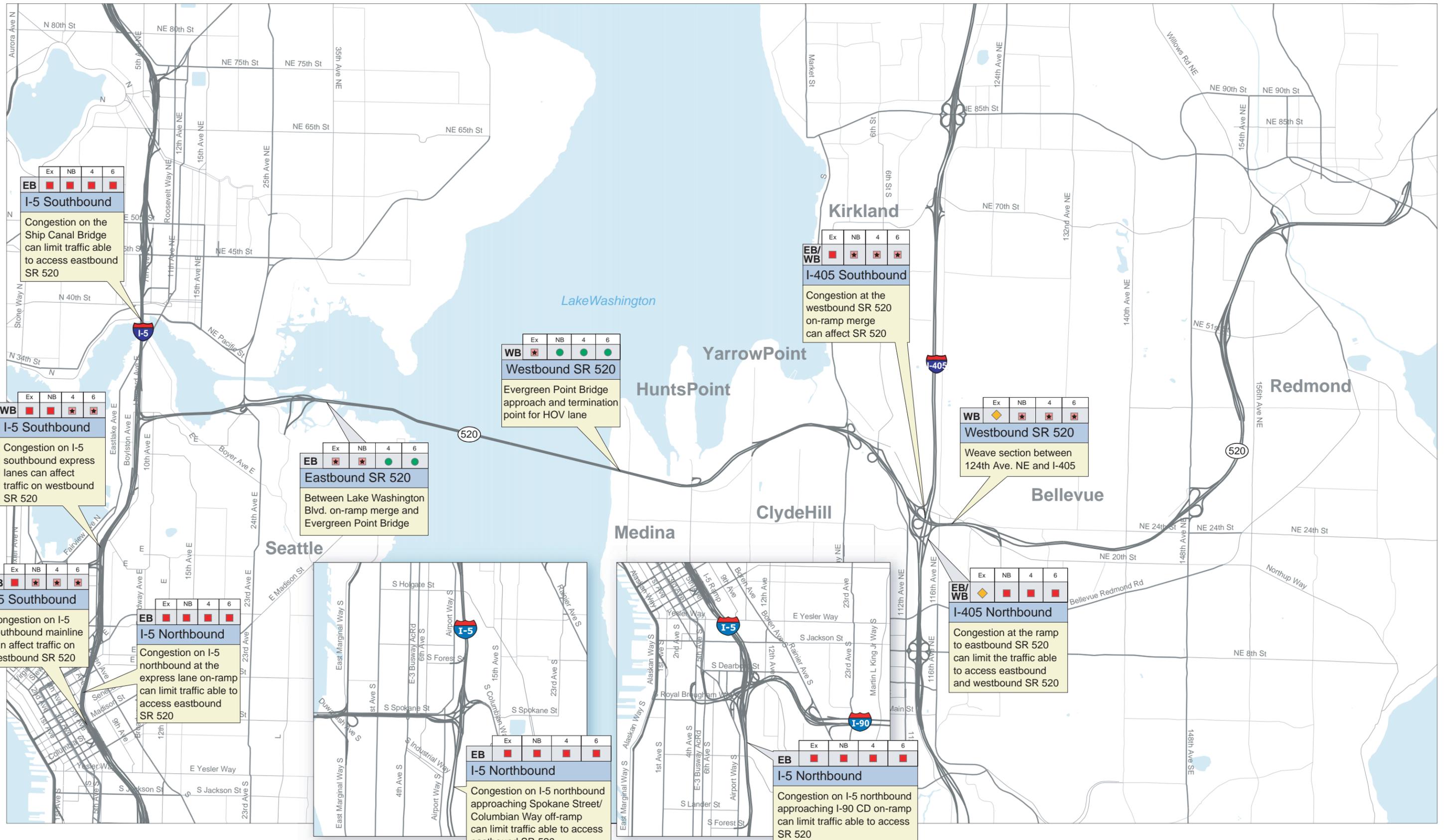


Washington would be forced to use either I-90 or SR 522 to cross the lake. Trips that start west of the lake and are destined for the University District would be forced to use the local arterial system. Several options would be available, though none with a great advantage over the other. Travelers from the Capitol Hill area would likely use the 23rd Avenue to Montlake Boulevard corridor to access the University District. People traveling on I-5 destined for the University would use the Northeast 45th Street interchange area until it became oversaturated with traffic. At that point people would begin to use alternate routes on the minor arterial system from Northeast 65th Street down to Northeast 50th Street to access the University District. People traveling from the northeast might also use Sand Point Way with more frequency. Travelers from the I-90 corridor destined for the University District could also divert off the freeway at the Lakeview exit to find their way to Eastlake Avenue East. How many people would divert their trips to which corridors is not quantifiable at this point, but there would be some level of effect on all of the local roadways.

Approximately 110,000 vehicles currently cross Lake Washington each day, and this number is anticipated to increase to 128,000 by 2030. Some percentage of these trips would likely be canceled as they are discretionary (not necessary) trips such as shopping, entertainment, or visiting trips. Some people would choose to continue to make the trip but would take the bus. The majority of the remaining trips would likely use the I-90 corridor as an alternate route. The transportation discipline team estimates that travel times between Redmond and Seattle would more than double if the SR 520 bridges experienced a catastrophic failure.

Because more traffic would use the I-90 corridor to cross Lake Washington, congestion on I-90 would increase along with congestion on I-405. More trips would likely divert onto the local roadways to bypass congestion on the freeways. Some possible diversion routes would be Bellevue Way for traffic destined to the Bellevue central business district, Southeast 8th Street off I-405 for traffic seeking alternate routes to the Crossroads area, and 150th Avenue Southeast off I-90 for another route into the Crossroads area of Bellevue. These are not the only alternate routes available, but they represent some of the options that travelers might use to bypass congestion and reach their destination in a reasonable time frame.





LEGEND

- No queuing at this location (speeds > 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 < 30 mph) but no effect on SR 520
- Queuing at this location (speeds < 30 mph) AND affects SR 520

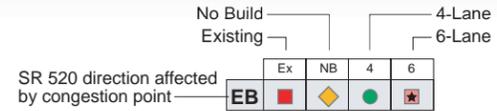


Exhibit 4-22. A.M. Peak Period Project Area Congestion Points
SR 520 Bridge Replacement and HOV Project