Michael McGinn
Mayor, City of Seattle

April 15th, 2010

The Honorable Christine Gregoire, Governor
State of Washington
PO Box 40002
Olympia, WA 98504-0002

Ms. Paula Hammond, Secretary
Washington State Department of Transportation
501 Maple Park Avenue SE
Olympia, WA 98504-7300

Ms. Jenifer Young
SDEIS Environmental Manager
SR 520 Project Office
600 Stewart Street, Suite 520
Seattle WA 98101

Re: **SR 520, I-5 to Medina: Bridge Replacement and HOV Project**
Supplemental Draft Environmental Impact Statement (SDEIS)

Dear Governor Gregoire, Secretary Hammond and Ms. Young,

L-007-001

Thank you for the opportunity to comment on the SDEIS for the SR 520 Bridge Project. This is a critically important project for our region. The 520 bridge serves as a vital transportation link between Seattle and the Eastside, while sharing a scenic corridor with highly-valued open space and park lands. The design of this bridge will affect generations to come. It should reflect current values and future transportation needs, not the priorities of the past.

The current SDEIS process fails in this regard. It does not provide a range of alternatives that speak to the priorities that are essential for our future — namely, the provision of high capacity transit in the form of light rail. The alternative that has received the most attention, the so-called "A+" option, is fundamentally flawed.

The recently released study by Nelson\Nygaard Consulting Associates documents this failure, concluding that the A+ plan would make future conversion to light rail very difficult, if not impossible. This conclusion suggests that the A+ design does not live up to state law, RCW 47.01.410, which mandates that the SR 520 bridge be designed to accommodate future light rail.

By prioritizing the movement of automobiles over the movement of people, the A+ option falls short in other important ways. If you don't have access to a car, or can't afford to pay for tolls and parking, then the A+ plan gives you poor choices for getting across SR 520. Moreover, in

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L-007-001

The development and analysis of alternatives for the SR 520 project was described in Attachment 8 to the SDEIS and is summarized in Chapter 2 of the Final EIS. This process, conducted with the participation of regional transit agencies, elected officials, and the public, gave extensive consideration to how and when SR 520 should accommodate high-capacity transit. The decision that I-90 should become the region's initial light rail corridor, while SR 520 would be designed for initial bus rapid transit and future accommodation of light rail, was made during that process and has been reaffirmed in all subsequent planning documents for regional transportation and land use.

WSDOT has worked with Sound Transit since 2003 to design for future rail compatibility in the corridor. The April 2010 Nelson/Nygaard report identified several changes to the SDEIS options that were believed to be necessary to "meet the mayor's goal of an SR 520 bridge that is readily convertible to rail." While WSDOT believed that the design already met this goal, the agency worked with the City of Seattle and Sound Transit to identify changes that would enhance the corridor's rail compatibility. The Preferred Alternative reflects these design changes and allows for two future rail options:

- Option 1: Convert the HOV/transit lanes to light rail. This approach would accommodate light rail by converting the HOV lanes to exclusive rail use. Trains would use the direct-access ramps at Montlake Boulevard to exit, or could utilize a 40-foot gap between the eastbound and westbound lanes of the west approach to make a more direct connection to the University Link station at Husky Stadium.
- Option 2: Add light-rail only lanes. This approach would allow several connections—via a high bridge, a drawbridge, or a tunnel, as suggested in the Nelson/Nygaard report—to the University Link station.

Ms. Jenifer Young
April 15, 2010
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L-007-001 order to accommodate two more lanes for cars, the A+ plan creates a much larger footprint through much of the western approach, which includes sensitive park land as well as several residential neighborhoods. Preservation of green spaces and quality of life in neighborhoods is essential. The range of alternatives in the SDEIS does not adequately address these issues.

L-007-002 Finally, the State's overall approach to the EIS process is flawed because the SDEIS examines the "I-5 to Medina" portion of the project in isolation, without considering the east side landing or the larger transportation network. Although this process may allow work to begin more quickly on the east side section, it also threatens to lock in a flawed overall project design. There should be a comprehensive plan for the whole project that integrates future light rail and is grounded in realistic cost and funding projections including all mitigation. This should be in place before any construction is started.

L-007-003 Due to these and other flaws of the A+ plan detailed in our attached comments, we urge that you delay announcing a preferred alternative and begin to immediately evaluate other options that can accommodate light rail and minimize impacts on sensitive parks and neighborhoods. This SDEIS should clarify the technical considerations of designing for light rail, evaluate alignment options, and consider construction phasing needed to accommodate light rail. New options studied under this SDEIS could then be considered side by side with the current A+ option. We believe that this could be done within 12 months. It would give policymakers and the public a clear choice about how to most effectively invest limited resources for our future.

The replacement for the SR 520 bridge will have a life of 75 to 100 years. This is our one chance to "get it right" and to build a bridge that meets the needs of Seattle and the region for years to come. I look forward to working with WSDOT to ensure that the project does just that.

Sincerely,

Michael McGinn, Mayor
City of Seattle

Attachments: SR 520 Light Rail Alternatives Draft Report, Nelson\Nygaard Consulting Associates
SR 520 Project Comment memo from the Mayor's Office
SR 520 Project Comment memo from the Seattle Department of Transportation
SR 520 Project Comment memo from the Seattle Fire Department
SR 520 Project Comment memo from the Seattle Department of Parks and Recreation
SR 520 Project Comment memo from the Seattle Department of Planning and Development
SR 520 Project Comment memo from Seattle Public Utilities
SR 520 Project Comment memo from the Seattle Office of Arts & Cultural Affairs

Copy: Seattle City Council

Both approaches would allow for the addition of supplemental floating bridge pontoons to support the additional weight of light rail, should the regional decision to do so be made and funded. Such a decision would need to be planned and programmed by regional land use and transit agencies, funded by a public vote, and evaluated in its own environmental analysis.

The purpose of the SR 520, I-5 to Medina project is to "improve mobility for people and goods." To this end, all traffic analysis for the project has measured not only vehicle trips across the corridor, but person-trips, which represent users of transit and carpools as well as single-occupant vehicles. The addition of HOV lanes to the corridor, with no increase in the existing number of general-purpose lanes, is expressly intended to improve the speed and reliability of transit service, providing an incentive to use transit rather than driving and making it a better option for people who depend on it. As noted in the discussion of project need on page 1-6 of the SDEIS, the prospect of substantially increased travel times in 2030 "makes it imperative that commuters be provided with travel choices that allow them to avoid driving along, and that the proposed project be built to support increased use of transit and HOVs." As discussed in section 5.1 of the SDEIS, and section 5.1 of the Final EIS, HOV and transit commuters would experience substantial travel time benefits in 2030 with the addition of the HOV lane.

L-007-002

WSDOT worked closely with FHWA to ensure that both the SR 520, I-5 to Medina Bridge Replacement and HOV Project and the SR 520, Medina to SR 202 Transit and HOV Project met the FHWA criteria for consideration as independent projects. According to 23 CFR 771.111(f), the purpose of these criteria is to "to ensure meaningful evaluation of alternatives and to avoid commitments to transportation improvements before they are fully evaluated." WSDOT and FHWA are satisfied that

City of Seattle
Office of the Mayor

Date April 15th, 2010

To Jennifer Young, Environment Manager, WSDOT

From Mayor Michael McGinn

Subject **SR 520 Project Comments**

L-007-004

Our comments address 1) changes that need to be made in order to accommodate light rail, and 2) Westside design characteristics.

There are three key changes that must be made to the current design of the bridge to accommodate light rail. More information on these design issues can be found the draft Nelson\Nygaard "SR 520 Light Rail Alternatives" (also included as an attachment).

1) The pontoons must be designed with additional floatation and stability necessary to support the weight and dynamic loading of light rail. WSDOT has stated that the additional cost to revise the design of the pontoons is $150-200 million. Because the pontoon contract has already come in significantly under the engineer's estimate, it makes sense to build the pontoons now, as the current bidding and construction climate is likely to generate greater savings than waiting to do this at another time.
2) There must be a "gap" between the eastbound and westbound lanes as the floating bridge approaches Foster Island in order to allow the two lanes of light rail to leave the mainline to connect with Husky Stadium.
3) Adequate width must be maintained on the floating bridge to allow space for light rail operations, including emergency evacuation. There is no reason to build a bridge that is too narrow for light rail at this time. It is a waste of taxpayer resources to generate additional expense and construction impacts down the road when this relatively minor detail can be addressed through the current process.

L-007-005

Additionally, we have concerns about the design of the Westside of the project, the focus of Nelson\Nygaard's work for the City Council. The current design should address the following issues:

1) The Montlake Interchange should employ an urban intersection design, with tighter turning radii, safe pedestrian crossings, and signal priority for transit.
2) The project as a whole, and particularly the Montlake Interchange, should be designed to a human scale. Details such as pedestrian lighting, well-marked crossings, and landscaping are particularly important with a project of this size and scale.

L-007-006

3) The pedestrian and bicycle path must be designed to City of Seattle standards. The current design includes a number of switchbacks that are not ideal for cyclists.

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this requirement has been met.

As discussed in the response to comment L-007-001, the proposed mode of high-capacity transit in the SR 520 corridor in the foreseeable future is bus rapid transit, with future rail funded only for long-range study and not included in any regional plan. Nevertheless, the design for the portion of SR 520 east of Lake Washington does not preclude potential future light rail or other high capacity transit mode. For specific information about how the SR 520, Medina to SR 202 project design addresses this topic, see pages 4-1 and 4-16 of the SR 520, Medina to SR 202: Eastside Transit and HOV Project Environmental Assessment (WSDOT 2009), published December 2009.

As discussed in Chapter 1 of the Final EIS, project cost estimates include all required mitigation. The estimated costs for natural environment and built mitigation have always been included in WSDOT's cost estimating process.

L-007-003

Please see the response to Comment L-007-001.

L-007-004

Please see the response to Comment L-007-001 regarding how the Preferred Alternative has been designed to accommodate light rail.

L-007-005

In developing and refining the design of the Preferred Alternative, WSDOT has worked collaboratively with the City of Seattle to address many of the ideas outlined in this comment. Much of this work occurred as part of the workgroup created under Engrossed Substitute Senate Bill (ESSB) 6392, which directed WSDOT to work collaboratively with the City of Seattle, University of Washington, regional agencies such as King

L-007-007

4) The project's footprint and its course through Seattle neighborhoods must be as small as possible. The current design does not meet Seattle's needs.

L-007-008

5) It is critical that the possibility of a four-lane replacement to the Portage Bay Viaduct is explored. With the departure of the center lanes from the mainline, it could be possible to reduce the number of lanes planned from Foster Island to I-5.

L-007-009

6) The height of the floating bridge should be as low as possible.

L-007-010

7) A legislative mandate should be established to manage the HOV/transit lanes on the bridge to a performance standard of 45 miles per hour 90% of the time.

L-007-011

8) Arboretum on- and off-ramps should be eliminated to reduce the impact on neighborhoods and the Arboretum.

L-007-012

9) If a second bascule bridge is part of the project design, this new facility should prioritize high capacity transit (including light rail), biking, and walking.

County Metro Transit and Sound Transit, and other stakeholders to consider design refinements and transit connections within the Preferred Alternative. The ESSB 6392 workgroup process also included the Seattle Department of Transportation, the City of Seattle Pedestrian Advisory Board, and the Seattle Bicycle Advisory Board. The group developed design refinements for bicycle and pedestrian facilities and to improve the bicycle and pedestrian environments near the SR 520 corridor. It also refined the project design in the Montlake area to increase transit mobility. The resulting design refinements are described in the ESSB 6392: Design Refinements and Transit Connections Workgroup Recommendations Report (Attachment 16 to the Final EIS). The workgroup recommendations will continue to shape the project as further design development occurs.

WSDOT will continue to include the Seattle Bicycle Advisory Board and Seattle Pedestrian Advisory Board in discussions that inform decisions about bicycle and pedestrian designs and amenities. As the SR 520, I-5 to Medina project progresses toward construction, WSDOT will develop a process to work with the boards to identify and refine construction routing options.

WSDOT will also work with the boards and the Seattle Design Commission to develop an aesthetic vision and goals for Seattle urban design and streetscapes in the project vicinity. This collaboration will be accompanied by a public process, and WSDOT will document the results as a set of urban design guidelines to inform and direct the final design details for bike and pedestrian routes.

L-007-006

Through the ESSB 6392 technical working groups, WSDOT continues to work in cooperation with the transit agencies and the City of Seattle to refine the design of the Preferred Alternative to achieve the desired connectivity for bicyclists and pedestrians. See the ESSB 6392 final

CITY OF SEATTLE MAYOR'S OFFICE

SR 520 Light Rail Alternatives

DRAFT Report

Nelson\Nygaard Consulting Associates
1402 Third Avenue, Suite 1200
Seattle, WA 98101

April 2010

Nelson|Nygaard consulting associates

report presented to Governor Gregoire outlining the recommended connectivity solutions and design processes moving forward: http://www.wsdot.wa.gov/Projects/SR520Bridge/6392workgroup.htm#report.

WSDOT has begun working with City of Seattle and the Seattle Design Commission to ensure that project elements, including the bicycle paths, are designed to meet appropriate standards.

L-007-007

Lane and shoulder widths for highways like SR 520 are determined through the use of design standards established to maintain driver safety. Where deviations from design standards are necessary, they must be approved by FHWA. In response to input from adjacent communities and the City, the SDEIS design options reduced lane and shoulder widths throughout the corridor. Under the Preferred Alternative, the SR 520 corridor between I-5 and the Montlake interchange would have a posted speed limit of 45 miles per hour and would operate as a boulevard or parkway. To support the boulevard concept, the width of the inside shoulders in this section of SR 520 would be further narrowed from 4 feet to 2 feet, and the width of the outside shoulders would be reduced from 10 feet to 8 feet. The 10-foot outside and 4-foot inside shoulders in the remainder of the corridor are the smallest that FHWA will allow.

L-007-008

Please see the response to Comment L-007-007 regarding the design of the Portage Bay Bridge under the Preferred Alternative. A 4-lane Portage Bay Bridge would not allow for HOV lanes, which maintain transit mobility and provide express lane connectivity, or for a managed shoulder in the westbound direction, which is needed to address congestion.

L-007-009

Since publication of the SDEIS, WSDOT has identified a Preferred Alternative, and modified the floating bridge deck to address community concerns while providing for bridge maintenance needs. Columns would be necessary at each end of the floating bridge to transition traffic from the high points located on the transition spans down to the 20-foot bridge height across the midspan. The height of the floating bridge at the midspan would be approximately 20 feet above the water. It would be approximately 10 feet higher than the existing bridge, and approximately 5 to 10 feet lower than previous designs considered in the DEIS and the SDEIS.

The raised-deck design allows maintenance activities that currently require bridge closures to be completed while keeping the facility open to traffic. A higher bridge deck also enhances the safety and reliability of the bridge during high winds and crashing waves, facilitates the potential future addition of light rail, and increases construction efficiency (see the text box on page 2-29 of the SDEIS).

L-007-010

Planning for the SR 520, I-5 to Medina project is subject to current federal and state policies. Under current policy the State Legislature confers management of HOV lanes upon state and local transportation authorities (RCW 46.61.165 and 47.52.025). The HOV operational criteria of 45 miles per hour, 90 percent of the time is defined in the WSDOT Design Manual Chapter 1410. This criteria is reflected in the transportation analysis performed by WSDOT for the EIS. The analysis for the DEIS, SDEIS, and Final EIS assumed that 3 persons per vehicle would be required for carpools in the HOV lanes. In 2010, the Legislature established the 3 person HOV requirement for SR 520 by policy in ESSB 6392 and stipulated that the legislature be informed when speeds in the HOV lanes fall below 45 miles per hour more than 10 percent of the time.

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The Preferred Alternative would remove the existing Lake Washington Boulevard ramps. Although traffic would still be able to move between Lake Washington Boulevard and SR 520, the change in access would reduce vehicle trips through the Arboretum. Under the Preferred Alternative in 2030, a.m. peak hour volumes on Lake Washington Boulevard through the Arboretum would be 1,330 vehicles per hour, compared to 1,950 vehicles per hour with the No Build Alternative. P.m. peak hour volumes would be 1,410 vehicles per hour compared to 1,730 with the No Build Alternative. See Section 5.1 of the Final EIS and the Final Transportation Discipline Report (Attachment 7 to the Final EIS) for further discussion of trip volumes. As part of the Arboretum Mitigation Plan, WSDOT has also committed to fund traffic calming measures along Lake Washington Boulevard and to work with the Seattle Department of Transportation on further measures to manage traffic in the Arboretum.

L-007-012

Please see the response to Comment L-007-005 regarding bicycle and pedestrian improvements that are part of the Preferred Alternative. The Preferred Alternative would improve transit reliability in the Montlake corridor by providing HOV lanes on Montlake Boulevard between SR 520 and the Montlake Multimodal Center and direct access HOV ramps to and from the east. In addition to providing this capacity for HOVs, the new bascule bridge would provide bicycle lanes across the Montlake Cut, as well as additional capacity and enhanced safety for pedestrians. See the response to Comment L-007-001 regarding how future light rail on the SR 520 corridor could connect to the University Link station.

Executive Summary

Mayor Mike McGinn commissioned this study by Nelson\Nygaard Consulting Associates to explore the possibilities for building light rail transit (LRT) on the State Route (SR) 520 corridor. The intent is to assist the mayor and staff in providing comment on the Supplemental Draft Environmental Impact Statement (SDEIS) for the SR 520 I-5 to Medina Bridge Replacement and HOV Project issued by the Washington State Department of Transportation (WSDOT) and the Federal Highway Administration.

The mayor's goal is to ensure that the SR 520 project is designed and built from the outset to reasonably accommodate light rail and reduce the impact of the new facility. To that end, the report focuses on several specific issues:

- Consider and analyze possible LRT alignments that connect major transit markets along the SR 520 corridor;
- Determine whether existing plans for the SR 520 bridge replacement preclude LRT or present significant obstacles to LRT conversion;
- Identify the steps necessary to build LRT in the SR 520 corridor; and
- Consider how SR 520 can be phased from the existing facility to a facility with a narrow footprint that will carry LRT, including shoreside connections.

Potential Light Rail Alignments

Sufficient transit markets exist on the east and west sides of the SR 520 bridge to warrant formal analysis of LRT in the corridor. The focus of the formal analysis would be to determine the market(s), alignment(s), and mode(s) for an intensive transit network, including the potential for a second light rail alignment crossing Lake Washington, in addition to I-90. Changes in the location of jobs and economic activity have markedly impacted the travel market on SR 520 over the past decade. The 2010 Census will provide valuable insight into these changes and will form a new basis to assess future transit markets. Transit ridership on the corridor in 2020 is forecasted to be about 25,000 person trips per day, up from approximately 15,000 per day in 2008.[1] The SDEIS projects that daily transit ridership on the corridor will reach more than 27,500 trips by 2030.

This report identifies five possible corridors that appear to have sufficient demand to warrant further investigation, acknowledging that identification of corridors and mode (i.e., bus, bus rapid transit, or light rail) must involve the jurisdictions and stakeholders from those communities to ensure that their policies are applied and the community needs are served.

In Seattle, the most promising LRT corridors all share the University of Washington as an important anchor for an SR 520 alignment. The Westside corridors recommended for further evaluation either connect Ballard to the University or connect the Aurora Avenue corridor (from north of the Ship Canal to about Haller Lake) to the University.

1. SR 520 High Capacity Transit Plan WSDOT, Sound Transit, King County Metro, University of Washington, 2008

Design and Construction Considerations

Both final design and construction should be done with a full understanding of future transit alignments, capacity, and mode split in the SR 520 corridor. The corridor between Foster Island and I-5 is sufficiently sensitive, environmentally and politically, that there will be but one opportunity to "get it right" in terms of construction for the next 75 to 100 years.

Option A+, the preferred alternative of the legislative work group, presents significant obstacles to converting the corridor to include light rail. While technically feasible, the costs involved with a subsequent retrofit (based on the design assumptions stated in the SDEIS) render the likelihood of conversion financially impractical, environmentally challenging, and/or require widening of the facility to an equivalent of eight lanes, which, from a policy perspective, is unacceptable to the City of Seattle. The primary changes needed to the current design in order to meet the mayor's goal of an SR 520 bridge that is readily convertible to light rail include the following:

- There must be sufficient space (i.e., a "gap") between the eastbound and westbound lanes of the SR 520 mainline between Foster Island and Montlake Boulevard to allow an LRT alignment and/or transit/high occupancy vehicle (HOV) lanes to diverge from SR 520.
- Adequate width on the west approach and bridge deck must be maintained to ensure that light rail can be added without significant structural modification. This could require added width of up to 10 feet for the bridge and west approach from the western high rise to Foster Island and transition width for the divergence of the LRT alignment from the mainline between Foster Island and Montlake Boulevard.
- The pontoons must include sufficient flotation and stability to meet the loading imparted by LRT and avoid future in-water construction necessitated by adding pontoons at a later date.

Phasing

This report identifies a scenario to phase safety-sensitive portions of the SR 520 Bridge Replacement and HOV Project while preserving the ability to convert the floating bridge and approaches to carry light rail in the future.

Six-Lane Bridge — 4 GP + 2 HOV Lanes SR 520 Convertible to LRT Operation

Main Features:

- Initial six-lane replacement for floating bridge, with four general purpose (GP) lanes and two HOV lanes
- Six-lane western approach constructed to Montlake that is LRT convertible
- Four-lane Portage Bay Viaduct rebuilt to improved version of current structure
- SR 520 (Medina to Montlake) phased to intensive HCT following regional planning effort

The current budget for constructing the replacement project has a funding shortfall of about $2.6 billion of the $4.65 billion needed. Given this shortfall and the urgency of addressing the public safety issues associated with the floating bridge, it is highly likely that the project will be constructed in phases. The phasing scenario presented in this document would require modification to the current environmental analysis for the SR 520 corridor.

Connections on East and West Shorelines and Departure from the Mainline

The report finds that light rail connections to the east and west shorelines are feasible, but careful planning will be necessary to ensure the preservation of future design options.

On the east side of the floating bridge, an LRT alignment would remain within the SR 520 corridor as it reaches and passes through the Evergreen Point Road area. At Evergreen Point, it would not be possible for LRT and bus rapid transit (BRT) service to share center lane operations and use of the Evergreen Point transit station without substantial reconstruction of the station. The LRT alignment would diverge from the SR 520 corridor somewhere between Evergreen Point Road and I-405, depending on the final alignment selected.

On the Westside, an LRT alignment could diverge from the SR 520 mainline between Foster Island and Montlake Boulevard, depending on the alternative selected for reaching Husky Stadium. This report identifies four options for a crossing of the Montlake Cut to reach the University of Washington:

- High level bridge (with either 70 or 110 feet of clearance),
- Tunnel,
- Low level bridge, or
- Surface approach on Montlake Boulevard with a new bascule bridge parallel to the existing historic Montlake Bridge.

These four alternatives imply an opportunity for a serious policy discussion about the needed, and desired, width of SR 520 between Foster Island and I-5.

Necessary Steps to Build Light Rail on SR 520

The steps necessary to bring light rail to the SR 520 corridor involve planning, environmental analysis, policy decisions, and funding. Regional transportation planning documents do not identify light rail on SR 520; however, to successfully build light rail in this corridor, these documents must be modified to reflect LRT and the intended alignment. Putting the necessary steps in perspective, consider that 20 years ago Central Link, now operating in Seattle, was in a similar situation—it was not included in regional transportation plans, environmental work had not been completed, and funding was uncertain, at best. Before the first passenger boarded Central Link, regional voters agreed to expand the system north to Lynnwood, south to Federal Way, and east to Bellevue and Overlake. This parallel is applicable to SR 520: if the region moves forward to formally consider plans for light rail on SR 520 today, light rail could be a reality in the corridor. On the other hand, if current plans for SR 520 remain unaltered, there are significant, perhaps insurmountable obstacles, to building light rail in the corridor, even if formal planning efforts identify light rail as the preferred option.

Chapter 1. Introduction

Need for this Study

Each day there are approximately 191,000 local and regional trips on the SR 520 corridor. In the future, the number of people making daily trips along this route between Seattle and the Eastside will grow. Mayor McGinn believes that the corridor must provide as many people as possible with the accessibility they want and need while preserving and improving the environment of Seattle. To meet the mayor's vision, the corridor must include light rail transit (LRT). To that end, the mayor commissioned this study to explore the possibilities for constructing light rail on the SR 520 corridor. This report, prepared for Mayor McGinn by Nelson\Nygaard Consulting Associates, accomplishes the following:

- Consider and analyze possible LRT alignments that connect major transit markets along the SR 520 corridor;
- Determine whether existing plans for the SR 520 bridge replacement preclude LRT or present significant obstacles to LRT conversion;
- Identify the steps necessary to build LRT in the SR 520 corridor; and
- Consider how SR 520 can be phased from the existing facility to a facility with a narrow footprint that will carry LRT, including shoreside connections.

Background

Seattle places a premium on the use of space. When space functions for people, the use supports a city that is both sustainable and livable. Decisions on how to use the SR 520 corridor to maximum advantage for the future of the region are being made at a time of changing perspectives on transportation. For the mayor and for many citizens of Seattle, thinking only about how to move cars is no longer acceptable; rather than focusing on vehicles, the transportation conversation must be about moving people and goods, providing access to the jobs, schools, goods and services, and recreational opportunities of Seattle and the region.

Under the leadership of Mayor McGinn, Seattle continues to expand its emphasis on transit, walking, and bicycling as the primary modes of transportation to and around the city. Therefore, the design and function of SR 520 must be based on this future of transportation and not on the traditions of the past. The mayor seeks to create an alternative solution for the SR 520 project that supports a more socially just, environmentally sound corridor that reflects the needs of Seattle residents. The mayor believes that future trends—considerably higher energy prices, focused efforts to reduce greenhouse gas emissions, and an aging population—imply a transportation system different than the status quo as well as changing market forces that will reshape land uses. Population centers will grow closer together, the distance between people and their jobs will shrink, technology will improve access, and people will be anxious to live in places where the grocery store is an easy walk or bike ride away.

This is the context in which the mayor views a multi-billion dollar investment that will last for the next 75 to 100 years. To that end, Mayor McGinn's goal is to ensure that the SR 520 project is built in such a way as to be fully designed for and convertible to light rail, with a maximum of six mainline lanes, on the day the project opens to traffic. The mayor expects light rail to become one

of the corridor's modes of transportation sooner rather than later, although light rail operations are likely to be phased into the corridor's operations at some time following the project's opening.

The mayor believes that Option A+, described as "preferred" by the legislative work group, does not adequately support people of lower income. Without high quality transit service (light rail, bus rapid transit, and bus) on the corridor, people traveling across the SR 520 floating bridge are "forced" into cars that must pay tolls. The implications for a person of low income are simple: to cross SR 520, you must have enough money for a car, for the toll to cross the bridge, and for parking when you arrive at your destination. To equitably connect the east and west sides of the SR 520 corridor, high quality, efficient transit service must be available for all people.

By state law, Washington has established targets for reducing transportation-related greenhouse gas emissions through a reduction in vehicle miles traveled (VMT) per capita. These targets require civic leaders and planners to consider VMT when developing projects such as SR 520, and the mayor's goal is to reduce VMT and impacts from greenhouse gas emissions for the SR 520 project. However, the mayor believes that Option A+ will increase VMT and seeks a design for the SR 520 corridor that will move people out of single occupancy vehicles and onto transit. Light rail is one important way that the corridor can move toward a reduction in VMT and toward a reduction in greenhouse gas emissions.

Three assumptions underlie this work:

1. The SR 520 bridge and approaches need to be replaced to promote public safety and security.
2. The design of SR 520 must be more sensitive to the needs of Seattle's citizens 20 years from now.
3. Maintaining the livability and integrity of Seattle neighborhoods is of paramount importance.

Chapter 2. Background and History

Overview of High Capacity Transit Planning to Date

Planning for high capacity transit (HCT) services—such as light rail transit (LRT) and bus rapid transit (BRT)—and other options for improving transit service in the SR 520 corridor have been included in many of the regional transit and transportation plans and corridor-specific studies and environmental analyses completed to date.

Transit service along the SR 520 corridor has been greatly expanded since the Trans-Lake Washington Corridor planning process began in 1998, yet additional improvements, including the development of HCT, are integral to fulfilling the SR 520 Bridge Replacement and HOV Project purpose of improving mobility for people and goods in the corridor. To date, the majority of transit enhancement options for the corridor have been evaluated only at a conceptual level. Moreover, these HCT options have not been analyzed with all possible combinations of roadway configurations, tolling scenarios, and transportation demand management (TDM) programs that might increase demand for transit services and ultimately optimize the movement of both people and goods across Lake Washington.

This section summarizes planning for and analysis and evaluation of transit modes and associated transit levels of service in the SR 520 corridor completed to date as part of the SR 520 Bridge Replacement and HOV Project as well as previous corridor plans and studies led by the Washington State Department of Transportation (WSDOT), Sound Transit, and King County Metro (Metro). Recommendations, proposals, and findings that are relevant to the City of Seattle's current interest in transit opportunities in the SR 520 corridor are highlighted for each of the following plans and studies, along with an assessment of key assumptions and/or limitations where appropriate.

Trans-Lake Washington Study

In 1998, the State Legislature initiated the Trans-Lake Washington Study to explore ways of improving mobility across and around Lake Washington. Two of the key goals of the study were to improve both transit operations and the mobility of people and goods. The study evaluated various modes of transportation including HCT, types of crossings and potential crossing alignments, and options for managing travel demand in the corridor, such as tolling and changing land use patterns. The following findings of the Trans-Lake Washington Study are relevant to the City of Seattle's interest in transit opportunities in the SR 520 corridor:

- Four, six, and eight-lane roadway alternatives were evaluated for a new crossing in the same alignment as the existing SR 520 bridge. However, only the six-lane and eight-lane alternatives were evaluated with and without HCT in the same alignment.[2]

2. The Supplemental Draft Environmental Impact Statement (SDEIS) for the SR 520 I-5 to Medina Bridge Replacement and HOV Project notes that the Lake Washington Study "recommended that the 6- and 8-Lane Alternatives be evaluated with and without high-capacity transit in the corridor, because no regional decision had yet been made on whether SR 520 or I-90 would be the initial corridor to carry HCT;" however, no explanation was provided for why the project team did not evaluate an alternative with a 4-lane roadway configuration implemented concurrently with HCT.

- According to travel forecasts developed for the Trans-Lake Washington Study, only one HCT corridor across Lake Washington was thought necessary to satisfy transit demand through the year 2020.
- The Trans-Lake Study noted that "at some point beyond the planning horizon of Sound Transit's Long Range Vision, it is possible that travel demand by transit could grow to a level that would justify a second trans-lake HCT corridor in addition to the I-90 corridor. Since both development of a third corridor across Lake Washington or expansion of the I-90 corridor is unlikely, the SR 520 corridor is the most viable option for the second corridor."

In August 2002, the Trans-Lake Washington Project Team published the Final HCT Accommodation Report with the intent to facilitate "policy-level discussions regarding what actions should be taken to preserve or accommodate future development of HCT facilities on the SR 520 corridor." This study addressed (1) HCT technology choices, (2) the range of options available for preserving, accommodating, and facilitating possible future construction of HCT in the corridor[3], (3) logical alignment locations and line configurations for a future SR 520 HCT line, and (4) costs and implications of this range of options for the roadway project. The study did not include an evaluation of the feasibility, costs, or impacts of implementing HCT concurrently with the roadway improvements planned for the SR 520 corridor, due to the fact that the regional transit agencies have determined that rail would not be incorporated in the corridor until after SR 520 is constructed. Relevant findings include the following:

- While a range of HCT technologies may be appropriate for the corridor, using the LRT-type envelope and design requirements would provide a good general basis for accommodating future fixed guideway HCT in the SR 520 corridor.
- In the short to medium term, an SR 520 HCT line could be merged into the Central Link LRT corridor to serve Capitol Hill and downtown Seattle. However, "when Central Link is extended beyond Northgate, the segment between the University of Washington and downtown Seattle will be capacity constrained and another HCT line between the University and downtown will be required."

SR 520 High Capacity Transit Plan

As required by ESSB 6099 (2007), WSDOT, Sound Transit, King County Metro, and the University of Washington (UW) collaborated to produce the SR 520 High Capacity Transit Plan, detailing (1) possible approaches to providing HCT service in the Redmond to Seattle SR 520 corridor, including LRT and BRT, and (2) options for improving multimodal access to and connectivity with the University Link light rail line and University of Washington LRT station currently under construction near Husky Stadium. Specified goals and objectives for the plan included "responding to projected travel demand forecasted for 2030," and identifying a "vision for the ultimate development of the SR 520 HCT system which may include exclusive, dedicated lanes in the corridor."[4]

The HCT Plan was submitted to the Governor and members of the Legislative Working Group in December 2008 and made the following findings and recommendations:

3. The range of HCT scenarios evaluated for the corridor included (1) no HCT accommodation, (2) HCT accommodation on the floating bridge, (3) HCT accommodation on the entire Lake Washington crossing and at key structures, and (4) HCT envelope preservation for the full corridor (from Redmond to Seattle), but did not evaluate the option of implementing HCT in the corridor concurrently with the reconstruction of the SR 520 bridge.

4. SR 520 HCT Plan, p. 21

- BRT service is identified as the "near-term HCT service in the SR 520 corridor." The full BRT service is identified in the plan initially as "HOV/Bus Rapid Transit," which utilizes:
  - Inside high occupancy vehicle (HOV) lanes (shared with carpools and vanpools) and direct-access ramps to avoid weaving across congested general-purpose lanes to reach stations and park and ride facilities,
  - Low-floor hybrid buses,
  - Off-board fare collection to expedite boarding, and
  - Real-time schedule information at stations, including next bus arrival times.
- The BRT concept proposed in the HCT Plan calls for service with 10-minute frequencies during peak hours on five routes, including three initial lines to be started in 2016 when the SR 520 corridor bridge and HOV improvements are complete:
  - Redmond/Overlake to the University District
  - Redmond/Overlake to downtown Seattle
  - Eastgate/Bellevue to the University District
- BRT service is proposed for implementation after 2022 from:
  - Totem Lake/Kirkland to downtown Seattle
  - Canyon Park/Woodinville to the University District
- In 2008, approximately 160,000 hours of bus service were provided in the SR 520 corridor. The proposed BRT plan calls for increasing service in the corridor by 130,000 hours at a cost of $16.5 million (2008 dollars) per year. (Note that Sound Transit's ST2 Plan anticipated the need for additional service hours in the corridor to support the HCT Plan. The hours funded by ST2 will be implemented in fall 2010 and account for the new ST 542 route as well as additional service on ST 545.King County has designated a $0.01 per thousand property tax to fund expanded transit operations in the SR 520 corridor. This is not sufficient to fund the entire $16.5 million per year estimated in the HCT plan, but makes substantial progress toward filling the gap.)
- Funding for the purchase of 45 new buses to serve these SR 520 BRT routes is identified in the Lake Washington Urban Partnership agreement between WSDOT, Metro, and the Puget Sound Regional Council (PSRC).
- By 2021, SR 520 BRT lines would connect with the East Link LRT line in downtown Bellevue or at the Overlake Transit Center.
- Recommended measures to improve access to BRT include expanding service on local routes connecting to BRT stations. No funding is identified for these local transit improvements.
- The Final HCT Plan developed four alternative concepts for the Montlake Multimodal Center, including:
  - A baseline concept that assumes expansion of existing bus zones on NE Pacific Street and construction of a grade-separated bridge from the UW Link LRT station over Montlake Boulevard and NE Pacific Place to the UW Campus.
  - A baseline concept, as described previously, that incorporates the Rainier Vista Concept Plan developed by UW, which would add a lid over NE Pacific Place and

pedestrian bridges from the Montlake Triangle over NE Pacific Street and over Montlake Boulevard to the UW Link LRT station.[5]

- A grade-separated NE Pacific Street/Montlake Boulevard NE intersection, with a lid allowing direct pedestrian access between the UW Link LRT station, the UW Medical Center, the Montlake Triangle, and expanded bus zones on NE Pacific Street.
- A grade-separated NE Pacific Street/Montlake Boulevard NE intersection that incorporates the Rainier Vista Concept Plan developed by UW.

- All three of the Westside interchange options under evaluation in 2008—Options A, K, and L—included removal of the Montlake Flyer stop. To replace the function of the Montlake Flyer stop, the plan calls for additional direct service from SR 520 to the University District. No funding is identified for such additional service, nor for additional direct service to Capitol Hill and other central and east Seattle neighborhoods that currently access SR 520 corridor transit destinations by way of transfers at the Montlake Flyer stop.
- Projections based on growth trends from 1998-2008 show weekday transit ridership in the SR 520 corridor reaching 25,000 daily riders by 2020 (from approximately 15,000 per day in 2008).[6]
- Transit ridership across Lake Washington has grown at a higher rate than the average 3.1% per year growth rate for the entire region (PSRC, Transportation 2040).
- The SR 520 BRT concept plan cannot be implemented with available funding. Among other funding options, state law identifies transit operations and capital as potentially eligible expenditures for toll revenues.[7]

Evaluation of Potential SR 520 HCT Alignments in Seattle

As part of the SR 520 Bridge Replacement and HOV Project, Sound Transit and WSDOT evaluated potential HCT alignments in Seattle and on the Eastside to ensure that the final configuration of SR 520—and connecting ramps and roadway supports—does not preclude the future development of HCT in the corridor. Potential SR 520 HCT alignments in Seattle included:

- **LRT to Ballard, via N 45th Street:** Tunnel under Union Bay and the Montlake Cut from the west approach in the vicinity of Foster Island to the vicinity of the UW Link LRT station, continuing north in a tunnel under Montlake Boulevard to the vicinity of N 45th Street, continuing west in a tunnel under N 45th Street to Ballard, via the University District and Wallingford. An alternative alignment would reach the vicinity of the UW Link LRT station from the west approach by way of a tunnel in an alignment under SR 520 and Montlake Boulevard.

5. This plan has since been updated and no longer includes the high level pedestrian bridges over Pacific Street or Montlake Boulevard. These have been replaced with at-grade crossings. Only the lid over Pacific Place remains in the current plan.

6. Projections did not include the I-90 East Link LRT project. The SR 520 I-5 to Medina SDEIS TDR Cumulative Effects section shows a decrease in transit ridership on SR 520 when East Link is implemented, with ridership growth regaining the losses within ten years.

7. It is not clear if additional legislative approval is required to dedicate toll revenue collected in the SR 520 corridor, or connecting or parallel corridors, to transit operations. ESHB 1773 (2009), codified as RCW 47.56.820, provides that toll revenues may be expended on public "conveyances" and "operations" in the tolled corridor. However, such expenditures are subject to appropriation by the State Legislature. In the SR 520 corridor, toll revenues collected according to the terms of the Urban Partnership Agreement with the Federal Highway Administration (FHWA) may be expended on transit capital (e.g., purchase of 45 transit buses dedicated to the SR 520 corridor BRT routes is authorized), but may not be expended on transit operations. It is not clear if legislative appropriation could be secured to dedicate toll revenues to support transit operations.

- **LRT to Ballard, via N 40th Street:** Tunnel from the west approach to Montlake Boulevard in the SR 520 alignment, continuing north in a tunnel under the Montlake Cut in the vicinity of the Montlake Bridge, northwest in a tunnel under Pacific Street to a station in the vicinity of Brooklyn Avenue NE, continuing west in a tunnel under Pacific Street and N 40th Street to Ballard, via Wallingford and Fremont.
- **BRT to the University District:** Tunnel in the same alignment as the potential LRT line from the west approach to Pacific Street and Brooklyn (along the SR 520 alignment, continuing north in a tunnel under the Montlake Cut in the vicinity of the Montlake Bridge, and northwest in a tunnel under Pacific Street), continuing north in a tunnel under Brooklyn Street to an underground terminal BRT station in the vicinity of Brooklyn Avenue NE and NE Campus Parkway.
- **BRT to downtown Seattle, via Eastlake:** BRT in the SR 520 HOV/transit lanes from the west approach, through the Montlake interchange to the eastern approach to the SR 520/I-5 interchange (with an in-line BRT station just east of Montlake Boulevard), continuing in a dedicated bus tunnel to a BRT station on the west side of I-5 in the Eastlake neighborhood, then on to the South Lake Union neighborhood and downtown Seattle via surface lanes in the alignment of I-5 and the southbound exit to Mercer Street and Fairview Avenue North.

Sound Transit Long-Range Plan

As the Regional Transit Authority (under Revised Code of Washington {RCW} Chapters 81.104 and 81.112), Sound Transit is responsible for regional HCT planning. The Sound Transit Regional Transit Long-Range Plan (LRP) is a long-term vision for the development of regional high capacity transit service in the Central Puget Sound Region. The Regional Transit Long-Range Vision, the first LRP adopted by the Sound Transit Board of Directors (then known as the Central Puget Sound Regional Transit Authority) in May 1996, was used as a basis for much of the multimodal transportation planning conducted for the SR 520 corridor to date. That plan identified the following regional transit service on corridors across Lake Washington:

- Express bus service on a "Regional HOV Expressway" in the SR 520 corridor, and
- Potential rail extensions from Seattle to Redmond, Kirkland, and Issaquah, via Bellevue and the I-90 corridor.[8]

In July 2005, following extensive analysis and public outreach, the Sound Transit Board adopted an updated Long-Range Plan, which included the following changes to the cross-lake corridors:

- University District to Redmond and Northgate to Bothell were each designated as HCT corridors.
- Downtown Seattle to Redmond, via I-90 to downtown Bellevue was identified as an LRT or Rail Convertible BRT corridor.

With voter approval of Sound Transit 2 (ST2) in November 2008, Sound Transit secured the local funding necessary to implement the ST2 Plan, including high capacity transit improvements throughout the region:

8. "Potential rail extensions" are defined in the Sound Move plan as "possible extensions of light rail, commuter rail, or other technology."

- East Link light rail, which is an extension of Link LRT service from downtown Seattle to Redmond, via Mercer Island, downtown Bellevue, and Overlake. The Seattle to Bellevue segment of East Link will use the I-90 corridor to cross Lake Washington. The alignment of East Link from downtown Bellevue to Overlake and downtown Redmond is not finalized, but will generally follow the SR 520 corridor and will allow passengers to transfer between East Link trains and SR 520 corridor BRT and/or other HCT service and local service.
- ST2 provides funding for a 17% increase in regional ST Express bus service, beginning in 2009. This includes funding for a new route in the SR 520 corridor connecting the University District with Overlake and Redmond, increased service \frequency and expanded hours of operation in the SR 522 corridor (Seattle to Bothell and Woodinville), additional service in the I-90 corridor, and a route connecting Overlake, Bellevue, and Auburn. (Other increases in service will occur in the South King, Snohomish, and Pierce County areas.)

The Regional Transit System Plan for the Central Puget Sound: Sound Transit 2: A Mass Transit Guide (July 2008), projected that the ST2 projects identified above would result in the following weekday peak hour transit travel time savings in 2030 (relative to the No Build Alternative):

- Bellevue to Seattle (14 minutes saved)
- University of Washington to Bellevue (6 minutes saved)
- Capitol Hill to Overlake/Redmond (25 minutes saved)
- Redmond/Overlake to SeaTac Airport (30 minutes saved)

To facilitate system expansion beyond the projects funded in the plan, ST2 also includes funding for planning studies, including HCT from Redmond to the University District via Kirkland in the SR 520 corridor, continuing on to Ballard and downtown Seattle.

Sound Transit HCT Planning: Assessment of Compatibility with the SR 520 Pacific Street Interchange Option

In 2005, Sound Transit commissioned Parsons Brinckerhoff (PB) to conduct a review of the proposed SR 520 Pacific Street Interchange Option and to assess its compatibility with potential future HCT across the SR 520 bridge. The intent of the study was to identify any elements of the proposed configuration for the Pacific Street Interchange Option that might preclude future introduction of an HCT connection from the SR 520 corridor to the LRT station that is currently under construction on University of Washington property adjacent to Husky Stadium (the U-Link LRT station). No design work was conducted as part of the study, but in order to identify potential conflicts, PB evaluated conceptual plans for both an elevated and an underground SR 520 HCT station on the parking lot south of Husky Stadium. Based on an evaluation of WSDOT and Sound Transit plans and these conceptual station options, the study made the following findings relevant to the design options currently under review by the City of Seattle:

- The Pacific Street Interchange Option can accommodate HCT with certain modifications and allows for either an elevated or an underground terminal station for a future SR 520 HCT line on the south parking lot of Husky Stadium.

- An underground station at the site would need to connect to the SR 520 alignment in the vicinity of Foster Island via a tunnel under Union Bay.
- An elevated terminal station could be connected to SR 520 by way of a bridge over Union Bay with either 70' or 110' clearance over the high water mark.[9] The lower 70' clearance requirement would make it easier to configure a new station on the south parking lot of Husky Stadium as a terminal station.
- Pedestrian access to an elevated station would be at the west end of the station, closer to the main entrance of the U-Link LRT station.
- An underground station could have a platform located at the elevation of the lower mezzanine of the U-Link LRT station, allowing for easy transfers to North Link trains and/or to a pedestrian tunnel under Montlake Boulevard.

This study did not evaluate the feasibility, impacts, or potential conflicts of constructing (1) an SR 520 LRT station adjacent to the U-Link LRT station without the Pacific Street Interchange (e.g., with a transit-only bridge or tunnel crossing of Union Bay and a station location in the path of the proposed Pacific Street extension through the south stadium parking lot), or (2) a non-terminal station at the same location, with an extension of SR 520 HCT service to the west and/or north of the site. The study notes that "if an extension to the west were to be required…it is anticipated that the station location would be quite different from the location examined in this study."[10]

PSRC Vision 2040

The Vision 2040 Growth Management, Environmental, Economic, and Transportation Strategy for the Central Puget Sound Region, which establishes multi-county planning policies under the Washington State Growth Management Act (RCW.36.70A), defines a series of urban growth centers in Redmond, Overlake, Bellevue, the University District, and Ballard to be linked by HCT in the SR 520/N 45th Street corridor.

SR 520 Bridge Replacement and HOV Project Supplemental DEIS

A Supplemental Draft Environmental Impact Statement (SDEIS) was initiated for the SR 520 Bridge Replacement and HOV Project in 2007 to define and evaluate the performance and impacts of multiple Westside design options for the six-lane alternative for the corridor. All options—Design Options A, K, or L, including all sub-options evaluated in the SDEIS—would (a) add HOV lanes in both directions across the SR 520 bridge, (b) add an HOV direct connection to the I-5 express lanes that would be open for westbound to southbound trips in the morning and northbound to eastbound trips in the afternoon, (c) add HOV bypass lanes on all interchange on-ramps, and (d) remove the Montlake Freeway Transit Station. Option A (and Option A with sub-options, commonly referred to as Option A+) would include a westbound transit-only off-ramp to northbound Montlake Boulevard; Option A with sub-options would also include an eastbound direct access on-ramp.[11] Relevant SDEIS elements and findings include the following:

9. The clearance requirement for such a bridge will be set by the US Coast Guard.
10. One notable constraint limiting the location and profile (elevated v. underground) of a station in the vicinity of Husky Stadium and any potential extension to the west is the requirement to protect the Rainier View Corridor from Red Square on the UW campus.
11. SDEIS (2009), p. 5-19

- With the No-Build Alternative, transit ridership in the corridor would increase by 8,150 person trips per day (+51% over current conditions {15,980 trips/day} to a total of 24,130 person trips per day). All of the six-lane options evaluated in the SDEIS are projected to increase transit ridership by an additional 3,450 person trips per day (+72% over current conditions to a total of 27,580 person trips per day).[12] This increase reflects the effect of HOV lane completion and tolling on mode choice.[13]
- Westbound transit travel times in 2030 from SR 202 to I-5 in the SR 520 corridor are projected to be five minutes faster during both the AM and PM peak periods under all of the six-lane design options evaluated in the SDEIS compared to the No Build Alternative.
- Eastbound transit travel times in 2030 from I-5 to SR 202 in the SR 520 corridor are projected to be up to 40 minutes faster during the PM peak period under all of the six-lane design options evaluated in the SDEIS compared to the No Build Alternative.
- King County Metro's *Transit Now* initiative will fund increased service, primarily on weekends and during the midday period, on two significant transit routes in the SR 520 corridor (271, 255). Additionally, King County has taken action to dedicate a one cent per thousand property tax to support King County's contribution to the Urban Partnership Agreement. This action does not fully finance the level of service proposed in the SR 520 HCT study, but it does support a very significant improvement in transit service.

Urban Partnership Agreement SR 520 Variable Tolling Project -- Transportation Discipline Report

In March 2009, WSDOT and the Federal Highway Administration (FHWA) released a Transportation Discipline Report, for the SR 520 Replacement Project, which evaluated the transportation effects of tolling the existing SR 520 bridge from 2010 to 2016. Three alternatives were evaluated, including a "Low Toll" alternative (one way tolls of $2.95 during AM and PM peak periods), a "High Toll" scenario (one way tolls of $3.80 during AM and PM peak periods), and a "No Build" alternative that assumed continuation of current toll-free operations on SR 520 through 2016 (effectively a "No Action" alternative). The impacts of tolling SR 520 and potentially I-90 after completion of the SR 520 Bridge Replacement and HOV Project were evaluated separately for each of several six-lane alternatives in the report

The methodological issues and findings of the SR 520 Variable Tolling Project Transportation Discipline Report that are relevant to the City of Seattle's current work include the following:

- The analysis of existing conditions indicates that vehicle traffic and person movements in the corridor peak in opposite directions. This means that total vehicle occupancy is higher westbound in the mornings and eastbound in the afternoons, reflecting the greater availability of transit serving the Seattle-bound commute and the greater transit accessibility of Westside commute destinations.[14]

12. SDEIS (2009), p. 5-20

13. SDEIS (2009), Page ES-29. Note that although the impact of tolling on transit demand was modeled for the three design options evaluated in the SDEIS, no comparably price-sensitive evaluation was documented for the alternatives evaluated in the 2006 DEIS.

14. Lower parking prices and/or the availability of free or subsidized parking at Eastside commute destinations may also encourage SOV travel from eastbound morning commutes, resulting in lower overall vehicle occupancy in that direction.

- Peak period transit ridership is projected to increase between 26% for the Low Toll scenario and 32% for the High Toll scenario relative to the No Build alternative.[15] This transit ridership advantage of the tolled scenarios is projected to remain constant through 2016.
- In 2010 and 2016, travel times for GP traffic and HOVs in the SR 520 corridor and on segments of I-405 would be significantly reduced as a result of implementation of either tolling scenario evaluated in the report.
- No significant change in travel time is projected for I-90 or SR-522 as a result of implementing either the High Toll or Low Toll scenarios for SR 520. Although some traffic would be diverted to these alternate routes, they are projected to have sufficient capacity to accommodate new trips without a significant reduction in travel speeds or increase in corridor travel times during the AM or PM peak periods in either 2010 or 2016.[16]
- As a result of implementing tolling, the total volume of vehicles crossing Lake Washington during peak periods—and associated vehicle miles traveled (VMT) and greenhouse gas emissions—is projected to decline by 3% to 5% during the morning peak period and by 4% to 5% during the afternoon peak period in 2010, as compared to the No Build alternative. This difference in traffic volumes between the tolled scenarios and the No Build alternative is projected to diminish slightly through 2016. In all tolled scenarios, total cross-lake VMT during peak periods will be lower than with the No Build alternative.[17]

Although these findings are useful in assessing the potential impacts of pursuing an SR 520 configuration with four tolled GP lanes plus two transit lanes, the benefits to mobility—including increased travel speeds for GP traffic and HOVs, reduced travel times, increased transit ridership, and reduced VMT—may be understated due to the limitations of the travel demand model used, the assumed travel network, and the availability of data inputs.

15. UPA SR 520 Variable Tolling EA, Transportation Discipline Report, Exhibit 4-20.
16. UPA SR 520 Variable Tolling EA, Transportation Discipline Report, Exhibits 4-15 to 4-18
17. UPA SR 520 Variable Tolling EA, Transportation Discipline Report, p. 4-13.

Chapter 3. Light Rail Opportunities

This section identifies and discusses potential light rail transit (LRT) segment alignment options on the Westside and Eastside of the SR 520 bridge. Segment alignment options are then evaluated for LRT potential and combined to develop a qualitative assessment of market and operation feasibility of LRT alignments connecting Seattle and Eastside destinations.

Assumptions

Several major assumptions have been made to conduct the analysis:

- LRT across the SR 520 corridor is feasible—the floating bridge, as designed, will accommodate the width and weight of LRT in the future.
- Details regarding alignment and guideway technology (e.g., at-grade, aerial, underground) in Seattle and on the Eastside are not yet designed and defined, and thus could change when conducting further engineering feasibility analyses.
- LRT levels of service (LOS) would at least match bus rapid transit (BRT) service planning assumptions (i.e., 7-minute frequency during peak hours, and 10-minute frequency during midday/off-peak hours).
- Crossing the Montlake Cut requires either an aerial structure with clearance of 110 feet above the water, a deep bore tunnel under the Lake Washington ship canal, or a second bascule bridge.
- U-Link and North Link tunnels cannot accommodate another line due to designed operation capacity and engineering design issues.

Introduction to LRT Segment Concepts

Preliminary LRT segment alignment concepts were identified on the west and east sides of SR 520. Segments were chosen following major travel and transit corridors in Seattle and the region that connect local activity centers (e.g., Seattle's Urban Villages) and regional activity centers (or regional growth centers as defined by PSRC), and that could support some form of high capacity transit (HCT) operation in the future (mostly LRT or BRT) based on expert knowledge and a qualitative assessment of existing and future market demand in the region.

Two basic "*bridge*" segments were defined for operation across Lake Washington on the SR 520 floating bridge:

- Evergreen Point to Husky Stadium
- Evergreen Point to Montlake Boulevard Interchange

A total of 15 segments were identified and evaluated in Seattle that could either connect with the bridge segment at Husky Stadium or at the Montlake Boulevard Interchange (see Figure 1, on page 19).

A total of 10 Eastside segments were identified and evaluated that would connect with the bridge segment at Evergreen Point (see Figure 1, on page 19).

Individual segment alignment maps and evaluation summaries are included in Appendices A and B, respectively, at the end of this report.

LRT Segment Evaluation Criteria

Eight major evaluation criteria were used to screen the LRT segment concepts. Criteria included origin-destination travel demand, potential corridor demand, network connectivity and duplication, land use and urban growth potential, a preliminary assessment of constructability and feasibility, a level of magnitude for potential costs, and potential impacts to neighborhoods and the environment. The methodology for screening each segment concept is described below.

1. Major Destinations Served

This criterion identifies Seattle neighborhoods, Eastside communities, regional centers, and urban villages served by potential LRT segment alignments.

Scoring Methodology:

- *Low = serves mostly residential community areas*
- *Medium = serves a mix of residential communities and activity centers*
- *High = serves multiple regional centers and urban villages*

2. Potential Market Reach

Potential market is defined as the total size of the market, or the number of persons and jobs that are within one-half mile of the potential LRT corridor segment.

Scoring Methodology:

- *Low = limited access from surrounding land uses, poor street connectivity, limited number of communities and destinations served*
- *Medium = combination of limited access and connections from many different communities and destinations*
- *High = corridor easily accessible from multiple communities and high number of connecting arterial streets*

3. Ridership Potential

Potential ridership is estimated at a qualitative level and based on current and expected transit ridership patterns, at the corridor level, for Metro and Sound Transit services.

Scoring Methodology:

- *Low = low ridership expectations based on existing and parallel corridors' ridership*
- *Medium = mixed ridership expectations based on existing ridership along comparable corridors*
- *High = high ridership levels in existing corridors and potential for increased transit demand*

4. System Connectivity

Potential transfer movements and the transit market shed for each LRT corridor option are described by identifying connections with major travel corridors in Seattle.

Scoring Methodology:

- *Low = low number of connections with major transit corridors in the system*

- *Medium = moderate number of connections or combination of segments with low and high connectivity with major transit corridors*
- *High = high levels of connectivity with major transit corridors and other transit services that could boost ridership in the corridor and system*

5. System Duplication

The corridor options are evaluated for duplication of existing HCT corridors as well as whether the LRT segment concept creates an alternative option that does not compete with existing or planned HCT infrastructure.

Scoring Methodology:

- *Low = directly competes with existing or planned HCT infrastructure, mostly the Link system*
- *Medium = moderate duplication or competition in limited segments of planned HCT system network*
- High = does not duplicate or compete with existing or planned HCT infrastructure

6. Land Use and Growth Potential

This criterion identifies residential and employment densities along major segments of the LRT corridor options and identifies the potential for densification and/or infill development along same corridors.

Scoring Methodology:

- *Low = primarily traverses areas that are highly consolidated in form and function and have few redevelopment and densification opportunities*
- *Medium = limited number of areas or segments with potential for redevelopment and densification*
- *High = traverses several segments of low density development or underdeveloped property with potential for redevelopment and densification*

7. Constructability and Feasibility

Potential guideway technology options are evaluated, such as at grade, aerial structures, and underground tunnels by segment given observable rights-of-way and topography; whether tunnel segments follow existing or planned alignments for Central, East, and North Link; and approximate significance of environmental impacts to communities and neighborhoods along the potential LRT corridor.

Scoring Methodology:

- *Low = high number of engineering challenges for LRT development, such as major grade changes, water bodies, tunneling, and complex aerial structure solutions with potentially high neighborhood impacts*
- *Medium = limited number of engineering challenges, complex solutions required at few locations only with limited impact*
- High = minimum number of impacts and/or engineering challenges for LRT development

8. Potential Cost

Based on approximate length in miles for each guideway technology, potential costs are estimated to allow comparison between segment alignment options.

Scoring Methodology:

- *Low = many underground segments that require new tunnels, long aerial structure segments, and/or complex engineering solutions at particular points*
- *Medium = combination of at-grade alignments with limited amount of tunneling work*
- *High = mostly at-grade alignment and limited number of grade changes, use of existing road or rail infrastructure*

LRT Segment Evaluation

Figure 1 on the next page presents a complete list of LRT segments considered for analysis and screening and the segments' scoring results for each evaluation criteria as described in the methodology above. The evaluation of LRT segment concepts is highly qualitative and is intended as a "first level" screening of potential LRT alignment segments, in both Seattle and on the Eastside, to select those segments that qualitatively present the best balance between a high number of opportunities for Seattle and its transportation system and a low number of difficulties for LRT implementation.

A few segments considered for evaluation closely duplicate funded Link system alignments. This was done purposefully to benchmark potential LRT segments west of the SR 520 bridge with approved Link alignment segments.

Many potential options exist to connect light rail along the SR 520 corridor with Seattle destinations and communities. Options are categorized from the outset by whether they cross the Montlake Cut or not. Segment concepts that do not cross the Montlake Cut stay on SR 520 and deviate at Montlake toward Capitol Hill and downtown or cross I-5 and deviate towards South Lake Union and downtown. All other segment concepts are proposed to serve North Seattle and Northeast Seattle neighborhoods and destinations, and places beyond.

As mentioned before, individual segment alignment maps and detailed evaluation summaries are included in the Appendices at the end of this report.

The scoring key utilized in the LRT segment evaluation matrix is as follows:

Scoring Key

1	Low
3	Medium
5	High

Figure 1: LRT Segment Evaluation

LRT Corridor Segment Options	EVALUATION CRITERIA								Evaluation/Scoring Comments
	Destinations Served	Potential Market	Ridership Potential	System Connectivity	System Duplication	Land Use and Growth Potential	Constructability & Feasibility	Potential Cost	
SR 520 Bridge – Husky Stadium/Montlake to Evergreen Point. No intermediate stops. Two options:									
1. Stop on north side of Montlake Cut by Husky Stadium	1	1	1	5	1	1	5	3	Segments #1 and #8 make central segment
2. Stop on south side of Montlake Cut on SR 520 ROW	1	1	1	1	1	1	5	5	Works with segments #3 and #4; not selected for further analysis
West of SR 520 Bridge – City of Seattle Options:									
3. Downtown Seattle via Roanoke, Eastlake and South Lake Union to Westlake Center Station	5	5	3	3	3	3	1	1	Not selected for further analysis
4. Downtown Seattle via 23rd Avenue and Madison to University Street Station	3	5	3	3	5	5	1	1	Not selected for further analysis
5. Downtown Seattle via Wallingford/Fremont, Queen Anne, Belltown to Westlake Center Station	5	5	5	5	5	3	1	1	Not selected for further analysis; mostly tunnel alignment, expected high cost
6. Downtown Seattle via Campus Pkwy, Eastlake, South Lake Union to Westlake Center Station	5	5	5	5	1	3	1	1	Not selected for further analysis; system duplication and high cost
7. Downtown Seattle via University Link Tunnel to Westlake Center Station	3	1	5	5	1	1	1	3	Not selected for further analysis; fatal flaw, University Link tunnel at capacity
8. University District via Pacific and Brooklyn to Brooklyn Link Station	1	3	3	3	3	3	5	5	Segments #1 and #8 make central segment
9. Northgate via Roosevelt/11th Avenue through University District and Green Lake	3	3	3	3	1	3	3	3	Not selected for further analysis; North Link duplication
10. Lake City via Roosevelt/11th Avenue and Lake City Way	3	5	3	3	3	5	3	3	Selected for analysis
11. Canyon Park via Lake City Way/SR 522 and UW Bothell Campus	5	5	5	5	3	5	3	1	Not selected for further analysis; potential extension of segmen: #10 at a later phase
12. Magnusson Park via Sand Point Way, Children's Hospital	3	1	1	1	5	3	5	5	Not selected for further analysis; low ridership expectations
13. Ballard via 45th Street and Market Street Corridors	5	5	5	5	5	5	1	1	Selected for analysis. Conceptual segment only; final alignment through Wallingford and Fremont TBD
14. Ballard via Campus Pkwy, 40th/39th Street and Leary Corridors	5	3	3	3	5	3	1	1	Not selected for further analysis; alternative to 45th Street alignmen:
15. Aurora Village via SR 99/Aurora Avenue and 45th Street to UW Station	5	5	5	5	1	5	3	1	Selected for analysis. Joint-operation with Rapid Ride is a major issue; can be shortened to Bitter Lake
16. Greenwood via Phinney Ridge and 45th Street Corridor	5	5	5	5	3	3	1	1	Selected for analysis
17. Whittier Heights via 85th Street, Green Lake, Ravenna and Roosevelt/11th Avenue Corridor	5	5	3	5	3	3	1	1	Selected for analysis
East of SR 520 Bridge – East King County Options:									
18. Woodinville Town Center via BNSF Corridor through Kirkland and Totem Lake Regional Center	3	1	1	5	5	3	5	3	Not selected for further analysis; low ridership expectations, right of way issues
19. Canyon Park via BNSF Corridor, Totem Lake, I-405 and UW Bothell Campus	5	3	3	5	5	3	3	1	Selected for analysis. Initial segment to Totem Lake with an extension to Canyon Park at a later phase
20. Downtown Redmond via Kirkland, BNSF Corridor, and 85th Avenue/Redmond Way Corridor	3	3	3	3	5	5	1	3	Not selected for further analysis; shorter variant of segment #21
21. Overlake Center via Kirkland (BNSF Corridor), 85th Street, and downtown Redmond	5	5	5	5	5	5	1	1	Selected for analysis. Initial segment to downtown Redmond; extension to Overlake interlined with East
22. Downtown Redmond via SR 520, 148th Avenue and Willows/90th Street	3	5	3	1	1	3	5	3	Not selected for further analysis; low accessibility
23. Downtown Redmond via downtown Bellevue, Bel-Red, and Overlake (East Link corridor)	5	5	5	5	1	5	3	3	Selected for analysis. Potential interlining with East Link
24. Downtown Bellevue to connect with East Link at Bellevue Transit Center	1	3	3	3	3	1	5	5	Selected for analysis. Connection with East Link
25. Downtown Bellevue via BNSF to connect with East Link at Overlake Hospital/NE 8th Street	1	1	1	3	3	1	3	3	Not selected for further analysis; alternative to segment #24
26. Bellevue Crossroads via downtown Bellevue and NE 8th Street Corridor	3	3	3	3	3	3	1	1	Not selected for further analysis; potential grade issues along NE 8th Street
27. Issaquah Transit Center via downtown Bellevue, Bellevue Community College and I-90	5	5	3	5	3	3	1	1	Not selected for further analysis

Selected LRT Alignment Concepts

From the evaluation conducted and presented in Figure 1 above, a limited number of segments were selected in Seattle and on the Eastside for further consideration, based on their combined attributes and potential for success. These selected LRT segments were then paired together to combine their scoring and explore end-to-end alignment concepts that show the greatest potential for LRT implementation. Figure 2 below presents the pairings and scoring of LRT segments selected for further consideration.

Figure 2: Selected LRT Segment Pairings

SR 520 Selected Segment Pairings	21. Overlake Center via Kirkland (BNSF Corridor), 85th Street, and downtown Redmond	23. Downtown Redmond via downtown Bellevue, Bel-Red, and Overlake (East Link corridor)	19. Canyon Park via BNSF Corridor, Totem Lake, I-405 and UW Bothell Campus	24. Downtown Bellevue to connect with East Link at Bellevue Transit Center
13. Ballard via 45th Street and Market Street Corridors	H	H	M	L
15. Aurora Village via SR 99/Aurora Avenue and 45th Street to UW Station	H	H	M	L
16. Greenwood via Phinney Ridge and 45th Street Corridor	M	M	L	L
10. Lake City via Roosevelt/11th Avenue and Lake City Way	M	M	L	L
17. Whittier Heights via 85th Street, Green Lake, Ravenna and Roosevelt/11th Avenue Corridor	M	M	L	L

Based on the results of this analysis, five preliminary LRT alignments were selected for further study and analysis:

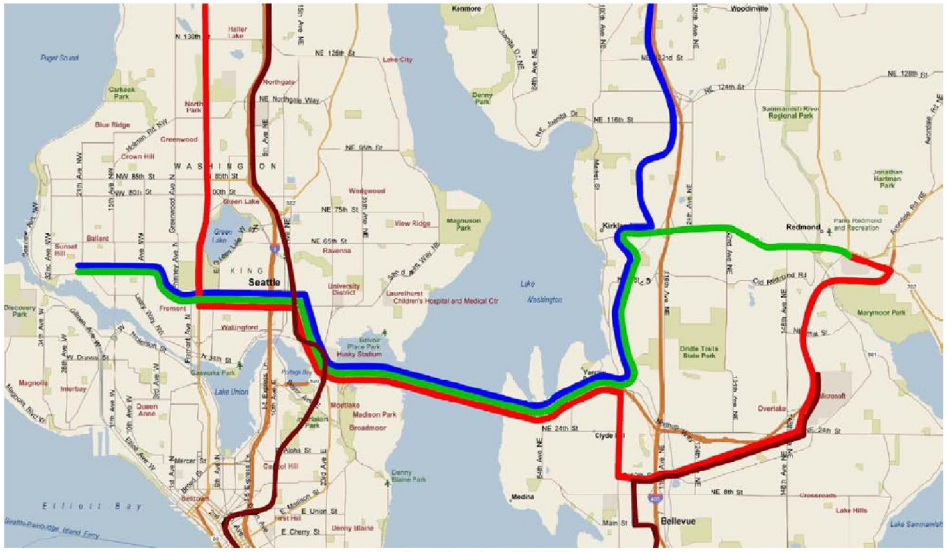
1. Ballard to Redmond, via Kirkland
2. Ballard to Redmond, via Overlake
3. Haller Lake to Redmond, via Kirkland
4. Haller Lake to Redmond, via Overlake
5. Ballard to Totem Lake, via the BNSF Corridor

A summary of conceptual LRT alignment concepts and strategies is presented in Figures 3 and 4 on the next pages.

Figure 3: LRT Conceptual Strategies

Source: Microsoft Corporation and NAVTEQ Data

Figure 4: LRT Conceptual Alignments



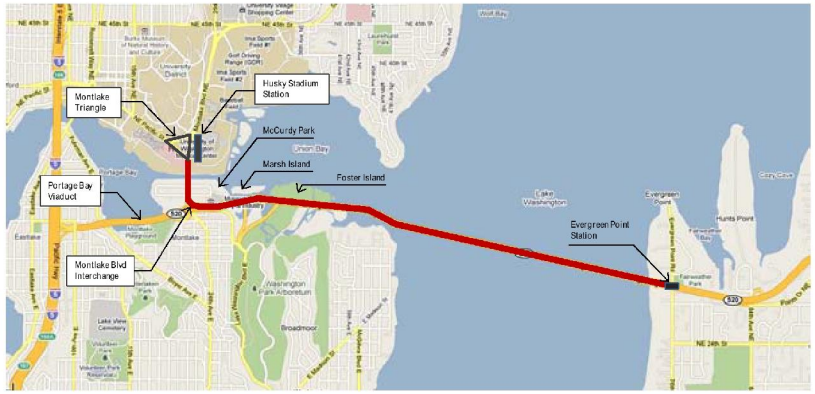
Source: Microsoft Corporation and NAVTEQ Data

Chapter 4. Phasing to Light Rail

The mayor's vision for the SR 520 corridor features a comprehensive high capacity transit (HCT) network, with a light rail alignment crossing the SR 520 bridge complemented by a robust bus rapid transit (BRT)/bus network. Accompanying that vision is a prediction of a future with different demands on the transportation system than those of today: a future where energy prices continue to increase, efforts to slow global climate change are more aggressive, and land use patterns demand higher capacity transportation connections. Such a future could significantly increase the transit and high occupancy vehicle (HOV) mode split crossing Lake Washington along the SR 520 corridor, well beyond the 17% estimated in the supporting transportation study of the Supplemental Draft Environmental Impact Statement (SDEIS).[18] Throughout the remaining chapter there are references made to various locations and their relationship to each other on the SR 520 corridor, Figure 5 is a vicinity map containing labels for geographic names reference in this and subsequent sections.

Two possible scenarios to phase to light rail transit (LRT) on the SR 520 corridor are identified in the following section; however, these are just two of many possible options. The subsequent pages provide additional description of the considerations for both scenarios. At the time of this writing, a final schedule for completion of the SR 520 I-5 to Medina Bridge Replacement and HOV Project is unknown, as the project budget currently has a $2.6 billion shortfall. The goal is to complete the floating bridge and landings in 2014; this portion of the project is fully funded as currently designed.

Figure 5: SR 520 Bridge Vicinity Map



18. Transportation Discipline Report Exhibit 11-9, Cumulative Effects Daily Cross-Lake Person Trips, HOV 45,400, Transit 51,420, for total non-SOV 96,820, total person trips 561,560; 96,820/561,560 = 17.2%

Design and Construction Considerations

This section provides information on the details of phasing to a light rail system on SR 520—including the assumptions, considerations, and alternatives to accomplish that phasing—if the bridge deck is originally constructed without light rail in place, as suggested in the two phasing scenarios discussed previously.

Assumptions

- ***LRT Extent*** — Based on the alignment selection process, it is assumed that light rail will diverge from the SR 520 mainline on the Westside between Foster Island up to and including Montlake Boulevard. The Eastside divergence point is less certain but is currently assumed to occur in the area east of Evergreen Point station and west of the junction with I-405.
- ***Lane Conversion*** — In the six-lane phasing scenarios it is generally assumed that two lanes of SR 520 will be converted to exclusive light rail operation, with the bridge remaining the equivalent of six lanes wide. However, the possibility exists that joint operations of buses and LRT could be pursued. If all the challenges of joint operation could be met, buses and light rail could share the center lanes, and non-transit HOV would be moved into the GP lanes.

The Bridge Deck

Roadway Structure

The roadway structure currently under design accommodates future LRT by including structural elements and stray current protection for LRT. However, the need to limit the height of the bridge deck above the water establishes how the LRT rails would be added to the structure. Under the current design, the rails would not be embedded in the bridge deck but would be installed on top of the bridge deck due to the "thinness" of the concrete deck, rendering the potential for joint operations infeasible. Designers report it may be possible to add depth on top of the currently designed deck to provide a rubber tire running surface, but the additional weight on the bridge would require the addition of buoyancy with flanker pontoons as well as modifications to the deck supporting structure.

One critical question that must be answered in the final design of the bridge is the required cross-section of structure necessary to accommodate a two-track light rail system. This basic design assumption must be confirmed and established as a design criterion for the bridge deck. Initial evaluation and discussions with Sound Transit indicate that LRT requires a minimum of 15 feet of clear distance between traffic barriers in each direction, plus a 4-foot center median to support the overhead power lines for LRT, and a 2-foot traffic barrier on the outside to separate general purpose (GP) traffic. The total width would be 38 feet minimum from outside of traffic barrier to outside of traffic barrier, which may be challenging to accommodate within the current design of the bridge. Additionally, the floating bridge is similar to a tunnel in that it would require inclusion of an emergency evacuation path for light rail passengers. There must be adequate space between the rail lines to support this provision. Taken together these design parameters indicate the bridge deck may need to be up to ten feet wider than the current option A+ design to support conversion to light rail.

Pontoons

As presently designed, the pontoons are capable of supporting a six-lane roadway section as outlined in the SDEIS. Engineers report the current design is being analyzed to determine the amount of additional buoyancy and stability that would be necessary to accommodate the added load of LRT on the bridge. The potential of joint operations complicates this analysis, as that feature would add weight to the structure to allow the addition of running-ways for buses, essentially recessing the tracks.

One assumption that has been made in the design of the structure and the pontoons is that light rail would be installed on the inside lanes of the bridge. Neither the pontoons nor the current roadway structure are designed to accommodate LRT on the outside of the roadway. This option should be considered infeasible and prohibitively expensive.

Approaches

The bridge approaches also must be considered in the SR 520 design process. Presently, the bridge approaches are not designed to accommodate light rail conversion. Under current plans the conversion could only occur following reconstruction of the approaches, particularly on the west side. There must be sufficient space (i.e., a "gap") between the eastbound and westbound lanes of the SR 520 mainline between Foster Island and Montlake Boulevard to allow an LRT alignment and/or transit/high occupancy vehicle (HOV) lanes to diverge from the SR 520 alignment. This is a technically challenging area as the current roadway plans utilize two separate structures for the eastbound and westbound lanes. Preliminary engineering would be required to assure that light rail could be successfully added to the currently designed structures.

Scenario 1: Four-Lane Bridge

Medina to I-5 SR 520 Expanded to LRT Operation

Central Features:

- Initial four-lane replacement for floating bridge
- Portage Bay Viaduct rebuilt to improved version of current structure
- SR 520 Medina to Montlake phased to light rail following regional planning effort
- Transit operations in general purpose (GP) lanes improved through dynamic tolling

In Scenario 1, the four-lane floating bridge, which is one of the most crucial safety concerns of the SR 520 project, is replaced first. The underlying assumption is that the current SR 520 bridge must be replaced due to catastrophic failure and a four lane bridge is all that can be constructed to expeditiously reconnect the SR 520 corridor. Given that construction of the six lane bridge is fully funded, it is unlikely a four lane bridge would be the starting point under any other set of circumstances. Its inclusion here is to outline how a bridge replacement caused by a catastrophic event could also be phased to LRT operation. The new bridge would be constructed and temporarily connected to the current western approach. This scenario represents a departure from the phased implementation outlined in the SDEIS. The SDEIS phasing scenario assumes that the new floating bridge would be built in its four GP + two HOV (4+2) lane configuration and

striped for six lanes with a transition to the existing four-lane cross-section in the west approach area.

Figure 6: Four-Lane Bridge Replacement Section

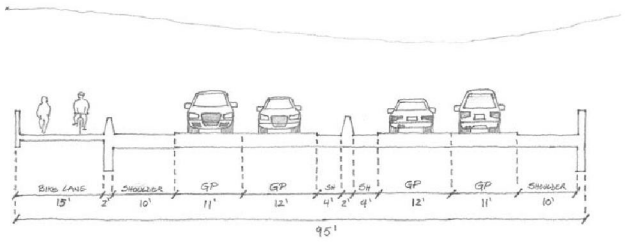
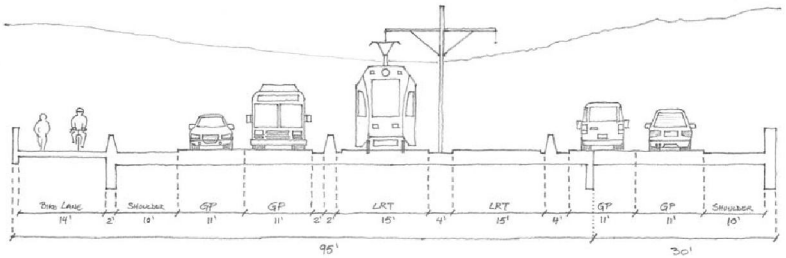


Figure 7: Expansion to LRT Operation



Scenario 2: Six-Lane Bridge

Four (4) GP + Two (2) HOV Lane SR 520 Converted to LRT Operation

Central Features:

- Initial six-lane replacement for bridge (4 GP lanes + 2 HOV lanes)
- Portage Bay Viaduct rebuilt to improved version of current structure
- Six-lane western approach constructed to Montlake that is LRT convertible
- SR 520 Medina to Montlake phased to light rail following regional planning effort

Scenario 2 begins with a six-lane replacement bridge and western approach that is constructed with the assumption that the two inside lanes will be converted to light rail operation. All necessary structural and floatation capacity to support LRT would be added to the bridge at the time of initial construction. The east and west approaches, including the Union Bay section, would be built to fully accommodate a light rail alignment. This requires inclusion of space between the eastbound and westbound roadways (i.e., a "gap" in the bridge) to allow a rail alignment to diverge from the center of the SR 520 mainline between Foster Island and McCurdy Park in the design of the western approach.

Depending on available funding and progress of the planning effort, HOV-exclusive access to Montlake Boulevard could be included in the initial construction phase. West of Montlake Boulevard, it may be possible to constrain the mainline section to four lanes, pending the outcomes of the planning effort; however, this would require supplemental environmental analysis that would also delay replacement of the floating bridge. The Portage Bay Viaduct would be reconstructed to address the seismic vulnerabilities of the structure, fix some of the traffic operations issues, improve stormwater collection, and incorporate a transit-only connection to the reversible HOV lanes on I-5, an important transit enhancement. The new structure would improve the current conditions with extended merge and diverge areas, managed shoulders, and more effective stormwater collection, while remaining four lanes wide through most of the alignment.

At the same time construction on the bridge and the approaches is underway, preparations for phasing to light rail could begin. Necessary planning, engineering, environmental analysis, and a regional decision-making process would be conducted to fully describe a light rail alignment and transit operating scenario for the SR 520 corridor. At completion of this effort—and in accordance with a new SR 520 Integrated HCT plan—the SR 520 corridor could be converted to include light rail in place of the HOV lanes.

How is Scenario 2 different than the Option A+ project described in the SDEIS?

- The floating bridge is slightly wider (up to 10 feet) and built to accommodate light rail (except rails, overhead power system, and separation barriers) at first construction. This includes additional roadway width and flotation and stability in the pontoon system.
- The western approach to the floating bridge would be specifically designed to accommodate light rail conversion in the future, including the divergence point between Foster Island and Montlake Boulevard.

- The eastern approach would also be designed to ensure light rail touches down in the Evergreen Point Station area. It is recognized this means that buses could no longer directly serve the platforms. To integrate the operations would require planning and construction of a new station.
- The Portage Bay Viaduct remains four lanes on initial build and, possibly, permanently.
- After corridor conversion to light rail, BRT/bus transit performance is achieved through traffic management alone, rather than with dedicated lanes and traffic management. (For example, the inside GP traffic lanes could become HOT lanes.)
- A new SDEIS process would be required to evaluate the design and operational differences between SDEIS Option A+ and the proposed scenario. The amount of delay would depend upon the time it took to make changes to the design and the extent of those changes. The floating bridge could not be replaced until the supplemental EIS was complete and all comments (on the DEIS and both SDEISs) were addressed.

Figure 8: Four GP Lanes + Two HOV Lanes Section

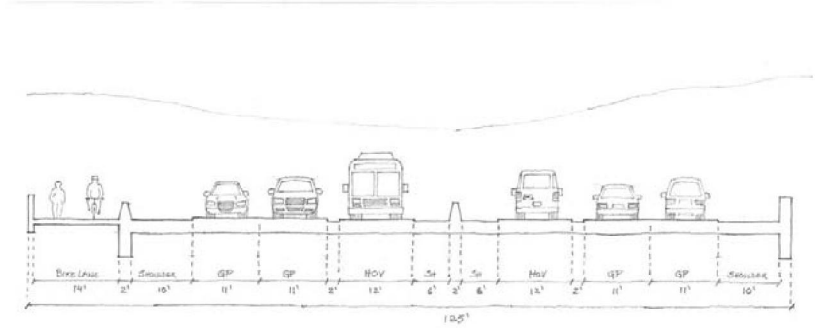
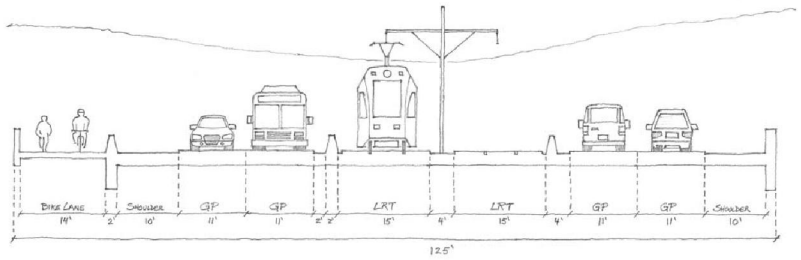


Figure 9: Four GP Lanes + LRT Operation Section



Shore-Side Connections

At the east and west ends of the bridge, or at some point along the alignment, it will be necessary for light rail to leave the center alignment of SR 520. Where and how this happens is of importance in the design of the bridge approaches and the corridor in order to maintain options for light rail development and to avoid significant construction or environmental costs when light rail is added to the corridor. Presently, the bridge approaches discussed in the SDEIS are not designed to accommodate light rail conversion. The addition of light rail assumes new construction on these approaches and the potential divergence points have not been established and designed.

Eastside

Current design for the Evergreen Point Transit station assumes LRT occupies a center position in the station, taking the place of bus operations. A new station would need to be designed to ensure good connectivity between buses and light rail; if joint operations were pursued, buses could enter the shared corridor at this location. East of the transit station, LRT would continue along the corridor and is expected to diverge from the SR 520 alignment prior to arriving at I-405. The roadway's width and outside retaining walls are being constructed so that LRT could be added to the freeway right of way while maintaining the six-lane (4+2) configuration. A consideration in the final alignment for light rail would be potential modifications to stations nearing construction in the Medina to SR 202 project. The specific alignment, where it diverges from the corridor, and the station locations would have potential impact on these stations.

Westside

Crossing the Lake Washington Ship Canal — All light rail alignments considered in this report assume a connection with the University Link at Husky Stadium. The connection is not necessarily on the same track or at the same depth as the U-Link station now under construction,

but an SR 520 light rail alignment would be built to allow connectivity between the SR 520 light rail line and what will then be the existing U-Link line (scheduled for opening in 2016). Crossing from the SR 520 corridor to Husky Stadium requires consideration of a number of constraints. No one of these constraints renders the crossing infeasible, but, taken together, the combination significantly limits feasible options. There are four different options under consideration for crossing the Montlake Cut:

1. High level fixed bridge
2. Low level bascule bridge
3. Tunnel
4. At grade on Montlake with the Option A+ Montlake bascule bridge

High Level Bridge

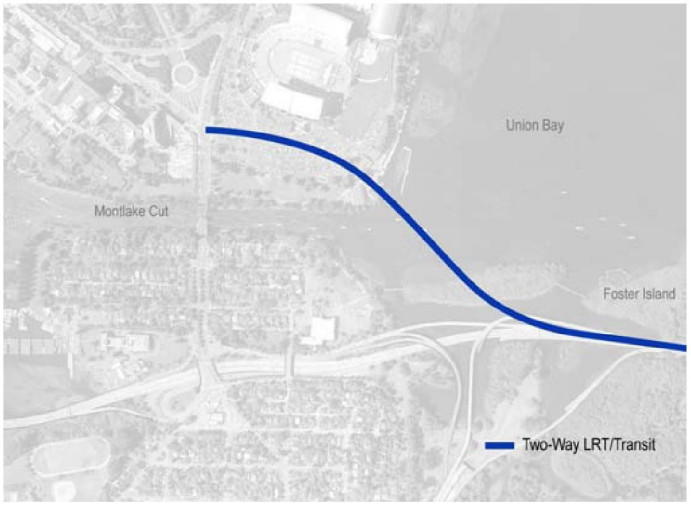
High level fixed bridge and Lake Washington Ship Canal (Montlake Cut) navigation channel — The current navigation channel, by Coast Guard regulation, must provide a minimum vertical clearance of 110 feet over the Ship Canal. (Some preliminary work has been conducted during the DEIS analysis on lowering the minimum vertical clearance to 70 feet, which is also the maximum vessel height for South Lake Washington; however, WSDOT was not successful in obtaining permission to use the lower clearance.) The SDEIS proposes that the 70 foot vertical navigation clearance would be governed by the SR 520 bridge, as the draw span is proposed to be removed and the vertical clearance of the east high rise is proposed to be 70 feet. The Coast Guard has a process they must follow to change the minimum navigational clearance for a body of water. This minimum vertical clearance establishes part of the potential design envelope for a high level bridge.

The navigational clearance is critical due to the adjacency of the centerline of the Lake Washington Ship Canal to what is the assumed station point for SR 520 light rail, next to the University Link station at Husky Stadium. These two points and the 6% maximum allowable grade for LRT establish the feasibility of a high level crossing over the Montlake Cut.

A high level bridge would also have some of the same environmental issues that created concerns about the DEIS Pacific Interchange design option. These include more columns in water and more shading over water, aesthetic concerns, filling of additional wetlands on Marsh Island, and conflicts with existing uses in the University of Washington South Campus area.

Bridges or elevated rail structures and Rainer Vista view corridor — The University of Washington Rainier Vista corridor is a protected view corridor. New view-blocking structures erected within the corridor would have to provide significant benefit and show that no feasible or prudent alternatives exist to offset impingement of the view corridor and to achieve approval from the University of Washington.

Figure 10: High Level Bridge over Lake Washington Ship Canal

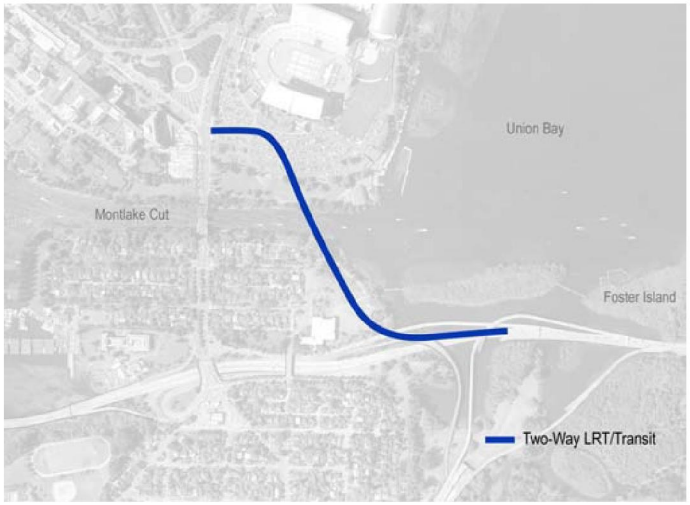


This graphic is for illustrative purposes only. No geometric analysis or preliminary engineering has been conducted.

Low Level Bridge

Drawbridge — This alternative for crossing the Montlake Cut utilizes a low level bascule bridge. LRT would begin leaving the SR 520 alignment between Foster and Marsh Islands and turn north in the vicinity of McCurdy Park, cross the Ship Canal, and end at a surface, or slightly subsurface, station at Husky Stadium. This alternative has the disadvantage compared to the high level bridge or tunnel of being less reliable as a result of bridge openings for vessel traffic. A possible solution might be to increase the "closed bridge" vertical clearance to meet a high percentage (e.g., 90 to 95%) of the vessel passages, leaving only a few vessels that would actually cause a bridge opening. The disadvantage of this strategy is that the piers for a bascule bridge are very substantial: the higher the fixed portion of the bridge, the greater the visual disruption. This design also conflicts with existing uses in the University of Washington South Campus area.

Figure 11: Low Level Bridge across Montlake Cut



This graphic is for illustrative purposes only. No geometric analysis or preliminary engineering has been conducted.

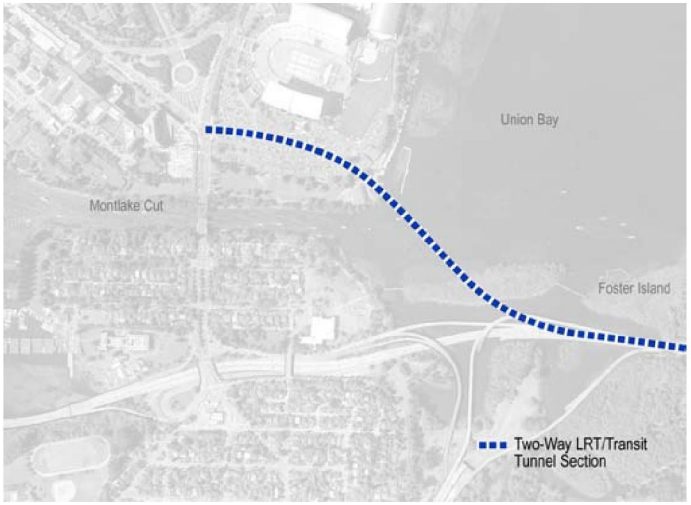
Tunnels

Tunnels and Foster Island traditional cultural property and endangered aquatic species — The portion of Foster Island that has historically been above the waterline of Lake Washington is presumed to be a traditional cultural property, making excavation in this area highly problematic in terms of negatively impacting the site. This designation adds a risk element to a tunneling option. It does not preclude a tunnel option for crossing the Montlake Cut (particularly if the alignment did not cross Foster Island), but is a significant constraint. Additionally, the southern edge of the Lake Washington Ship Canal is a known migration path of several Endangered Species Act listed salmon species. Construction in water or near shorelines is severely restricted to protect these species. Tribal treaty fishing also occurs in the vicinity of SR 520, and the tribe has expressed serious concerns about tunneling options in the past. Also, cut or fill in open water or wetlands is regulated by the Corps of Engineers, who will only issue a permit for the least environmentally damaging alternative under consideration. Again, this does not rule out the possibility of a tunnel but does add significant restrictions and costs.

Tunnel slopes, paths and emergence points — In evaluating the feasibility of a tunnel crossing in the SDEIS, WSDOT noted that the slopes required to cross under the Montlake Cut and make a slightly subsurface approach to the Montlake and Pacific intersection are in the range of 7-9% grades, more than the 6% allowed for light rail operation. However, these grades assumed a shallow tunnel and not a bored tunnel. This suggests that an LRT tunnel crossing the Montlake Cut would likely be longer than those analyzed for Option K in the SDEIS and would likely require

the new light rail tunnel to pass under the U-Link tunnel with a very deep station in order to maintain the necessary gradients for operation. This deep tunnel would establish the feasible surface point for the light rail, meaning that the line would likely be in a tunnel for some distance past Husky Stadium before a surface alignment becomes feasible given the required depth of the station and maximum grade allowed for LRT design.

Figure 12: Tunneling under Montlake Cut

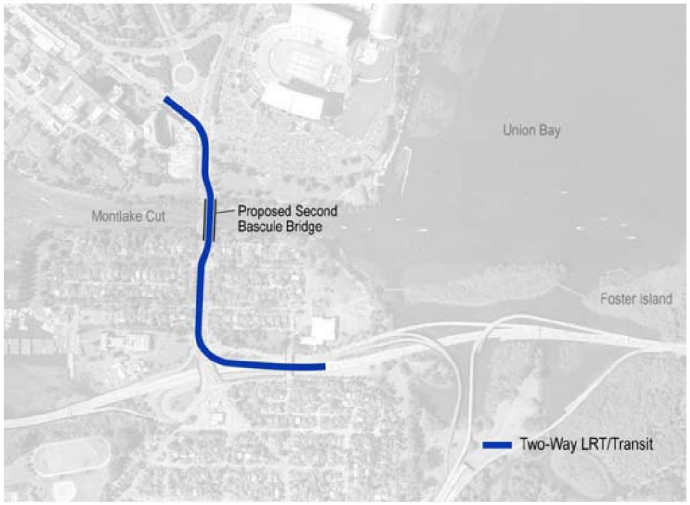


This graphic is for illustrative purposes only. No geometric analysis or preliminary engineering has been conducted.

Surface Approach

Surface Approach on Montlake Boulevard — This alignment alternative maintains LRT in the SR 520 alignment until it reaches either 24th Avenue or Montlake Boulevard. The alignment would rise to the level of Montlake, make a sharp right turn, and proceed on Montlake Boulevard, over the Option A+ new bascule bridge to cross the Montlake Cut. The current Montlake Bridge, a historic structure, is not capable of supporting the weight of the rails within the lift mechanism. There are also substantial questions about the structural ability of this older bridge to handle the dynamic loading of a light rail vehicle. The radius of the turn from SR 520 to Montlake Boulevard would be near the minimum 100 foot radius allowable and would require very slow speeds (i.e., 5 to 10 mph) to negotiate the curve. It should be noted that minimum radius curves are a frequent source of rail noise, a sort of high pitched squeal. The same issues regarding reliability discussed in the low level crossing would apply here, but the potential to mitigate those by raising the closed clearance of the new bridge is not possible without impacting the historic bridge.

Figure 13: Second Bascule Bridge across Montlake Cut



This graphic is for illustrative purposes only. No geometric analysis or preliminary engineering has been conducted.

Joint Operations

The current bridge is configured as a six-lane structure with the inside lanes (i.e., lanes 3 and 4) dedicated to transit/HOV operations. Under a scenario where LRT is added to the transit/HOV lanes, the question arises about the possibility of joint operation of buses and LRT in these lanes. There are several considerations that impact the cost and feasibility of joint operations.

1. There are no known high speed (more than 25 mph) joint operations of buses and LRT. While high speed joint operations is theoretically possible from a control and signaling perspective, a system has not been developed, tested, and approved for this type of operation. The possibility exists that such a system could be invented for the SR 520 corridor, but the probability that such a system will be developed in the near future is slim. Comparing the results of 25 mph operation versus 50 mph operation, the time difference from Evergreen Point to Montlake is about 3 minutes, over a distance of about 2.7 miles.

    a) Low speed (25 mph or less) joint operations of LRT and buses have been successful at several locations in North America, one in Seattle's Downtown Transit Tunnel. While low speed joint operations may be possible on SR 520 from a control standpoint, there are important perception considerations as well; for passengers on the LRT and buses, the extended distance of low speed operation and the visibility of traffic flowing at higher speeds would act as a substantial deterrent to building ridership. Bridge operation with tolls in place will likely render higher speeds in the

general purpose traffic lanes, again making transit seem like a second choice rather than the primary choice.

b) In evaluating options for the I-90 East Link crossing, Sound Transit studied the feasibility of joint operations extensively. Their studies showed that the regulatory and safety considerations far outweighed the potential benefits on the I-90 corridor, and the possibility was eliminated from further consideration (although in the case of I-90, buses will be operating in an HOV lane rather than in a GP lane as would be the case on SR 520).

c) It is unlikely that King County Metro would elect to use the shared BRT/LRT/transit lanes given the possibility that the speed performance in the general purpose lanes may higher than joint operations would allow. This would also avoid the issues of buses getting stuck behind disabled transit vehicles in a lane with no ability to bypass the disabled vehicle.

2. The structure, as reviewed above, would have to be revised to provide a running surface for buses/BRT vehicles over the tracks. The structure of the bridge could be strengthened to accommodate the additional load, but the weight of the running surface and structure could require that floatation capacity be added to the pontoons. While the pontoons are being designed to accommodate the possibility of adding floatation through the use of "flanker" pontoons, there is a substantial cost to add new floatation capacity.
3. To cross SR 520 with light rail, it would be necessary to include an emergency evacuation pathway for customers (likely between the light rail tracks) should it be necessary to leave the light rail vehicle and exit the bridge structure in an emergency situation. Specific accommodation for this space would need to be resolved before the final cross-section and structural design for a joint operation bridge is pursued.
4. The Federal Railroad Administration, National Highway Safety Administration, Federal Transit Administration, and Federal Highway Administration would all have a measure of approval authority that impacts joint operations. The weight and braking capabilities, as well as the federal crash resistance construction standards, are substantially different between the two vehicle types. Federal safety authorities would have to approve joint operations, even in the presence of a feasible control system. The outcome of the regulatory authorities could substantially restrict even low speed operations to the point that the transit carrying capacity of the bridge is reduced below the capability of either LRT or BRT/bus operating independently due to spacing requirements to meet safety standards (i.e., that only one bus or light rail vehicle in each direction is allowed on the bridge deck at any given time).
5. Similar to joint bus and light rail operations at the terminals of the Downtown Seattle Transit Tunnel, merge points would be essential for safe operations. This requires space for buses or light rail vehicles to wait until they can be safely merge into the joint operation. For example, it is not unusual to observe two or more buses waiting for their "turn" to enter the Seattle Transit Tunnel complex. In Portland this merge and diverge area has been, and remains, one of the major design issues in the Willamette Multi-Modal Bridge (which will have light rail, streetcars, and BRT sharing right of way). On SR 520 the west merge area would look like a small interchange and would present challenging design issues to allow all the different movements while ensuring a safe operation. It is important to remember that a significant number of buses would continue to be destined to downtown Seattle from the Eastside and would need to continue west from the point on

SR 520 where the light rail leaves the mainline. The Eastside connection would be similarly complex but would be contained in a landside location where there is a planned joint bus/transit station, allowing the queuing space to be designed into the station, which would require re-design of the plans currently included in the SR 520 Eastside Project.

HOV Lanes on SR 520 West of Montlake Blvd

If light rail occupies the transit/HOV lanes from Evergreen Point to Montlake, a question to be answered is whether building HOV lanes on SR 520 between Montlake Blvd and I-5 is necessary to ensure reliable transit operations to downtown Seattle. It is likely, except under a possible joint operation scheme, that buses and HOVs will operate in the four GP lanes from somewhere in Medina to Montlake Boulevard. The distance from Montlake to I-5 is about 0.6 mile.

The current SDEIS Option A+ assumes that the HOV lanes connect to and from the south in the I-5 express lanes. Buses would operate in the same direction as the express lanes on I-5—that is, westbound SR 520 to southbound I-5 in the morning and northbound I-5 to eastbound SR 520 in the afternoon. When the opposite direction is not available, transit vehicles will operate in the general purpose traffic lanes as they currently operate.

Traffic operations on the Portage Bay Viaduct are characterized by considerable weaving and merging as drivers merge from north and southbound I-5 to get off at Montlake or continue on SR 520 eastbound. Westbound drivers are selecting a lane to go north or south on I-5 while the traffic from Montlake is being added and drivers are moving to a lane based on their desired direction. The trade-off for not building the HOV lanes in this segment of SR 520 is a significantly reduced footprint for the Portage Bay Viaduct. However, the operational effects of eliminating the HOV lanes would require supplemental environmental analysis, resulting in delay.

Transit Direct Access Ramps at Montlake

The other issue raised by the transition is how to treat transit or HOVs in the Montlake vicinity. As stated above, under Scenario 2 it is expected there will be some period of time between opening of SR 520 HOV lanes and moving traffic out of the center lanes for construction and operation of light rail. There are essentially two possibilities between opening of SR 520 and opening of light rail. One is that transit, and possibly HOVs, are offered exclusive on and off ramps to and from the east from Montlake or 24th Avenue much as designed in Option A+ of the SDEIS. When light rail construction begins, these ramps might continue to be usable depending on how light rail crosses the Montlake Cut.

A second option, not proposed in the phasing scenarios, is to pre-build the light rail crossing of the Montlake Cut and use that as the transit and HOV priority access until light rail construction begins. After that time, non-LRT transit and HOVs would have the same priority as general purpose traffic, with no facilities to support preferential access. Even with light rail in place across the floating bridge from the Eastside, buses will continue to play a significant role in providing cross-lake mobility between Eastside areas not served by light rail and the Westside. This approach would likely require supplemental EIS analysis for the new structure, since its design is unknown and it was not evaluated in the SDEIS.

Transit/HOV Lane Usage

The second scenario proposed above includes transit and HOV lanes constructed as part of the project; matching the codified direction of the legislature. This raises the potential for an extended policy discussion about later conversion of this facility to a light rail only facility, thus removing transit and HOV use of the HOV lanes. Taking a page from Sound Transit's history, this was one of the more challenging issues in the public discourse regarding installation of East Link light rail on I-90.

Traffic Operations, Tolling, and Level of Service

Light Rail Transit

Under a scenario where LRT is operating on SR 520, assuming the alignment connects reasonably large activity centers, toll levels on the bridge would have an impact on transit ridership; the higher the toll, the greater the transit ridership. Levels of LRT service would need to be increased accordingly. One of several outcomes of higher tolls on SR 520 would be diversion of auto traffic to non-tolled facilities crossing Lake Washington. The entire tolling plan would have to be reviewed and likely modified (e.g., tolls implemented on I-90) to account for this diversion. The process for accomplishing this modification includes legislative action and new a new toll structure set by the Washington State Transportation Commission…

Transit (BRT/Buses)

The level of service for BRT/bus transit is directly dependent on where it operates in the corridor: in exclusive lanes, in HOV lanes, or in GP lanes. Similar to LRT, higher tolls for single occupant vehicles will tend to increase transit ridership, route diversion, time of day diversion, and trips not taken. Again it must be noted that even in the presence of an LRT line crossing the SR 520 corridor, there will continue to be a need for high quality bus/BRT service due to the dispersed origins and destinations on the Eastside of Lake Washington. East Link will serve a significant proportion of new transit trips to Eastside activity centers. While there is good potential to establish a second light rail corridor that could attract significant ridership across the lake, the singular alignment characteristics, even in conjunction with East Link, will not be capable of meeting all cross-lake access needs. Thus a robust bus network remains an important element in the SR 520 crossing.

In a scenario where buses and BRT are mixed with HOVs, only commitment to an active traffic management plan will assure transit performance. A continuously measured performance objective (e.g., 45 miles per hour, 90% of the time), adjustment to minimum occupancy requirements, and/or varying toll levels based on occupancy would be required to assure BRT/bus transit performance and level of service.

If BRT/bus transit are mixed with GP traffic—as in the first scenario or the second after light rail is added to the corridor—the conditions listed above for management of HOV lanes would need to be significantly expanded and applied to all GP traffic to assure operating speeds for transit could be maintained. Theoretically there is a price at which enough vehicle demand can be dampened to maintain speeds over SR 520 at peak times; whether the toll levels necessary to accomplish this are politically tenable is a different question.

HOVs

The phasing plans noted above could move HOVs out of the HOV lanes and into the GP lanes. Without a complex tolling strategy, HOVs essentially perform with the same travel time characteristics as single occupant vehicles. This type of operation would require a re-evaluation of the SR 520 tolling strategy and almost could lead to tolls on other cross-lake facilities.

General Purpose Traffic

Similar to HOVs, general purpose traffic receives maximum benefit when the two center lanes of the bridge are reserved for all high occupancy vehicles. The higher the volume of HOVs that utilize the center lanes, the more capacity becomes available to low occupancy vehicles in the remaining lanes. If HOVs and/or BRT/bus transit are added to the GP lanes, low occupancy vehicles must compete with transit and HOVs for road space, thus reducing the level of service available and increasing corridor congestion. The level of service for autos may be addressed through a comprehensive, performance-based tolling system. This means that general purpose traffic capacity would be constrained by applying market-based transportation demand management techniques as a way to assure a given level of service for the roadway. This type of tolling operation would require a new SR 520 tolling strategy and could lead to tolls on other cross-lake facilities.

Chapter 5. Conditions for Success

This chapter identifies the potential challenges associated with implementing a high capacity transit network including bus rapid transit (BRT) and/or light rail (LRT) on SR 520. There is a combination of singular challenges and processes to be observed in bringing this potential transit improvement to construction and operation. Each section below represents a separate, although often related, set of processes to be followed or issues to be resolved. This description is not intended to appear to be an insurmountable set of process steps that must be given attention to potentially built light rail in the SR 520 corridor. Rather it is intended to outline what it takes to build light rail, or a significant HCT corridor, in any location with some special attention give to the unique issues presented by the SR 520 project.

Statutory Changes

In 2007 the Washington State Legislature established a process to find an acceptable alternative for safety replacement and improvement of SR 520. The legislature created the mediation process in Revised Code of Washington (RCW) Chapter 47.01.405 (1), then went on in 47.01.405 (5) to define the intended scope of the corridor:

> *"(5) The process established in subsection (1) of this section shall result in a project design that provides six total lanes, with four general purpose lanes and two lanes that are for high occupancy vehicle travel that could also accommodate high capacity transportation. The bridge shall also be designed to accommodate light rail in the future and to support a bus rapid transit system."*

The language in this statute is sufficiently ambiguous to allow a number of potential interpretations.

In 2009 the state legislature took the unusual step of establishing in law the basic design criteria and cross-section of SR 520. Chapter 47.01.408 RCW reads in part:

> "…shall be designed to provide six total lanes, with two lanes that are for transit and high-occupancy vehicle travel, and four general purpose lanes."

This appears to rule out the possibility that the two lanes designated for high occupancy vehicles (HOV) could be dedicated solely to transit operations or that the six lanes would only cover part of the corridor from SR 202 to I-5.. In order to move forward with LRT on SR 520. Further legal analysis would be required but it appears this law would need to be amended to establish transit-only operations in what are presently designated as transit and HOV lanes.

Planning and Environmental Processes

In many respects, this is the area where the most work is needed to ensure the success of HCT, BST or LRT, on the SR 520 corridor. Key steps include:

- Conduct alternatives analysis/analyses (AA) on potential corridors on the Westside and Eastside to arrive at and describe a "locally preferred alternative" (not to be confused with a "preferred alternative" in an environmental process, although the two are often merged). Given the dispersal of urban centers on the Eastside and the existence of East Link, connecting the highest market potential of these urban centers is an important step for establishing an alignment that attracts sufficient ridership to warrant the investment in an HCT system that could include a second light rail line for the over Lake Washington.
- Conduct an environmental review process that would result in a "preferred alternative."

- Update the Sound Transit Long-Range Plan to recognize the findings of the AA and environmental analysis.
- Update Transportation 2040, if necessary; high capacity transit (HCT) is identified in the SR 520 corridor, however, rail alignments not directly related to the bridge are not included in the current plan.
- Using the preferred alternative, conduct an initial corridor design study (i.e., 30% design) to fully resolve any specific issues related to engineering challenges.
- When the currently funded Sound Transit Link light rail network reaches full build out in about 2020, the current projection is that it will be necessary to operate near capacity on the segment between downtown Seattle and Northgate to serve the high ridership forecast for that segment. Future planning studies must carefully evaluate transfer activity between a potential SR 520 HCT system and the U-Link line to ensure an overcrowding or over-capacity situation is not created at the Husky Stadium station due to increased demand resulting from the connection.
- Determine local support for the preferred alternative. This could be a rewrite and vote on the Sound Transit finance plan or an independent effort to establish a separate funding source, likely also to be a public vote.

These steps must be undertaken in partnership with the Washington State Department of Transportation (WSDOT), regional transit providers (i.e., Sound Transit, King County Metro), the University of Washington, Eastside constituents, and Seattle residents. A full planning process for light rail on the corridor is an expensive undertaking that requires significant time and resources.

Funding

There are no light rail or HCT planning or design funds programmed until 2016, as a Sound Transit ST II project, to begin consideration of LRT/HCT on the SR 520 corridor. A planning study to be undertaken in 2016 is currently funded by the voter-approved Sound Transit 2 Transit Development Program (ST2); however, funds for environmental review, preliminary engineering design, final design, and construction dollars are not available through ST2.

Federal funding of rail starts and new starts is changing rapidly. It is currently forecast that Congress will change the program even further. This could be a key funding source and may, in the next two years, offer greater opportunity for SR 520 light rail development to be recognized for the ability to reach measures of performance related to energy consumption, livability, job creation and access, and greenhouse gas emissions, all of which appear to be priorities of Congress and the current administration.

Although no project budget or funding plan has been established for building light rail in the SR 520 corridor, it will be important to look at the bonding capacity of the region at the time bonding might be necessary to finance construction.

While not a necessity to establish a light rail project on the SR 520 corridor, it is notable that use of the revenues generated from tolls on SR 520 are limited based on Chapter 47.56.820 RCW. Transit construction and operation directly related to the facility may be eligible for toll revenue under this chapter. However, the funds must first be appropriated by the legislature. To date no funds for transit operations on any state toll facility have been appropriated by the legislature. As some parts of the RCW chapters dealing with tolling have been changed in the 2010 session of

the legislature, an important next step is to conduct further research with the Code Reviser's Office to understand any recent modifications.

Engineering

Joint Operations — No evidence has been found to indicate that joint operations with buses and light rail vehicles is possible at speeds higher than 25 mph. Joint operations have been successful in low speed environments like the Downtown Seattle Transit Tunnel or transit malls (e.g., Downtown Portland). In addition to lack of evidence to support joint operations in high speed situations, approval would be needed from the Federal Highway Administration (FHWA) and the Federal Transit Authority (FTA).

Design Assumptions — LRT requires a minimum of 15 feet of clear distance between traffic barriers in each direction, plus a 4-foot center median to support the overhead power lines for LRT, and a 2-foot traffic barrier on the outside to separate general purpose (GP) traffic. The total width would be 38 feet minimum from outside of traffic barrier to outside of traffic barrier, which may be challenging to accommodate within the current design of the bridge.

If a bus were to operate in the same lane as the light rail vehicle, then the bus lane would be only 15 feet wide. This would allow for an 11-foot travel lane and a distance of 2 feet to the traffic barrier on the right side. However, the lane may need to be wider to accommodate bus operating requirements. This means that if a bus or light rail vehicle breaks down in the transit lane, all LRT service is halted and bus service in the lane is trapped until the disabled vehicle is towed out of the way, as there would not be a way to drive around the stalled vehicle due to the traffic barrier on the outside of the LRT corridor . LRT service requires barriers between GP traffic and LRT service; bus traffic would require a center median barrier for opposing travel. Additionally, the floating bridge is similar to a tunnel in that it would require inclusion of an emergency evacuation path for light rail passengers. There must be adequate space in the center to support this activity.

Connecting with U-Link — From an engineering perspective, the most challenging areas of light rail planning for the corridor are where a light rail system would depart from the SR 520 mainline on both sides of the water. This is a pivotal issue that could well establish the feasibility of light rail in the corridor. These features must be agreed upon before WSDOT completes final design for the Westside or Eastside approaches and the bridge. Crossing the Montlake Cut and joining the system to a useable connection point with U-Link is of primary importance. This does not imply that the SR 520 light rail occupies the same track as U-Link, but it must land with adjacency that facilitates system connectivity.

Chapter 6. Recommendations and Next Steps

Decisions on how to use the SR 520 corridor to maximum advantage for the future of the region are being made at a time of changing perspectives on transportation. Mayor McGinn seeks to create an alternative solution for the SR 520 project that supports a more socially just, environmentally sound corridor that reflects the needs of Seattle residents.

Mayor McGinn's goal is to ensure that the SR 520 I-5 to Medina Bridge Replacement and HOV Project is built in such a way as to be fully designed for and convertible to light rail transit (LRT) on the day the project opens to traffic. The mayor expects light rail to become one of the corridor's modes of transportation sooner rather than later, although light rail operations are likely to be phased into the corridor's operations at some time following the project's opening.

Sufficient transit markets exist to warrant a formal alternatives analysis of high-capacity transit (HCT) in the SR 520 corridor. This analysis should fully consider the potential benefits of HCT alignments that tie Eastside travel sheds to Westside travel sheds north of the Lake Washington Ship Canal. For SR 520 the final design and construction of the bridge and approach replacement project should be done with a full understanding of future transit alignments, capacity, and mode split in the SR 520 corridor. The corridor between Foster Island and I-5 is sufficiently sensitive, environmentally and politically, that there will be but one opportunity to "get it right" in terms of construction for the next 75 to 100 years.

Phasing: Next Steps

This report identifies two scenarios to phase safety-sensitive portions of the project while preserving the ability to convert the floating bridge and the east and west approaches to carry light rail in the future. The current budget for constructing the replacement project has a funding shortfall of about $2.6 billion of the $4.65 billion needed. Given this shortfall and the urgency of addressing the public safety issues associated with the floating bridge, phasing of project construction is nearly assured.

The SR 520 Medina to I-5 Bridge Replacement and HOV Project should be phased and constructed in such as way as to immediately address the safety issues in the corridor, minimize the cost of adding LRT to the corridor at a future time, and allow the planning work described above to proceed to a conclusion that will inform how best to phase an increase in transit capacity on the SR 520 corridor.

Careful consideration and basic design coordination for LRT on the SR 520 bridge should take place between WSDOT and Sound Transit to ensure adequate footprint, structure, and stability exist to support LRT on a six-lane bridge deck and/or that the modifications and the costs necessary to add light rail to a four-lane bridge should be well understood.

Construction that expands the current number of vehicle lanes, general purpose or HOV, between Foster Island and I-5 must be accomplished only with a full understanding of future transit alignments, capacity, and mode split in the SR 520 corridor. This portion of the corridor is sufficiently sensitive, environmentally and politically, that the probability is there will be but one opportunity to "get it right" in terms of construction for the next 75 to 100 years.

Light Rail Planning: Next Steps

Sound Transit's current project to construct light rail to the Eastside over I-90 should continue unabated. The focus of effort on SR 520 should be assessing the potential to add a second cross-Lake Washington LRT corridor, not to replace the current planning and design work underway.

An Alternatives Analysis for HCT alignments crossing the SR 520 bridge and traveling through the Eastside should begin as soon as travel demand data is available from the 2010 Census (about 2012), using a 2040 planning horizon, at a minimum.

In parallel with the Alternatives Analysis for SR 520, the City of Seattle should pursue an Alternatives Analysis for city-based HCT corridors that include Husky Stadium as a station or a line terminus.

At the completion of the two Alternative Analyses, the Sound Transit Long Range Plan, City of Seattle Transit Plan, and Transportation 2040 should be updated.

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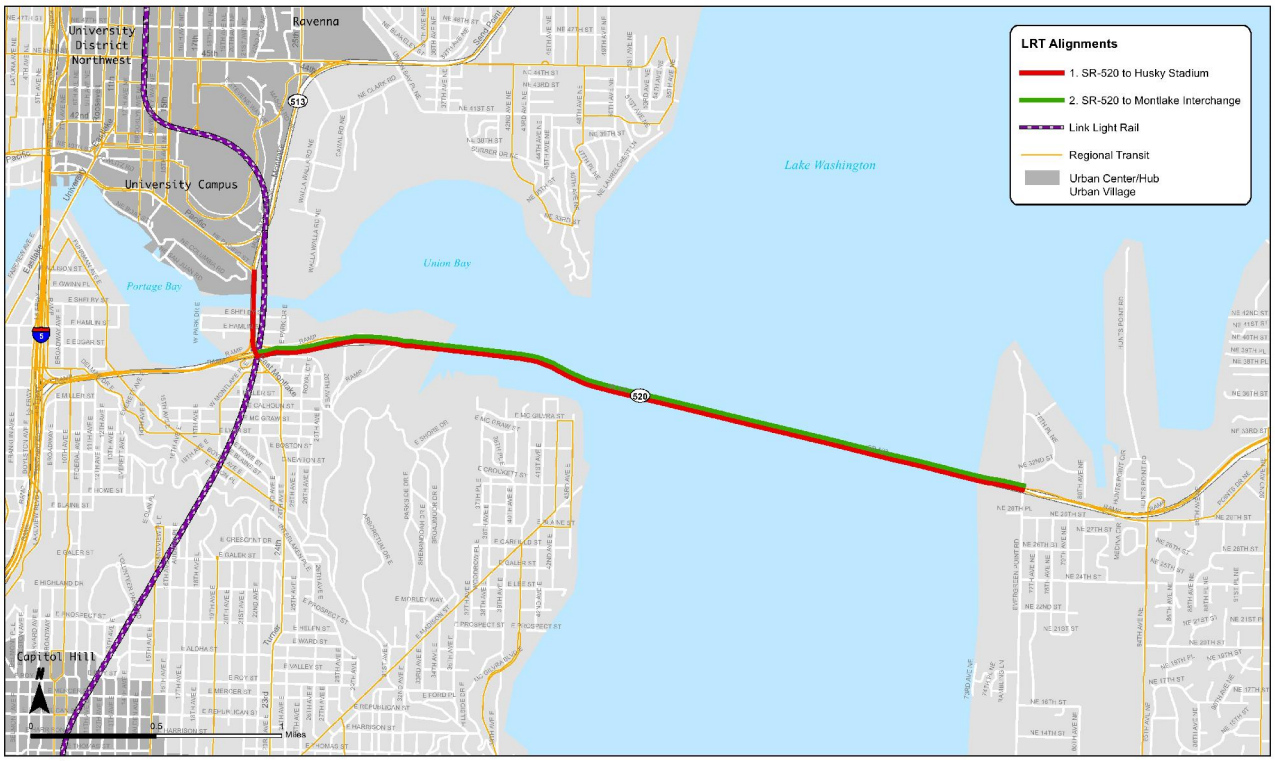
Appendix A
LRT Segment Evaluation Maps

Potential Light Rail Alignments - SR-520 (Draft)



Nelson|Nygaard consulting associates

GIS Data Sources: King County, City of Seattle, Sound Transit, WSDOT

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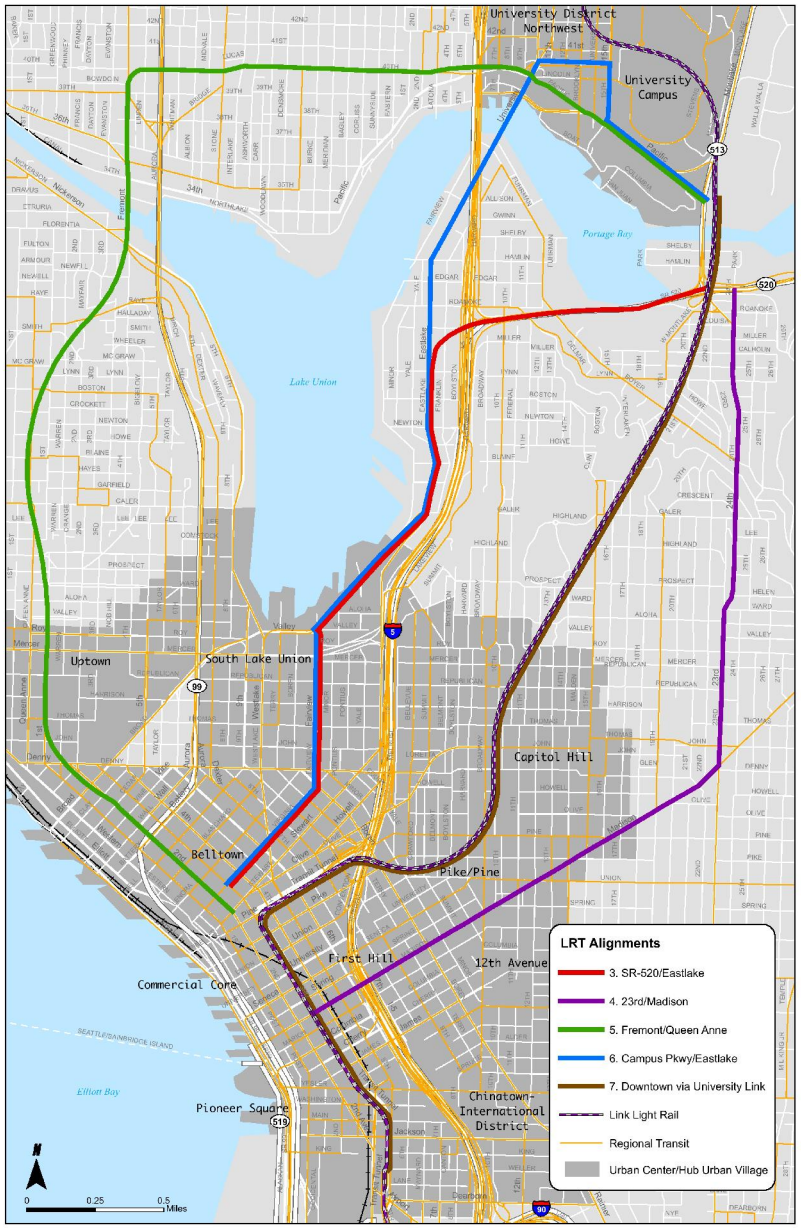

Nelson\Nygaard consulting associates

GIS Data Sources: King County, City of Seattle, Sound Transit, WSDOT

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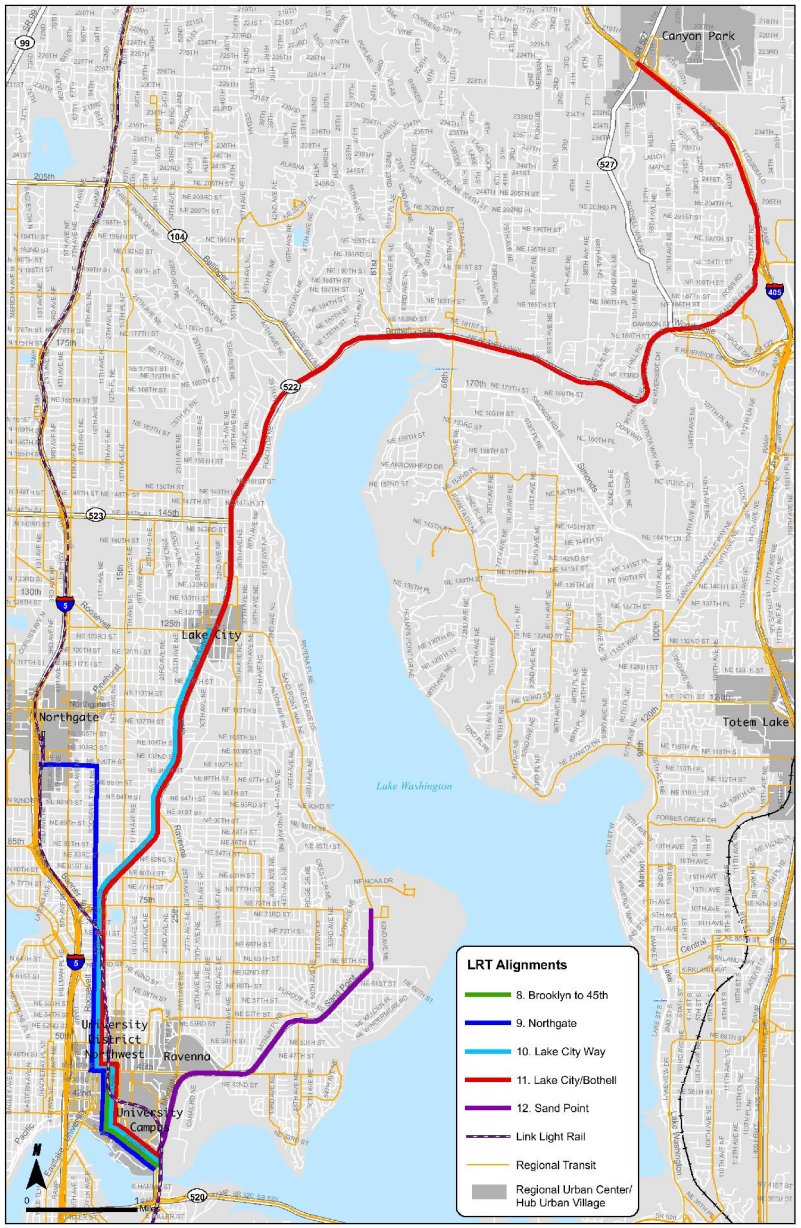

Nelson\Nygaard consulting associates

GIS Data Sources: King County, City of Seattle, Sound Transit, WSDOT

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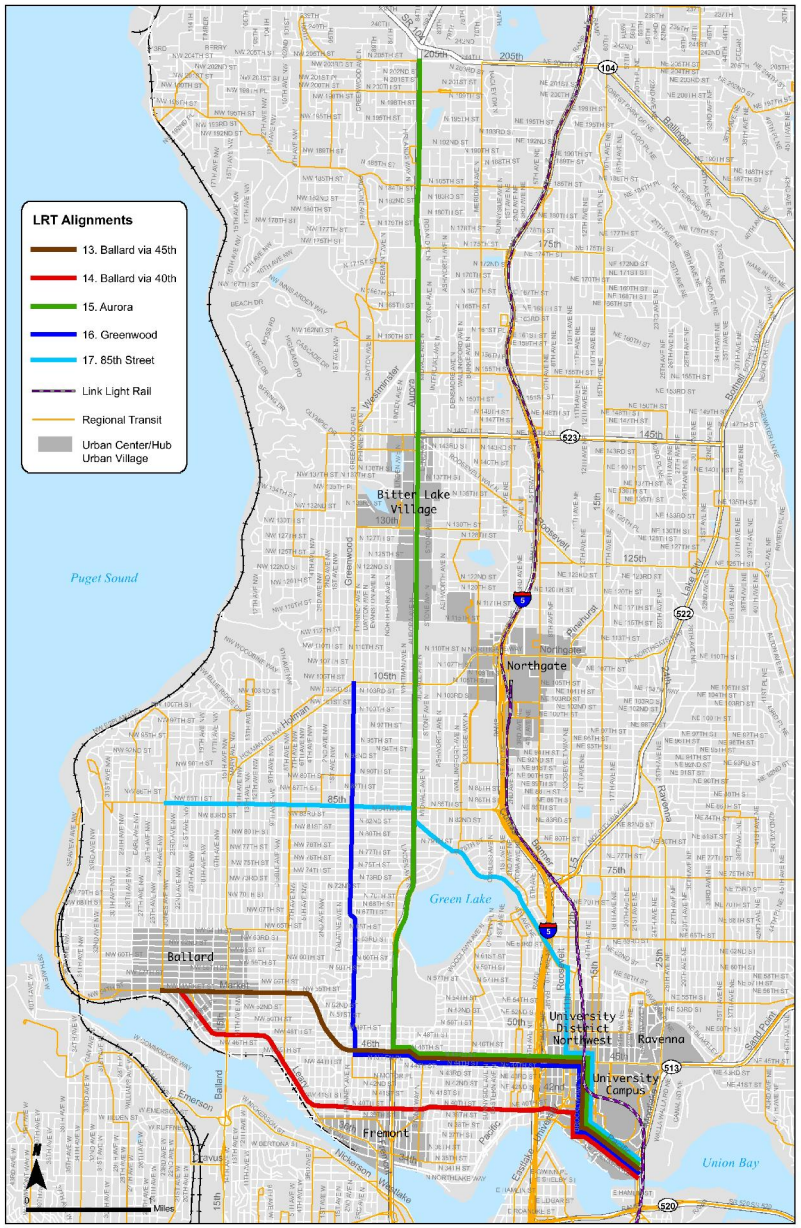
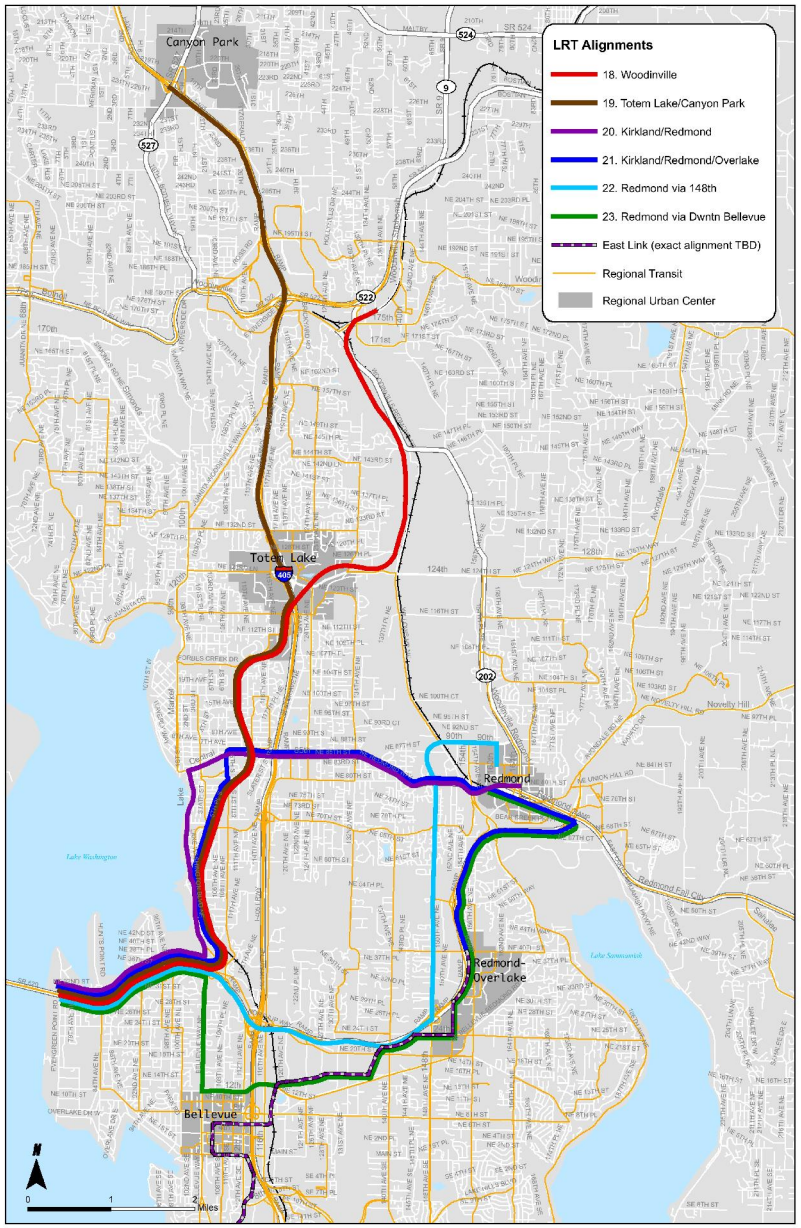


Nelson|Nygaard consulting associates

GIS Data Sources: King County, City of Seattle, Sound Transit, WSDOT

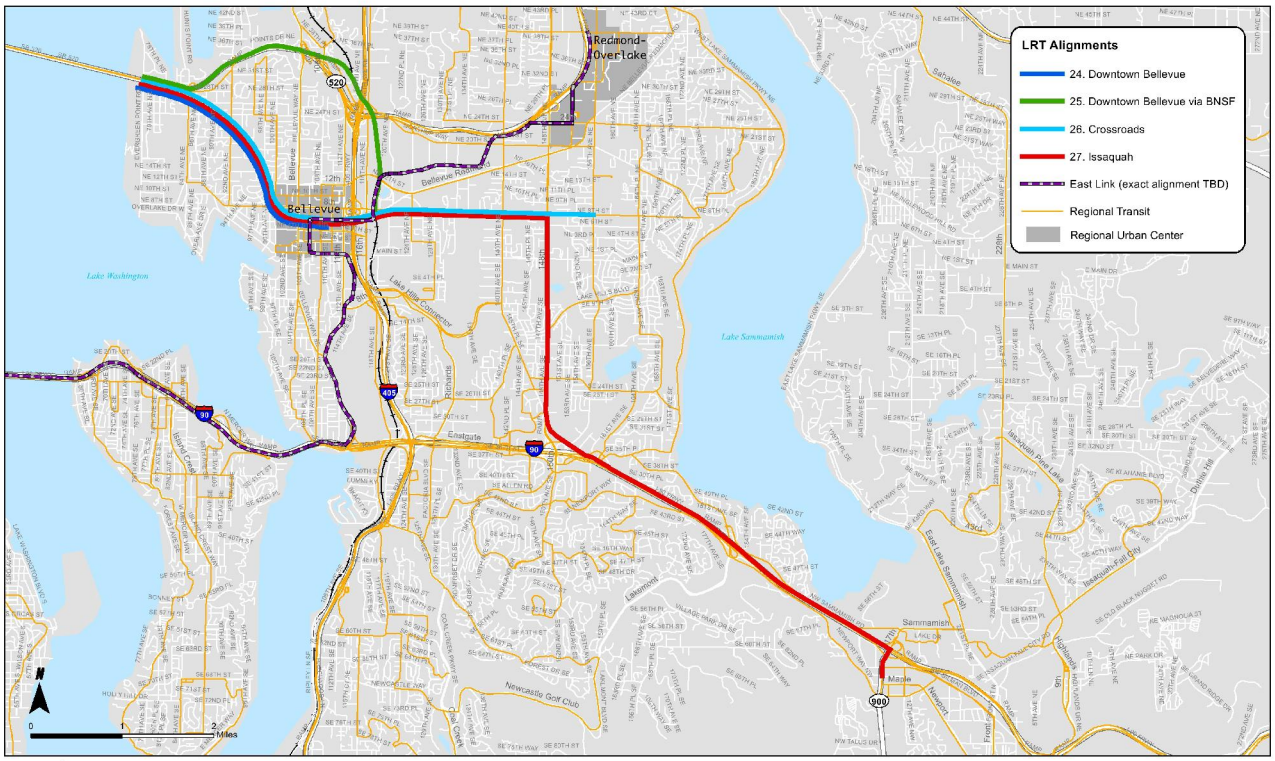
Potential Light Rail Alignments - Eastside (Draft)



Nelson\Nygaard consulting associates

GIS Data Sources: King County, PSRC, Sound Transit, WSDOT

Potential Light Rail Alignments - Eastside (Draft)



Nelson|Nygaard consulting associates

GIS Data Sources: King County, PSRC, Sound Transit, WSDOT

Appendix B
LRT Preliminary Alignments Evaluation

1. Ballard to Redmond, via Kirkland

The following segments have been identified for the purpose of describing the alignment (they do not imply a construction phasing sequence):

- Segment 1: Ballard to Fremont
- Segment 2: Fremont to University District
- Segment 3: University District to SR 520/BNSF Corridor
- Segment 4: SR 520/BNSF Corridor to Downtown Kirkland
- Segment 5: Downtown Kirkland to Downtown Redmond

Regional Travel Origins and Destinations Served

The alignment would connect key areas in North Seattle with portions of Kirkland and Redmond. Origins and destinations along the alignment in Seattle include Ballard, Fremont, Wallingford, and the University District. On the Eastside, the major destinations served would be downtown Kirkland and downtown Redmond.

Regional System Connectivity

The line could connect with many significant transit services in Seattle, including Link light rail, Ballard-Uptown RapidRide, Aurora Avenue RapidRide, and local bus service along Greenwood/Phinney, Roosevelt/11th Avenue NE, and to the University District. On the Eastside, the line could connect with Bellevue-Redmond RapidRide along 148th Avenue, transit centers in Kirkland and Redmond, the South Kirkland Park and Ride, and transit service along Market Street and 124th and 132nd Avenues in East Kirkland.

Bus Operations Impacts and Opportunities

In Seattle, the alignment would duplicate existing King County Metro (KCM) service between Ballard and the University District, such as routes 44 and 46. On the Eastside, the line would duplicate services currently provided by Sound Transit (ST) route 540, and would likely capture many riders from the planned ST 542 service (Redmond to the University District).

Land Use and Growth Potential

In Seattle, there is significant retail and commercial development along the corridor in Ballard, Wallingford, and the University District. There is high-density housing in Ballard and the University District, with low to mid-density housing in between. The most significant employment density is in the University District. Potential for growth in both population and employment density exists in Ballard and along the Market and 45th Street corridors in Wallingford. On the Eastside, the most significant retail and commercial development is in downtown Kirkland, downtown Redmond, and along the 85th Street corridor. High-density residential development exists in downtown Kirkland and downtown Redmond, and low to mid-density residential development exists along 85th Street and Redmond Way. Employment densities are low to mid-level along portions of the BNSF corridor, 85th Street, and in Redmond's Sammamish Valley area and downtown. There is potential for densification along the BNSF corridor and 85th Street.

Ridership Potential

The potential ridership in this alignment is estimated to be high as compared to other alignments selected for further analysis. In Seattle, the line would potentially capture riders traveling between Ballard, Wallingford, and the University District, as well as those traveling to the Eastside. The service would be crossed by three high capacity transit lines: one light rail and two bus rapid transit. High frequency service would allow convenient transfers between the different services. On the Eastside, ridership would likely be lower because it would serve lower density areas and smaller employment centers. The line would serve commuters traveling from Redmond and Kirkland to the University District and other parts of Seattle as well as mid-day travel between Redmond and Kirkland. Ridership could be increased by connecting and interlining this alignment with East Link at downtown Redmond or by extending the line to the Overlake Transit Center.

Phasing and Expansion Opportunities

The line could be constructed in phases. Initially, a line between the University District and downtown Kirkland could be constructed to connect Seattle to the Eastside. Extensions to Ballard and downtown Redmond could follow to increase coverage and ridership. An extension from downtown Redmond to Overlake would connect the line to East Link. The line at build out could create a fast and direct HCT connection between North Seattle and Redmond or Overlake.

Construction Feasibility and Impacts

Along Segment 1, the line could be at grade, elevated, or underground. Segment 2 through Fremont and Wallingford to the University District would likely need to be underground for two main reasons: 1) There is only one corridor (Market/45th Street) that travels continuously through Wallingford, Fremont, and Ballard, and it has a relatively narrow right-of-way, which would make the insertion of a light rail line difficult; and, 2) A surface or elevated alignment would be affected by steep grades, and a surface operation would likely have worse travel time performance than a exclusive ROW. Once in the University District, Segment 3 would need to cross the Montlake Cut and travel along the SR 520 corridor before heading north. Segment 4 would run along the Burlington Northern Santa Fe (BNSF) right-of-way. The line could run at grade, although there are numerous street crossings along the route that may require grade separation. The alignment would need to deviate from the BNSF corridor to provide closer accessibility to downtown Kirkland, and then it would travel east along Segment 5 via 85th Street and Redmond Way to downtown Redmond. The right-of-way along this segment could be at grade, elevated, or underground, but the feasibility of each has not been evaluated. Steep grade issues might exist between downtown Kirkland and I-405 and also in the stretch between Rose Hill and downtown Redmond.

Environmental Impacts

The environmental and neighborhood impacts of the line would be partially dependent on the utilized rights-of-way. Noise pollution is possible along any surface or elevated alignments. A tunnel along Segment 2 to the University District would keep vehicle noise underground, although construction activity at the portals would impact nearby residents. The segment traveling from the University District onto the SR 520 floating bridge would need to be engineered carefully to avoid impacting sensitive environmental areas and nearby residents. Along Segment 4, the line would impact neighboring residential areas, although utilizing the BNSF corridor might reduce takings of private property. Depending on the alignment, the line could impact traffic and businesses along 85th Street and Redmond Way.

Potential Cost

A Ballard-Kirkland-Redmond line would likely have a high-level of cost when compared to the other selected options. A tunnel between Wallingford and the University District would be expensive, as would be either an underground tunnel or an aerial structure across the Montlake Cut to connect with the SR 520 floating bridge. Construction in the Kirkland and Redmond segments may be less costly. The at-grade segment along the BNSF corridor, if feasible, would be less expensive than an elevated or underground alignment but would require many expensive grade-separated crossings.

Summary: Opportunities and Challenges

The Ballard-Kirkland-Redmond alignment is an excellent candidate for a light rail line. It has the potential for high ridership, as it would serve dense urban neighborhoods in Seattle (including the University District) and downtown Redmond, which have been designated by the Puget Sound Regional Council (PSRC) as regional growth centers. These areas could accommodate additional growth spurred by the light rail line. The line could replace heavily used bus routes and connect with significant current and future transit lines, including Link light rail and RapidRide bus rapid transit (BRT). There are a number of engineering challenges that would need to be overcome, including tunneling between Wallingford and the University District and a connection to the SR 520 Bridge across the Montlake Cut that could drive up construction costs. Final engineering design solutions are needed to determine level of costs on this alignment. In addition, further market demand, alignment, and guideway technology feasibility analyses are required.

2. Ballard to Redmond, via Overlake

The following segments have been identified for the purpose of describing the alignment (they do not imply a construction phasing sequence):

- Segment 1: Ballard to Fremont
- Segment 2: Fremont to University District
- Segment 3: University District to SR 520/Bellevue Way
- Segment 4: SR 520/Bellevue Way to Downtown Bellevue
- Segment 5: Downtown Bellevue to Overlake Transit Center [East Link]
- Segment 6: Overlake Transit Center to Downtown Redmond

Regional Travel Origins and Destinations Served

The alignment would connect dense portions of North Seattle with high density areas on the Eastside. Origins and destinations along the alignment in North Seattle include Ballard, Fremont, Wallingford, and the University District. On the Eastside, the corridor would follow the alignment of East Link from downtown Bellevue to downtown Redmond. The destinations served could include downtown Bellevue, Overlake, and downtown Redmond, which are PSRC regional growth centers.

Regional System Connectivity

The line could connect with many significant transit services in Seattle, including Link light rail, Ballard-Uptown RapidRide, Aurora Avenue RapidRide, and bus services along Greenwood/Phinney, Roosevelt/11th Avenue NE, and in the University District, such as Community Transit express buses. On the Eastside, the line would connect to East Link in downtown Bellevue and proceed along the East Link alignment, connecting to other transit routes at Overlake Transit Center and downtown Redmond.

Bus Operations Impacts and Opportunities

In Seattle, the alignment would duplicate existing King County Metro (KCM) service between Ballard and the University District, such as routes 44 and 46. On the Eastside, the line would duplicate East Link for travel to the University District, as well as the planned ST route 542; additionally, the alignment would likely capture some riders from ST route 545, from Redmond and Overlake to downtown Seattle.

Land Use and Growth Potential

In Seattle, there is significant retail and commercial development along the corridor in Ballard, Wallingford, and the University District. There is high-density housing in Ballard and the University District, with low to mid-density housing in between. The most significant employment density is in the University District. Potential for growth in both employment and residential density exists in Ballard and along the Market and 45th Street corridors. On the Eastside there is low density residential along the SR 520 corridor and Bellevue Way. Downtown Bellevue has very high residential and employment densities and can accommodate more growth, and there is future transit-oriented development (TOD) potential along the Bel-Red Corridor. Overlake has high employment density and increasing residential density, while downtown Redmond is

expected to grow in residential density and is surrounded by large employment centers in the Sammamish Valley and Southeast Redmond (Redmond-Fall City Road).

Ridership Potential

Ridership potential for this alignment is also estimated to be high when compared to other options selected for analysis. In Seattle, the line would capture riders traveling between Ballard, Wallingford, and the University District, as well as those traveling to the Eastside. The alignment would be crossed by three high capacity transit lines: one light rail and two bus rapid transit corridors. High frequency service would allow for convenient transfers between the different lines. For residents of the Eastside, the line would provide a fast connection to the University District. There are many people who travel between these areas who could potentially use the route. One factor that might lead to lower ridership is that the line duplicates or approximates some service that will be provided by the currently funded Link alignments. People traveling between downtown Bellevue and Seattle will already be served by Link, as will those traveling between downtown Bellevue and Overlake.

Phasing and Expansion Opportunities

The line could be constructed in phases. Initially, a line between the University District and downtown Bellevue could be constructed to connect to East Link and provide more choices to riders in the Eastside. This relatively short line can potentially create a more comprehensive Link system and provide a fast connection between the University District and the Eastside. An extension to Ballard could follow to increase system coverage and ridership.

Construction Feasibility and Impacts

Along Segment 1, the line could be at grade, elevated, or underground. Segment 2 through Fremont and Wallingford to the University District would likely need to be underground for two main reasons: 1) There is only one corridor (Market/45th Street) that travels continuously through Wallingford, Fremont, and Ballard, and it has a relatively narrow right-of-way, which would make the insertion of a light rail line difficult; and, 2) A surface or elevated alignment would be affected by steep grades, and a surface operation would have worse travel time performance than an exclusive ROW. From the University District, the line would travel either underground in a tunnel parallel to Link or on an aerial structure to cross the Montlake Cut and connect with the SR 520 bridge, to then proceed at grade along SR 520 to Bellevue Way. From there it could proceed at grade along Bellevue Way (or via the BNSF corridor parallel to I-405) and then connect with East Link in downtown Bellevue and follow the East Link alignment.

Environmental Impacts

The environmental and neighborhood impacts of the line would be partially dependent on the utilized rights-of-way. Noise pollution is possible along any surface or elevated alignments. A tunnel along Segment 2 to the University District would keep vehicle noise underground, although construction activity at the portals would impact nearby residents. The segment traveling from the University District onto the SR 520 bridge would have to be engineered carefully to avoid impacting sensitive environmental areas and nearby residents. The line could create noise along Bellevue Way if running at-grade. Utilizing the East Link alignment would create additional noise along that route due to the increased frequency of service.

Potential Cost

A Ballard-Bellevue-Redmond line would likely have a medium-level of construction cost when compared to other options. A tunnel between Wallingford and the University District would be expensive, as it would be either an underground tunnel or an aerial structure across the Montlake Cut to connect with the SR 520 Bridge. Construction on the SR 520 and Bellevue Way segments presumably would be less costly, as they could be done at grade. Utilizing the existing East Link right-of-way would extend the line while minimizing additional costs and maximizing opportunity for Eastside residents. However, having two lines operate in this corridor would require further market analysis and demand evaluation. The cost of operating two routes between downtown Redmond and downtown Bellevue at high frequency to serve Seattle would result in very high frequency levels along Segments 5 and 6 of the alignment. This cost may not be warranted by future demand in the corridor.

Summary: Opportunities and Challenges

The Ballard-Bellevue-Redmond alignment is a very good candidate for a light rail line. It has the potential for high ridership, as it would serve dense urban neighborhoods in Seattle and four PSRC regional growth centers: the University District, downtown Bellevue, Overlake, and downtown Redmond. These areas could accommodate additional growth spurred by the light rail line. The line could help to create a more integrated regional transit system by connecting to significant current and future transit lines, including Link light rail and RapidRide BRT. There are a number of engineering challenges that would need to be overcome, including tunneling from Fremont to the University District and connecting to the SR 520 corridor across the Montlake Cut that may drive up construction costs. Final engineering design solutions are needed to determine level of costs on this alignment. Also duplication of East Link on the Eastside is an issue that requires further demand and cost-benefit evaluation.

3. Haller Lake to Redmond, via Kirkland

The following segments have been identified for the purpose of describing the alignment (they do not imply a construction phasing sequence):

- Segment 1: Haller Lake to Aurora Avenue/45th Street
- Segment 2: Aurora Avenue/45th Street to University District
- Segment 3: University District to SR 520/BNSF Corridor
- Segment 4: SR 520/BNSF Corridor to Downtown Kirkland
- Segment 5: Downtown Kirkland to Downtown Redmond

Regional Travel Origins and Destinations Served

This alignment would connect key areas in North Seattle with important centers on the Eastside. In Seattle, the neighborhoods served include Haller Lake, North College Park, Greenwood, Phinney Ridge, Fremont, Wallingford, and the University District. On the Eastside, the destinations served would include downtown Kirkland and downtown Redmond, which is a PSRC regional growth center.

Regional System Connectivity

The alignment could connect to a number of existing and planned transit operations in Seattle including Link light rail, Aurora Avenue RapidRide (which would need to be redesigned with light rail on the corridor), bus services along 85th Street, 45th Street, Roosevelt/11th Avenue NE, and to the University District. On the Eastside, the line could connect with Bellevue-Redmond RapidRide along 148th Avenue, transit centers in Kirkland and Redmond, the South Kirkland Park and Ride, and transit service along Market Street and 124th and 132nd Avenues in East Kirkland.

Bus Operations Impacts and Opportunities

In Seattle, the alignment would duplicate portions of the planned Aurora Avenue RapidRide and KCM route 44, and it would likely capture riders on KCM route 48 traveling to the University District. The line would provide a "*one-seat ride*" (a trip with no transfers) to the University District for residents of the Haller Lake and Bitter Lake neighborhoods, which is not a service provided today. Local bus service on Aurora Avenue would continue to be important for people traveling to and from downtown Seattle. On the Eastside, the line would duplicate services currently provided by ST route 540 and would likely capture many riders from the planned ST route 542 service (downtown Redmond to University District). Duplication of Aurora Avenue RapidRide and joint LRT/BRT operations are major issues for this alignment; the feasibility of joint operations has not been evaluated in the Aurora Avenue corridor.

Land Use and Growth Potential

Segment 1 of the alignment along Aurora Avenue consists of low-density residential, retail, and commercial development, and potentially it could be redeveloped at higher densities. There is low to mid-density residential and commercial development along the 45th Street corridor and high residential and commercial density in the University District. On the Eastside, the most significant retail and commercial development is in downtown Kirkland, downtown Redmond, and along the NE 85th Street corridor. High-density residential exists in downtown Kirkland and downtown Redmond, and low to mid-density residential development exists along 85th Street and Redmond Way. There is low to mid-level employment density along portions of the BNSF Corridor, 85th

Street, and in Redmond's Sammamish Valley area and downtown. Large housing tracts exist along the BNSF corridor in Kirkland that could potentially be redeveloped at higher density. The NE 85th Street corridor also has room for potential TOD.

Ridership Potential

Potential ridership on this alignment is estimated at medium level when compared to other options selected for analysis. The line could serve people in North Seattle headed to the University District, as well as those traveling to/from Kirkland and Redmond. On the Eastside, ridership would likely be lower because the line would serve lower density areas and smaller employment centers. The line could serve commuters traveling from Redmond and Kirkland to the University District and other parts of Seattle as well as midday travel between Redmond and Kirkland. Ridership could be increased by connecting to and interlining with East Link at Overlake or Redmond.

Phasing and Expansion Opportunities

The line could be constructed in phases. Initially, a line between the University District and downtown Kirkland could be constructed to connect Seattle to the Eastside. Extensions to Aurora Avenue and downtown Redmond could follow to increase coverage and ridership. An extension from downtown Redmond to Overlake would connect the line to East Link, which may potentially create a fast and direct connection between North Seattle and Overlake. Connecting with East Link could also strengthen connections and ridership between major Eastside destinations and communities, including Kirkland, Redmond, Overlake, and Bellevue with a continuous HCT service link between them.

Construction Feasibility and Impacts

Segment 1, which would travel south from Haller Lake along Aurora Avenue, could be constructed at grade given Aurora Avenue's wide right-of-way. Segment 2, from Aurora Avenue/45th Street to the University District, would likely need to be underground given the lack of adequate right-of-way along 45th Street. Once in the University District, Segment 3 would need to cross the Montlake Cut on either an underground tunnel or an aerial structure to meet with the SR 520 floating bridge, and then travel at grade before heading north. Segment 4 would run along the Burlington Northern Santa Fe (BNSF) corridor. The line could run at grade, although there are numerous street crossings along the route that may require grade separation and further alignment evaluation. The alignment would need to deviate from the BNSF corridor to provide closer access to downtown Kirkland and then travel east along Segment 5, via 85th Street and Redmond Way to downtown Redmond. This segment could be constructed at grade, elevated, or underground, but the feasibility of each has not been evaluated. Steep grade issues might exist between downtown Kirkland and I-405 and in the stretch between Rose Hill and downtown Redmond.

Environmental Impacts

The environmental and neighborhood impacts of the line would be dependent on the rights-of-way used. Noise pollution is possible along any surface or elevated alignments. A tunnel to the University District would keep vehicle noise underground, although construction activity at the portals would impact nearby residents. The segment traveling from the University District onto the SR-520 bridge would need to be engineered carefully to avoid impacting sensitive environmental areas and nearby residents. Along Segment 4, the line would impact neighboring residential areas, although using the BNSF corridor might reduce takings of private property. Depending on

the right-of way utilized, the line could impact traffic and businesses along NE 85th Street and Redmond Way.

Potential Cost

A Haller Lake-Kirkland-Redmond line would likely have a medium-level of cost when compared to other options. A tunnel for Segments 2 would be expensive, and on Segment 3 either a deep tunnel under the Montlake Cut and/or an aerial structure to connect with the SR 520 Bridge would be expensive and challenging. Construction on the Aurora Avenue, Kirkland, and Redmond segments would theoretically be less costly. The at-grade segment utilizing the BNSF corridor would be less expensive than an elevated or underground alignment, but would still require many grade-separated crossings.

Summary: Opportunities and Challenges

The Haller Lake-Kirkland-Redmond alignment is a good candidate for a light rail line, as it could potentially provide a fast link between North Seattle and key centers on the Eastside. Existing public right-of-way could be used for much of the route, making it less expensive than other options. Although portions of Aurora Avenue are not very densely developed, the line could serve as a catalyst for growth and revitalization along the corridor. The most difficult and potentially expensive segments to construct would likely be Segments 2 and 3 from Aurora Avenue to SR 520. Also, the joint LRT/BRT operations along Aurora Avenue may prove unfeasible which could render this option less attractive than other selected alignments. Further market analysis and engineering design are needed in this alignment to determine operational feasibility and costs.

4. Haller Lake to Redmond, via Overlake

The following segments have been identified for the purpose of describing the alignment (they do not imply a construction phasing sequence):

- Segment 1: Haller Lake to Aurora Avenue/45th Street
- Segment 2: Aurora Avenue/45th Street to University District
- Segment 3: University District to SR 520/Bellevue Way
- Segment 4: SR 520/Bellevue Way to Downtown Bellevue
- Segment 5: Downtown Bellevue to Overlake Transit Center [East Link]
- Segment 6: Overlake Transit Center to Downtown Redmond

Regional Travel Origins and Destinations Served

The alignment would connect key areas in North Seattle with important centers on the Eastside. In Seattle, the neighborhoods served would include Haller Lake, North College Park, Phinney Ridge, Fremont, Wallingford, and the University District. On the Eastside, the major destinations served would include downtown Bellevue, Overlake, and downtown Redmond.

Regional System Connectivity

The alignment could connect to a number of existing and planned transit operations in Seattle including Link light rail, Aurora Avenue RapidRide (which would need to be redesigned with light rail on the corridor), bus services along 85th Street, 45th Street, Roosevelt/11th Avenue NE, and services to the University District (i.e., Community Transit). On the Eastside, the line could connect to East Link in downtown Bellevue and proceed along the East Link alignment, connecting to major transit routes at the Overlake Transit Center and in downtown Redmond.

Bus Operations Impacts and Opportunities

In Seattle, the alignment would duplicate portions of the planned Aurora Avenue RapidRide and KCM route 44 and would likely capture riders on KCM route 48 traveling to the University District. It could provide a one-seat ride to the University District for residents of the Haller Lake and Bitter Lake neighborhoods, which is not a service available today. Local bus service on Aurora Avenue would continue to be important for people traveling to and from downtown Seattle. On the Eastside, the line would duplicate the planned ST route 542 (downtown Redmond to U. District) and would likely capture some riders from ST route 545 (Redmond to downtown Seattle). Duplication of Aurora Avenue RapidRide and joint LRT/BRT operations is a major issue for this alignment; the feasibility of joint operations has not been evaluated on the Aurora Avenue corridor.

Land Use and Growth Potential

Segment 1 of the alignment along Aurora Avenue consists of low-density residential, retail, and commercial development, which potentially could be redeveloped at higher density. There is low to mid-density residential and commercial development along the 45th Street corridor and high residential and commercial density in the University District. On the Eastside there is low-density residential along SR 520 and Bellevue Way. Downtown Bellevue has very high residential and employment densities and can still accommodate more growth, and there is future transit-oriented development potential along the Bel-Red Corridor. Overlake has high employment density and

increasing residential density, while downtown Redmond is currently growing in residential density and is surrounded by large employment centers in the Sammamish Valley and Southeast Redmond (Redmond-Fall City Road).

Ridership Potential

Potential ridership on this alignment is estimated to be medium-level as compared to other alignments selected for analysis. The line could serve people in North Seattle headed to the University District, as well as those traveling to Bellevue and Redmond. For residents of the Eastside, the line could provide a fast connection to the University District. There are many people who travel between these areas who could potentially use the route. One factor that might lead to lower ridership is that the line would duplicate or approximate service that will be provided by the currently funded Link alignments. People traveling between North Seattle and the University District will already be served by Link, as will those traveling between downtown Bellevue and Overlake.

Phasing and Expansion Opportunities

An initial alignment could connect the University of Washington with downtown Bellevue and East Link. This starter line would connect a number of regional growth centers as well as two lines in the Link system. Later phases could extend the line to Aurora Avenue/85th Street, and later to Aurora Avenue/130th Street.

Construction Feasibility and Impacts

Segment 1, which would travel south from Haller Lake along Aurora Avenue, could be constructed at grade given Aurora Avenue's wide right-of-way. Segment 2, from Aurora Avenue/45th Street to the University District, would likely need to be underground given the lack of adequate right-of-way along 45th Street. From the University District, the line would travel either underground in a tunnel parallel to Link or on an aerial structure, across the Montlake Cut and onto the SR 520 bridge, and then proceed along SR 520 until Bellevue Way. From there it could travel at grade along Bellevue Way (or via the BNSF corridor parallel to I-405) and then connect with East Link in downtown Bellevue and follow the East Link alignment.

Environmental Impacts

The environmental and neighborhood impacts of the line would be dependent on the rights-of-way used. Noise pollution is possible along any surface or elevated alignments. A tunnel to the University District would keep vehicle noise underground, although construction activity at the portals would impact nearby residents. The segment traveling from the University District onto SR 520 would need to be engineered carefully to avoid impacting sensitive environmental areas and nearby residents. The line could create significant noise along Bellevue Way if running at-grade. Utilizing the East Link alignment could create additional noise along that route due to the increased frequency of service.

Potential Cost

A Haller Lake-Bellevue-Redmond line would likely have a lower level of cost when compared to other options. A tunnel for Segment 2 would be expensive, as it would be either a deep tunnel or aerial structure across the Montlake Cut to connect with the SR 520 Bridge, in Segment 3. Construction on the Aurora Avenue, SR 520, and Bellevue Way segments would be less costly, as they are assumed to be done at grade. Utilizing the existing East Link right-of-way would

extend the line while minimizing additional costs and maximizing opportunity for Eastside residents. However, having two lines operate in this corridor would require further market analysis and demand evaluation. The cost of operating two routes between downtown Redmond and downtown Bellevue at high frequency to serve Seattle would result in very high frequency levels along Segments 5 and 6 of the alignment. This cost may not be warranted by future demand in the corridor.

Summary: Opportunities and Challenges

The Haller Lake-Bellevue-Redmond alignment is a good candidate for a light rail line. It would serve heavily used transit corridors in Seattle and provide a fast link between North Seattle and key centers on the Eastside. Existing public rights-of-way could be used for much of the route, making it less expensive than other options. The line could also serve as a catalyst for growth and revitalization along Aurora Avenue. The most difficult segments to construct would likely be Segments 2 and 3 from Aurora Avenue to SR 520. Final engineering design solutions are needed to determine construction cost level on this alignment. One downside to the alignment is that it would serve many of the same areas on the Eastside as the currently funded Link alignments, including North Seattle, the University District, downtown Bellevue, the Bel-Red corridor, and Overlake. An alignment that served different areas would be more equitable. Duplication of East Link on the Eastside is an issue that requires further demand and cost-benefit evaluation.

5. Ballard to Totem Lake, via the BNSF Corridor

The following segments have been identified for the purpose of describing the alignment (they do not imply a construction phasing sequence):

- Segment 1: Ballard to Fremont
- Segment 2: Fremont to University District
- Segment 3: University District to SR 520/BNSF Corridor
- Segment 4: SR 520/BNSF Corridor to Downtown Kirkland
- Segment 5: Downtown Kirkland to Totem Lake

Regional Travel Origins and Destinations Served

The alignment would connect key areas in North Seattle with portions of Kirkland, Juanita, and Totem Lake. Origins and destinations along the alignment in North Seattle include Ballard, Fremont, Wallingford, and the University District. On the Eastside, the major destinations served would be downtown Kirkland and Totem Lake, which is a PSRC regional growth center.

Regional System Connectivity

The line could connect with many significant transit services in Seattle, including Link light rail, Ballard-Uptown RapidRide, Aurora Avenue RapidRide, and bus services along Greenwood/Phinney Avenue, Roosevelt/11th Avenue NE, and to the University District. On the Eastside, the line could connect with the South Kirkland Park and Ride, transit service along NE 85th Street and NE 116th and 124th Streets, and potentially the Kingsgate Park and Ride.

Bus Operations Impacts and Opportunities

In Seattle, the alignment would duplicate existing King County Metro service between Ballard and the University District, such as routes 44 and 46. On the Eastside, the line would duplicate services currently provided by KCM route 277, ST route 540, and would likely capture many riders from a number of express routes that operate between Kirkland and downtown Seattle.

Land Use and Growth Potential

In Seattle, there is significant retail and commercial development along the corridor in Ballard, Wallingford, and the University District. There is high-density housing in Ballard and the University District, with low to mid-density housing in between. The most significant employment density is in the University District. Potential for growth in both residential and employment density exists in Ballard and along the Market and 45th Street corridors. On the Eastside, the most significant retail and commercial development is in downtown Kirkland and Totem Lake. There is high-density residential in downtown Kirkland, while there is low to mid-level residential density in Totem Lake. There is low to mid-level employment density along portions of the BNSF corridor, and mid-level retail and employment density in Totem Lake. Considerable potential for growth and redevelopment exists in Totem Lake. The City of Kirkland has been working with the owner of Totem Lake Mall to redevelop the property, although the project has been put on hold. A light rail station would spur growth in the area.

Ridership Potential

Ridership potential for the alignment is estimated to be lower than other options. In Seattle, the line would capture riders traveling between Ballard, Wallingford, and the University District, as well as those traveling to the Eastside. The line would be crossed by three high capacity transit lines: one light rail and two bus rapid transit. High frequency service would allow convenient transfers between these lines. On the Eastside, ridership would likely be lower because the alignment would serve lower-density areas and smaller employment centers. Although many people work in Totem Lake and other areas of Kirkland, it is likely that only a small percentage would use light rail for commuting to work given the auto-oriented environment that currently is predominant in the area.

Phasing and Expansion Opportunities

The line could be constructed in phases. Initially, a line between the University District and downtown Kirkland could be constructed to connect Seattle to the Eastside. Extending the line to Totem Lake could potentially be done at a relatively low cost (if done at grade), and an extension to Ballard could follow to increase coverage and ridership. From Totem Lake the line could be extended to Canyon Park (a regional growth center in the county boundary between King and Snohomish) or alternatively to Woodinville or Redmond via the BNSF corridor. The adequacy of the BNSF corridor to support light rail has not yet been evaluated.

Construction Feasibility and Impacts

Along Segment 1, the line could be at grade, elevated, or underground. Segment 2 through Fremont and Wallingford to the University District would likely need to be underground for two main reasons: 1) There is only one corridor (Market/45th Street) that travels continuously through Wallingford, Fremont, and Ballard, and it has a relatively narrow right-of-way, which would make the insertion of a light rail line difficult; and, 2) A surface or elevated alignment would be affected by steep grades, and a surface operation would have worse travel time performance than an exclusive ROW. Once in the University District, Segment 3 would need to cross the Montlake Cut on either an underground tunnel or an aerial structure to connect with the SR 520 bridge before heading east. Segment 4 would run along the BNSF corridor before deviating to the west to serve downtown Kirkland through a tunnel or other right-of-way. Segment 5 would travel from downtown Kirkland and rejoin the BNSF corridor and proceed to Totem Lake. Many street crossings along the BNSF corridor may require grade separation; further evaluation and feasibility of this alignment as an at-grade option is needed.

Environmental Impacts

The environmental and neighborhood impacts of the line would be partially dependent on the rights-of-way used. Noise pollution is possible along any surface or elevated alignments. Tunnels in Seattle and Kirkland would keep vehicle noise underground, although construction activity at the portals would impact nearby residents. The segment traveling from the University District onto SR 520 would need to be engineered carefully to avoid impacting sensitive environmental areas and nearby residents. Along Segments 4 and 5, the line would impact neighboring residential areas, although utilizing the BNSF corridor might reduce takings of private property.

Potential Cost

A Ballard-Kirkland-Totem Lake line would likely have a medium to high-level of cost when compared to other selected options. A tunnel between Fremont and the University District would

be expensive, as would an underground tunnel or aerial structure across the Montlake Cut to connect with the SR 520 bridge. Construction in the SR 520 corridor to Kirkland and the Kirkland to Totem Lake segments would likely be less costly if at grade operation is feasible (no LRT feasibility determined yet). The assumed at-grade operation on segments utilizing the BNSF corridor would be less expensive than an elevated or underground alignment, but they would require many grade-separated crossings with local streets. An underground tunnel constructed to better serve downtown Kirkland would also be costly.

Summary: Opportunities and Challenges

The Ballard-Totem Lake alignment is a weaker candidate for a light rail line than other options analyzed herein. It would expand light rail to areas that do not have planned service and would improve regional transit connections for dense Seattle neighborhoods, downtown Kirkland, and Totem Lake. By connecting to a regional growth center, the alignment would fit in with PSRC's regional growth strategy. The drawback is that it would likely have lower ridership than other alignment options because it does not connect with the major employment centers on the Eastside: downtown Bellevue and Overlake. Compared to other options this alignment may be less expensive to build and could open access to areas with potential for residential and commercial redevelopment, making it an attractive option. Further engineering design and market demand evaluation is needed to determine feasibility and cost-benefit.