Trans-Lake Washington Project

Multimodal Alternatives Evaluation Report

Committee Discussion Draft

Prepared for

Washington State Department of Transportation
Office of Urban Mobility
401 Second Avenue South, Suite 300
Seattle, Washington 98104

Sound Transit
401 South Jackson Street
Seattle, Washington 98104

Prepared by

Trans-Lake Washington Project Team

Parametrix, Inc.
CH2M HILL
Parsons Brinckerhoff
EnviroIssues
Puget Sound Transit Consultants

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1. ALTERNATIVES EVALUATED

1.1 INTRODUCTION

This report summarizes the results of 8 multimodal alternatives being considered by the Trans-lake Washington project. The alternatives represent the range of highway, high capacity transit and transportation demand management (TDM) actions being considered for the SR 520 corridor between Redmond and Seattle, including the Lake Washington crossing. The alternatives analysis is being conducted to help select alternatives for further examination in an Environmental Impact Statement focused on SR 520.

As part of the analysis, the project is also considering the comparative benefits, impacts and costs of using I-90 or SR 520 as a route for high capacity transit to cross Lake Washington.

Chapter 1 of this report describes the alternatives currently being considered. Chapter 2 provides the transportation effectiveness results, Chapter 3 provides environmental results (to be distributed in mid-June), and Chapter 4 provides cost results.

1.2 MULTIMODAL ALTERNATIVES

The following multimodal alternatives were identified following earlier analysis and refinement of a larger set of highway, high capacity transit (HCT) and transportation demand management (TDM) actions. In April, the project's Executive Committee selected eight alternatives to represent the most promising range of actions for meeting the project's purpose and need, and asked that these alternatives be further evaluated before environmental impact statement (EIS) alternatives are selected.

Figure 1-1 summarizes the proposed multimodal alternatives. The text and figures that follow briefly describe the alternatives and depict the major features and assumptions.

1.2.1 Alternative 1: No Action

This alternative (Figure 1-2), represents SR 520 with no major improvements or actions to the corridor. It assumes that the floating bridge will continue to be maintained and operated as it is today, at least until the year 2020. It does not include replacement of the floating bridge or any of the bridge structures to reduce the risk of failure due to catastrophic events such as a major storm or an earthquake.

1.2.2 Alternative 2: SR 520 Safety and Preservation with I-90 LRT

1.2.2.1 SR 520 Improvements

Alternative 2 (Figure 1-3) represents the SR 520 corridor with no major capacity improvements, but it would replace the floating bridge due to its limited remaining service life. All seismically substandard bridges on SR 520 would also be replaced. A 12-foot bicycle and pedestrian path would be provided along SR 520 between Lake Washington Boulevard in Seattle and 84th

Avenue NE in Medina, connecting with existing bicycle and pedestrian paths. The replaced segments are assumed to be reconstructed to full design standards, which would include inside and outside shoulders and a median. Construction requirements would also involve realigning the facility up to 200 feet to the north at Portage Bay and across Lake Washington.

1.2.2.2 I-90 High Capacity Transit

On I-90, light rail would connect downtown Seattle to Bellevue, with lines connecting to Kirkland/Redmond. The route is shown in Figure 1-10. Although the majority of Trans-Lake transit riders would be focused to the I-90 light rail system, SR 520 would still serve regional bus routes between the University District and Bellevue, Kirkland and Redmond. A route from central Kirkland to downtown Seattle would also use SR 520.

1.2.3 Alternative 3: SR 520 HOV with I-90 LRT

1.2.3.1 SR 520 Improvements

On SR 520, a continuous HOV lane would be provided each way from I-5 to SR 202/Redmond Way (Figure 1-4). This would provide two GP lanes and one HOV lane each way for a total of six lanes, with the HOV lanes relocated to the inside. The Portage Bay and Lake Washington bridges would be replaced and realigned up to 200 feet to the north. The widening assumes full design standards, including shoulders on the inside and outside (each way), and a 12-foot bicycle/pedestrian path on the north side of the new facility. Areas within a half-mile of interchanges and transit stations could be two to four lanes wider to accommodate vehicles merging and weaving between on and off ramps.

A number of interchange design and access options are also being tested with this alternative (all are shown on Figure 1-4), but the set of options unique to this alternative are:

- HOV ramps to and from SR 520 and the I-5 express lanes to the south.
  - Direct HOV-to-HOV connections at the I-405/SR 520 interchange
  - A Montlake area tunnel under the Montlake cut connecting transit and HOV directly to Pacific Street in the University District

1.2.3.2 I-90 Light Rail

The I-90 light rail system would be the same as described in Alternative 2 (see Figure 1-10).

1.2.4 Alternative 4: SR 520 HOV and GP with I-90 LRT

On SR 520, Alternative 4 (Figure 1-5) would add one HOV lane and one general purpose lane in each direction between I-5 and West Lake Sammamish Parkway, for a total of eight lanes. The new general purpose lanes would end at West Lake Sammamish Parkway on the east. The added HOV lanes would continue east to SR 202/Redmond Way.

- All of the interchanges and overpasses in the corridor would be reconstructed to accommodate the wider highway. As with Alternative 3, full design standards are

assumed, a bicycle and pedestrian path would be provided on the north side of the facility, the HOV lanes would be relocated to the inside, and the Portage Bay and Lake Washington bridges would be replaced and realigned up to 200 feet to the north. Areas within a half-mile of interchanges and transit stations could be two to four lanes wider to accommodate vehicles merging and weaving between on and off ramps.

- Interchange and access design options are being tested at I-5, Montlake Boulevard, Bellevue Way NE, Bellevue Way/NE 108th, I-405 and SR 202/West Lake Sammamish Parkway. The set of options unique to the alternative are:
- HOV ramps to and from the I-5 express lanes to the south and to the north.
- HOV-to-HOV connections at the I-405/SR 520 interchange
- An HOV/transit tunnel from SR 520 to the University District
- An Eastlake area tunnel for general purpose traffic, connecting SR 520 to Eastlake/Fairview Avenues.

1.2.4.1 I-90 Light Rail

The I-90 light rail system would be the same as described in Alternative 2 (see Figure 1-10).

1.2.5 Alternative 5: SR 520 HOV and HCT

1.2.5.1 SR 520 Highway Improvements

The Alternative 5 highway improvements to SR 520 would be the same as described for Alternative 3, with continuous HOV lanes provided between I-5 and SR 202/Redmond Way (see Figure 1-6).

The interchange and access design options are similar to Alternative 3, except for :

- Approaching I-5, the SR 520 HOV lane designation would end and HOV traffic would use general purpose ramps to the I-5 mainline.
- There would not be a HOV/bus transit tunnel to the University District

1.2.5.2 SR 520 HCT

A fixed guideway[1] line would begin in downtown Seattle pass through Fremont and Wallingford to the University District, and then follow the SR 520 corridor across Lake Washington (Figure 1-11). The main line would proceed to Redmond, with a branch to downtown Bellevue. There would also be a Kirkland-Bellevue shuttle. Although most Trans-Lake along the corridor will be focused to the SR 520 HCT line, some would continue to use the I-90 corridor. Regional bus routes from southeast Bellevue and Issaquah would use I-90 to serve downtown Seattle. Bus service would also be provided from the I-405 south corridor into downtown Seattle via I-90.

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[1] A fixed guideway is assumed to be a rail or rubber-tired transit system that operates predominantly in an exclusive right-of-way at, below or above grade.

(The I-90 center roadway is assumed to maintain current operations with this alternative, with the center roadway operating reversibly.)

1.2.6 Alternative 6: SR 520 HOV and GP and HCT

1.2.6.1 SR 520 Highway Improvements

The highway improvements to SR 520 for Alternative 6 would be similar to Alternative 4, with an 8-lane highway providing three general purpose lanes and one HOV lane each way (Figure 1-7). However, the west side terminus for the added general purpose lanes would be at Montlake.

The interchange and access options would be the same as alternative 4, except for:

- A tunnel would connect general purpose traffic to Pacific Avenue in the University District (it would not be an exclusive HOV connection).
- There would not be a Fairview Avenue/Eastlake Avenue general purpose connection.

1.2.6.2 SR 520 HCT

The SR 520 HCT would be as described for Alternative 5 (with the route shown in Figure 1-11).

1.2.7 Alternative 7: SR 520 HOV with BRT connections

1.2.7.1 SR 520 Highway Improvements

SR 520 would be a 6-lane highway (Figure 1-8) with continuous HOV lanes provided between I-5 and SR 202/Redmond Way, similar to Alternative 7. However, the HOV lanes would be shared by bus rapid transit (BRT) vehicles[2].

The interchange and access options would be the same as Alternative 3, except:

- The SR 520 HOV lane designation would end at I-5, and HOV traffic would use general purpose ramps to the I-5 mainline.
- An HOV / BRT tunnel would connect SR 520 to Eastlake and Fairview Avenues.
- There would also be a BRT/HOV connection to the University District

1.2.7.2 SR 520 BRT

All-day BRT routes would link Bellevue, Redmond/Overlake and Kirkland/Totem Lake to downtown Seattle or to the University District. Peak-service only transit routes on the east side would supplement this service, and local transit routes would also connect to the all-day BRT

[2] Bus rapid transit would be an express/limited stop rubber tired transit system operating predominantly in a "managed lane" roadway environment. This would include bus-only lanes, HOV 3+ lanes (restricted to vehicles with three or more occupants), or HOT lanes (restricted to vehicles with three ore more occupants or vehicles paying tolls).

routes. For I-90, BRT service is also assumed for the I-90 Corridor, and the I-90 center roadway is assumed to operate reversibly, as it does today.

1.2.8 Alternative 8: SR 520 HOV with BRT connections and GP

SR 520 would be an 8-lane highway including one additional HOV lane and one additional general purpose lane each way (Figure 1-9), similar to Alternative 4. BRT vehicles would share the HOV lanes for most of the corridor, but there would be added connections and facilities in several locations.

The options are similar to Alternative 4, except:

- A tunnel for general purpose and HOV / BRT traffic would connect SR 520 to Eastlake Avenue/Fairview Avenue in the south Lake Union area.
- A busway would connect from Eastlake Avenue/Fairview to Downtown Seattle.
- A new tunnel for general purpose traffic would connect SR 520 directly to the University District.
- An exclusive HOV lane between SR 520 and the University District would be provided by converting one lane in each direction.

1.2.8.1 SR 520 BRT

All-day BRT routes would link Bellevue, Redmond/Overlake and Kirkland/Totem Lake to downtown Seattle or to the University District. Peak-service only transit routes on the east side would supplement this service, and local transit routes would also connect to the all-day BRT routes. For I-90, BRT service is also assumed for the I-90 Corridor, and the I-90 center roadway is assumed to operate reversibly, as it does today.

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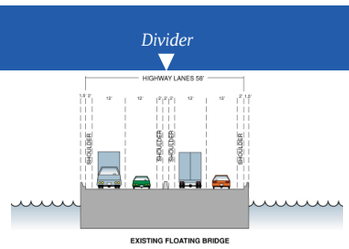
Proposed Multi-Modal Alternatives

1 — No Action

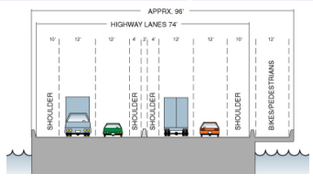
STATUS QUO



- Continued maintenance of facility
- No other action taken

2 — SR 520 Safety & Preservation, I-90 LRT

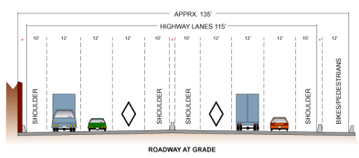
I-90 LRT · Bike / Pedestrian · Seismic Retrofitting



- Replace and realign the floating bridge and seismically deficient structures, add bicycle/pedestrian facilities and shoulders, and implement aggressive strategies to manage transportation demand
- Add light rail on I-90
- Includes provisions for mitigation and enhancement

3 — SR 520 HOV, I-90 LRT

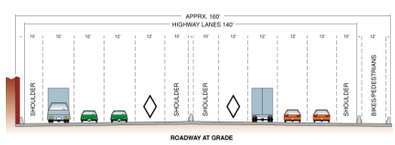
I-90 LRT · Bike / Pedestrian · HOV



- Add one high occupancy vehicle (HOV) lane each direction, add bicycle/pedestrian facilities and shoulders, realign the floating bridge and the Portage Bay Viaduct, and implement aggressive strategies to manage transportation demand
- Add light rail on I-90, HOV/Bus facilities on SR 520
- Includes provisions for mitigation and enhancement

4 — SR 520 HOV, GP, I-90 LRT

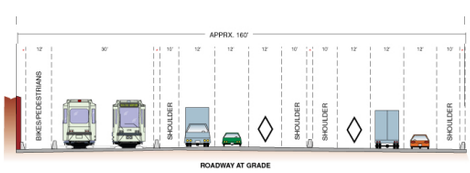
I-90 LRT · Bike / Pedestrian · HOV · GP



- Add one HOV lane and one general purpose (GP) lane each direction, add bicycle/pedestrian facilities and shoulders, realign the floating bridge and the Portage Bay Viaduct, and implement aggressive strategies to manage transportation demand
- Add light rail on I-90, HOV/Bus facilities on SR 520
- Includes provisions for mitigation and enhancement

5 — SR 520 HOV, SR 520 HCT

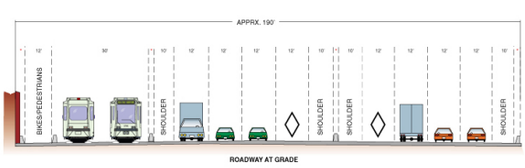
SR 520 HCT · Bike / Pedestrian · HOV



- Add one HOV lane each direction, add bicycle/pedestrian facilities and shoulders, realign the floating bridge and the Portage Bay Viaduct, and implement aggressive strategies to manage transportation demand
- Add fixed guideway on SR 520
- Assume HOV/Bus in I-90 reversible roadway
- Includes provisions for mitigation and enhancement

6 — SR 520 HOV, GP, SR 520 HCT

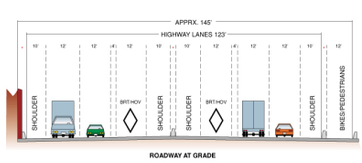
SR 520 HCT · Bike / Pedestrian · HOV · GP



- Add one HOV lane and one GP lane each direction, add bicycle/pedestrian facilities and shoulders, realign the floating bridge and the Portage Bay Viaduct, and implement aggressive strategies to manage transportation demand
- Add fixed guideway on SR 520
- Assume HOV/Bus in I-90 reversible roadway
- Includes provisions for mitigation and enhancement

7 — SR 520 HOV with BRT Connections (Bus Rapid Transit)

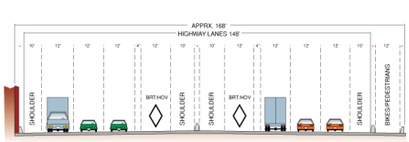
Bike / Pedestrian · HOV / BRT



- Add one HOV lane each direction, shared by BRT, with BRT connections
- Add bicycle/pedestrian facilities and shoulders, realign the floating bridge and the Portage Bay Viaduct, and implement aggressive strategies to manage transportation demand
- Assume HOV/Bus in I-90 reversible roadway
- Includes provisions for mitigation and enhancement

8 — SR 520 HOV with BRT Connections, GP

Bike / Pedestrian · HOV / BRT · GP

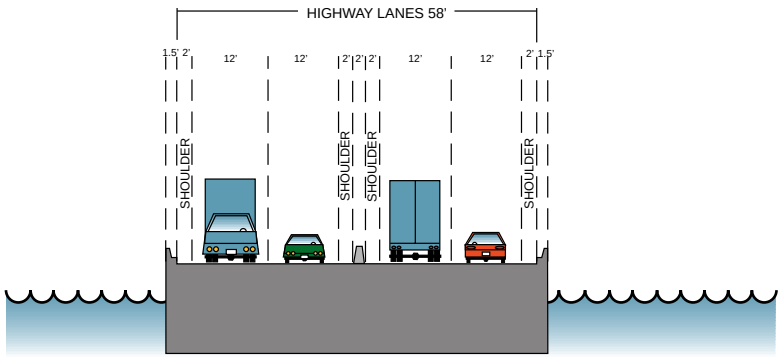


- Add one HOV lane and one GP lane each direction, with BRT connections
- Add bicycle/pedestrian facilities and shoulders, realign the floating bridge and the Portage Bay Viaduct, and implement aggressive strategies to manage transportation demand
- Assume HOV/Bus in I-90 reversible roadway
- Includes provisions for mitigation and enhancement

Figure 1-1

[As approved by the Executive Committee April 25, 2001]

Typical cross-section for floating bridge segment.



EXISTING FLOATING BRIDGE

- No major changes or improvements to SR 520. Only continued maintenance of facility
- Assume I-90 would continue reversible center roadway operations.
- Other committed regional projects and services would be implemented, but there would be no substantial action on SR 520.

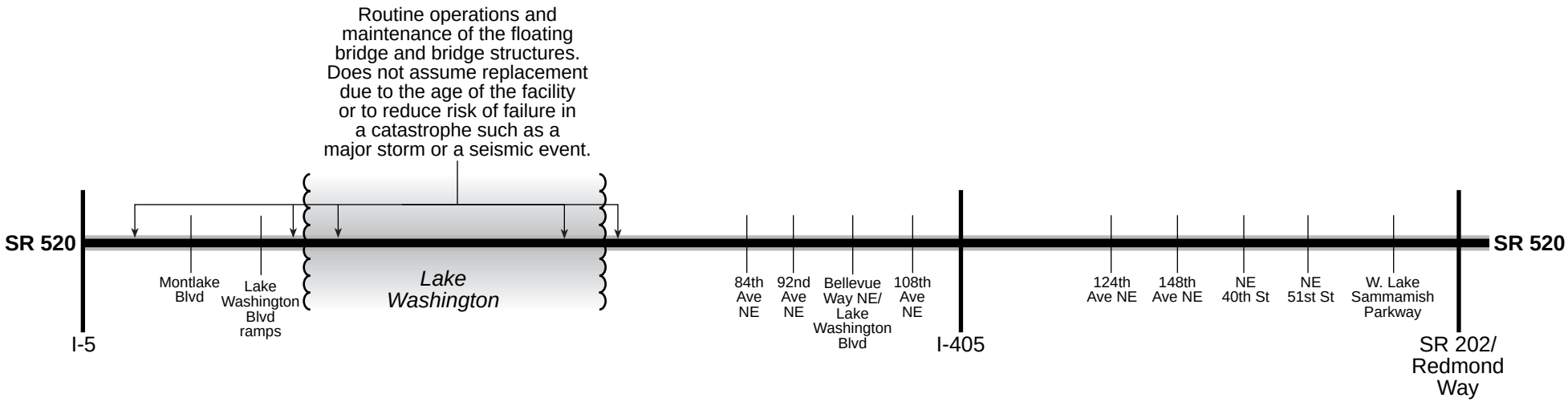


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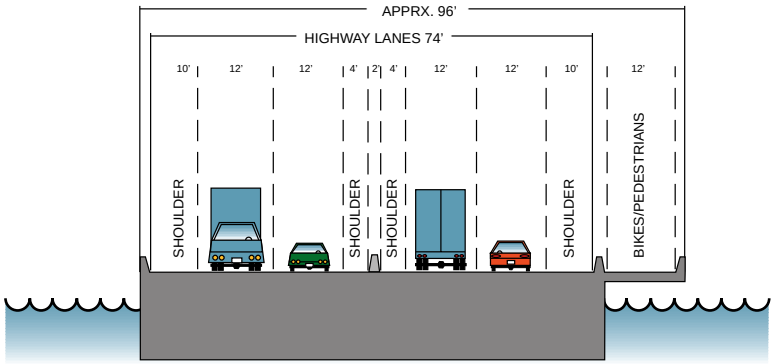
Figure 1-2
Alternative 1
No Action

Typical cross-section for floating bridge segment.
Other segments particularly approaching I-5 and Montlake interchanges, would be wider.



- Replace and realign the floating bridge and seismically deficient structures. Add bicycle/pedestrian facilities and shoulders. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Light rail on I-90.

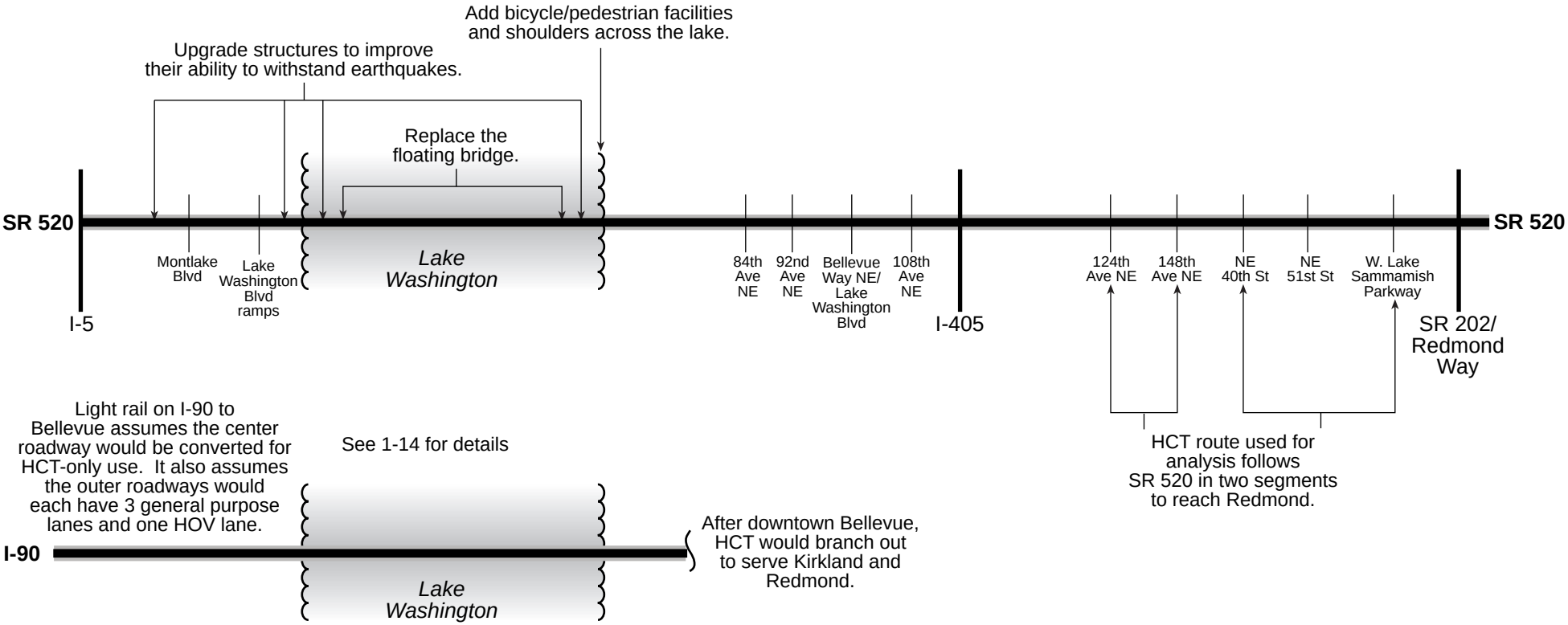


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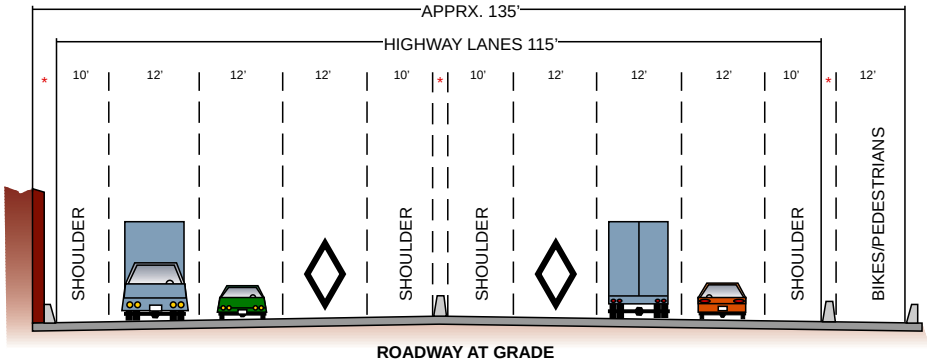
Figure 1-3
Alternative 2
SR 520 Safety and Preservation with I-90 HCT

Typical mainline cross-section for a 6 lane SR 520.
Areas within a halfmile of interchanges could be wider by at least 2 to 4 lanes to accomodate standard on and off ramps.



- Add one HOV lane each direction. Realign the floating bridge, highrises, and the Portage Bay viaduct. Add bicycle and pedestrian facilities. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Light rail on I-90.

SR 520 HOV lanes terminate at I-5, but a connection to the I-5 express lanes (south of SR 520 only) would serve westbound HOV in the morning, and eastbound HOV in the evening.

Buses and HOV would have a direct route to the University District.

Bicycle and pedestrian facilities would serve the full corridor but are adjacent to SR 520 approaching and across the lake.

Full interchange at Bellevue Way. Ramps at 108th Ave NE would be closed to general purpose traffic.

Direct connection between HOV lanes and S. Kirkland Park & Ride.

HOV lanes would have exclusive ramps to connect to/from NB/SB HOV lanes on I-405.

Direct connections between HOV lanes and Overlake Park & Ride or freeway transit station.

HOV lanes end.

SR 520

I-5 — Montlake Blvd — Lake Washington Blvd ramps — *Lake Washington* — 84th Ave NE — 92nd Ave NE — Bellevue Way NE/ Lake Washington Blvd — 108th Ave NE — I-405 — 124th Ave NE — 148th Ave NE — NE 40th St — NE 51st St — W. Lake Sammamish Parkway — SR 202/ Redmond Way

SR 520

HCT route used for analysis follows SR 520 in two segments to reach Redmond.

Light rail on I-90 to Bellevue assumes the center roadway would be converted for HCT-only use. It also assumes the outer roadways would each have 3 general purpose lanes and one HOV lane.

I-90 — *Lake Washington*

After downtown Bellevue, HCT would branch out to serve Kirkland and Redmond.

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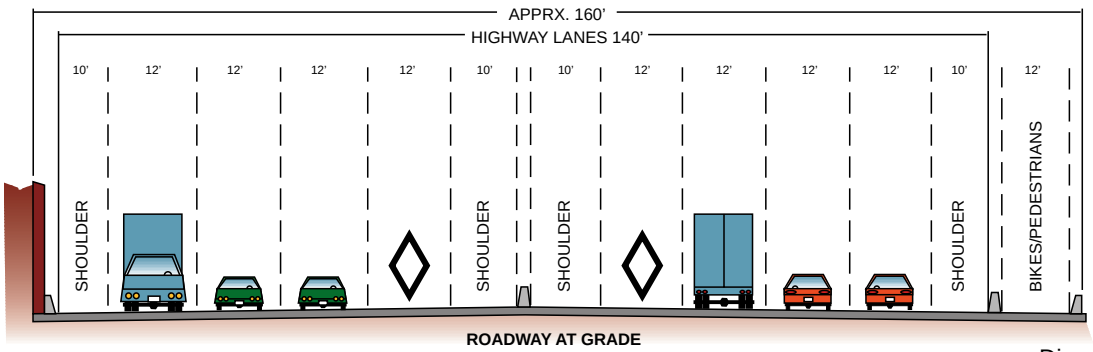
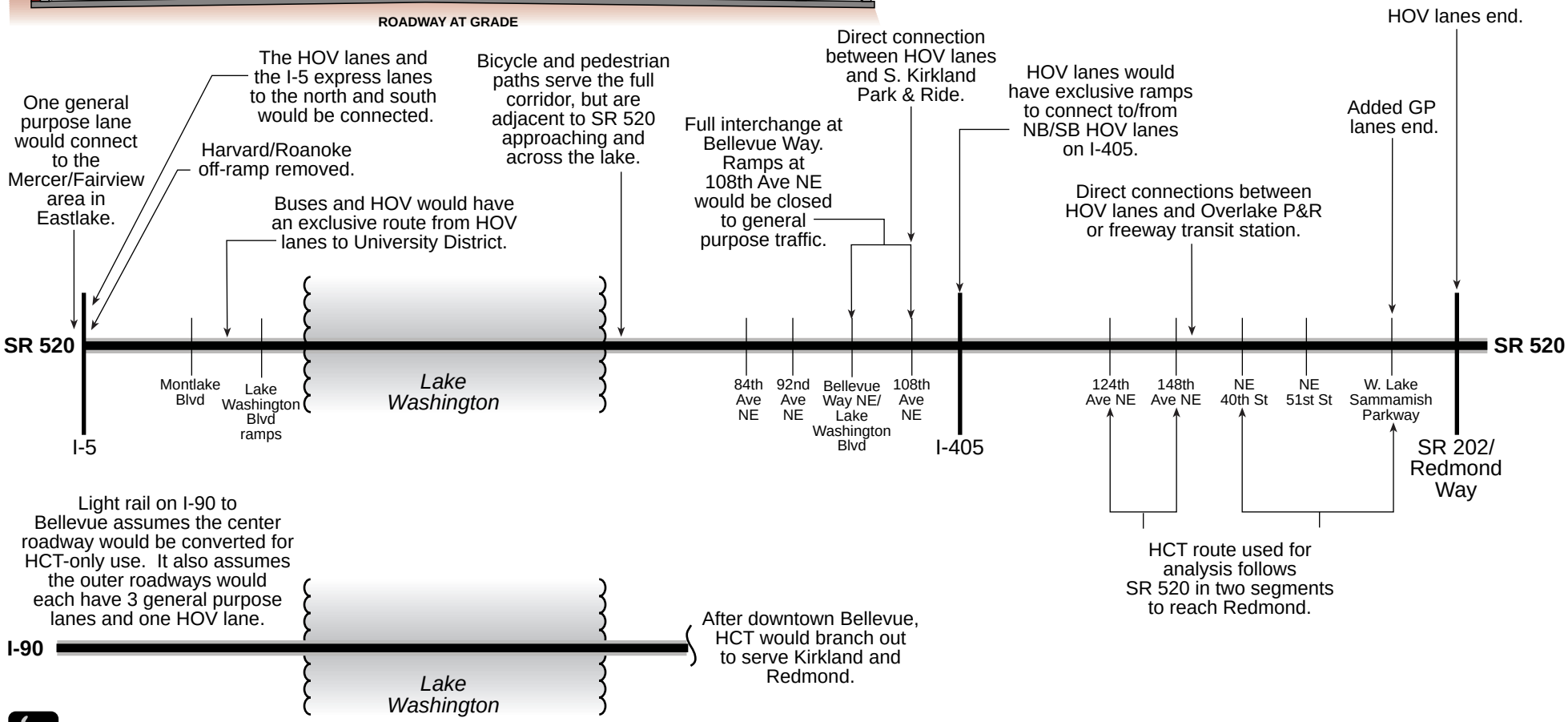
Figure 1-4
Alternative 3
SR 520 HOV with I-90 LRT

Typical mainline cross-section for a 8 lane SR 520.
Areas within a halfmile of interchanges could be wider by at least 2 to 4 lanes to accomodate standard on and off ramps.



- Add one HOV and one general purpose (GP) lane each direction. Realign the floating bridge, highrises, and the Portage Bay viaduct.Improve HOV/Bus facilities. Add bicycle and pedestrian facilities. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Light rail on I-90.

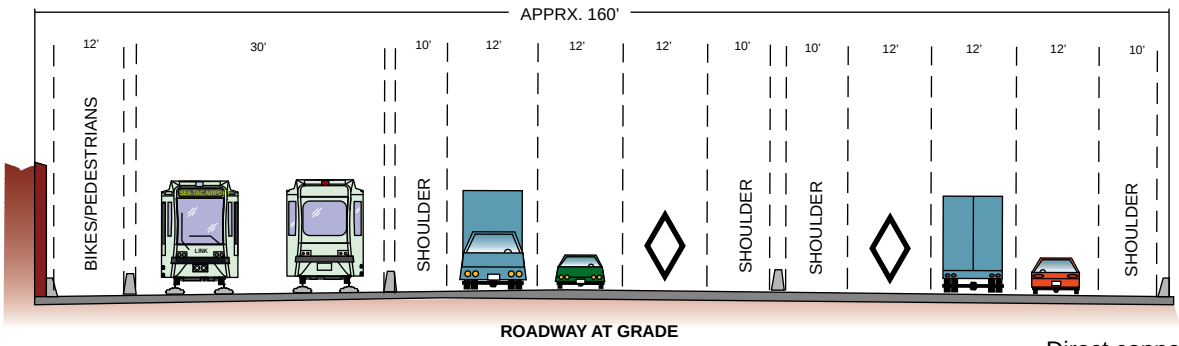


Trans-Lake Washington Project

PMX 234-1631-025/13(130300) (K), F3, 05/29/01

Figure 1-5
Alternative 4
SR 520 HOV and GP with I-90 LRT

Typical mainline cross-section for a 6 lane SR 520 with fixed guideway HCT.
Areas within a halfmile of interchanges could be wider by at least 2 to 4 lanes to accomodate standard on and off ramps.



- Add one HOV lane each direction. Realign the floating bridge, highrises, and the Portage Bay viaduct. Add bicycle and pedestrian facilities. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Add fixed guideway on SR 520.
- Assume HOV/Bus in I-90 reversible roadway.

SR 520 HOV lanes terminate approaching I-5

Bicycle and pedestrian facilities would serve the full corridor but are adjacent to SR 520 approaching and across the lake.

Full interchange at Bellevue Way. Ramps at 108th Ave NE would be closed to general purpose traffic.

Direct connection between HOV lanes and S. Kirkland P&R.

HOV lanes would have exclusive ramps to connect to/from NB/SB HOV lanes on I-405.

Transit center or freeway station with access to/from SR 520 HOV lanes.

HOV lanes end.

SR 520 — **SR 520**

I-5 — Montlake Blvd — Lake Washington Blvd ramps — *Lake Washington* — 84th Ave NE — 92nd Ave NE — Bellevue Way NE/ Lake Washington Blvd — 108th Ave NE — I-405 — 124th Ave NE — 148th Ave NE — NE 40th St — NE 51st St — W. Lake Sammamish Parkway — SR 202/ Redmond Way

After connecting Westlake, Seattle Center, and the University District, HCT would enter the SR 520 corridor here.

HCT leaves SR 520 corridor to reach S. Kirkland P&R and follows the Burlington Northern railroad right-of-way to Bellevue. A spur route would serve Kirkland.

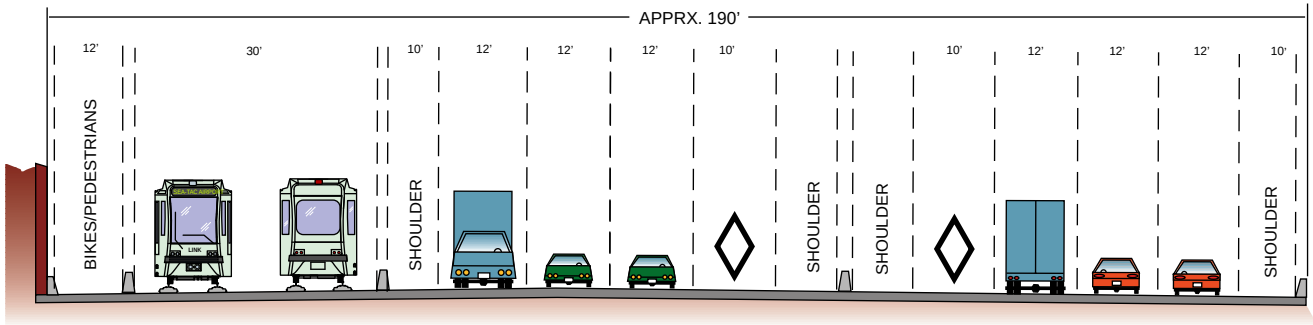
HCT route used for analysis follows SR 520 in two segments to reach Redmond.

Trans-Lake Washington Project

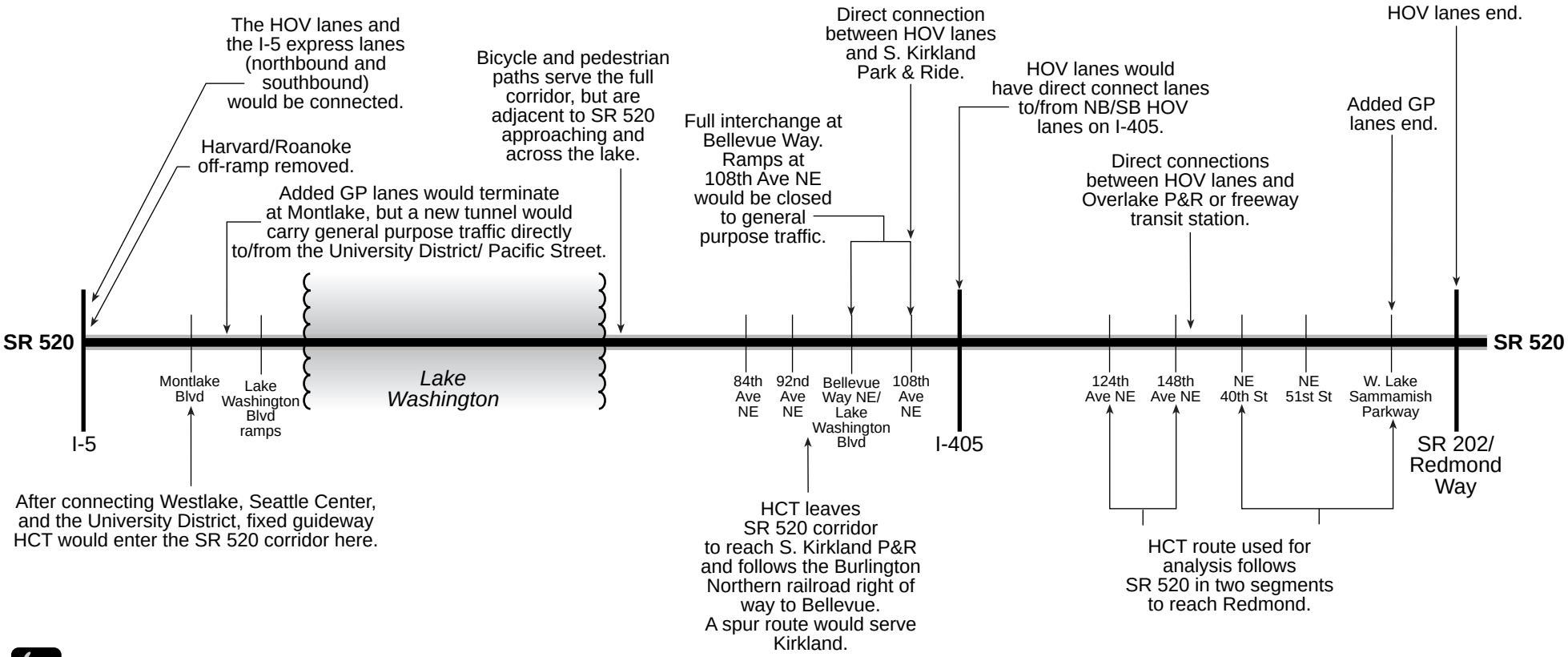
PMX 234-1631-025/13(130300) (K), F3, 05/29/01

Figure 1-6
Alternative 5
SR 520 HOV and HCT

Typical mainline cross-section for a 8 lane SR 520 with fixed guideway HCT.
Areas within a halfmile of interchanges could be wider by at least 2 to 4 lanes to accomodate standard on and off ramps.



- Add one HOV and one general purpose (GP) lane each direction. Realign the floating bridge, highrises, and the Portage Bay viaduct. Add bicycle and pedestrian facilities. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Add fixed guideway HCT on SR 520.

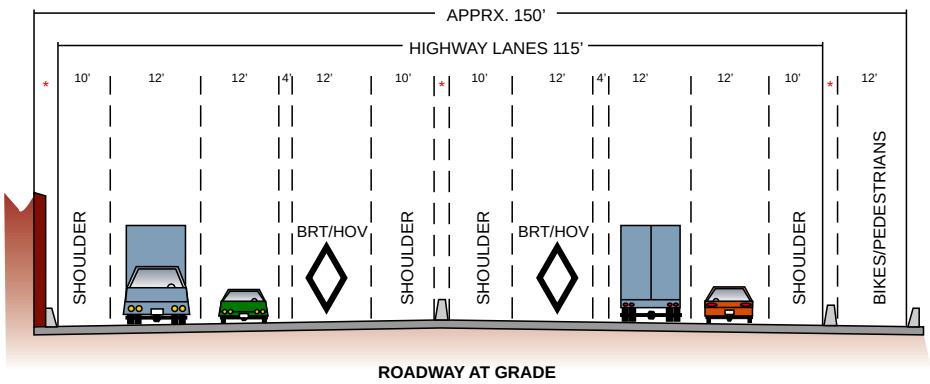


Trans-Lake Washington Project

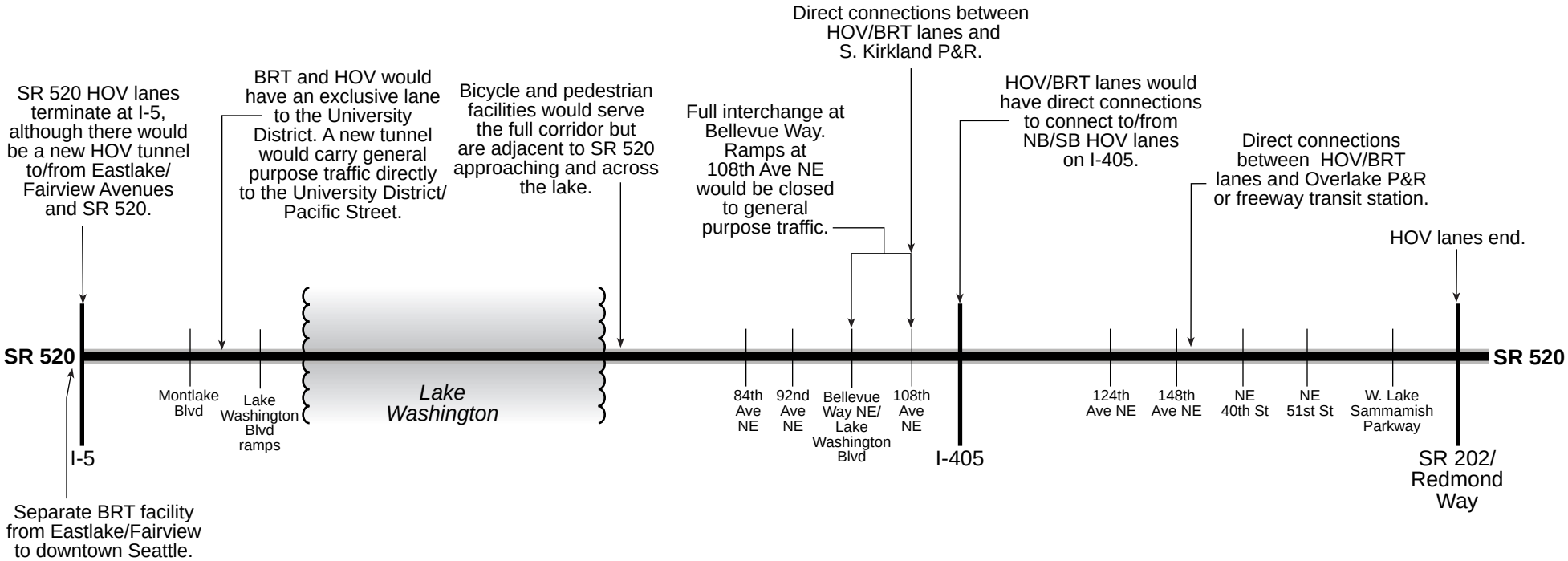
PMX 234-1631-025/13(130300) (K), F3, 05/29/01

Figure 1-7
Alternative 6
SR 520 HOV and GP and HCT

Typical mainline cross-section for a 6 lane SR 520.
Areas within a halfmile of interchanges could be wider by at least 2 to 4 lanes to accomodate standard on and off ramps.



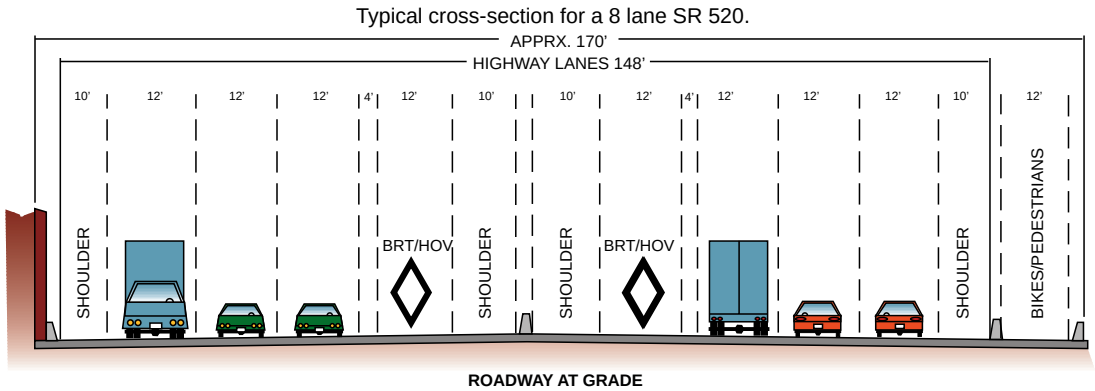
- Add one HOV/BRT lane each way on SR 520, with Bus Rapid Transit connections to downtown Seattle, University District, S. Kirkland and Overlake.
- Add bicycle and pedestrian facilities. Realign the floating bridge, highrises, and the Portage Bay viaduct. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Assume bus/HOV in I-90 convertible center roadway.



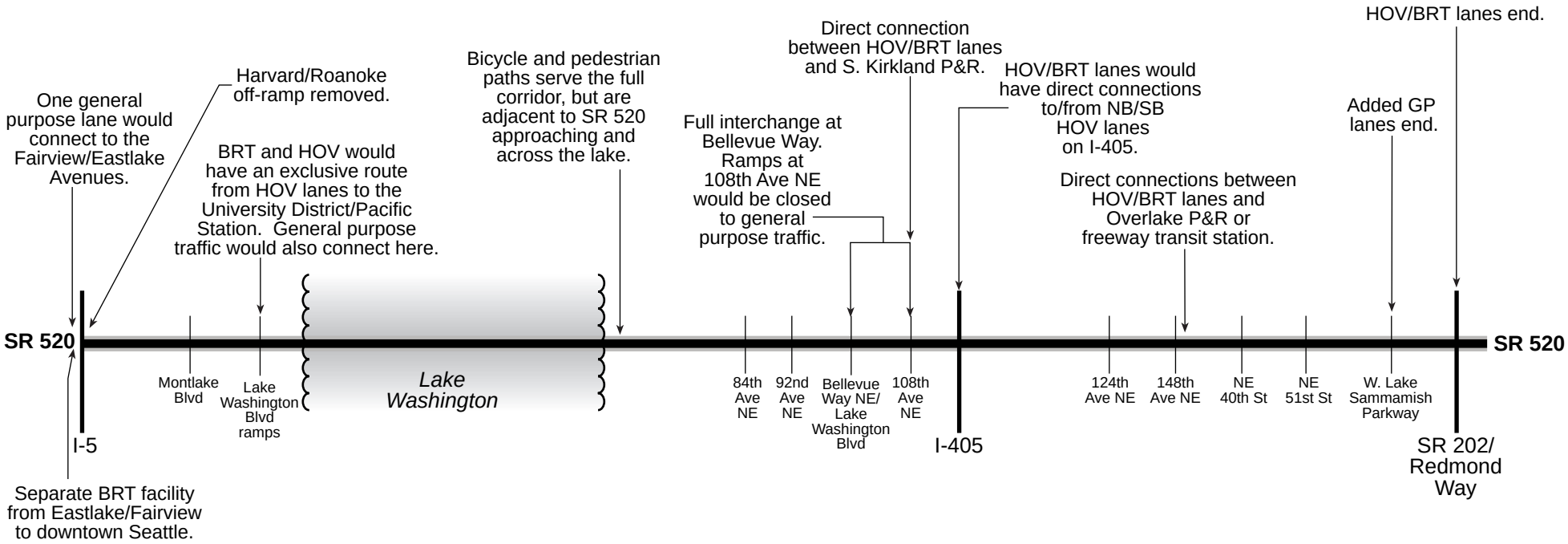
Trans-Lake Washington Project

PMX 234-1631-025/13(130300) (K), F3, 05/29/01

Figure 1-8
Alternative 7
SR 520 HOV with BRT Connections



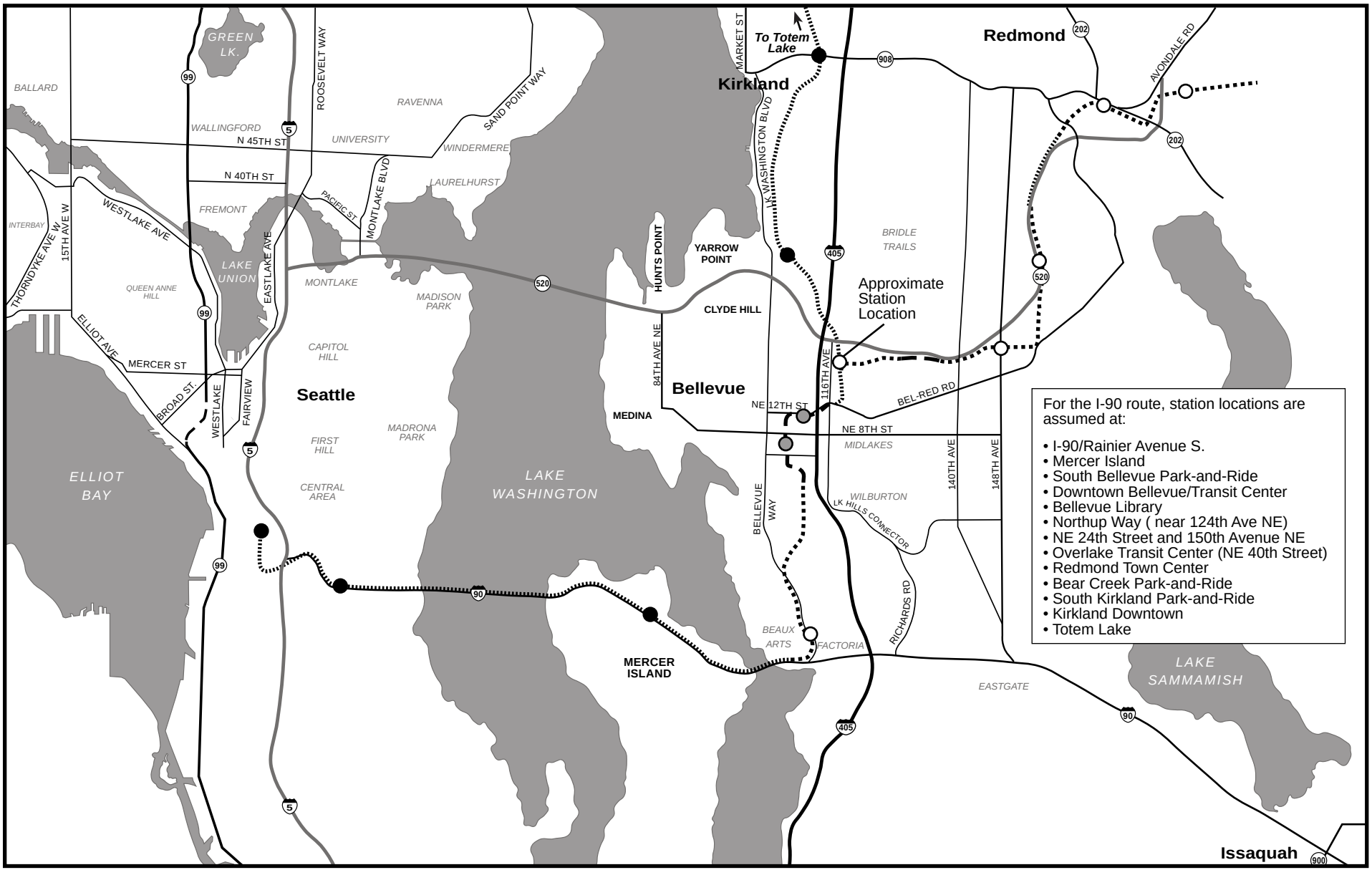
- Add one HOV/BRT and one GP lane each way on SR 520, with Bus Rapid Transit connections to downtown Seattle, University District, S. Kirkland and Overlake.
- Add bicycle and pedestrian facilities. Realign the floating bridge, highrises, and the Portage Bay viaduct. Implement aggressive strategies to manage transportation demand. Include provisions for mitigation and enhancement.
- Assume bus/HOV in I-90 convertible center roadway.



Trans-Lake Washington Project

PMX 234-1631-025/13(130300) (K), F3, 05/29/01

Figure 1-9
Alternative 8
SR 520 HOV with BRT Connections and GP



Trans-Lake Washington Project

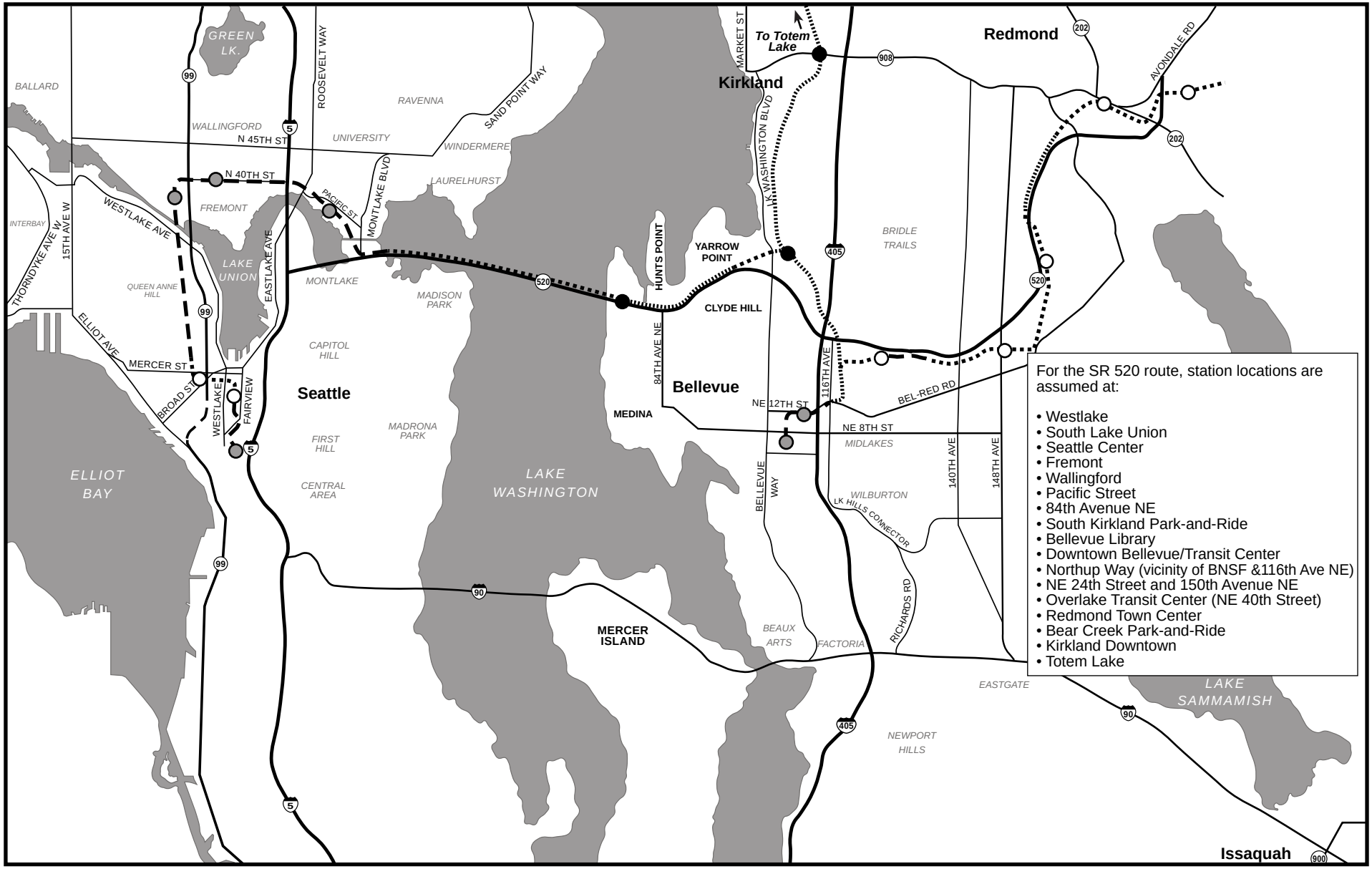
130303PMX2F030901.fh8

N

Alignment		Station
	Aerial	○
	Subway	●
	At Grade	●

Note: Short transition sections not shown

Figure 1-10
Alternatives 2, 3, 4 HCT Element
I-90 Light Rail Route
Downtown Seattle-Bellevue-Kirkland/Redmond*



Trans-Lake Washington Project

130303PMX2F030901.fh8

N

Alignment		Station
·····	Aerial	○
— — —	Subway	●
·····	At Grade	●

Note: Short transition sections not shown

Figure 1-11
Alternatives 5 and 6 HCT Element
SR 520 Fixed Guideway Route
Downtown Seattle-U District-Kirkland/Redmond/Bellevue

2. TRANSPORTATION EFFECTIVENESS

This chapter summarizes the transportation performance of the eight multimodal alternatives. Twelve mobility criteria and three reliability and safety criteria were developed for use in the evaluation. These criteria provide measures of the relative and cumulative contributions of highway, transit (including HCT), and TDM elements for the corridor.

The Puget Sound Regional Council's travel demand forecasting model was the primary information source for determining future transportation demand for the evaluation. To establish existing conditions information, the project team also collected transportation data from the state and local jurisdictions and transportation agencies, and conducted traffic counts along the corridor.

The PSRC model predicts daily and peak period travel demand for the corridor in the year 2020. The model forecasts person trips and vehicle trips, and also predicts travel speeds, travel times, and the mode of travel. The model also provides general assumptions about the growth of traffic throughout the corridor and region. A variety of other data sources and analytical tools were used to calculate future operating conditions along the corridor, including traffic volumes by time of day and location, the level of congestion, and local street impacts.

The performance of the alternatives under each transportation criteria is discussed below. The criteria and their definitions are followed by a summary of the transportation performance of each alternative. In some cases, the criteria definitions have been adjusted to reflect changes in methodology, but each criterion is still applied. These changes are shown in strikeout.

2.1 MOBILITY CRITERIA

The mobility criteria cover broad measures of corridor performance, including the number of people and vehicles served, or the level of transit ridership. There are also more detailed measures to reflect conditions on highways and local streets, including congestion, delay and queuing.

2.1.1 Person Throughput

Criteria Definition: *The number of people being moved in each SOV and HOV lane for the corridor will be quantified. The total person throughput on freeway links for each alternative will also be quantified.*

The demand for travel across Lake Washington for each of the alternatives for the SR 520 and I-90 corridors combined is illustrated in Figures 2-1a and 2-1b. The person trips are detailed in Tables 2-1, 2-2, and 2-3 which also include the qualitative ratings for the alternatives. The forecasts are from the Puget Sound Regional Council's model, as applied for this project. The forecasts include daily and peak periods, predicting future demand for travel across a mid-lake north-south screenline through SR 520 and I-90. Appendix A to this report provides forecasts for the alternatives that also specify the mode of travel, although the changes in mode preference are discussed in more detail in the mode share and transit ridership criteria in this chapter.

Demand forecasts provide a measure of how many people would be attracted to Trans-Lake corridors in 2020 under each alternative, but they do not necessarily indicate how many people could be accommodated, particularly at peak periods. Other models and analysis were used to evaluate the corridor's ability to serve the forecast demand. See criteria for congestion queue length and travel speeds for more discussion of these factors.

Figure 2-1a
Trans-Lake Daily Person Trips
SR 520 and I-90

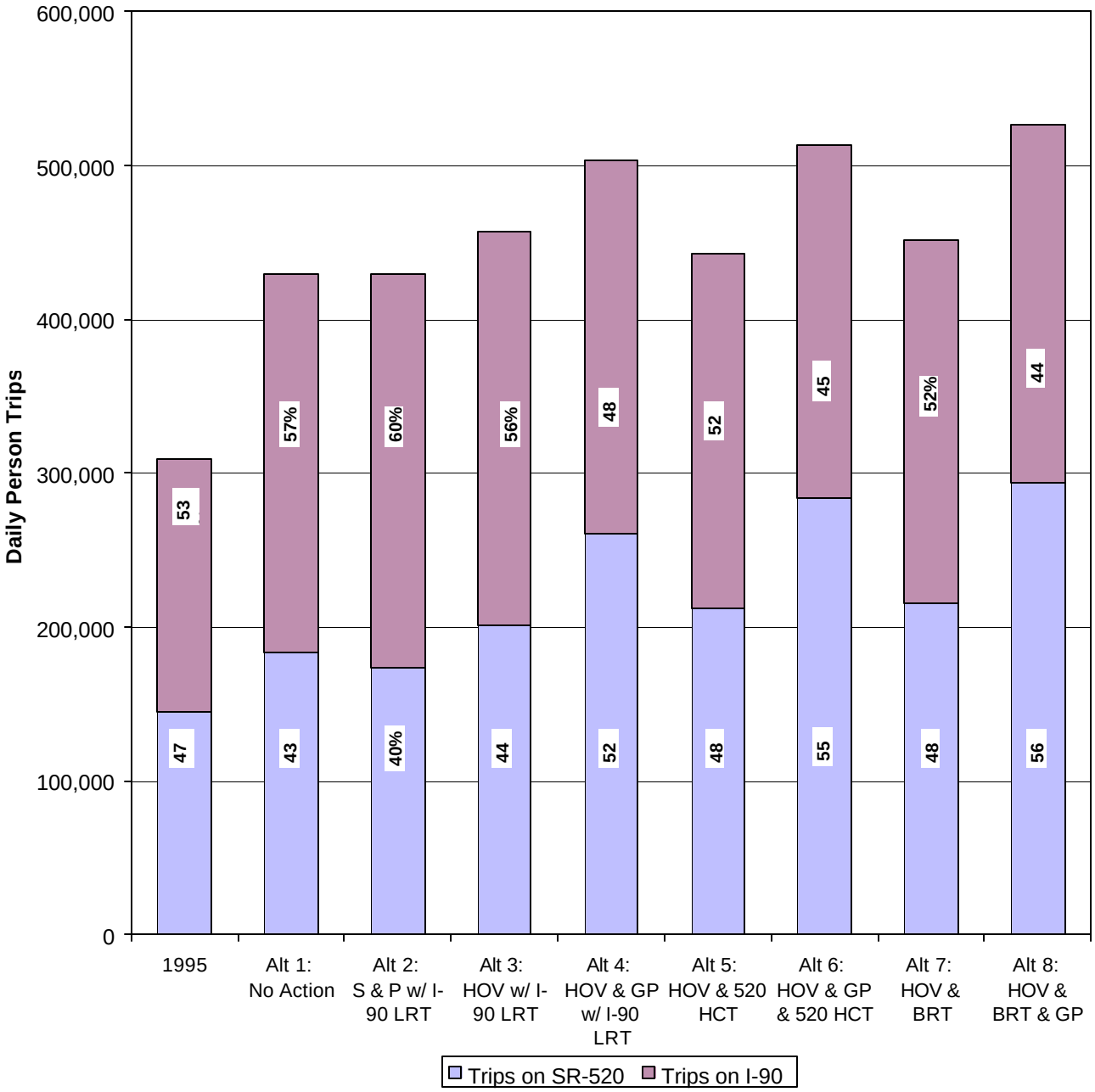


Figure 2-1b
Trans-Lake Peak Period Person Trips
SR 520 and I-90

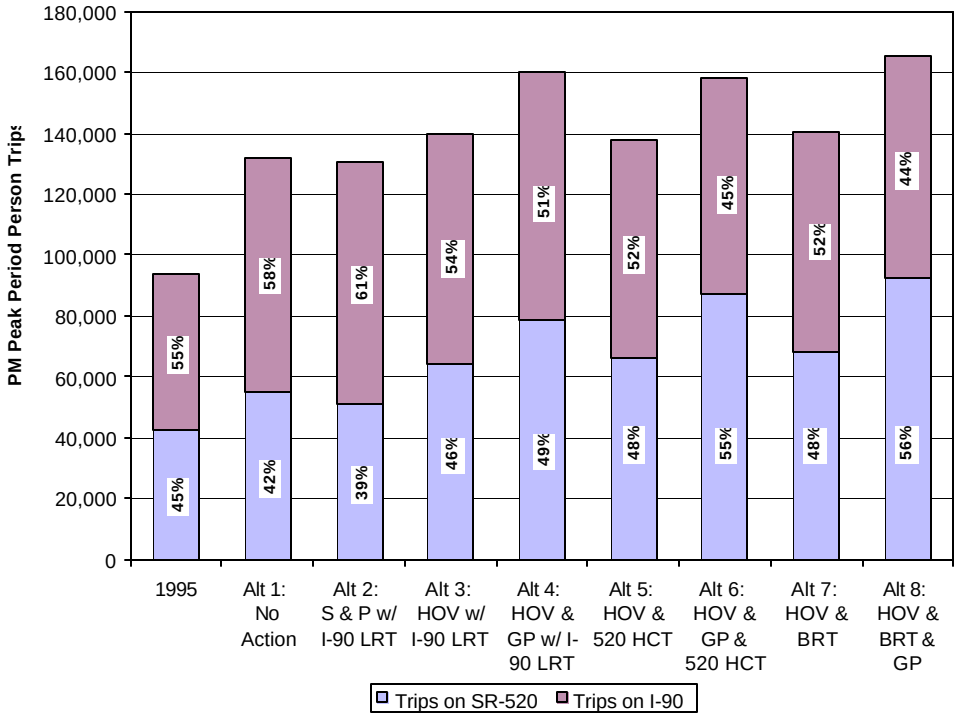


Table 2-1. Person Throughput
Daily and Peak Period Demand Forecasts for Person Trips on SR 520 and I-90

Facilities	1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & 520 HCT	Alt 6: HOV & GP & 520 HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
DAILY PERSON TRIPS									
SR 520									
Person Trips	144,600	183,200	173,200	200,700	261,200	212,225	284,190	215,200	293,600
I-90									
Person Trips	164,900	245,900	255,700	256,675	242,060	230,700	229,300	236,100	232,400
Total	**309,500**	**429,100**	**428,900**	**457,375**	**503,260**	**442,925**	**513,490**	**451,300**	**526,000**
PEAK PERIOD PERSON TRIPS									
SR 520									
Person Trips	42,400	54,900	51,000	64,100	78,900	66,330	87,250	68,000	92,400
I-90									
Person Trips	51,400	77,200	79,600	75,590	81,430	71,700	71,000	72,700	72,700
Total	**93,800**	**132,000**	**130,600**	**139,690**	**160,330**	**138,030**	**158,250**	**140,700**	**165,100**

Source: PSRC Regional Forecasting Model

Table 2-2. Person Throughput Criteria Rating

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & 520 HCT	Alt 6: HOV & GP & 520 HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	2	2	3	5	3	5	3	5

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

2.1.1.1 Overview of Person Throughput Forecasts

Based on the model, total daily person trips across the lake in 1995 were about 310,000 on a typical weekday. By 2020, with no improvements to either SR 520 or I-90, this demand is expected to grow to about 430,000 people/day, an increase of approximately 40%. With No Action, most of the increased travel demand would be in HOV and transit usage.

In alternatives with no major increase in SR 520 capacity (Alternatives 1 and 2), the daily person-trips for SR 520 are similar, at around 170,000 to 180,000 people per day by 2020. However, both Alternatives 1 and 2 would have high rates of increases in HOV and transit trips compared to 1995, yet they would involve incomplete HOV facilities on SR 520 and high levels of congestion in the general purpose lanes. For these reasons, the forecasts for person trips could be considered optimistic, and would not fully account for the effect of low reliability and variable travel times for HOV and transit in highly congested general purpose lanes. They also would include substantial lengthening of the peak period, lasting most of the day. The forecasts assume that people will still want to make their trips even if it would require traveling hours before or after the traditional peak.

When HOV capacity is added to the SR 520 corridor (Alternatives 3, 5 and 7), person trips increase by 10 to 17 percent on SR 520, 16,000 to 32,000 people, compared to No Action. This total includes increased HOV and transit use, and a relatively slight increase in general purpose trips. In all alternatives with an HOV facility on SR 520, there is a consistent reduction of about 10,000 people using the HOV travel mode in the I-90 corridor.[3] The shift of HOV users from I-90 to SR 520 indicates that a substantial number of HOV users in the Trans-Lake area would prefer the SR 520 corridor if HOV facilities were available.

When HOV or general purpose capacity is added to the SR 520 corridor, (Alternatives 4, 6 and 8) the proportion of people using SR 520 increases to over half of the trips for SR 520 and I-90 combined. This would place 78,000 to 110,000 people more people on SR 520 than No Action. (Trips overall on I-90 and SR 520 combined would increase by about 73,000 to 97,000). For the GP+HOV alternatives, the person trips on I-90 are similar to or lower than No Action. Again,

[3] Although there are different assumptions for HOV facilities on the I-90 corridor among the alternatives, HOV users on I-90 would still enjoy travel time advantages over people in the general purpose lanes in all alternatives.

this indicates that SR 520 would be an attractive choice for more people in the year 2020 if the corridor had added capacity.

The effect of choosing I-90 or SR 520 for HCT is more subtle, based on the forecasts and the alternatives as defined. If HCT is placed within the SR 520 corridor rather than the I-90 corridor (Alternatives 5-8) the proportion of total daily cross-lake trips carried by the SR 520 corridor increases by about 3-4%, but remains similar overall. A similar increase to I-90 would occur when that corridor has HCT. The transit forecasts are discussed in more detail in the transit ridership criteria.

2.1.1.2 Ranking the Person Throughput Results

Alternative 4, 6 and 8, which all involved adding general purpose and HOV lanes to the SR 520 corridor, would serve the highest numbers of people and were given the highest ratings. Alternatives 3, 5 and 7, which would add HOV lanes to SR 520 but had less dramatic increases in person trips compared to No Action, had moderate ratings. Alternatives 1 and 2, which would not add additional lane capacity to SR 520, had the lowest ratings. The ratings are based on the assumption that the more trips served by the corridor the better.

Alternatives 7 and 8, the Bus Rapid Transit alternatives, had the highest ratings for the SR 520 corridor for 6 and 8 lane configurations, and Alternative 8 had the highest rating overall. However, the BRT service assumed in these alternatives would need to be carefully considered if these alternatives move forward. The performance for BRT depends in large part on competitive travel times. The additional on-street buses in Downtown Seattle and the U-District, where street capacity is limited, could result in slower travel times and increased congestion. These factors could significantly reduce BRT ridership. The higher performance of Alternative 8 was also due in part to the design options that were tested, which added two new general purpose access points in Seattle (one to the University District and one to Eastlake).

The 8-lane alternatives resulted not only in the highest total person trips, but they also created the highest transit and HOV ridership levels in real numbers. This tends to reflect the model's assumption that overall vehicle capacity increases result in a proportionate increase in the use of other modes.

2.1.2 Traffic Volumes

Criteria Definition: *Daily, AM-peak-period and PM-peak-period traffic volumes will be summarized and compared at 10 to 15 locations on freeway ~~and principal arterial links~~ within the Trans-Lake Washington study area.*

The traffic volume forecasts for daily travel and peak periods represent the demand for vehicle travel on Trans-Lake routes, as forecast by the PSRC regional travel demand model. For peak periods, the forecasts are for SR 520, and are based on the model's predicted rates of traffic growth at specific points in the corridor, and applied to year 2000 traffic volumes. These volumes represent the demand for travel at the peak period; they do not indicate the number of vehicles that could be served. Daily traffic demand is charted in Figure 2-2, and summarized in Table 2-3. (A more complete table is provided in Appendix A.) Peak period traffic demand for 6 and 8 lane alternatives is charted in Figure 2-3. (Principal arterial volumes are discussed under the congestion criteria.)

Figure 2-2
Daily Trans-Lake Vehicle Volumes
SR 520 and I-90

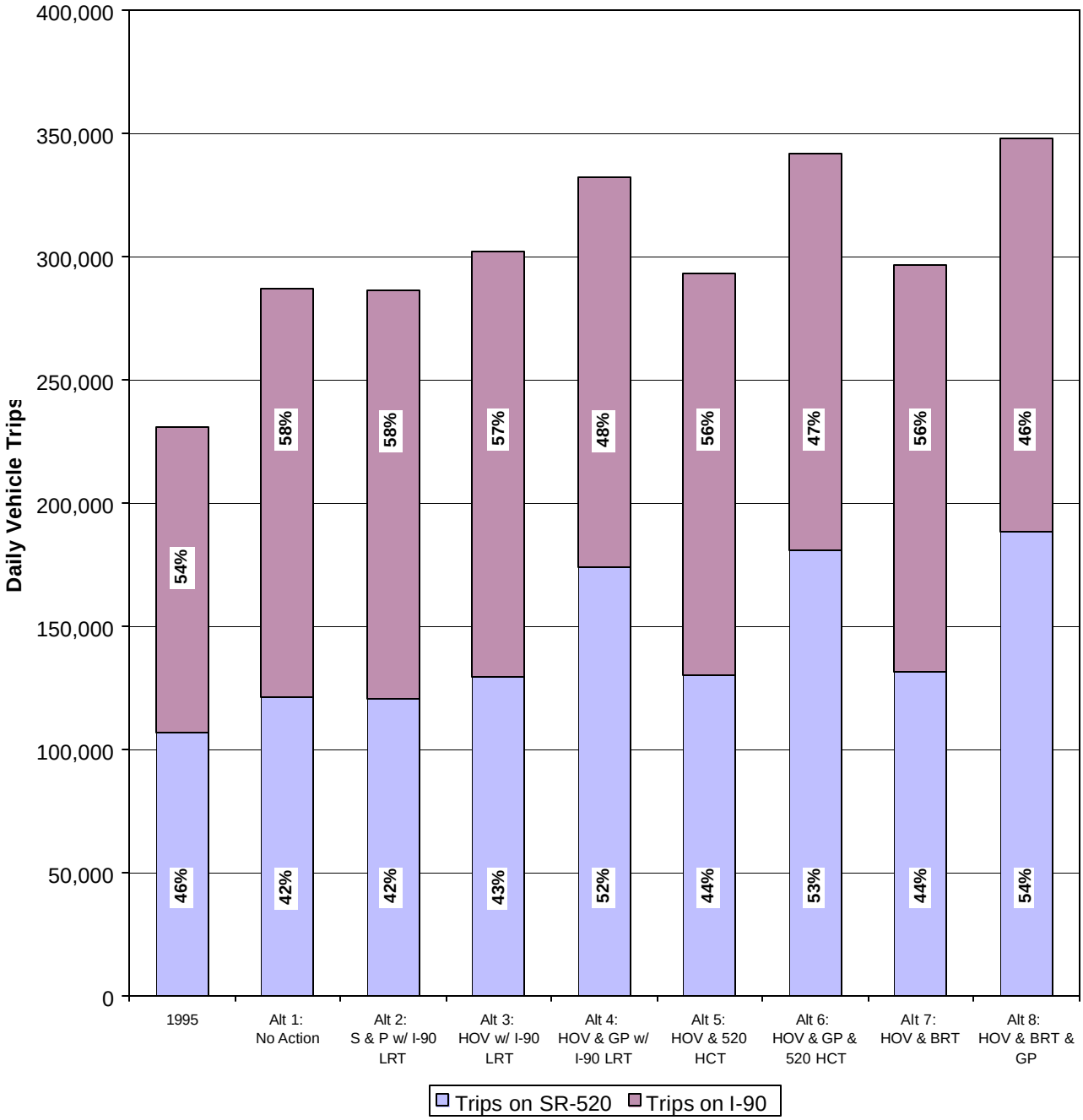
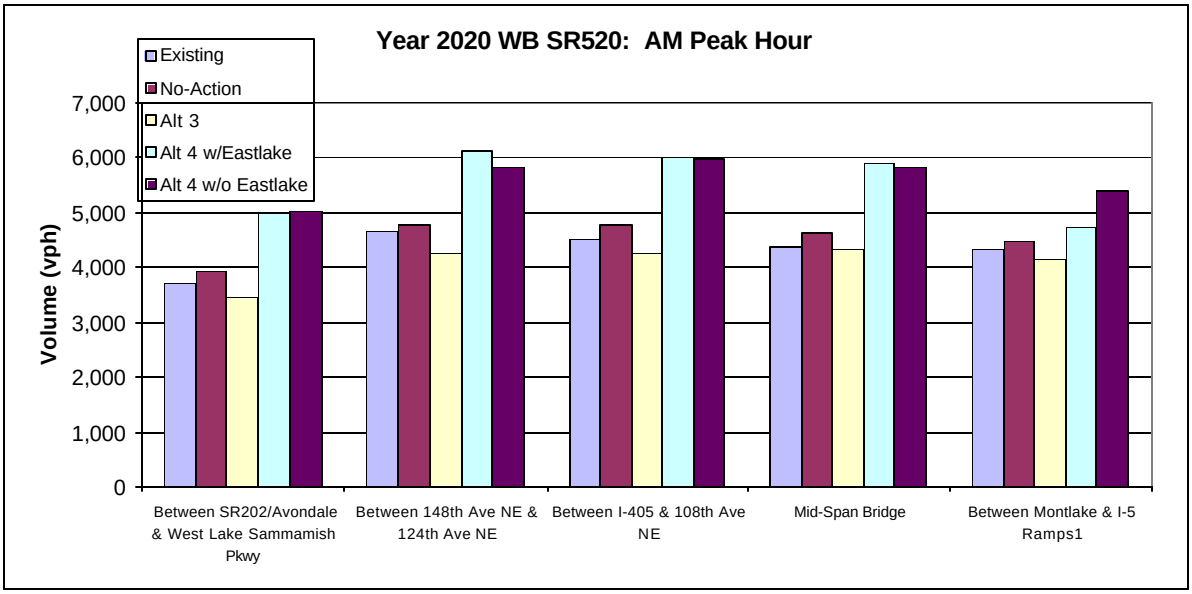


Figure 2-3
Peak Period SR 520 General Purpose Vehicle Volumes (AM)



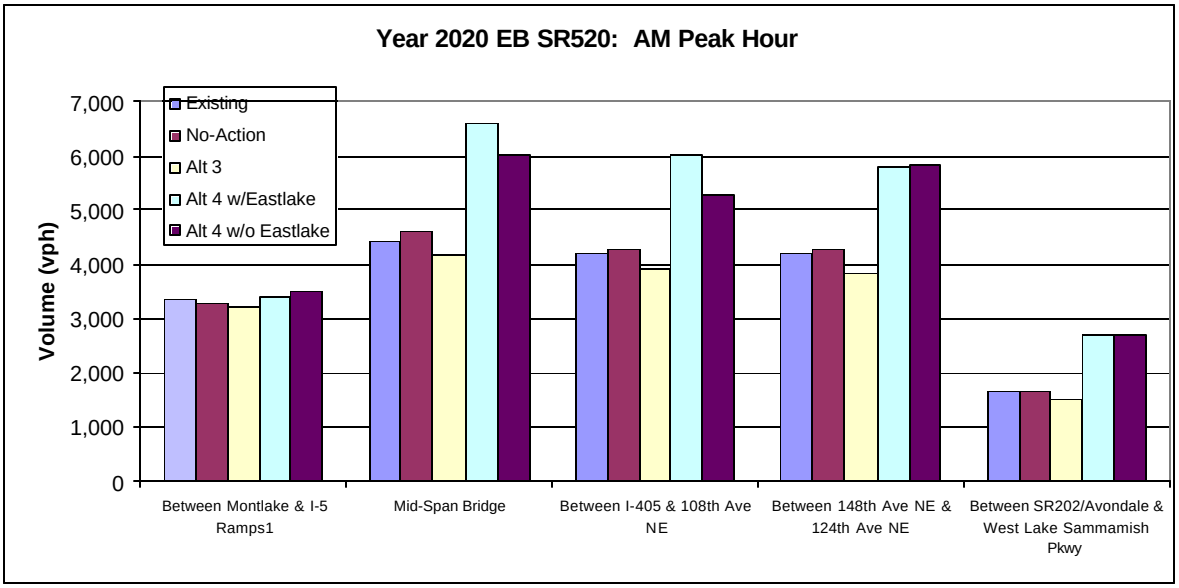
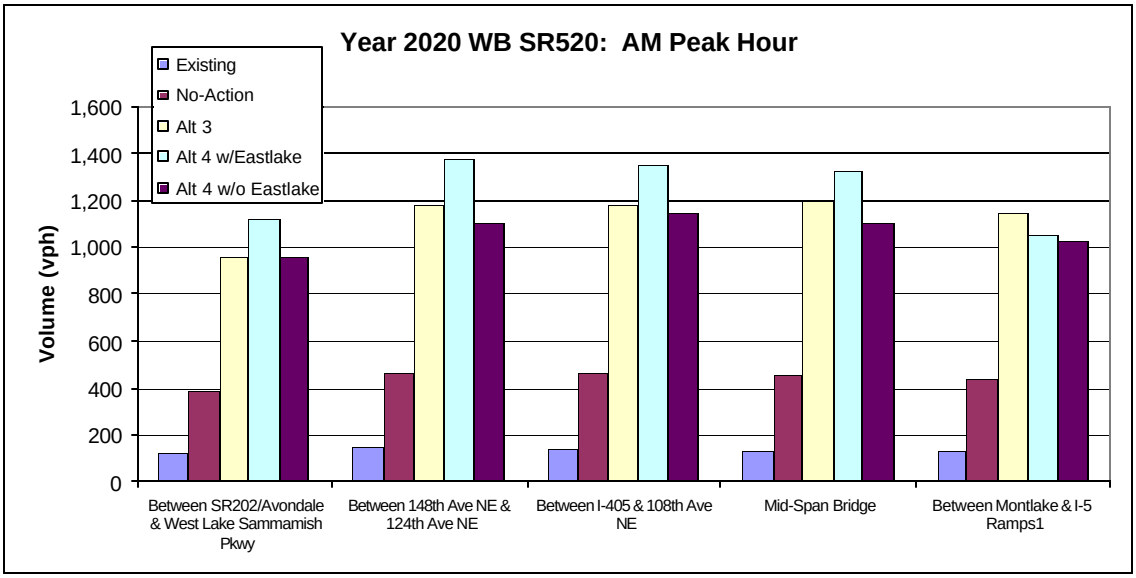


Figure 2-4
Peak Period SR 520 HOV Vehicle Volumes (AM)



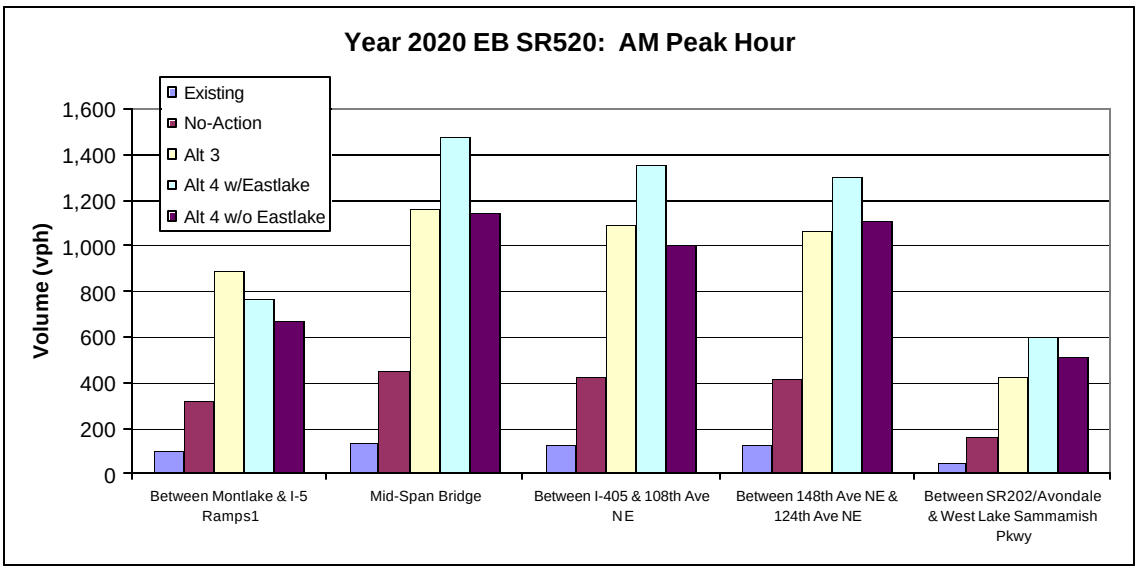


Table 2-3. Daily Trans-Lake Vehicle Volumes by Alternative, Facility, and Mode

Facilities	1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
SR 520									
Non-HOV	82,600	89,900	86,700	88,800	124,600	89,100	128,200	90,200	134,200
Commercial	23,700	29,600	29,600	29,500	37,600	30,100	40,000	30,400	41,600
HOV (3+)	700	4,800	4,200	11,100	11,900	11,200	12,900	11,100	12,300
Total Vehicle Trips	107,000	121,300	120,500	129,400	174,100	130,400	181,100	131,700	188,100
I-90									
Total Vehicle Trips	124,100	165,700	165,600	172,300	158,100	162,800	160,600	164,600	159,800
Totals	**231,100**	**287,000**	**286,100**	**301,700**	**332,200**	**293,200**	**341,700**	**296,300**	**347,900**

Source: PSRC Regional Forecasting Model

Table 2-4. Traffic Volume Criteria Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	3	3	4	5	4	5	4	5

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

Alternative 1 (No Action) sets the baseline level of travel growth that would be expected on Trans-Lake corridors with no capacity improvements in 2020. Alternative 2 (SR 520 Safety and Preservation with I-90 HCT) is similar in terms of vehicle trips. Compared to 1995, the 121,300 vehicle trips in Alternative 1 for SR 520 would represent a nearly 13% increase. Interestingly, this is substantially lower than the 34% increase in traffic growth that I-90 is forecasted to experience by 2020. This would tend to reflect I-90's capacity to absorb additional traffic growth, while SR 520 is already over its capacity for much of the day. Compared to person-trip growth, vehicle-trip growth would occur at a slower rate in both corridors, in large part because no additional general purpose capacity is planned, and most of the person trips growth would be focused on transit and HOV.

As shown in Figure 2-3, total daily vehicle trips for SR 520 and I-90 combined in 1995 were about 231,000 on a typical weekday, with SR 520 carrying 46% of trips and 54% on I-90. By 2020, this would translate to an increase of approximately 24% compared to 1995.

For SR 520, existing traffic volumes on the corridor already exceed the available capacity during peak periods. For the No Action alternative, the growth in traffic would occur before and after traditional peak periods. For instance, in the AM peak period, the growth would most likely be earlier (prior to 6 AM) when the highway would still have available capacity. In the PM peak, growth would likely fill the minimal available capacity during mid-day hours and extend later into the evening (after 7 PM).

By 2020 with No Action, SR 520 would have 9 lower share of total vehicle person-trips across the lake, dropping from 46% in 1995 to 42% in 2020. Since SR 520 is now congested for many hours of the day, most of the growth in future daily vehicle trips across the lake would be outside the current peak periods of travel, and more growth would occur on I-90. Figure 2-4 shows the peak period volumes in more detail, but the spreading of the peak is shown in more detail under the congestion criteria discussion. As shown in Figure 2-4, growth in non-HOV vehicle trips across SR 520 during peak periods of travel is expected to be low since the facility has already reached its theoretical capacity and is congested for many hours of the day.

The key findings for the traffic volume criteria are:

- In Alternatives 1 and 2, which have no increase in SR 520 lane capacity, the daily vehicle volumes on SR 520 are similar, around 120,000 vph by 2020. This represents a 13 percent growth over the year 1995. The addition of an LRT line to the I-90 corridor (Alternative 2) does not substantially affect the number of daily vehicle trips. Although HCT encourages more people to switch to transit, vehicle trips remain steady because more trips are attached to the corridor as capacity becomes available. It is also important to note that all alternatives with LRT on 1-90 assume that HOV lanes would be placed on the outer roadways. If this did not occur and I-90 capacity is effectively reduced to 6 lanes, vehicle trips would be affected.
- When new HOV capacity is added on SR 520 in addition to the I-90 LRT (Alternative 3), the overall daily vehicle volumes across the lake increase by about 15,000 vehicles over no build, due to substantial increases in HOV 3+ vehicles, along with lesser increases in GP traffic. This reflects the movement of HOV vehicles from GP lanes to the HOV lane, and a smaller increase in GP vehicles to fill the available capacity.
- If GP and HOV lanes are added to SR 520, (Alternatives 4, 6 and 8), the total daily vehicle volumes across the lake would increase about 45,000 to 60,000. On SR 520, the highest traffic volumes would occur with Alternative 8 (SR 520 HOV with BRT connections and GP), which would have 188,100 daily vehicle trips on SR 520, or a 55% increase over No Action. The other 8-lane alternatives (Alternatives 4 and 6) would have similar traffic growth. The differences in traffic growth for the 8-lane alternatives appear to be related to design options that would provide general purpose access to the University District and to Fairview Avenue N./Eastlake Avenue N. The effect of HCT in

  the I-90 center roadway also affects traffic volumes across the lake, as reversible operations would cease and HOV lanes would be assumed on the outer roadways.
- If HCT is placed within the SR 520 corridor rather than the I-90 corridor (Alternatives 5-8) the proportion of daily vehicle volumes across the lake on SR 520 does not appear to

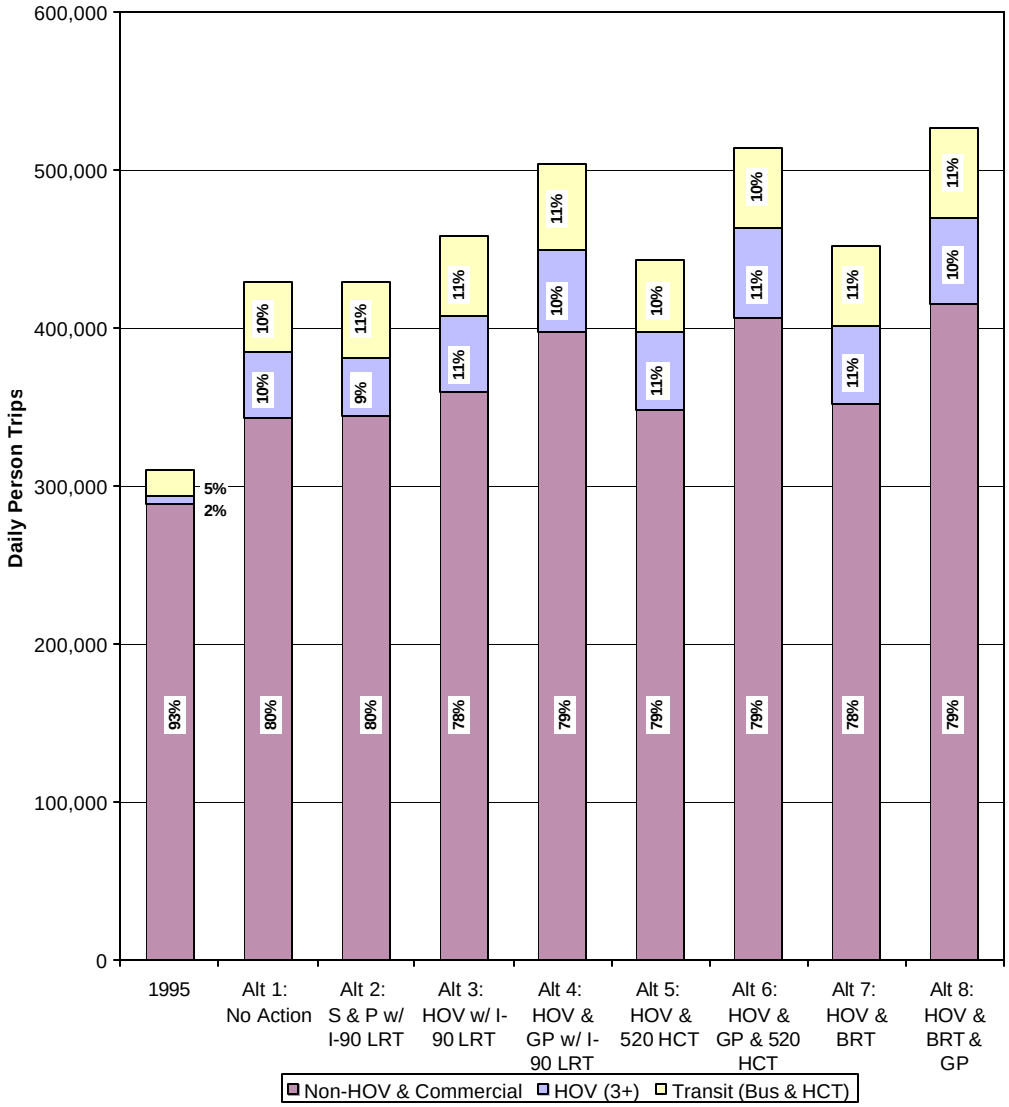
change significantly. As people switch from driving to transit, new vehicle trips are attracted to the corridor.

2.1.3 Mode Share

Criteria Definition: *The anticipated mode share of non-HOV (general purpose), HOV and transit will be quantified.*

The mode share analysis focuses on the percentage of trips made by mode for each of the alternatives. The percentages are drawn directly from the PSRC model person trip forecasts for the SR 520 and I-90 corridors combined. The results are charted in Figure 2-5, with more detail in Table 2-5.

Figure 2-5
Mode Share for Trans-Lake Person Trips
I-90 and SR 520 Corridors Combined



The most notable change in mode share is not in the alternatives being considered for 2020, but in the change from 1995 to 2020. For the "No Action" alternative, the daily transit mode share across the lake would double from 5% in 1995 to 10% in 2020, while HOV 3+ mode share is forecasted to increase five-fold from 2% to 10%. The increased use of transit and HOV in No Action would result from increased congestion for travel across the lake, the travel time advantages provided by existing HOV facilities in the SR 520 and I-90 corridors, and other changes in the "baseline" transit system. However, these forecasted increases for the No Action alternative could be considered optimistic as they do not fully account for the effect of low reliability and variable travel times for HOV and transit using highly congested GP lanes

The key findings for mode share are:

- For Alternatives 1 and 2 (no additional lanes on SR 520), and for Alternatives 3, 5, and 7 (adding HOV lanes on SR 520), most of the future growth in trips would be focused on increased use of transit or carpools/vanpools. A relatively small amount of growth would be by non-HOV/commercial, and most of this growth would occur on I-90.
- The proportion of HOV and transit trips to all forecasted trips remains relatively constant for all 2020 alternatives, although total trips across the lake increase substantially compared to No Action.
- None of the alternatives would reduce the volume of non-HOV/commercial trips compared to No Action, but they would reduce the proportion of all trips that are made by non-HOV/commercial vehicles. The change in mode share comes from the amount of additional HOV and transit use that would occur with all alternatives.
- The alternatives that would add HOV lanes to SR 520 (Alternatives 3, 5 and 7) would have the highest shares for HOV as a percentage of all trips, but it is within one percent of the 8-lane alternatives.
- All of the 8-lane alternatives (Alternatives 4, 6 and 8) would decrease the percentage of non-HOV/commercial trips compared to No Action. However, as noted above, they would result in substantially higher non-HOV/commercial volumes than No Action or the 6-lane alternatives. Because the 8-lane alternatives include HOV and transit improvements, more people would be forecast to use these modes as well, so the proportionate share of non-HOV/commercial remains similar to alternatives without a general purpose lane addition.
- Daily transit mode share is very consistent across all the alternatives, although there are minor decreases (less than 1%) when a GP lane is added to SR 520 (comparing Alternatives 3,5 and 7 to Alternatives 4,6 and 8).
- The forecasts show noticeable changes in mode share for the I-90 corridor. Transit use increases substantially on I-90 with Alternatives 2 through 4, as I-90 is used for HCT and the majority of east/west transit users are focused to I-90 (dropping the usage levels on SR 520). The use of HOV in I-90 is affected by assumptions for the center roadway's operation with or without HCT, and by the addition of HOV lanes on SR 520, which attracts more carpool/vanpool users to the SR 520 corridor.

Table 2-5
Daily Mode Shift Summary
Based on Year 2020 Daily Person Trip Forecasts

Facilities	1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
SR 520									
Non-HOV	76.0%	63.1%	66.6%	58.9%	63.5%	55.9%	60.5%	55.8%	60.8%
Commercial	16.4%	16.2%	17.1%	14.7%	14.4%	14.2%	14.2%	14.1%	14.2%
HOV 3+	1.6%	8.3%	7.7%	17.4%	14.4%	16.6%	14.4%	16.3%	13.2%
Transit	6.0%	12.4%	8.6%	9.0%	7.8%	13.3%	10.9%	13.8%	11.8%
I-90									
Non-HOV	77.6%	66.2%	63.9%	67.4%	66.5%	70.9%	70.4%	70.1%	69.1%
Commercial	16.4%	14.3%	13.8%	14.8%	13.4%	15.3%	15.0%	15.1%	14.7%
HOV 3+	1.6%	10.5%	9.3%	5.3%	6.0%	6.5%	6.6%	6.1%	6.8%
Transit	*4.4%*	*9.0%*	*13.0%*	*12.5%*	*14.1%*	*7.4%*	*7.9%*	*8.7%*	*9.4%*

Source: PSRC Regional Forecasting Model

Table 2-6. Mode Share Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	3	3	3	3	3	3	3	3

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

2.1.4 Transit Ridership

Three measures for transit ridership are used in the analysis of multimodal alternatives: regional transit ridership, study area transit ridership, and ridership by subarea. The forecasts for transit are charted in Figure 2-6. Tables 2-7 and 2-8 have more detail on the ridership forecasts.

Figure 2-6
Daily Transit Ridership Forecasts
SR 520 and I-90 Transit Ridership

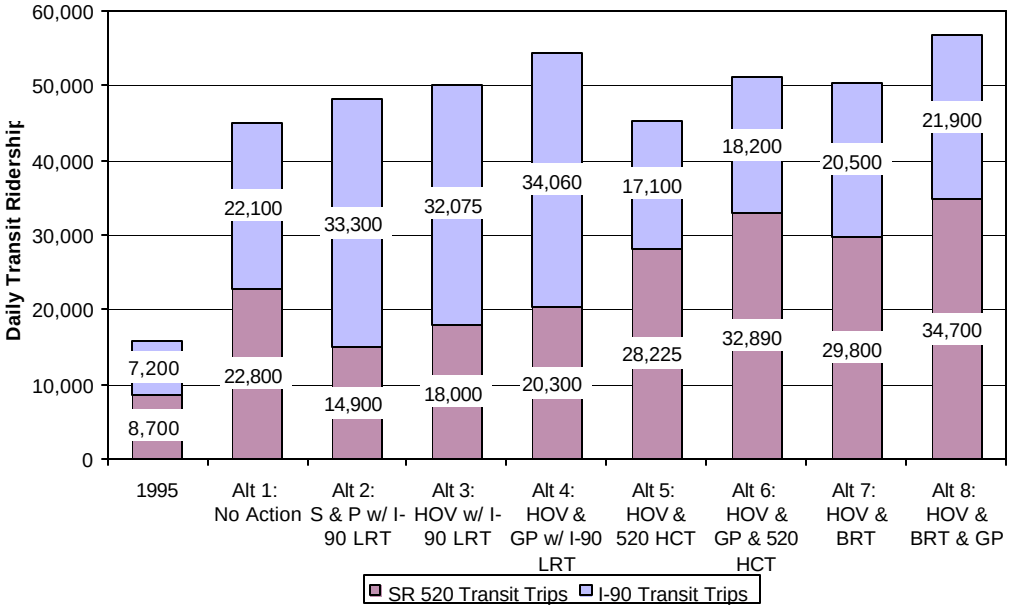


Table 2-7. Daily Transit Trip Forecasts

Facilities	1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & 520 HCT	Alt 6: HOV & GP & 520 HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
SR 520									
Bus Transit	8,700	22,800	14,900	18,000	20,300	700	700	--	--
HCT	--	--	--	--	--	27,525	32,190	29,800	34,700
All Transit	8,700	22,800	14,900	18,000	20,300	28,225	32,890	29,800	34,700
I-90									
Bus Transit	7,200	22,100	3,600	3,400	3,500	17,100	18,200	20,500	21,900
HCT	--	--	29,700	28,675	30,560	--	--	--	--
All Transit	7,200	22,100	33,300	32,075	34,060	17,100	18,200	20,500	21,900
All Cross-Lake Routes									
Bus Transit	15,900	44,900	18,500	21,400	23,800	17,800	18,900	20,500	21,900
HCT	--	--	29,700	28,675	30,560	27,525	32,190	29,800	34,700
All Transit	15,900	44,900	48,200	50,075	54,300	45,325	51,090	50,300	56,600
Regional System Total									
Transit	281,553	652,710	659,826	656,748	652,710	651,426	648,048	655,288	653,048

Table 2-8. Peak Period Transit Volumes

Facilities	1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & 520 HCT	Alt 6: HOV & GP & 520 HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
SR 520									
Transit	3,100	8,300	5,400	6,400	7,200	9,130	10,651	10,400	12,000
I-90									
Transit	2,800	7,400	11,200	10,790	11,630	6,300	6,300	6,900	7,400
All Cross-Lake Routes									
Transit	5,900	15,700	16,600	17,190	18,830	15,430	16,951	17,300	19,400

Table 2-9. Transit Ridership Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	2	3	4	4	3	4	4	4

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

Overview of Transit Ridership Forecasts

Daily Trans-Lake ridership in 1995 was about 16,000 in the model, representing a mode share of about 5% of total cross-lake person trips. By 2020, under the "No Action" alternative, this is expected to increase to about 44,000, a 65% increase, and a doubling of transit's mode share.

In 2020, the alternative with the highest cross-lake transit ridership forecasts is Alternative 8 (SR 520 HOV / BRT+GP), with 63,400 total transit trips per day. Alternative 7, which also provided BRT, had relatively high ridership for a 6-lane SR 520 configuration, but the forecasts were similar to Alternative 3, which would provide HCT on I-90.

The alternative with the lowest daily cross-lake transit ridership in 2020 is Alternative 2 (Safety/Reliability and Preservation with I-90 HCT), at 48,900 per day. The next lowest is Alternative 5 (SR 520 HOV plus HCT), at 49,425 per day.

Alternative 8 achieved high ridership forecasts in part because of its two-corridor service strategy, which balanced service on I-90 and SR 520. Alternative 8 also had higher overall person trips and vehicle trips due to the 8-lane SR 520 and its new access options to University District and Eastlake. The model assumed that the increase in total trips would also result in a proportionate increase in transit ridership.

Ridership for the BRT alternatives (Alternatives 7 and 8), could be viewed as optimistic at this point, because they could be negatively affected by reliability, as well as operating constraints. In particular, there are long term challenges for operating BRT on downtown Seattle and University District streets. If buses are subjected to large and unpredictable delays as a result of congestion in the Seattle CBD and/or the University District, BRT would be less likely to attract and accommodate the levels of ridership forecast. The BRT options may also require significant additional improvements to allow reliable bus operations in the Seattle CBD and the University District.[4] Outside of the University District and downtown Seattle, the BRT vehicles are also expected to share lanes with HOVs, which could negatively affect travel speeds and reliability if the HOV lanes become congested.

Other observations for the transit forecasts are:

- Daily 2020 Trans-Lake transit ridership for the build alternatives ranges is forecasted to range from 45,000 to 57,000, or 0% to 23% higher than the "No Action" alternative.
- In general, the alternatives with the SR 520 Fixed Guideway alignment have lower cross-lake ridership (about 45,000 and 51,000 per day), and the I-90 Fixed Guideway and SR 520 BRT alternatives have higher levels of ridership (between 50,000 and 57,000 per day). It appears that the longer westside HCT alignment associated with Alternatives 5 and 6 result in less attractive transit service for cross-lake trips. Also, the I-90 LRT alternatives improve the frequency of service for the Central Link route, due to through routing of trains between Northgate and the Eastside, which increased ridership in the downtown tunnel stations and Capitol Hill. (See Table 2-9 for more detail on station boardings.)

2.1.5 HCT Boardings

Criteria: *Transit boardings for each Trans-Lake alternative will be quantified, including the added boardings on stations for the Central Link LRT system.*

Because this criteria involves a combination of Trans-Lake as well as all-east or all-west transit usage, the results are provided without an additional ranking. On the Eastside, most of the alternatives had similar ridership levels at both the station area and the total eastside levels. The areas with the largest boardings were in downtown Bellevue, South Bellevue, both areas that would also have high rates of transfers. The boardings for Redmond remained relatively constant (highest for Alternative 8, which would include BRT and an 8-lane SR 520). Kirkland boardings fluctuated, but this in large part reflects transfer activity in South Kirkland

[4] The No Action alternative bus volumes approach the estimated operating capacity for transit on the downtown and University District surface streets in 2020, and there would be little to no room for future growth. Accommodating the additional volume of buses from BRT alternatives would likely require actions such as peak period restrictions on Third Avenue, join bus/rail operations in the DSTT, or bus intercept terminals.

Table 2-10. Trans-Lake Daily HCT Station Boardings

Station	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
Westside Station Areas								
Northeast Seattle		4,100	4,100	4,100				
University District		6,500	6,500	6,500	17,200	17,200	9,700	12,100
Capitol Hill/First Hill		11,100	11,100	11,100				
Downtown Seattle		28,900	28,900	28,900	10,400	10,400	17,000	17,900
South Seattle		1,300	1,300	1,300	400	400		
Seattle Center /S Lake Union					12,300	12,300	2,800	2,800
North Seattle					12,400	12,400		
HCT West Side Totals		**51,900**	**51,900**	**51,900**	**52,700**	**52,700**	**29,500**	**32,800**
Eastside Station Areas								
Mercer Island		2,300	2,300	2,300				
South Bellevue		5,900	5,900	5,900				
Central Bellevue		10,300	10,300	10,300	9,900	11,000	9,000	9,600
Kirkland		2,300	2,300	2,300	9,600	10,500	7,000	7,300
Evergreen Point					1,200	1,300	1,600	1,800
Redmond		5,500	5,500	5,500	5,200	5,800	6,200	6,900
HCT East Side Totals		**26,300**	**26,300**	**26,300**	**25,900**	**28,600**	**23,800**	**25,600**
East and West Side Grand Totals		**78,200**	**78,200**	**78,200**	**78,600**	**81,300**	**53,300**	**58,400**

Source: PSRC Regional Forecasting Model

Seattle boardings were more complex to evaluate because they reflect Central Link service changes as well as the effects of added east/west service. Downtown Seattle boardings increased with all HCT alternatives. The highest increases were with I-90 routes, which would increase the frequency of Central Link stations from the International District station to Northgate, improving ridership.

The fixed guideway alternatives across the lake (Alternatives 2 through 6) appeared to increase overall boardings at Central Link stations in the downtown Seattle transit tunnel. The BRT alternatives did not have that effect, and resulted in the lowest levels of combined boardings for East and West side.

2.1.6 Vehicle Miles Traveled and Vehicle Hours Traveled

Criteria Definition: *Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT)—Daily, VMT and VHT within the Trans-Lake Washington study area will be quantified.*

Estimates of future daily vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) were directly output from the regional traffic model. Although several variants of this value were originally proposed (creating a per-person value), the results would be similar to daily VMT and VHT. In general, this criteria indicates whether the alternatives would have a substantial effect on overall transportation system performance.

Overall, the alternatives were similar to No Action at the regional level. See Table 2-11 for values and Table 2-12 for castings. The 8-lane alternatives (Alternatives 4, 6 and 8) are the only alternatives that would change VMT and VHT by any significant amount. With the 8-lane SR 520, VMT increases 2.5% to 2.7% in the study area, while VHT increases 1.5 to 2.2 percent. This suggests that average trip lengths areawide would increase, but average travel times would be lower, reflecting congestion relief and/or shorter in-vehicle times per trip and/or the benefits of ridershare and transit use. The 6-lane alternatives (Alternatives 3, 5 and 7) would result in minor increases in VMT, indicating a small increase in distance traveled, and/or a reduction in the number of vehicles used per person to make the trip. Alternatives 3 and 5 also reduce VHT, which indicates shorter trips and/or improvements in travel times. The ratings assume that lower VMT and VHT are better.

Table 2-11. Study Area and Regional Vehicle Miles Traveled/Vehicle Hours Traveled

VMT and VHT	ALTERNATIVES								
	1995	Alt 1 No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & 520 HCT	Alt 6: HOV & GP & 520 HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
Study Area									
Vehicle-Miles Traveled	15,215,000	20,198,000	20,743,000	20,205,000	20,743,000	20,238,000	20,703,000	20,283,000	20,743,000
% change*		32.8%	2.7%	0.0%	2.7%	0.2%	2.5%	0.4%	2.7%
Vehicle-Hours Traveled	535,000	1,021,000	1,043,000	1,010,000	1,043,000	1,016,000	1,038,000	1,028,000	1,036,000
% change*		90.8%	2.2%	-1.1%	2.2%	-0.5%	1.7%	0.7%	1.5%
Regional									
Vehicle-Miles Traveled	69,523,000	100,596,000	101,060,000	100,556,000	101,060,000	100,611,000	101,046,000	100,643,000	101,058,000
% change*		44.7%	0.5%	0.0%	0.5%	0.0%	0.4%	0.0%	0.5%
Vehicle-Hours Traveled	2,293,000	3,943,000	3,966,000	3,932,000	3,966,000	3,939,000	3,963,000	3,951,000	3,958,000
% change*		72.0%	0.6%	-0.3%	0.6%	-0.1%	0.5%	0.2%	0.4%

* The No Action % change is compared to 1995. The alternatives % change is compared to No Action.

Table 2-12. VMT/VHT Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	3	3	4	3	4	3	4	3

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, at reducing VMT/VHT	Low Effectiveness	Medium Effectiveness	Increased Effectiveness	Most Effective at reducing VMT/VHT

2.1.7 Travel Time

Criteria Definition: *How effective are overall point to point travel times for each alternative and travel mode? The origin-destination (O-D) pairs selected for the analysis will be the same for all alternatives. This will include calculation of weighted average travel times. O-D pairs will include those crossing Lake Washington and some exclusively on the east or west side of Lake Washington (e.g., Capitol Hill to University District on the west side or downtown Bellevue to downtown Kirkland on the east side).*

Travel time forecasts were obtained directly from the PSRC model. The times are provided for travelers using highways (Table 2-13), HCT or bus transit.

The average travel time for highways is for all travelers during the PM peak period between two points, using any combination of routes, which could include SR 522, SR 520, and I-90, as well as local streets. *Particularly for GP travel, the times do not fully reflect the cumulative delays of high traffic congestion, including delays at bottlenecks or interchanges.* However, the travel times provided below give a reasonable comparison of the relative benefits of the Trans-Lake alternatives by location, and among various modes of travel.

For comparing travel times due to changes to the SR 520 corridor, the Redmond/Seattle pairing was considered the most reliable indicator, since more travelers between those points use SR 520. However, other combinations were also reviewed for changes that would indicate a substantial difference among alternatives.

HOV and transit vehicles consistently have travel times 25 to 30 percent faster than non-HOV vehicles for all alternatives, or up to 10 minutes faster. All of the alternatives with HOV lanes (Alternatives 3, 5 and 7) and no new general purpose lanes would provide travel time savings of up to 3 to 5 minutes for HOV travelers, compared to a Alternative 1 (No Action) (using a representative Seattle and Redmond trip). These alternatives do not notably improve travel times for non-HOV vehicles.

Table 2-13. Trans-Lake Travel Time Comparison
Weighted Average PM Peak Period Travel Time (minutes) Between Designated Districts

(Year 2020 Forecasts for all available highway routes incl. SR 520, I-90 and SR 522, and for bus, HCT and BRT routes. Transit times are for in-vehicle travel only.)

District-to-District Pair		1995	Alt 1 No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/ I-90 LRT	Alt 5: HOV & 520 HCT	Alt 6: HOV & GP & 520 HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
Downtown Seattle to Bellevue	GP	29.5	32.4	32.3	32.7	29.3	32.3	31.6	32.7	31.5
	HOV	25.7	25.2	25.0	23.8	23.1	24.4	24.0	24.4	24.4
	Transit	25.9	24.1	25.1	24.3	24.4	23.3	23.4	23.7	23.9
Downtown Seattle to Redmond	GP	37.4	44.8	44.6	45.0	41.0	44.6	43.0	44.9	42.8
	HOV	33.7	35.3	35.0	31.1	31.3	32.6	31.4	32.6	32.7
	Transit	38.8	37.4	39.0	36.8	36.8	35.1	35.2	35.8	36.6
Downtown Seattle to Issaquah	GP	38.8	44.1	44.0	44.4	41.1	43.9	43.6	44.4	43.6
	HOV	35.8	37.7	37.5	37.4	36.4	37.7	38.0	37.7	37.9
	Transit	37.2	31.2	33.7	33.7	33.6	30.9	30.9	31.0	31.0
Downtown Seattle to Kirkland	GP	32.0	37.3	37.1	37.5	34.5	37.2	36.4	37.5	36.1
	HOV	29.5	30.1	29.9	25.7	25.8	27.4	26.1	27.3	27.4
	Transit	31.2	31.1	30.7	26.8	26.7	27.1	27.3	28.9	29.0
University District to Redmond	GP	34.2	41.5	41.3	42.0	38.1	41.4	37.9	41.8	38.7
	HOV	33.4	36.9	36.8	29.8	30.1	29.6	29.2	29.6	29.4
	Transit	32.6	31.1	33.8	30.3	30.3	26.3	26.6	26.0	26.7

% change compared to No Action.

Alternatives 4, 6 and 8, which would provide HOV and general purpose lane additions, would also improve travel times for general purpose vehicles as well as for HOV travel. In particular, Alternative 4 (SR 520 HOV+GP and I-90 LRT) would improve travel times for general purpose travelers by nearly 10%, or by nearly 4 minutes. Again, however, these savings do not fully reflect the delays at bottlenecks or interchanges.

Transit travel times were competitive with general purpose travel times for most alternatives and most locations. For the most part, all of the alternatives offered the same advantages in terms of HOV facilities, the location of transit, and transit travel times. The areas most likely to be affected by changes in transit travel time were located to the north of SR 520 or to the south or east of I-90, where transfers or longer routes would be involved.

Ratings were not assigned to this criterion because the results tended to have benefits that differed by area and mode, and showed no substantial trend.

2.1.8 Total Hours of Delay

Criteria Definition: *How effective is the alternative at reducing total person hours of delay compared to the No Action alternative?*

To be provided as an addendum in mid-June.

2.1.9 Traffic Congestion

Criteria Definition: *Volume/capacity (v/c) ratios for the AM- and PM-peak-period will be*

calculated and compared at the 10 to 15 locations where year 2020 traffic volume forecasts are available.

To be provided as an addendum in mid-June.

2.1.9.1 Congestion on Local Streets

To be provided as an addendum in mid-June.

2.1.9.2 Vehicle Queue Lengths

Criteria Definition: *Average and maximum vehicle queue lengths for the AM- and PM-peak-period will be quantified for each alternative on freeway and principal arterial links within the Trans-Lake Washington study area*

To be provided as an addendum in mid-June.

2.1.9.3 Travel Demand Reduction

Criteria Definition: *The anticipated AM-peak-period, PM-peak-period, and daily travel demand reduction will be quantified for each alternative.*

Table 2-14. Travel Demand Reduction Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	3	4	4	2	4	2	4	2

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

This criteria focuses on the overall effects of the alternatives in influencing travel demand, based on the model forecasts developed for the project. It does not reflect additional benefits of travel demand management strategies, which are discussed in more detail in the Transportation Demand Management Element Technical Report.

The primary factors used in this criteria rating were traffic volumes, VMT/VHT and mode split criteria, all of which provided an initial indication of the influence that each of the alternatives would have on travel behavior in the corridor.

As noted in the person throughput, mode split and transit ridership criteria discussions, the forecasts for all of the alternatives have large increases in the number and percentage of people who will be traveling by HOV or transit by 2020, compared to 1995.

All of the alternatives would provide key infrastructure and transit service improvements needed to help Trans-Lake reduce drive-alone trips. As a result, all alternatives increased the numbers of total trips made by HOV and transit. All of the alternatives would also support increased investment in TDM.

The greatest increase in HOV and transit usage in percentage terms was with Alternatives 3, 5 and 7. These alternatives had the most competitive travel times for HOV lanes and transit, compared to general purpose travel, and they had the lowest increases in the use of non-HOV vehicles.

Alternatives 4, 6 and 8 also increased the number of people using transit and HOV, but there was also large increase in the proportion and volume of general purpose vehicles. In reducing total vehicles, these alternatives would be least effective. However, the improvements in transit and HOV facilities and usage provide an alternative to driving alone. They also tended to focus more travel on the SR 520 corridor, where it has a strong potential to be influenced by focused TDM programs.

All of the alternatives could further improve their trip reduction performance by imposing costs tied to the usage of the corridor. A separate evaluation paper addresses pricing strategies in more detail, but previous estimates have stated that up to 6% of vehicle trips could be eliminated through the use of tolls or other costs to the transportation user.

2.2 RELIABILITY AND SAFETY CRITERIA

2.2.1 Exclusive/Non-Exclusive Right-of-Way

Criteria Definition: *How much of the alternative is located within exclusive versus non-exclusive right-of-way? (This will be evaluated only for alternatives with an HCT component.)*

This criterion reflects a basic difference between the HCT and the BRT alternatives. Alternative 1 does not provide additional rights-of-way for HCT. Alternatives 2 through 6 provide exclusive rights of way for HCT on either a SR 520 or I-90 route. Alternatives 7 and 8 would have BRT on HOV lanes for most of the corridor, and a busway to downtown Seattle.

Table 2-15. Reliability and Safety Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	4	5	5	5	5	3	3

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

2.2.2 Safety

Criteria Definition: *How effective will the alternative be in minimizing traffic accidents?*

Table 2-16. Safety Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	2	3	4	3	4	4	5

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

As full design standards are assumed for Alternatives 2 through 8, they would all achieve higher safety ratings than the No Action alternative, which would leave the corridor unchanged. Many segments of the current corridor lack shoulders and have geometric features that would not meet current design standards.

Alternative 2 receives the next lowest rating because it would have limited improvements to the corridor. The bridge and viaducts across Lake Washington and Portage Bay would be improved and full shoulders are assumed, but no other major improvements would occur in the highway corridor. The HCT component of the alternative would be rated high because of its exclusive right of way, the same as the HCT component of Alternatives 3 through 6.

Alternatives 3 and 5 would further improve safety in the corridor by completing the HOV lanes, adding shoulders, and through other geometric and functional improvements, particularly approaching interchanges. The safety rating is lower than 8 lane alternatives because the expected levels of congestion in the two general purpose lanes would have vehicles in those lanes moving much more slowly than HOV vehicles. Although all alternatives would have congested general purpose lanes, the 6-lane alternatives would have congestion for longer periods of time compared to the 8-lane alternatives.

Alternative 7, which includes BRT operations in a 6-lane SR 520, had the highest rating for 6-lane alternatives. It would add an additional 4-foot buffer between the HOV and GP lanes, reducing the degree of friction between HOV / BRT and other vehicles. This improvement would be offset slightly by the higher volumes of transit vehicles on SR 520, compared to HCT

on an exclusive right of way.

Alternatives 4 and 6 also were rated for increased safety, similar to Alternative 7. The rating reflects the relative benefits to congestion offered by three general purpose lanes each way, compared to two. Although congestion will still occur in general purpose lanes, the congested periods would be shorter than a 6-lane corridor, and would reduce the potential for conflicts between HOV and general purpose vehicles.

Alternative 8, with BRT operations in an 8-lane SR 520, had the highest rating overall. As with Alternative 7, it would add an additional 4-foot buffer between the HOV and GP lanes, reducing the degree of friction between HOV / BRT and other vehicles. This improvement would be offset slightly by the higher volumes of transit vehicles on SR 520, compared to HCT on an exclusive right of way.

Alternatives 3 through 8 feature direct access options for HOV and transit vehicles, including at I-405, S. Kirkland park-and-ride and other locations. These options offer a substantial safety (as well as travel time) benefit to HOV and transit vehicles, which would otherwise move through general purpose lanes to enter and exit.

2.2.3 Travel Time Reliability

Criteria Definition: *How reliable is the travel time during different times of the day and year for both person and freight movement. This will qualitatively address how different design features associated with each alternative may affect the reliability of travel time from day to day.*

Table 2-17. Travel Time Reliability Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	2	3	4	3	4	2	3

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

For the reliability criteria, there was less of a difference among the different alternatives when the relative benefits to each of the modes was considered. The discussion below is first by mode, and then secondly applied to the total rating for each of the alternatives.

The alternatives (Alternatives 3 through 8) that provided continuous HOV lanes in each direction on SR 520 would offer a substantial improvement in travel time reliability to bus transit and HOV users.

The general purpose lanes, which would include commercial and freight traffic, would have

significant levels of congestion for all alternatives, which would result in lower travel time reliability across the board, compared to transit or HOV. However, the rates of congestion in general purpose lanes would be worst with Alternatives 1 and 2, which offer no additional lanes to the corridor (neither HOV nor GP). Conditions would improve with an additional HOV lane, which would move HOV and transit from HOV lanes. An additional improvement would occur with the 8-lane alternatives. However, the forecasts and subsequent analysis show that congestion remains substantial because additional trips are attracted to the corridor when additional capacity is provided. Although GP congestion levels remain high for all alternatives, the 8-lane alternatives would carry more vehicles during the congested periods, and the periods of congestion would be somewhat shorter for an 8-lane SR 520 than for 6 or 4 lane corridors.

High Capacity Transit would have higher reliability levels, particularly when the corridor is in an exclusive right-of-way (as it is in Alternatives 2 through 6). Travel times would be very predictable with high frequency HCT service, and the service would not be vulnerable to incidents or congestion on the roadway. The BRT alternatives (Alternatives 7 and 8) would have an additional 4 foot buffer between the HOV, which would offer an improvement in reliability compared to HOV alone. However, they would be considered less reliable than HCT in an exclusive right of way. On SR 520, incidents or congestion on the highway could still affect BRT. In addition, initial analysis indicates that BRT reliability would suffer as buses move through downtown Seattle and the University District, where on-street capacity for buses would be near capacity in 2020. (See transit ridership for more discussion.)

When considered cumulatively:

- Alternative 1 would result in the lowest rating due to the lack of reliability for all modes.
- Alternative 2 would be rated the next lowest, with a slight improvement for HOV or GP reliability, and a high rating for its HCT element, which would operate on the I-90 center roadway and then on other exclusive rights of way.
- Alternative 7 also had a low rating, reflecting the lower reliability for BRT on SR 520 and in areas with limited capacity for bus operations, such as downtown Seattle and University District; HOV reliability would be improved over Alternatives 1 and 2, and slightly better than other alternatives with HOV alone because of the additional buffer between GP and HOV lanes.
- Alternatives 3 and 5 had moderate improvement ratings, as they would improve HOV reliability and also have exclusive routes for HCT, but they would not markedly improve reliability for GP travel (still a substantial share of all travel).
- Alternative 8 also had a moderate rating, reflecting the benefit of addition of GP lanes but the lower rating for BRT. The issues for BRT are the same as noted for Alternative 7.
- Alternatives 4 and 6, which would improve conditions for transit, HOV and commercial/GP travelers, had higher ratings, comparatively.

2.2.4 Incident Management

Criteria Definition: *The extent to which the alternative maintains travel speeds in the SOV and HOV lanes after an incident will be summarized and compared.*

Table 2-18. Incident Management Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	2	3	4	3	4	3	4

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

This rating remains a qualitative assessment based on major physical factors assumed in the alternatives definition, as well as travel forecasts. Operating conditions at specific locations in the corridor were not considered in as much detail at this stage, but they would be factors in an EIS analysis. With the exception of BRT, the HCT component of the alternative was considered an even factor for the alternatives, with the same rating for all fixed guideway alternatives.

Overall, the ratings resemble those of the safety criterion, reflecting the addition of shoulders and/or buffers along the corridor, which would improve incident recovery times.

Alternative 1 received the lowest rating, as it would offer no corridor improvements. Alternative 2 received the next lowest rating because it would have limited improvements to the corridor. Alternatives 3 and 5 and 7 would further improve incident recovery because they would complete the HOV lanes, adding shoulders and other geometric and functional improvements, particularly approaching interchanges. The 8-lane alternatives had the next highest ratings, reflecting the relative benefits offered by three general purpose lanes each way, compared to two, allowing more room for incident recovery and a higher ability to continue traffic movement.

2.3 SYSTEM COMPATIBILITY CRITERIA

The criteria in this section were also applied in the initial screening as well as the modal analysis stages, and they have already helped to narrow the alternatives to established corridors (SR 520 or I-90).

Although there are substantial differences among multimodal alternatives, they have many similar elements when considered at a system level. Except for Alternatives 1 and 2, which would not expand the corridor, all of the alternatives would complete the regional HOV system. All of the alternatives would also provide high quality transit services across the lake, serving largely the same transit markets. All of the alternatives would implement a TDM program. The major difference that affects policy and plan-related criteria would be the addition of general

purpose capacity across the lake, which offers benefits to some aspects of the system and conflicts with others.

2.3.1 Compatibility with Regional and Local Transportation Plans and Improvement Projects

Criteria Definition: *Is the alternative compatible with regional and local plans and planned transportation improvement projects?*

Table 2-19. Compatibility with Regional and Local Plans and Projects Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	2	5	3	5	3	4	2

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

The ratings primarily reflect the regionally planned programs included in the Puget Sound Regional Councils Metropolitan Transportation Plan and the update, Destination 2030. They also include Sound Transit's Sound Move Program and its Long Range Vision Plan, and WSDOT's Puget Sound Regional HOV System Plan.

Alternative 1 had the lowest ratings, reflecting no action to implement long standing regional and local plans to improve SR 520's transportation performance and to complete the regional HOV system plan. Alternative 2 had the next lowest rating, with no improvement to SR 520 but it would include I-90 HCT which would be consistent with the Sound Transit Long Range Vision. Alternative 3 would have the highest rating, as it would be consistent with regional plans that promote alternatives to non-HOV travel, and it would be consistent with Sound Transit's Long Range Vision. All of the alternatives with 8-lanes (including an added general purpose lane) were rated as slightly lower, although they would still support HOV travel. Alternative 3 had the highest rating, reflecting consistency with regional highway plans and with Sound Transit's long range system plan. Alternative 5 and 6 would require a change to Sound Transit's long-range vision, but, as defined, still meet the transit capacity requirements and objectives of the long-range vision. Alternatives 7 and 8 would have lower ratings because the BRT/HOV does not address long-range transit capacity constraints in downtown Seattle and the University District.

2.3.2 System Continuity

Criteria Definition: *Does the alternative maintain continuity and connectivity with the regional transportation system and eliminate or improve existing system bottlenecks?*

Table 2-20. System Continuity Ratings

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	1	4	3	4	3	3	2

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

The ratings reflect continuity for the HOV and HCT systems and for overall traffic continuity on the freeway system.

Alternatives 1 and 2 received the lowest ratings because they would not complete the regional HOV system, and would also represent a constraint for improving I-405 because there would be no additional receiving capacity on SR 520.

Alternatives 3, 5 and 7 all have higher ratings because they all would provide a continuous HOV connection across the lake, and they would have a greater ability to accept added travel related to I-405 improvements. The HCT routes are assumed to have a similar continuity ratings, regardless of whether they would be I-90 or SR 520. Although an I-90 HCT route is assumed in long range operating scenarios for Sound Transit's Central Link system, the SR 520 routes as defined would also provide continuity within the system. They would involve continuous service between the Eastside and downtown Seattle and they effectively connect with Central Link as well as other transit services. However, the effectiveness of Alternative 7's BRT element (as noted earlier) depends on the ability to address operating constraints on downtown Seattle and University District streets.

Alternatives 4, 6 and 8 would also have moderate ratings because they involve the same HOV and HCT components of Alternatives 3, 5, and 7, but the effect of added general purpose lanes is mixed. The general purpose lanes would offer the highest ability to address increased volumes from an improved I-405, but this would be offset by bottlenecks approaching I-5.

2.3.3 Compatibility with Statewide, Regional, and Local TDM and Land Use Plans and Programs

Criteria Definition: Is the alternative consistent with statewide, regional, and local TDM and land use goals and policies?

Table 2-21. Compatibility with Statewide, Regional and Local TDM and Land Use Plans and Programs.

1995	Alt 1: No Action	Alt 2: S & P w/ I-90 LRT	Alt 3: HOV w/ I-90 LRT	Alt 4: HOV & GP w/I-90 LRT	Alt 5: HOV & HCT	Alt 6: HOV & GP & HCT	Alt 7: HOV / BRT	Alt 8: HOV / BRT & GP
--	1	1	3	3	3	3	3	3

Rating Key

WORST				BEST
1	2	3	4	5
Least Effective, Most Impacts	Low Effectiveness, Medium Impacts	Medium Effectiveness, Low Impacts	Increased Effectiveness, No Impact	Most Effective, Improved Conditions

Alternatives 1 and 2 would be rated lowest because planned population and employment growth in the region would outpace cross-lake capacity, particularly on SR 520, which is already unable to meet current demand. The other alternatives are all rated similarly because they differ only in the choice of route for HCT and whether or not added general purpose capacity would be offered. The HOV and HCT elements would be consistent with plans at all levels. The general purpose lanes included in the 8-lane alternatives would have a mixed rating for compatibility on its own. The added general purpose lanes in Alternatives 4, 6 and 8 would be consistent with the levels of growth planned, and they are compatible with planning policies regarding effective commercial mobility. However, they are less compatible with regional and local planning policies that call for reduced reliance on general purpose travel.

3. ENVIRONMENTAL

4. COST ESTIMATES

The cost estimates are provided in three sections: 1) Capital Costs, 2) Annual Costs, and 3) Other Potential Costs,

- Capital costs represent the initial cost investment in the alternatives for construction and certain type of mitigation.
- Annual costs are those that will be incurred on a yearly basis. These costs include operation and maintenance for the alternatives. It also includes costs for the transportation demand management element. For comparison purposes, the costs for private vehicles caused through gas consumption and wear on the vehicles is also provided as an annual costs.
- Other costs refer to costs such as storm water, environmental mitigation, noise mitigation, and lidding. These costs are known to exist but the exact nature and impact is unknown in many cases. These costs can also vary greatly depending on future environmental regulations.
- Life cycle analysis examines all these different cost elements and looks at how these alternatives would be implemented to provide a way of comparing all the different cost elements. These different costs are summarized in Table 4-1.

4.1 CAPITAL COST

The Capital Cost Opinions provided in this report reflect a wide range of assumptions based on the preliminary information developed to date. These cost opinions represent the cost of construction in 2001 dollars. Capital cost may vary significantly due to changes in inflation, rate of construction and years of expenditure. Full design standards have been assumed for all the improvements. It is important to recognize that this is a planning-level cost opinion developed the different alternatives. Capital costs are developed here for use in the Life Cycle Analysis.

4.1.1 Inclusions

The multi-modal capital cost opinion represents the complete scope of the project as implied in the definition of the alternatives report and includes the following items:

- Related civil and traffic work.
- High capacity transit guideway, including trackwork.
- Rail and BRT transit stations.
- System support elements for alignments and stations.
- Light rail and bus transit vehicles.
- Cost of Park and Ride upgrades.
- Right-of-way.
- Agency costs.

Table 4-1a. Multi-Modal Alternative Cost Summary
(In millions of 2001 dollars)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
	No Action	Safety and Preservation, I-90 HCT	HOV and I-90 HCT	HOV+GP and I-90 HCT	HOV and SR 520 HCT	HOV+GP and SR 520 HCT	HOV / BRT	HOV / BRT+GP
Total Alternative Capital Cost Opinion	$0	$4,080	$5,740	$7,200	$7,130	$8,690	$4,100	$5,200
Annual Cost Elements	$7	$109	$55	$114	$54	$106	$31	$81
Other Costs	$0	$340 to $4,050	$760 to $4,720	$1,740 to $5,990	$740 to $5,030	$1,640 to $6,240	$820 to $4,670	$1,850 to $5,970

Table 4-1b. Multimodal Alternative Cost Summary
Comparison Analysis: Change from No Action

Life Cycle Analysis[1] (NPV)	$0	$2,919	$3,071	$4,596	$3,989	$4,734	$2,544	$4,100
Index, Low Cost = 100 (or 100%)		115	121	181	157	186	100	161

Note 1: Includes estimated cost of noise walls, storm water mitigation, local street improvements. Environmental mitigation assumed to be 5% of capital cost. Does not include the cost of freeway lids.

4.1.2 Exclusions

- Operating and maintenance cost.
- Improvements outside those described in the engineering documents.

4.1.3 Limitations

This is a Class 5 cost opinion as defined by the Association for the Advancement of Cost Engineering (AACE). The expected accuracy range of this estimate is -30 percent to +50 percent or greater based on information available at the planning level. This planning-level cost opinion is intended only for the purpose of economic comparison of the different alternatives based on information available at the time of preparation. Because of the preliminary nature of this cost opinion, final project costs will vary from those shown and will depend on actual costs for labor, construction equipment, disposal, and materials as well as surface and subsurface conditions, regulatory constraints, approach to corridor mitigation, labor productivity, competitive market conditions, final project scope, schedule, and other factors. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

4.1.4 Contingencies

There is insufficient detail contained in the design documents to provide precise cost opinions. Therefore the estimators use design, construction, and scope contingencies to address cost elements that are known to exist but cannot be easily quantified. These contingencies reflect incomplete design and project staging information, uncertainties about the evolution of the design, and changes in the construction market conditions. There are three different contingencies used in establishing the capital cost opinion. These contingencies are:

- **Design contingency.** The design contingency is used to account for incomplete design information, design changes during the evolution of the project, and changing construction market conditions. For the highway cost methodology the individual design elements carry an inherent design contingency built into their unit prices. A detailed chart of how the design contingency is applied to the HCT costs is shown below.
- **Construction contingency.** The construction contingency accounts for unforeseen conditions that are encountered during construction. For the highway cost methodology the construction contingency is taken at 15%. Construction contingency for the HCT portion of the cost opinion is shown below.
- **Scope contingency.** The scope contingency accounts for the scope evolution during the project development period. In the multi-modal estimate the highway scope contingency will be applied to each segment and is taken to be 20%. HCT scope contingency is included in the unit prices for each segment or section.

Project Component	Design Contingency (percentage of extended cost)	Construction Contingency (percentage of contingency)
Submerged Floating Tunnel	50%	25%
Floating/Movable Bridge	35%	15%
Tunnel Guideway & Stations	35%	15%
Aerial Guideway & Stations	30%	10%
At-Grade Guideway & Stations	25%	10%
Specialty Items	35%	10%
Vehicles & Maintenance Base	15%	10%

4.1.5 Summary of cost findings

The Multi-Modal alternatives under consideration show a large range of capital cost, with alternative 2 having the lowest cost opinion of $4.46 billion up to alternative 6 which has the highest cost opinion of $10.6 billion. These cost are summarized in Table 4-2. As expected HCT along the SR 520 corridor is significantly more expensive than converting the center lane of I-90 for HCT transit usage. BRT capital costs are also lower than either light rail alternative. Alternatives with 8 lanes or BRT facilities are more expensive than 6 lane alternatives due to the increased complexity required at interchanges.

4.2 ANNUAL COSTS

Annual costs are those costs not included in the capital cost but result from the increases in infrastructure and include Operations and Maintenance (O&M), annual TDM costs, and private costs. Annual cost will occur at different times for different alternatives due to the differing lengths of construction for each alternative. Therefore annual costs are assigned to begin at different dates. In order to understand the affect of annual costs between alternatives they should be evaluated in the Life-Cycle analysis.

4.2.1 Operation and Maintenance Costs

4.2.1.1 Introduction

Operation and maintenance includes the cost of keeping the highway, tunnels and HCT guideway in good repair and the cost of operating the transit system and monitoring tunnels. These costs represent the cost of O&M of these alternatives in 2001 dollars. Actual implementation if the alternatives can change these costs based on inflation, rate of construction, and year of expenditure assumptions.

4.2.1.2 Inclusions

- Roadway Maintenance.
- Bridge Maintenance.

Table 4-2. Multi-Modal Alternative Capital Cost Opinion Summary
(In millions of 2001 dollars)

	Alternative 1 No Action	Alternative 2 Safety and Preservation, I-90 HCT	Alternative 3 HOV and I-90 HCT	Alternative 4 HOV+GP and I-90 HCT	Alternative 5 HOV and SR 520 HCT	Alternative 6 HOV+GP and SR 520 HCT	Alternative 7 HOV / BRT	Alternative 8 HOV / BRT+GP
Hwy Multi-Modal Capital Cost Opinion	$0	$1,360	$3,020	$4,480	$2,420	$3,980	$3,830	$4,930
Transit Multi-Modal Capital Cost Opinion	$0	$2,720	$2,720	$2,720	$4,710	$4,710	$270	$270
Total Alternative Capital Cost Opinion	**$0**	**$4,080**	**$5,740**	**$7,200**	**$7,130**	**$8,690**	**$4,100**	**$5,200**
Index, Low Cost = 100		100	141	176	175	213	100	127

Note 1: Transit capital cost include HCT fixed guideway, cost for all BRT only structures, roadway and stations plus Park and Ride upgrade costs.

- Vehicle Operations.
- Vehicle Maintenance.
- Facilities Maintenance.
- HCT or BRT Administration and Support.

4.2.1.3 Summary of Operation and Maintenance Findings

A summary of O&M costs can be found on Table 4-3. These cost are shown as an incremental increase over the No Action alternative. O&M for tunnel is a large portion of the overall O&M cost for Highway alternatives. This is due the high cost of staff for monitoring and the maintaining the electrical and mechanical for the tunnels. The table also shows that the O&M cost for operating Rail in the SR 520 corridor are slightly lower than for the I-90 corridor, but the O&M cost associated with BRT are considerably less expensive than either HCT option. On options where O&M is shown as a negative number this means that the O&M cost associated with that alternative is lower than the current projected No Action alternative.

4.2.2 Annual TDM Costs

The cost estimates for the Transportation Demand element reflect a proposed level of investment in the programs and actions described in the Initial TDM Element Definitions Report (May 2001). The relative emphasis of different categories in the TDM element are still being determined, but the estimates are based on an overall assumption that the investment in TDM would be similar to other current regional proposals for TDM. The Puget Sound Regional Council's Destination 2030 (Draft) proposed a long-range regional program for TDM with costs of $2.35 billion through 2030. This was the primary source for predicting costs for the Trans-Lake program. For comparison purposes, the cost estimates for the TDM element of the I-405 EIS were also used.

The Trans-Lake TDM element cost elements were developed by applying the Destination 2030 investment levels to the Trans-Lake corridors, based on the corridors' share of regional transit/HOV travel. The corridors would include SR 520, SR 522 and I-90. The PSRC travel demand model applied for the Trans-Lake project provided the regional and corridor forecasts that were used.

The costs for the TDM element have been annualized, but they were developed based on an assumed program that would provide TDM actions and services in the Trans-lake corridors through the year 2020. These costs are shown in Table 4-3.

4.2.3 Annual private cost

4.2.3.1 Introduction

Private costs represent the cost of owning and operating private vehicles including fuel, oil, maintenance, tires, depreciation, finance charges, tax and license, and insurance. As part of the multi-modal cost evaluations, private costs are estimated for each highway alternative by multiplying total vehicle miles traveled by automobiles and trucks by per-mile private costs.

Table 4-3. Multi-Modal Alternative Annual Cost Summary

Multi-Modal Alternative Annual O&M Cost Opinion
(In millions of 2001 dollars)

	Alternative 1 No Action	Alternative 2 Safety and Preservation, I-90 HCT	Alternative 3 HOV and I-90 HCT	Alternative 4 HOV+GP and I-90 HCT	Alternative 5 HOV and SR 520 HCT	Alternative 6 HOV+GP and SR 520 HCT	Alternative 7 HOV / BRT	Alternative 8 HOV / BRT+GP
Highway O&M Annual Costs								
Tunnel	$0	$0	$0.74	$1.79	$0.00	$1.28	$1.69	$3.03
Other	$0	$0.18	$0.67	$1.43	$0.65	$1.37	$0.81	$1.23
Transit O&M Annual Costs								
Rail	$0	$48.4	$48.4	$48.4	$47.1	$47.1	$0	$0
Bus	$0	$2.0	$2.5	$2.4	-$2.9	-$3.1	$15.6	$15.6
Incremental Annual O&M Cost Opinion vs. Alternative 1	**$0**	**$50.58**	**$52.31**	**$54.02**	**$44.85**	**$46.65**	**$18.10**	**$19.86**

Note 1: All O&M cost are incremental costs vs. the No Action alternative.

Multi-Modal Alternative Annual TDM Cost Opinion
(In millions of 2001 dollars)

	Alternative 1 No Action	Alternative 2 Safety and Preservation, I-90 HCT	Alternative 3 HOV and I-90 HCT	Alternative 4 HOV+GP and I-90 HCT	Alternative 5 HOV and SR 520 HCT	Alternative 6 HOV+GP and SR 520 HCT	Alternative 7 HOV / BRT	Alternative 8 HOV / BRT+GP
Annual TDM Cost	0	$6.75	$7.70	$8.34	$7.54	$8.42	$7.79	$8.66

Note 1: Represents average annual TDM costs based on proposed TDM investments through 2020. The 2020 TDM costs were projected based on PSRC Destination 2030 transportation plan. Actual implementation costs may vary annually.

Multi-Modal Alternative Annual Private Cost Opinion
(In millions of 2001 dollars)

	Alternative 1 No Action	Alternative 2 Safety and Preservation, I-90 HCT	Alternative 3 HOV and I-90 HCT	Alternative 4 HOV+GP and I-90 HCT	Alternative 5 HOV and SR 520 HCT	Alternative 6 HOV+GP and SR 520 HCT	Alternative 7 HOV / BRT	Alternative 8 HOV / BRT+GP
Annual Private Costs	$0	$52	-$5	$52	$2	$51	$5	$52

Note 1: Private costs are incremental cost vs. the No Action alternative. These costs are based on 2020 travel projections.

Total vehicle miles traveled for each alternative are taken from the travel model results. Consistent with the assumption made during analysis conducted for the I-405 EIS, it is assumed that 95 percent of non-transit vehicle miles are driven by automobiles and 5 percent are driven by trucks.

The per-mile private costs used for this analysis are as follows:

- $0.39 per mile for automobiles (includes fuel, oil, maintenance, tires, depreciation, finance charges, tax and license, and insurance).
- $1.29 per mile for trucks (includes same costs as automobile: excludes labor cost of driver).

4.2.3.2 Summary of Private Cost Findings

The private costs can be seen in Table 4-3. These costs show that those alternatives with increased vehicle miles traveled have a higher private cost associated with them. Thus the eight-lane alternatives such as 4, 6 and 8 have higher private costs than the six-lane alternatives 3, 5, and 7.

4.3 OTHER POTENTIAL COSTS

These cost deal with noise, storm water, local streets improvements, environmental mitigation and lidding issues but can include other mitigation or enhancements not listed here but necessary for a project of this nature. These costs can vary greatly depending on current environmental regulations, alternative elements included, and decisions on lidding options.

4.3.1 Noise Walls

It is assumed that Noise walls will be constructed along the SR 520 corridor to help with noise mitigation. Alternatives 2 through 8 include noise walls along 90 percent of the westside corridor from I-5 to Lake Washington. This includes noise wall along the Portage Bay Bridge. These alternatives also include noise walls along 90 percent of the corridor from Lake Washington to I-405. Alternatives 3 through 8 include noise walls along 60 percent of the corridor from I-405 to SR 202. Noise wall costs have been included in the Life-Cycle Analysis.

4.3.2 Storm Water Mitigation

In the SR 520 corridor treating and detaining water will be a large cost. Storm Water Mitigation costs were established using the storm water treatment requirements from the Sea-Tac Third Runway project to come up with a cost per lane mile for the alternatives. This cost includes treatment of the storm water runoff and water retention facilities. These regulations are subject to change and could significantly change the mitigation costs. The projected storm water mitigation costs have been included in the Life-Cycle Analysis.

4.3.3 Local Street Improvement

A project of this highway project of this size will of local street improvements. The exact magnitude of these local street impacts is unknown at this time but is taken as a percentage of the total capital cost. Eight lane alternatives will have a significantly higher impact on local street then six lane due to increased volumes of traffic coming on and off the freeway. These cost include but are not limited to street widening, lane arterial lanes and turn lanes, new signals, sidewalks, landscaping, and additional storm water upgrades. The projected local street improvement costs have been included in the Life-Cycle Analysis.

4.3.4 Environmental Mitigation

Environmental mitigation costs include wetland mitigation, habitat restoration, park mitigation, fisheries, etc. The impact of the corridor and these costs is not yet known, but is assumed to be significant. These cost can also vary depending upon future environmental regulations. Environmental Mitigation costs are projected to range from 1 to 10 percent of the total capital cost for each alternative. For purposes of comparing alternatives in the Life Cycle Analysis the cost for environmental mitigation was taken to be 5 percent of the capital costs.

4.3.5 Lidding Opinions and Opportunities

Lidding costs are shown as a range based on the "Lidding Options and Opportunities Report". Costs for lid opinions vary due to length, width, ventilation, fire suppression, and regrading necessary for each concept within an alternative. Lid costs are not included in the Capital Cost Opinion or Life Cycle Analysis for the different alternatives.

4.4 LIFE-CYCLE ANALYSIS

Life-cycle analysis accounts for the cost of a project over its entire useful life. It allows for the comparison of alternatives that are phased in over different time periods. In a life-cycle analysis, costs in each year are discounted back to the present, which enables a comparison of alternatives based on the present value of the stream of expenditures over a consistent evaluation period. For this analysis, the basis for comparison of alternatives will be the net present value of costs over a 30-year time horizon.

4.4.1 Assumptions

Life-cycle costs are estimated on the basis of the following assumptions:

- All costs are estimated in year 2001 dollars.
- The net present value of costs is calculated using a 4 percent real discount rate.
- In each alternative, all capital cost estimates are assumed to be spent during the mid-point year of construction. Private costs and O&M costs begin during the year of implementation.

- The remaining useful life of capital expenditures is included at the end of the analysis period as a negative cost assuming straight line depreciation.
- The analysis period is from 2001 to 2030.
- Project implementation dates are estimated using the following annual capital expense burn rate:
  - if the project capital costs are less than $7 billion, the burn rate is $500 million/year.
  - if the project capital costs are greater than or equal to $7 billion, the burn rate is assumed to be $750 million/year.

4.4.2 Results

Table 4-5 presents the results of the life-cycle cost analysis. The results presented in the table reflect the difference in cost of each build alternative when compared to the no-build alternative. The net present value of the cost of the build alternatives ranges from approximately $2.2 billion for Alternative 7 to approximately $4.8 billion for Alternative 6. The present value of costs are also shown as an index whereby the low cost build alternative (Alternative 7) is set to 100 and all other alternatives are shown as multiple of that cost. For example, Alternative 8 has an index number of 134, which means the present value of costs for Alternative 8 is 34 percent higher than for Alternative 7.

As shown, the present value of the capital costs accounts for the majority of the project costs for all alternatives. Notice that the present value of the capital costs is not the same, and is less than, the estimated project construction costs in 2001 dollars (Table 4-2). This is because the present value analysis discounts future expenditures at an annual rate of four percent, and the remaining useful life of the assets is included in the present value of capital costs as a negative cost in 2031. This is done to ensure that alternatives that are implemented at a different pace can be compared on a common basis.

The private cost of vehicle operation is included in order to ensure that the cost of operating private vehicles and transit vehicles are both included. Private costs are highest for those alternatives that include the highest vehicle miles of travel. Roadway and operation and maintenance (O&M) costs include the cost of maintaining roads, related structures, and bus O&M costs. Rail O&M includes the cost of maintaining rail track and structures, and the cost of operating and maintaining rail vehicles. A negative O&M cost occurs if the O&M cost for the build alternative is less than the existing O&M cost for Alternative 1.

Table 4-4. Other Potential Costs
(In millions of 2001 dollars)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
	No Action	Safety and Preservation, I-90 HCT	HOV and I-90 HCT	HOV+GP and I-90 HCT	HOV and SR 520 HCT	HOV+GP and SR 520 HCT	HOV / BRT	HOV / BRT+GP
Noise Walls [1]	$0	$30	$60	$60	$60	$60	$60	$60
Storm Water Mitigation[2]	$0	$90	$330	$570	$320	$560	$340	$570
Local Street Improvements [3]	$0	$40	$180	$900	$150	$800	$240	$1,030
Environmental Mitigation[4]	$0	$50 to $410	$60 to $580	$80 to $720	$80 to $720	$90 to $870	$50 to $410	$60 to $520
Lids [5]	$0	$130 to $3480	$130 to $3570	$130 to $3740	$130 to $3780	$130 to $3950	$130 to $3620	$130 to $3790

Note 1 Noise walls for Alt. 2-8 are assumed along 90% of the westside mainline, 90% of the corridor from Lake Washington to I-405, and for Alt. 3-8 along 60% of the corridor from I-405 to SR 202. These cost are included in the life cycle analysis.

Note 2 Storm water cost were modeled off the Sea-Tac Third runway storm water requirements. Any changes in storm water regulation from can cause these costs to vary. These cost are included in the life cycle analysis.

Note 3 Local street improvements are taken as a percentage of the highway construction costs. This percentage ranges from 3% for alternative 2, to 6% for the six-lane alternative and 20% for the eight-lane alternatives. These costs are included in the life cycle analysis.

Note 4 Environmental Mitigation includes wetland mitigation, habitat restoration, park mitigation, etc. It may range from 1-10% of the capital cost for each alternative. For purposes of the Life Cycle analysis the environmental mitigation cost was taken at 5%.

Note 5 Lid cost are not included in the life cycle analysis.

Table 4-5. Multi-Modal Alternative Life Cycle Analysis
(Net Present Value of Costs over 30 years, in millions of 2001 dollars)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
Capital Costs[1]	$0	$2,161	$2,811	$3,902	$3,641	$4,191	$2,337	$3,588
Private Costs[2]								
Auto	$0	$366	-$25	$308	$11	$259	$35	$266
Truck	$0	$64	-$4	$54	$2	$45	$6	$46
TDM	$0	$51	$37	$44	$48	$36	$50	$61
O&M Costs[3]								
Roadway[4]	$0	$120	$84	$102	$70	$55	$116	$139
Transit[5]	$0	$158	$168	$186	$218	$147	$0	$0
Total Costs	**$0**	**$2,919**	**$3,071**	**$4,596**	**$3,989**	**$4,734**	**$2,544**	**$4,100**
Index, Low Cost = 100		115	121	181	157	188	100	161

Note 1 Includes estimated cost of noise walls, storm water mitigation, local street improvements. Environmental mitigation assumed to be 5% of capital cost. Does not include the cost of freeway lids.

Note 2 Total private costs are shown for no build and build alternatives. Other costs shown are differences from the no build.

Note 3 O&M and private costs begin in year of implementation.

Note 4 "Roadway" includes O&M costs for fixed bridges, floating bridges, highway, and tunnel.

Note 5 "Transit" includes O&M costs for buses, rail cars, rail structures, and rail operations.

APPENDIX A

Regional Travel Demand Forecasts for Translake

Table 1a
Daily Trans-Lake Person Trip Volumes by Alternative, Facility and Mode

Facility	*1995 Model Results*	*2020 No-Action*	*2020 Alternative2*	*2020 Alternative3*	*2020 Alternative4*	*2020 Alternative5*	*2020 Alternative6*	*2020 Alternative7*	*2020 Alternative8*
SR-522									
Non-HOV[1]	59,600	86,800	86,600	87,000	83,200	86,800	85,300	87,300	85,600
Commercial	6,600	9,800	9,800	9,800	9,400	9,800	9,600	9,900	9,700
HOV 3+	1,000	3,200	3,200	2,600	2,900	2,600	2,600	2,600	2,600
Bus Transit	2,100	4,000	3,800	3,700	3,800	4,100	4,300	3,600	3,800
High Capacity Transit	—	—	—	—	—	—	—	—	—
Transit Subtotal	*2,100*	*4,000*	*3,800*	*3,700*	*3,800*	*4,100*	*4,300*	*3,600*	*3,800*
Total All Modes	69,300	103,800	103,400	103,100	99,300	103,300	101,800	103,400	101,700
SR-520 Crossing									
Non-HOV[1]	109,900	115,600	115,400	118,200	165,800	118,600	170,600	120,000	178,500
Commercial	23,700	29,600	29,600	29,500	37,600	30,100	40,000	30,400	41,600
HOV 3+	2,300	15,200	13,300	35,000	37,500	35,300	40,700	35,000	38,800
Bus Transit	8,700	22,800	14,900	18,000	20,300	700	700	—	—
High Capacity Transit	—	—	—	—	—	27,525	32,190	29,800	34,700
Transit Subtotal	*8,700*	*22,800*	*14,900*	*18,000*	*20,300*	*28,225*	*32,890*	*29,800*	*34,700*
Total All Modes	144,600	183,200	173,200	200,700	261,200	212,225	284,190	215,200	293,600
I-90 Crossing									
Non-HOV[1]	128,000	162,700	163,500	173,100	161,000	163,500	161,400	165,400	160,600
Commercial	27,100	35,200	35,200	37,900	32,500	35,200	34,500	35,700	34,100
HOV 3+	2,600	25,900	23,700	13,600	14,500	14,900	15,200	14,500	15,800
Bus Transit	7,200	22,100	3,600	3,400	3,500	17,100	18,200	20,500	21,900
High Capacity Transit	—	—	29,700	28,675	30,560	—	—	—	—
Transit Subtotal	*7,200*	*22,100*	*33,300*	*32,075*	*34,060*	*17,100*	*18,200*	*20,500*	*21,900*
Total All Modes	164,900	245,900	255,700	256,675	242,060	230,700	229,300	236,100	232,400
Total Trans-Lake									
Non-HOV[1]	297,500	365,100	365,500	378,300	410,000	368,900	417,300	372,700	424,700
Commercial	57,400	74,600	74,600	77,200	79,500	75,100	84,100	76,000	85,400
HOV 3+	5,900	44,300	40,200	51,200	54,900	52,800	58,500	52,100	57,200
Bus Transit	18,000	48,900	22,300	25,100	27,600	21,900	23,200	24,100	25,700
High Capacity Transit	—	—	29,700	28,675	30,560	27,525	32,190	29,800	34,700
Transit Subtotal	*18,000*	*48,900*	*52,000*	*53,775*	*58,160*	*49,425*	*55,390*	*53,900*	*60,400*
Total All Modes	378,800	532,900	532,300	560,475	602,560	546,225	615,290	554,700	627,700
Total Region									
Non-HOV[2]	9,631,854	13,572,204	13,565,758	13,566,706	13,572,204	13,571,688	13,574,302	13,569,012	13,570,658
HOV 3+	39,395	228,237	227,603	229,745	228,237	230,065	230,946	228,857	229,600
Transit	281,553	652,710	659,826	656,748	652,710	651,426	648,048	655,288	653,048
Total All Modes	9,952,801	14,453,151	14,453,187	14,453,199	14,453,151	14,453,179	14,453,295	14,453,157	14,453,306

[1] Includes SOVs and 2 person HOVs with an overall AVO of 1.33

[2] Includes SOVs, 2 person HOVs, and Commercial vehicle-trips

Table 1b
Daily Trans-Lake Person-Trip Modal Shares by Alternative and Facility

Facility	*1995 Model Results*	*2020 No-Action*	*2020 Alternative2*	*2020 Alternative3*	*2020 Alternative4*	*2020 Alternative5*	*2020 Alternative6*	*2020 Alternative7*	*2020 Alternative8*
SR-522									
Non-HOV[1]	86.0%	83.6%	83.8%	84.4%	83.8%	84.0%	83.8%	84.4%	84.2%
Commercial	9.5%	9.4%	9.5%	9.5%	9.5%	9.5%	9.4%	9.6%	9.5%
HOV 3+	1.4%	3.1%	3.1%	2.5%	2.9%	2.5%	2.6%	2.5%	2.6%
Bus Transit	3.0%	3.9%	3.7%	3.6%	3.8%	4.0%	4.2%	3.5%	3.7%
High Capacity Transit	—	—	—	—	—	—	—	—	—
Transit Subtotal	*3.0%*	*3.9%*	*3.7%*	*3.6%*	*3.8%*	*4.0%*	*4.2%*	*3.5%*	*3.7%*
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
SR-520 Crossing									
Non-HOV[1]	76.0%	63.1%	66.6%	58.9%	63.5%	55.9%	60.5%	55.8%	60.8%
Commercial	16.4%	16.2%	17.1%	14.7%	14.4%	14.2%	14.2%	14.1%	14.2%
HOV 3+	1.6%	8.3%	7.7%	17.4%	14.4%	16.6%	14.4%	16.3%	13.2%
Bus Transit	6.0%	12.4%	8.6%	9.0%	7.8%	0.3%	0.2%	—	—
High Capacity Transit	—	—	—	—	—	13.0%	10.7%	13.8%	11.8%
Transit Subtotal	*6.0%*	*12.4%*	*8.6%*	*9.0%*	*7.8%*	*13.3%*	*10.9%*	*13.8%*	*11.8%*
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
I-90 Crossing									
Non-HOV[1]	77.6%	66.2%	63.9%	67.4%	66.5%	70.9%	70.4%	70.1%	69.1%
Commercial	16.4%	14.3%	13.8%	14.8%	13.4%	15.3%	15.0%	15.1%	14.7%
HOV 3+	1.6%	10.5%	9.3%	5.3%	6.0%	6.5%	6.6%	6.1%	6.8%
Bus Transit	4.4%	9.0%	1.4%	1.3%	1.4%	7.4%	7.9%	8.7%	9.4%
High Capacity Transit	0.0%	—	11.6%	11.2%	12.6%	—	—	—	—
Transit Subtotal	*4.4%*	*9.0%*	*13.0%*	*12.5%*	*14.1%*	*7.4%*	*7.9%*	*8.7%*	*9.4%*
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Trans-Lake									
Non-HOV[1]	78.5%	68.5%	68.7%	67.5%	68.0%	67.5%	67.8%	67.2%	67.7%
Commercial	15.2%	14.0%	14.0%	13.8%	13.2%	13.7%	13.7%	13.7%	13.6%
HOV 3+	1.6%	8.3%	7.6%	9.1%	9.1%	9.7%	9.5%	9.4%	9.1%
Bus Transit	4.8%	9.2%	4.2%	4.5%	4.6%	4.0%	3.8%	4.3%	4.1%
High Capacity Transit	—	—	5.6%	5.1%	5.1%	5.0%	5.2%	5.4%	5.5%
Transit Subtotal	*4.8%*	*9.2%*	*9.8%*	*9.6%*	*9.7%*	*9.0%*	*9.0%*	*9.7%*	*9.6%*
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100%
Total Region									
Non-HOV[2]	96.8%	93.9%	93.9%	93.9%	93.9%	93.9%	93.9%	93.9%	93.9%
HOV 3+	0.4%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
Transit	2.8%	4.5%	4.6%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[1] Includes SOVs and 2 person HOVs with an overall AVO of 1.33

[2] Includes SOVs, 2 person HOVs, and Commercial vehicle-trips

Table 2
Daily Trans-Lake Vehicle Volumes by Alternative, Facility and Mode

Facility	*1995 Model Results*	*2020 No-Action*	*2020 Alternative2*	*2020 Alternative3*	*2020 Alternative4*	*2020 Alternative5*	*2020 Alternative6*	*2020 Alternative7*	*2020 Alternative8*
SR-522									
Non-HOV[1]	44,800	65,200	65,100	65,400	62,500	65,200	64,100	65,600	64,300
Commercial	6,600	9,800	9,800	9,800	9,400	9,800	9,600	9,900	9,700
HOV 3+	300	1,000	1,000	800	900	800	800	800	800
Total All Modes	51,700	76,000	75,900	76,000	72,800	75,800	74,500	76,300	74,800
SR-520 Crossing									
Non-HOV[1]	82,600	86,900	86,700	88,800	124,600	89,100	128,200	90,200	134,200
Commercial	23,700	29,600	29,600	29,500	37,600	30,100	40,000	30,400	41,600
HOV 3+	700	4,800	4,200	11,100	11,900	11,200	12,900	11,100	12,300
Total All Modes	107,000	121,300	120,500	129,400	174,100	130,400	181,100	131,700	188,100
I-90 Crossing									
Non-HOV[1]	96,200	122,300	122,900	130,100	121,000	122,900	121,300	124,300	120,700
Commercial	27,100	35,200	35,200	37,900	32,500	35,200	34,500	35,700	34,100
HOV 3+	800	8,200	7,500	4,300	4,600	4,700	4,800	4,600	5,000
Total All Modes	124,100	165,700	165,600	172,300	158,100	162,800	160,600	164,600	159,800
Total Trans-Lake									
Non-HOV[1]	223,600	274,400	274,700	284,300	308,100	277,200	313,600	280,100	319,200
Commercial	57,400	74,600	74,600	77,200	79,500	75,100	84,100	76,000	85,400
HOV 3+	1,800	14,000	12,700	16,200	17,400	16,700	18,500	16,500	18,100
Total All Modes	282,800	363,000	362,000	377,700	405,000	369,000	416,200	372,600	422,700
Total Region									
Non-HOV[2]	7,361,013	10,186,554	10,182,346	10,181,106	10,181,288	10,186,180	10,185,926	10,183,902	10,182,718
HOV 3+	12,198	69,239	69,043	69,455	69,693	69,791	70,056	69,429	69,649
Total All Modes	7,373,211	10,255,793	10,251,389	10,250,561	10,250,981	10,255,971	10,255,982	10,253,331	10,252,367

[1] Includes SOVs and 2 person HOVs with an overall AVO of 1.33

[2] Includes SOVs, 2 person HOVs, and Commercial vehicle-trips

Table 4a
PM Peak Period Person-Trips by Alternative, Facility and Mode (Both Directions)

Facility / Transporatic	*1995 Model Results*	*2020 No-Action*	*2020 Alternativ e2*	*2020 Alternativ e3*	*2020 Alternativ e4*	*2020 Alternativ e5*	*2020 Alternativ e6*	*2020 Alternativ e7*	*2020 Alternativ e8*
SR-522									
Non-HOV[1]	22,200	32,200	32,100	32,600	29,700	32,100	30,900	32,400	31,200
HOV 3+	400	900	800	600	800	700	700	700	700
Transit[2]	800	1,400	1,500	1,400	1,500	1,600	1,600	1,300	1,300
Total All Modes	23,400	34,500	34,400	34,600	32,000	34,400	33,200	34,400	33,200
SR-520 Crossing									
Non-HOV[1]	38,600	41,700	42,000	43,800	57,300	43,200	62,600	43,600	64,900
HOV 3+	700	4,900	3,600	13,900	14,400	14,000	14,000	14,000	15,500
Transit[2]	3,100	8,300	5,400	6,400	7,200	9,130	10,651	10,400	12,000
Total All Modes	42,400	54,900	51,000	64,100	78,900	66,330	87,251	68,000	92,400
I-90 Crossing									
Non-HOV[1]	47,500	59,400	59,800	60,000	64,400	59,700	59,000	60,100	59,300
HOV 3+	1,100	10,400	8,600	4,800	5,400	5,700	5,700	5,700	6,000
Transit[2]	2,800	7,400	11,200	10,790	11,630	6,300	6,300	6,900	7,400
Total All Modes	51,400	77,200	79,600	75,590	81,430	71,700	71,000	72,700	72,700
Total Trans-Lake									
Non-HOV[1]	108,300	133,300	133,900	136,400	151,400	135,000	152,500	136,100	155,400
HOV 3+	2,200	16,200	13,000	19,300	20,600	20,400	20,400	20,400	22,200
Transit[2]	6,700	17,100	18,100	18,590	20,330	17,030	18,551	18,600	20,700
Total All Modes	117,200	166,600	165,000	174,290	192,330	172,430	191,451	175,100	198,300

[1] Includes SOVs, 2 person HOVs, & commercial vehicles
[2] Includes both bus & HCT modes where applicable
* Indicates data not yet available

Table 4b
PM Peak Period Person-Trips (%) by Alternative, Facility and Mode (Both Directions)

Facility / Transpora	*1995 Model Results*	*2020 No-Action*	*2020 Alternative2*	*2020 Alternative3*	*2020 Alternative4*	*2020 Alternative5*	*2020 Alternative6*	*2020 Alternative7*	*2020 Alternative8*
SR-522									
Non-HOV[1]	94.9%	93.3%	93.3%	94.2%	92.8%	93.3%	93.1%	94.2%	94.0%
HOV 3+	1.7%	2.6%	2.3%	1.7%	2.5%	2.0%	2.1%	2.0%	2.1%
Transit[2]	3.4%	4.1%	4.4%	4.0%	4.7%	4.7%	4.8%	3.8%	3.9%
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
SR-520 Crossing									
Non-HOV[1]	91.0%	76.0%	82.4%	68.3%	72.6%	65.1%	71.7%	64.1%	70.2%
HOV 3+	1.7%	8.9%	7.1%	21.7%	18.3%	21.1%	16.0%	20.6%	16.8%
Transit[2]	7.3%	15.1%	10.6%	10.0%	9.1%	13.8%	12.2%	15.3%	13.0%
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
I-90 Crossing									
Non-HOV[1]	92.4%	76.9%	75.1%	79.4%	79.1%	83.3%	83.1%	82.7%	81.6%
HOV 3+	2.1%	13.5%	10.8%	6.4%	6.6%	7.9%	8.0%	7.8%	8.3%
Transit[2]	5.4%	9.6%	14.1%	14.3%	14.3%	8.8%	8.9%	9.5%	10.2%
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Trans-Lake									
Non-HOV[1]	92.4%	80.0%	81.2%	78.3%	78.7%	78.3%	79.7%	77.7%	78.4%
HOV 3+	1.9%	9.7%	7.9%	11.1%	10.7%	11.8%	10.7%	11.7%	11.2%
Transit[2]	5.7%	10.3%	11.0%	10.7%	10.6%	9.9%	9.7%	10.6%	10.4%
Total All Modes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[1] Includes SOVs, 2 person HOVs, & commercial vehicles
[2] Includes both bus & HCT modes where applicable
* Indicates data not yet available