

3 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 OVERVIEW

This chapter provides a summary of the process used to develop the detailed alternatives that are described in Chapter 4 and evaluated in Chapter 5. The alternatives development and evaluation process consists of three stages as summarized in Figure 3-1: initial concept development and screening, Level 1 alternatives development and evaluation, and Level 2 alternatives development and evaluation. The sections that follow summarize the findings of the first two steps in the process. Further details can be found in the *Final Level 1 Alternatives Analysis and Evaluation* report (Sound Transit 2011a). The chapter also discusses the criteria and methodology used to evaluate the alternatives at each step of the process. The alternatives are also described as they evolved through the three evaluation stages, including the alternatives and options that were dropped at each stage. The last section of this chapter describes the alternatives carried forward into the Level 2 evaluation. Chapter 6 gives an overview of the early scoping process that was used to consult with the public, agencies, and tribes as well as the results of these discussions.

3.2 EVALUATION PROCESS

3.2.1 Basis in Purpose and Need

The North Corridor Transit Project's Purpose and Need, described in Chapter 2, is summarized into six broad categories that form the basis for the development of the screening and evaluation criteria at each step of the process. These categories are as follows:

- Transportation effectiveness in meeting mobility, access, and capacity needs
- Equitable community impacts and benefits
- Supportive land use and economic development effects



- Preservation of a healthy environment
- Affordable and constructible project
- Consistency with Sound Transit's long-range vision

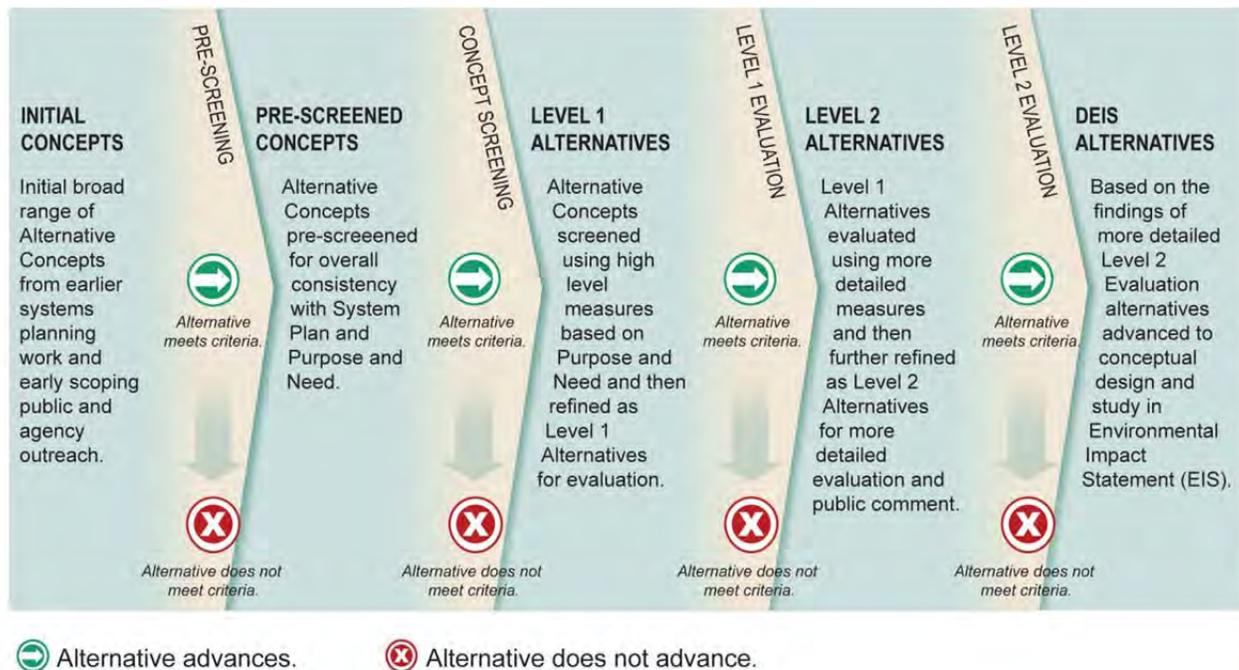


Figure 3-1. Alternatives Analysis Evaluation Framework

TRANSPORTATION EFFECTIVENESS AND COMMUNITY EQUITY

The transportation effectiveness and community equity categories relate the first two Purpose Statements of improving regional mass transit service from Seattle north into Snohomish County by:

- 1) *Providing reliable, rapid, and efficient two-way, peak and off-peak transit service of sufficient capacity to meet the existing and projected demand between the communities and activity centers located in the North Corridor and the other urban centers in the Central Puget Sound area; and*
- 2) *Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system.*

The transportation effectiveness and community equity categories are derived from the following Need Statements:

- a) *Meet the rapidly growing needs of the corridor and the region's future residents and workers by increasing mobility, access, and transportation capacity to and from regional growth and activity centers in the North Corridor and the rest of the region, as called for in the region's adopted plans, including PSRC's VISION 2040 and Transportation 2040, as well as related county and city comprehensive plans.*
- b) *Address the problems of increasing and unreliable travel times for transit users in the North Corridor, who are now dependent on the corridor's highly congested roadway and HOV systems.*
- c) *Address overcrowding facing current and future North Corridor transit riders due to insufficient capacity of the current transit system.*
- d) *Provide an alternative to automobile trips on I-5 and SR 99, the two primary highways serving the corridor, which are unreliable and over capacity throughout significant portions of the day.*
- e) *Ensure long-term regional mobility, multimodal connectivity, and convenience for North Corridor citizens and communities, including travel-disadvantaged residents and low-income and minority populations.*

LAND USE AND ECONOMIC DEVELOPMENT EFFECTS AND ENVIRONMENTAL PERFORMANCE

The land use and economic development effects and environmental performance categories were derived from the third Purpose Statement of improving regional mass transit service from Seattle north into Snohomish County by:

- 3) *Supporting North Corridor communities' and the region's adopted land use, transportation and economic development vision, which promotes the well-being of people and communities, ensures economic vitality, and preserves a healthy environment.*

The land use and economic development effects and environmental performance categories were derived from the following Need Statements:

- f) *Provide the transit infrastructure needed to support the development of Northgate and Lynnwood as designated regional growth centers providing housing, employment, public services, and multimodal transportation connections.*
- g) *Help support the environmental and sustainability goals of the state and region, including state regulations setting goals for reducing annual per capita vehicle miles traveled by 2050, in accordance with RCW 47.01.440, and the reduction of greenhouse gas emissions (Limiting Green House Gas Emissions, Chapter 702.35).*

COST, CONSTRUCTABILITY, AND CONSISTENCY WITH SOUND TRANSIT'S LONG-RANGE VISION

The cost, constructability, and consistency with Sound Transit's Long-Range Vision categories were derived from the fourth Purpose Statement of improving regional mass transit service from Seattle north into Snohomish County by:

- 4) *Supporting the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan for high quality regional transit service connecting major activity centers in King, Pierce and Snohomish counties, including a connection between Seattle and Everett.*

The cost, constructability, and consistency with Sound Transit's Long-Range Vision categories were derived from the following Need Statement:

- h) *Implement the long-range vision for HCT service established by Sound Transit's Long-Range Plan, with a regional transit investment that supports economic vitality, preserves the environment, preserves communities, and allows for the future extension of HCT north to Everett.*

Sound Transit's Long-Range Plan (Sound Transit 2005a) includes the ultimate development of light rail transit to connect and serve the four major regional centers—Everett, Seattle, Tacoma, and Bellevue, as well as the following cost-related objectives:

- Offer cost-effective and efficient transportation solutions within available resources, and
- Create a financially feasible system that is affordable to build, run, and use.

As a result, consistency with Sound Transit's Long Range Plan is determined based on the capacity to accommodate ridership growth associated with future extensions of transit service north to Everett as well as cost effectiveness and financial feasibility based on Sound Transit's current financial plan.

3.2.2 Evaluation Methodology and Criteria

The Purpose and Need was used to develop the evaluation criteria and measures; these criteria are grouped by the broad categories described above. The AA evaluation process used to determine the alternatives to be carried forward into the next stages of project development is illustrated in Figure 3-1. Each evaluation level employed criteria and measures that address FTA's Alternatives Analysis and New Starts guidelines as well as the project's Purpose and Need. The alternatives evaluation consisted of three major steps:

1. **Initial Concept Screening and Alternatives Development:** Before the start of the initial screening, a pre-screening was conducted to assess whether proposed concepts were consistent with the definition of the North Corridor as identified in Sound Transit's 2005 *Regional Transit Long-Range Plan* (Sound Transit 2005a) and whether they met the project's Purpose and Need. Those concepts surviving pre-screening were developed further, while those that did not were screened out. The surviving concepts were then further evaluated and refined to form the Level 1 Alternatives.

2. Level 1 Alternatives Evaluation: The Level 1 evaluation employed quantitative and qualitative assessments of benefits, impacts, and costs of a refined set of alternatives. Alternatives that were determined to have sufficient merit were carried forward, modified, and refined for the Level 2 evaluation. Poorly performing alternatives were dropped from further consideration.
3. Level 2 Alternatives Evaluation: The Level 2 evaluation was a detailed evaluation of further refined alternatives using more quantitative analysis and information. Alternatives that were determined to have sufficient merit are recommended to be evaluated in the Draft EIS.

Table 3-1 lists the screening criteria and measures that were used in the initial concept development. Table 3-2 lists the evaluation criteria and measures used in the Level 1 and Level 2 evaluations. The criteria and measures are grouped in the tables by the broad categories described above in order to link them back to the project’s Purpose and Need Statements. A more detailed discussion of these criteria and how they were used is contained in the *Alternatives Evaluation Framework, Criteria, and Methodologies Technical Memorandum* (Sound Transit 2011b).

Table 3-1. Initial Concept Development Review Screening Criteria and Measures	
Screening Criteria	Measures
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs	
Rider Benefits	Peak-period travel time from the Lynnwood Transit Center and Shoreline to Northgate Link light rail station, including transfer time to rail at Northgate
Reliability	Miles of operation on non-exclusive guideway Number of at-grade intersections traversed
Capacity	Passengers per hour per direction
Connections to Regional Multimodal Transportation System	Number of transfers to reach regional transit system at Northgate
Purpose and Need: Equitable Community Impacts and Benefits	
<i>Not used for initial concept development review</i>	
Purpose and Need: Supportive Land Use and Economic Development Effects	
Land Use and Economic Development Potential	Number of identified existing and future activity centers within 0.5 mile of alignment
Purpose and Need: Preservation of a Healthy Environment	
Environmental Considerations	General requirements for new right-of-way and associated implications
	Qualitative impacts on existing transportation systems
Purpose and Need: Cost and Constructability	
Cost Considerations	Major cost factors associated with each concept
Purpose and Need: Consistency with Sound Transit’s Long-Range Plan	
Accessibility to PSRC-designated Regional Growth Centers	Peak period travel times in both directions between representative PSRC Regional Growth Centers and Lynnwood
	Number of PSRC Regional Growth Centers reachable via one seat ride from Lynnwood

Table 3-2. Levels 1 and 2 Evaluation Criteria and Measures

Level 1 Evaluation Measures	Level 2 Evaluation Measures
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs	
Project Daily Riders Annual New Riders User Benefit Estimate—Annual Hours of Travel Time Saved Practical Capacity (Directional Passenger/Hour) Peak Transit Travel Time: Lynnwood to Northgate Operations on Non-Exclusive Right-of-Way Number of At-Grade Signalized Intersections Traversed	2030 Project Daily Riders 2030 Annual New Riders 2030 Annual Hours of Travel Time Saved 2030 New Weekday Transit Trips to Regional Center Capacity in passengers per hour per direction 2030 Peak Hour Passenger Demand/Capacity 2030 Peak Transit Travel Time: Lynnwood to Northgate 2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Northgate) Operations on Non-Exclusive Right-of-Way Signalized Intersections Traversed Number of Transfers to Reach Major Destinations 2030 Reduction in Weekday Vehicle Miles Traveled
Purpose and Need: Equitable Community Impacts and Benefits	
<i>Not considered for Level 1 screening.</i>	Impacts to Affected Communities Transportation Benefits to Affected Communities
Purpose and Need: Supportive Land Use and Economic Development Effects	
Consistency with PSRC’s VISION 2040 and Regional Economic Strategy Consistency with comprehensive plans, land use and zoning Total existing and forecast population and employment within 0.5 mile of stations Number of activity centers within 0.5 mile of stations	Consistency with PSRC’s VISION 2040 and Regional Economic Strategy Station area existing land use orientation and character Station area existing and forecast population, employment and housing Station area mix of uses Connectivity to major trip generators Station area transit supportive plans and policies
Purpose and Need: Preservation of a Healthy Environment	
New Transportation Right-of-Way Requirements Impacts on General Purpose Traffic Operations	Ecosystems Effects Water Resources Effects Potential Park or Historic Resources Effects, Including Section 4(f) Properties Reduction in Air Pollutants and Greenhouse Gas Emissions Visual Impacts Potential for Noise Impacts Requiring Mitigation Potential Land Acquisitions (Acres) Traffic Impacts Pedestrian and Bicycle Travel Construction Effects on Transportation System

Table 3-2. Levels 1 and 2 Evaluation Criteria and Measures

Level 1 Evaluation Measures	Level 2 Evaluation Measures
Purpose and Need: Cost and Constructability	
Capital Cost 2030 Annual O&M Cost	Capital Costs 2030 Net Annual Operations and Maintenance Costs Cost per Hour of 2030 User Benefits Incremental Cost per 2030 New Passenger
Purpose and Need: Consistency with Sound Transit’s Long-Range Plan	
Operations in General Purpose Traffic Lanes Consistency with Definition of HCT in Long-Range Plan	Meets State Definition of HCT Consistent with Sound Transit Long-Range System Plan, as measured by capacity to accommodate ridership growth and consistency with Sound Transit’s current financial plan.

3.3 INITIAL CONCEPT DEFINITION

Initial concepts were identified and screened by the project team through an iterative process. The North Corridor is characterized by a very mature and well-used public transit system operated by three public transit agencies, along with supporting transit and HOV facilities developed and maintained by WSDOT. The project area also has a long and rich history of transportation studies aimed at addressing many of the issues identified in the project’s Purpose and Need. The findings of the recently completed system planning study and other previous studies, documented in the *Previous Studies and Findings Technical Memorandum* (Sound Transit 2010c), as well as input from agency staff and the public through early scoping, were the basis for the development of the initial list of alternative concepts.

3.3.1 Early Public and Agency Involvement

Sound Transit undertook a significant public and agency outreach effort early in the AA process to gather input on the project’s Purpose and Need, the evaluation and screening criteria, and the initial alternatives. Chapter 6 provides a detailed description of those efforts.

Sound Transit and the FTA undertook early scoping, which is an optional step in the state and federal environmental review processes, to engage the public and stakeholders in the AA study process, before defining formal alternatives that would undergo more detailed engineering and environmental study. The early scoping process for the North Corridor Transit Project began September 24, 2010 with a series of public notices, advertisements, and mailings and continued through October 27, 2010. Three public meetings and an agency meeting were held and public comments were received in a wide variety of formats.

The project used an online questionnaire tool, which was available on the project Web site (<http://www.soundtransit.org/NorthHCT>) throughout the early scoping period. Nearly 275 people completed the questionnaire, and almost half of them submitted additional informal written comments at the end of their entry. Nearly 90 written comment letters were received; nine of these comment letters were provided by state and local agencies. Several key themes emerged from the public meetings and online questionnaire tool regarding the alternatives as follows:

- Light rail was the mode suggested by most participants, which was expected because voters had recently approved local funding for light rail in the 2008 ST2 ballot measure.
- Most people said that ease of access to the regional transit system was important, including strong east-west connections with coordinated and direct feeder buses, sufficient park-and-ride capacity, and easy bicycle and pedestrian access.
- Most people identified either I-5 or SR 99 as appropriate routes for the system. Several thought 15th Avenue NE should be considered.
- Responses about potential station areas and numbers of stations were mixed. Many people understood why the planned location of system termination is at the Lynnwood Transit Center, but many asked if it could be extended farther north to Alderwood Mall. Many people thought the new Mountlake Terrace Transit Center could provide good access to the system, whereas comments varied about potential southern station areas on I-5 and potential station areas on SR 99.
- Overall, participants wanted to know more about the potential tradeoffs and impacts of the project. Some expressed concerns about how the project would be affected by Sound Transit's current financial situation and tradeoffs being explored by the Sound Transit Board.

3.3.2 Operating Strategy

Development of the initial concepts began with high-level consideration of a transit operating strategy to address the project's Purpose and Need in the context of the regional transportation plan, Sound Transit's Long-Range Plan, and the identified travel markets.

OPERATING STRATEGY AS IT RELATES TO ADOPTED PLANS

Two current adopted plans in the region (*Transportation 2040*, May 2010; *Sound Transit Regional Transit Long-Range Plan*, July 2005) call for light rail transit, linking the region's four major regional centers—Everett, Seattle, Tacoma, and Bellevue. Connecting the interim light rail terminus at Northgate with Lynnwood is a key component of the ultimate connection to Everett. As a result, this North Corridor segment will ultimately serve a large "through" movement market—requiring sufficient capacity and service levels (i.e., frequent headways [the time between successive train movements in a given direction], higher speeds, and reliability) necessary for this critical connection between Everett and Seattle. The alternative concepts for

the Northgate-to-Lynnwood segment were crafted and screened with this ultimate objective in mind.

OPERATING STRATEGY AS IT RELATES TO TRANSIT MARKET

An analysis of transit ridership patterns in the North Corridor was conducted at the outset of the AA process. Results are contained in the *Project Context and Baseline Conditions Technical Memorandum* (Sound Transit 2010b). Table 3-3 summarizes the estimated daily transit trip pairs between the North Corridor and all other districts. Each of the districts is ranked based on the number of existing (2010) transit trip pairs. This information is also shown graphically in Figure 2-6 in Chapter 2.

As shown in Table 3-3 (and illustrated in Figure 2-6 in Chapter 2), the Seattle central business district (CBD) is the single largest market for transit trips from the North Corridor; the second largest market for transit trips is the University District. In light of these factors, it was important to design alternative operating concepts that provide a high level of service to these activity centers, both in terms of capacity and speed.

Table 3-3. Estimated Existing Daily Transit Trip Pairs from the North Corridor to Various Districts

District Name	Share of Total Transit	District Name	Share of Total Transit
Seattle CBD	22.3%	North Lynnwood	1.3%
University District	15.3%	Bothell	1.2%
North Seattle	11.4%	West Bellevue	1.1%
Ballard	6.4%	West Seattle	0.9%
Shoreline	5.5%	Redmond	0.6%
Capitol Hill	5.4%	Bellevue	0.5%
South Everett	5.3%	SeaTac	0.5%
Lynnwood	4.9%	Renton	0.4%
Queen Anne	3.8%	Kent	0.1%
Rainier	3.2%	Issaquah	0.1%
North Everett	2.4%	Lakewood	0.0%
North Creek	2.2%	Federal Way	0.0%
Edmonds	2.0%	North Tacoma	0.0%
Kirkland	1.8%	Puyallup	0.0%
Mountlake Terrace	1.5%	South Tacoma	0.0%
Total	93.4%	Total	6.7%

Source: Sound Transit Regional Transit Ridership Forecasting Model

Ideally, this would be accomplished by providing a one-seat ride on the regional transit system to both downtown Seattle and the University District from the North Corridor. The rail concepts, by virtue of linking into the rail system at Northgate, inherently provide a one-seat ride on the regional system to both destinations. Existing express bus services that directly connect the corridor with the Seattle CBD and the University of Washington were assumed to be eliminated with the rail concepts. However, the BRT and transportation systems

management (TSM) concepts, which require a bus-to-rail transfer at Northgate, do not in themselves provide a one-seat ride to these key destinations. Hence, it is assumed that the existing parallel express bus services directly serving the Seattle CBD and the University District from key points within the corridor are maintained for these concepts. The result is that with the TSM and BRT concepts, three separate routes would serve Northgate, the University District, and the Seattle CBD as shown in Figure 3-2.

In addition to serving the two primary regional center destinations, another need is to improve regional access to the North Corridor communities from all other activity centers. The existing regional express bus system adequately connects (albeit with the inherent traffic congestion-related reliability and travel time problems) the project area to the Seattle CBD and the University District. However, travel to other major centers is poorly served by this system. Thus, the ultimate operating strategy for the rail alternatives (once the remainder of the Sound Transit system is complete) is a one-seat ride to all regional centers. For the bus alternatives, the strategy is to augment the one-seat ride service provided to the Seattle CBD and University District with the best two-seat ride available through a transfer to light rail at Northgate.

Finally, while this project will connect North Corridor communities with other activity centers, it will also ultimately serve as a segment in the larger regional system extending north to Everett. Thus, the operating strategy for this corridor must be designed to accommodate the larger “through market” as well as trips beginning or ending within the project area.

3.3.3 Concepts Eliminated in Pre-Screening

Two concepts were eliminated in pre-screening because they were judged to be inconsistent with Sound Transit’s Long-Range Plan and failed to meet the project’s Purpose and Need.

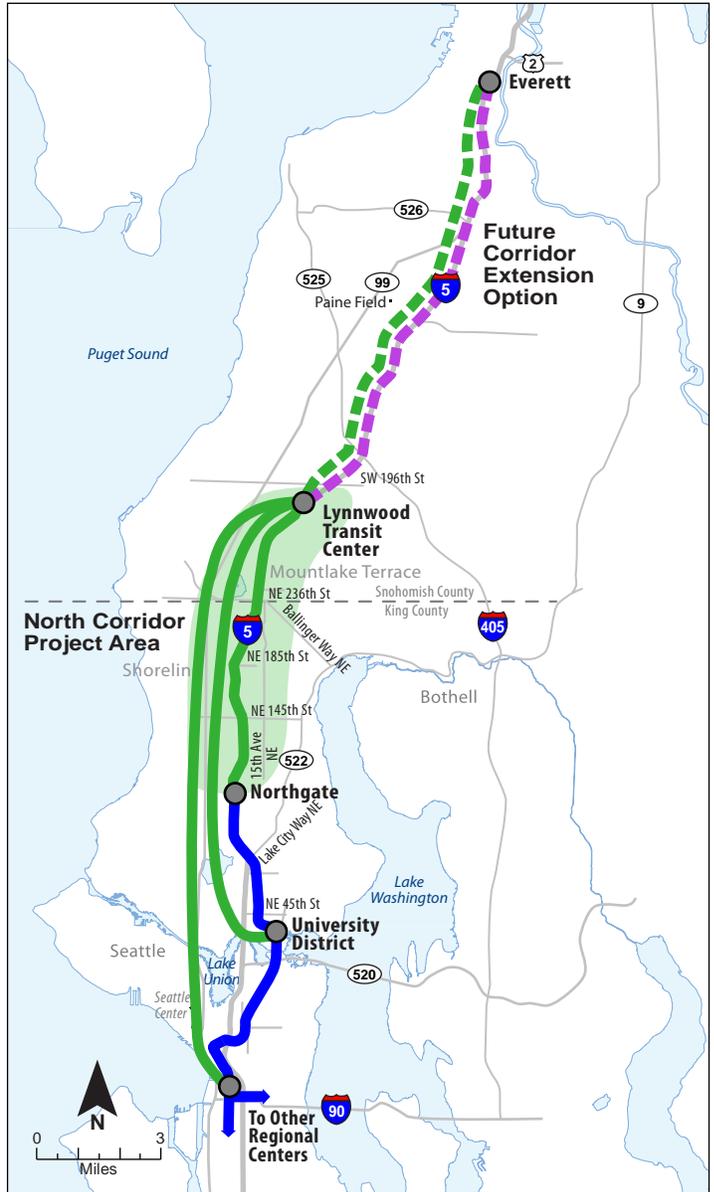
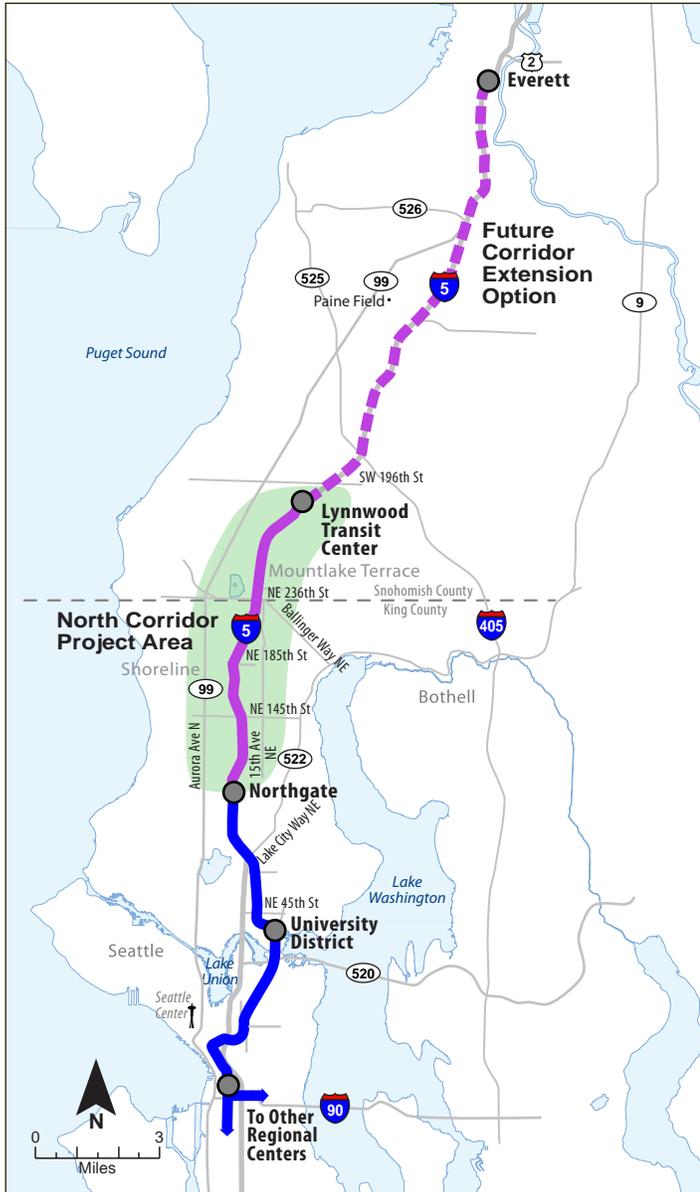
LAKE CITY WAY/SR 522 ALIGNMENT

This concept would use Lake City Way/SR 522 to connect Northgate to Lynnwood. SR 522/Lake City Way lies to the east of the study corridor and runs generally northeast/southwest. The SR 522/Lake City Way alignment is longer than any other route considered, and does not connect the communities and travel markets served by the current major north-south transit system the project is intended to improve.

In Sound Transit’s Long-Range Plan, the SR 522 corridor is separate and distinct from the North Corridor primarily as a result of differing travel patterns and is subject to a separate project development process. In addition, because of its location, a Lake City Way/SR 522 alignment is not consistent with the project’s Purpose and Need related to transportation effectiveness; therefore, it was eliminated from further consideration.

Rail Operating Concepts

Bus Operating Concepts



- █ Baseline Light Rail
- █ Light Rail Concept
- █ Potential Future Light Rail
- █ Bus Concept
- █ Potential Future Bus

Figure 3-2. Conceptual Operating Strategy for North Corridor Transit Concepts

LIGHT RAIL IN MIXED TRAFFIC

For this concept, light rail would be located at-grade on SR 99 and 15th Avenue NE, operating in mixed general purpose traffic, or mixed with buses in the SR 99 business access and transit (BAT) lanes. During the system plan work leading to the development of both the 1996 voter-approved *Sound Move* (Sound Transit 1996) and 2008 voter-approved ST2 plans, surface light rail operating in mixed traffic was found to have insufficient capacity, slow average speeds, and low reliability. This concept would result in light rail operating more as a streetcar, which is not compatible with the Link light rail system's required train lengths and headways and therefore would not provide reliable service as outlined in Sound Transit's Long-Range Plan.

During preliminary engineering for Central Link, similar concepts were studied for the DSTT and the E3 Busway. Temporary joint operation of bus and rail in the DSTT would work, but it would eventually be converted exclusively to light rail operations once warranted by train headways. A similar operation on the E3 Busway was determined to be unworkable because of frequent at-grade roadway crossings and the trains and buses having to serve different stations. Operation of light rail in the SR 99 BAT lanes would present problems similar to the joint use of the E3 Busway, with the additional problem of mixing rail operations with right-turning general purpose traffic.

Because this concept would have insufficient capacity, slow average speeds, and low reliability, it does not meet the project's Purpose and Need related to transportation effectiveness. As a result, it was eliminated from further consideration.

3.3.4 Initial Concepts Carried Forward for Screening and Development

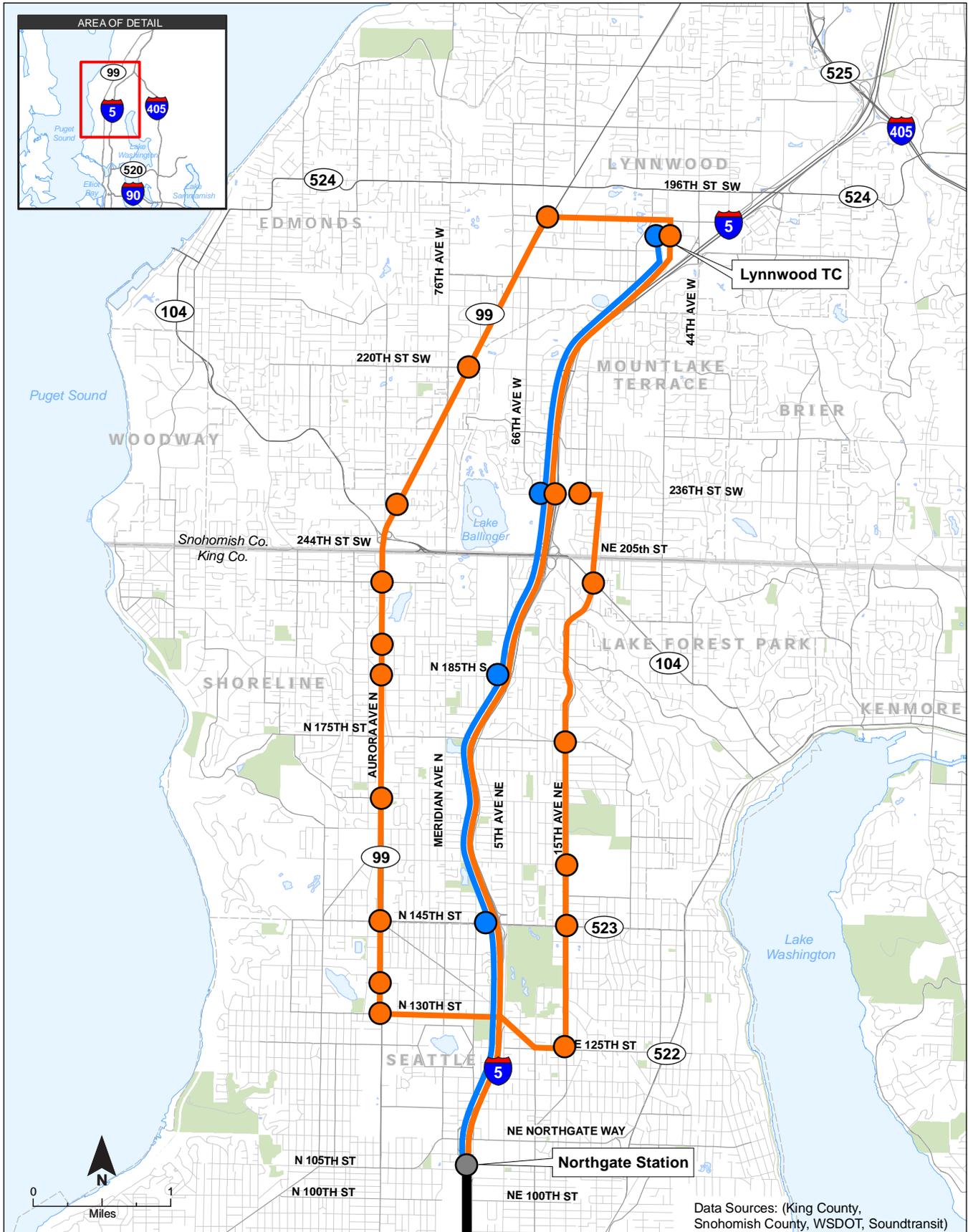
In addition to a No Build Alternative, eight other initial build concepts were judged promising enough to be screened as part of the development of Level 1 alternatives. These concepts are shown in Figures 3-3, 3-4, and 3-5 and include the following:

No Build Concept: The No Build Concept includes only those improvements committed to and funded for implementation by the transportation providers in the region.

TSM/Baseline Concept: The TSM concept, shown in Figure 3-3, improves the regional transit system in the project area to the greatest extent possible without making a major new capital investment.

Light Rail Concepts (5): Five light rail concepts and sub-concepts were identified to connect Northgate to Lynnwood including an alignment along I-5, two concepts for an alignment along SR 99 (one at-grade and one on elevated structure), and two concepts along 15th Avenue NE (one at-grade and one on an elevated structure). These concepts are illustrated in Figure 3-4.

BRT Concepts (2): Two BRT concepts were developed. One concept focuses on I-5 and attempts to duplicate the I-5 light rail line. The other includes BRT service along three corridors including portions of I-5, SR 99, and 15th Avenue NE.



Data Sources: (King County, Snohomish County, WSDOT, Soundtransit)

- North Link Light Rail Service
- SR 99/I-5/15th Avenue NE BRT Alternative
- I-5 BRT Alternative
- North Link Station
- Potential BRT Station*

*ST2 Representative Alignment has 4 LRT Stations

Figure 3-5. BRT Concepts

3.3.5 TSM/Baseline Concept

The intent of the TSM/Baseline Concept is to do the most that can reasonably be done to improve regional mass transit service in the project area with improved bus facilities and services without major new capital investment.

The existing bus network is focused on the peak-period commuter travel markets between the project area and areas to the north, the University District, and downtown Seattle. The bus service additions focus on connecting the project area to the Link light rail network. The following elements would be added to complement existing services:

- A new express bus route would operate in the I-5 HOV lanes between the Lynnwood Transit Center and the Northgate Link Station.
- A second express route would originate at the Shoreline Park-and-Ride and serve areas through Shoreline.
- Five hundred new park-and-ride stalls would be provided at both Shoreline Park-and-Ride and Lynnwood Transit Center.
- Low-cost traffic engineering improvements would be implemented to give buses priority, decrease travel times, and increase reliability between the I-5 Northgate ramps to/from the north and the Link light rail station.

The TSM/Baseline Concept is shown in Figure 3-3.

3.3.6 I-5 Light Rail Concept

The I-5 Light Rail Concept is the same as the representative alignment that was the basis for the project included in the ST2 Plan. This alignment assumes a fully grade-separated, elevated double-track rail line from Northgate to the Lynnwood Transit Center. The I-5 Light Rail Concept is shown in Figure 3-4 and includes the following elements:

- Operation of light rail trains, up to four cars in length, between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes.
- Expansion of the existing light rail vehicle fleet and additional operation and maintenance (O&M) facility capacity sufficient to support the extension.
- Four new light rail stations north of Northgate including stations at NE 145th Street, NE 185th Street, SW 236th Street, and the Lynnwood Transit Center.
- Five hundred new park-and-ride stalls at each of the 145th Street, 185th Street, and Lynnwood Transit Center Link stations.
- Restructured bus services consistent with 2007 bus/light rail service integration of Sound Transit, Community Transit, and King County Metro for ST2.

Variations of this concept could include a combination of elevated and, where feasible, at-grade (in exclusive right-of-way) configurations along I-5, and various combinations of I-5 east side, median, and west side alignments. A number of alternative station locations and configurations are also possible, which are shown in Figure 3-4.

3.3.7 SR 99 Light Rail Concept

For the purpose of concept screening, two representative versions were considered, one at-grade and one elevated along SR 99. Both versions assume operation of light rail trains in its own exclusive right-of-way, whether on aerial structure or at-grade with cross streets. They also assume that adequate right-of-way would be acquired to maintain the existing number of travel lanes on SR 99, including BAT lanes. The two representative versions assume a connection would be made to the SR 99 corridor from Northgate with an elevated alignment along the North 110th Street corridor. The connection back to Lynnwood would be made using the SR 104 and I-5 corridors. The SR 99 Light Rail Concept is shown in Figure 3-4 and includes the following elements:

- Operation of light rail between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes for the fully grade-separated variation, and 8-minute peak, 10-minute off-peak headways for the variation running at-grade along SR 99.
- Five new light rail stations north of Northgate, either elevated or at-grade. Station location variations are shown in Figure 3-4.
- Expansion of the existing light rail vehicle fleet and additional O&M facility capacity sufficient to support the extension.
- Five hundred new park-and-ride stalls at both the Shoreline Park-and-Ride and the Lynnwood Transit Center.
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication.

Figure 3-4 also illustrates the large number of variations that were considered for SR 99. These include three different paths for the connection from Northgate, possible use of portions of the parallel former Interurban right-of-way in King and Snohomish counties, and four options for the connection back to the Lynnwood Transit Center.

3.3.8 15th Avenue NE Light Rail Concept

The 15th Avenue NE Light Rail Concept assumes either a fully elevated alignment, or a mixed elevated/at-grade alignment extending north from the Northgate Link Station generally along 15th Avenue NE to the Mountlake Terrace Transit Center, and from there along I-5 to the Lynnwood Transit Center in an elevated alignment. Both versions assume operation of light rail trains in an exclusive right-of-way, which could be elevated or at-grade with cross streets. For the purposes of the concept development and screening, the representative route follows I-5 from Northgate to North 145th Street in an elevated alignment, and then continues elevated

along North 145th Street east to 15th Avenue NE. North of this point the alignment could be either elevated or at-grade through the North City neighborhood in Shoreline. South of Ballinger Way, the at-grade variation would become elevated again to cross Ballinger Way and the SR 104/I-5 interchange, before connecting into the Mountlake Terrace Transit Center. Variations of this alignment are discussed below. The 15th Avenue NE Light Rail Concept is shown in Figure 3-4 and includes the following elements:

- Operation of light rail between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes for the fully grade-separated option, and 8-minute peak headways and 10-minute off-peak headways for the at-grade option. It is anticipated that 4-minute headways would not be possible to maintain with an at-grade alignment due to the impacts on traffic signal operations at several intersections with high conflicting traffic volumes.
- Expansion of the existing light rail vehicle fleet and additional O&M facility capacity sufficient to support the extension.
- Four new light rail stations north of Northgate (either elevated or at-grade). Station location variations are shown in Figure 3-4.
- Approximately 500 additional park-and-ride stalls at the Lynnwood Transit Center.
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication of transit service on 15th Avenue NE.

Figure 3-4 also illustrates the variations that were considered for connecting from Northgate to 15th Avenue NE. In addition to the representative alignment, these include an alignment along Northgate Way, Roosevelt Way, and Pinehurst Way reaching 15th Avenue NE at NE 117th Street, as well as an alignment along I-5 and NE 130th Street and the southern edge of the Jackson Park Golf Course.

3.3.9 I-5 BRT Concept

The I-5 BRT Concept consists of a BRT line using the I-5 HOV lanes between the existing Northgate and Lynnwood Transit Centers. The BRT line would provide service similar to the I-5 Light Rail Concept, but with modifications to take advantage of the greater routing flexibility possible with roadway-based transit service. As with the TSM/Baseline Concept, existing bus services in the project area would remain in place. The I-5 BRT Concept is shown in Figure 3-5.

Physical improvements to facilitate the BRT line would include the following:

- **Northgate Transit Center:** Transit-only direct access ramps to and from the north would provide direct connections to the I-5 HOV lanes. Three additional in-service bus bays and four bays for layover space would be provided at the Northgate Link Station.
- **NE 145th Street:** Transit-only direct access ramps would be provided between the I-5 HOV lanes and a BRT station located in the northeast quadrant of the interchange.

Park-and-ride, feeder bus access, and other access improvements similar to those included in the I-5 Light Rail Concept would be provided.

- **NE 185th Street:** Direct access ramps would be provided between the I-5 HOV lanes and the NE 185th Street Bridge over I-5, with bus bays located just north of the bridge. Park-and-ride, feeder bus access, and other access improvements similar to those included in the rail alternative would be provided.
- **SW 236th Street:** The newly constructed Mountlake Terrace Freeway Station, which provides all the needed BRT facilities at this location.
- **Lynnwood Transit Center:** Additional park-and-ride capacity similar to that included in the I-5 Light Rail Concept would be provided.
- **Rider Amenities:** Real-time operating information and off-board fare collection would be incorporated at the five BRT stations.

3.3.10 Multi-Corridor BRT Concept

Initially, BRT concepts were considered for each of the alignments within the North Corridor that were considered for light rail concepts. However, it was quickly realized that new BRT service concentrated solely on SR 99 or 15th Avenue NE would perform poorly compared to BRT in I-5. At the same time, developing new bi-directional I-5 HOV lane direct access ramps or freeway stations similar to the new station in Mountlake Terrace presented serious challenges, particularly in the portions of the freeway located in King County. In the areas where the median is insufficient to accommodate these new facilities, the entire freeway would require reconstruction for more than a mile in the vicinity of the new ramps or station. To address these problems the Multi-Corridor BRT Concept, consisting of three BRT lines between the existing Northgate and Lynnwood Transit Centers, was developed. Direct access ramps to and from the north would provide direct connections for transit between the Northgate Transit Center and the I-5 HOV lanes. Additionally, transit direct access ramps to and from the south connecting into the I-5 HOV lanes would be provided at NE 130th Street. As with the TSM/Baseline Concept, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. The three proposed routes comprising this concept are shown in Figure 3-5 and would be designed as follows:

- The SR 99 route would overlay and complement *Swift* and RapidRide E Line service along SR 99 while not replacing either one of those services. The route would use the transit direct access ramps at Northgate to access the I-5 HOV lanes, and then the direct access ramps at NE 130th Street to reach the surface street system. From there the route would travel west on North 130th Street to SR 99, north to 200th Street SW in Snohomish County, and east to the Lynnwood Transit Center. Headways would be 10 minutes during peak periods and 15 minutes during off-peak periods.
- The I-5 route would also use the transit direct access ramps to access the I-5 HOV lanes from Northgate, and continue north on I-5 stopping at the Mountlake Terrace in-line freeway station prior to reaching the Lynnwood Transit Center via the existing HOV

direct access ramp. Headways would be 2 minutes during peak periods and 10 minutes during off-peak periods.

- The 15th Avenue NE route would also use the transit direct access ramps at Northgate to access the I-5 HOV lanes, and then the direct access ramps at NE 130th Street to reach the surface street system. From there the route would travel east on NE 130th Street/NE 125th Street to 15th Avenue NE, and then north on 15th Avenue NE through North City in Shoreline. From North City the route would continue north on 15th Avenue NE and then turn northeast onto NE 196th Street, which transitions to 19th Avenue NE and then 56th Avenue West. Finally, the route would turn west onto 236th Street SW to the Mountlake Terrace Transit Center. Headways would be 15 minutes during peak and off-peak periods.

Physical improvements to facilitate the Multi-Corridor BRT Concept would include the following:

- **Northgate Transit Center:** Transit-only direct access ramps to and from the north would provide direct connections to the I-5 HOV lanes. Additional bus bays and layover space would be provided at the Northgate Link Station. Seven additional in-service bays and eight layover bays would be required to accommodate the anticipated route changes.
- **Mountlake Terrace Transit Center:** One bay for drop-off and one bay for pick-up for one articulated bus and layover space for up to two articulated buses would be required.
- **Lynnwood Transit Center:** Additional park-and-ride capacity similar to that included in the I-5 Light Rail Concept would be provided, including a new 500-stall parking structure. There would also be a need for three additional bus layover spaces.
- **Shoreline Park-and-Ride:** 500 new park-and-ride stalls would be provided.
- **Transit Signal Priority:** Transit signal priority improvements are required at all signals along 15th Avenue NE, 200th Street SW, and North 130th Street. Also, because the existing transit signal priority systems on SR 99 in King and Snohomish counties use different technologies, BRT vehicles would be equipped with both types of technology to use each system.
- **Roadway:** New transit direct access ramps would be provided on I-5 at NE 130th Street to connect into the I-5 HOV lane to/from the south.
- **Stations:** This BRT concept would mostly use existing stations. Six new BRT stations are required, the majority of which would be in the 15th Avenue NE corridor.
- **Rider Amenities:** Real-time operating information and off-board fare collection would be incorporated at BRT stations.

3.4 INITIAL CONCEPT SCREENING RESULTS

This section presents results of the initial screening of alternative concepts. A summary matrix of the screening results is provided in Table 3-4 and the recommendations for the development of the Level 1 alternatives are shown in Table 3-5. More detail on the screening results is provided in the *Level 1 Definition of Alternatives Technical Memorandum* (Sound Transit 2011c). Key findings from this work include the following:

- All of the concepts, other than the 15th Avenue NE Light Rail Concept with the at-grade variation, provide a faster travel time than the TSM/Baseline Concept, with the elevated concepts being the fastest. The I-5 Light Rail Concept provides the shortest travel time as a result of its short length, lack of speed-reducing curves, full grade separation, and only four station stops. Similar results were found for reliability, capacity, and connections to the regional multimodal system.
- The greatest land use and economic development potential was found for the SR 99 Light Rail Concept and the Multi-Corridor BRT Concept, based solely on the larger number of stations provided for each concept.
- Because of the quantity of new construction and possible new transportation right-of-way required, all of the build concepts would result in more potential impacts on the man-made and natural environments than the TSM/Baseline Concept. Because the light rail concepts involve the largest amount of new construction, they are judged to have the most impacts. Of the light rail concepts, the SR 99 and 15th Avenue NE concepts are judged to have the greatest impacts because they would require the largest amounts of new transportation right-of-way.
- The best accessibility to the PSRC-designated Regional Growth Centers would be provided by the I-5, elevated SR 99, and elevated 15th Avenue NE light rail concepts.

As a result of the initial screening, a number of concepts, as well as several concept variations, were dropped from further consideration. The sections that follow discuss the reasons these were dropped from further study.

3.4.1 15th Avenue NE Light Rail Concepts Screened Out

Based on the initial concept screening, the 15th Avenue NE Light Rail Concepts, including the at-grade and elevated variations, were dropped from further consideration in the AA process.

While elevated light rail along 15th Avenue NE meets some of the project's Purpose and Need related to rider benefits and transit capacity, it has no clear transportation advantages over either the I-5 or SR 99 light rail concepts because its accessibility is more limited than the other routes. In addition, the concept would have potentially serious impacts to the local communities through which it would pass.

Table 3-4. Initial Concept Review and Screening Summary



	TSM/ BASELINE	I-5 Light Rail	SR 99 Light Rail (Elevated)	SR 99 Light Rail (At-Grade)	15th Ave Light Rail (Elevated)	15th Ave Light Rail (At-Grade)	I-5 BRT	I-5 + SR 99 + 15th Ave NE BRT
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs								
Travel Time	●	●	◐	●	◐	◐	◐	◐
Reliability • Miles on non-exclusive guideway • Number of signalized intersections traversed	●	●	●	◐	●	◐	◐	◐
Capacity	●	●	●	◐	●	◐	◐	◐
Connections to Regional Multimodal System	●	●	●	◐	●	◐	●	●
Peak period travel times between Lynnwood and selected regional growth centers	●	●	◐	●	◐	◐	◐	◐
Number of regional growth centers reachable via a one-seat ride	●	●	●	◐	●	◐	●	●
Purpose and Need: Equitable Community Impacts and Benefits								
Not considered for concept screening.								
Purpose and Need: Supportive Land Use and Economic Development Effects								
Land Use and Economic Development Potential: Number of activity centers within 1/2 mile of alignment	●	●	◐	◐	●	●	●	●
Purpose and Need: Preservation of a Healthy Environment								
Right-of-way Impacts	●	◐	◐	●	●	●	◐	◐
Community Impacts	●	◐	◐	◐	◐	●	◐	◐
Transportation System Impacts	●	●	◐	◐	◐	◐	●	●
Purpose and Need: Cost and Constructability								
Cost: Extraordinary cost considerations	●	◐	●	◐	●	◐	◐	◐
Purpose and Need: Consistency with Sound Transit Long-Range Vision								
Not considered for concept screening.								

Table 3-5. Recommended Level 1 Alternatives

<div style="border: 1px solid black; padding: 5px; display: inline-block; margin-bottom: 10px;"> Alternative carried forward. Alternative dropped. </div>		
Level 1 Alternatives	Reasons for Advancing or Dropping Alternative	Recommended Level 1 Refinements
TSM/ BASELINE	Required by FTA for New Starts comparisons	Enhance based on findings of BRT alternatives development and evaluation
I-5 Light Rail	<ul style="list-style-type: none"> • Best performing on all transportation effectiveness measures • Lower right-of-way impacts compared to other light rail alternatives • Lower community impacts compared to other light rail alternatives • Lower transportation system impacts compared to other light rail alternatives 	<ul style="list-style-type: none"> • Consider options to bring some stations and portions of alignment down to grade to reduce impacts and improve affordability • Work with WSDOT to optimize tradeoffs between acquiring new right of way and minimizing impacts to I-5
SR 99 Light Rail (Elevated)	<ul style="list-style-type: none"> • Transportation effectiveness of elevated alternative superior to at-grade • Highest land use and economic development potential of alternatives • Fully elevated most costly of all alternatives 	Consider options to mix elevated with at-grade alignment in selected sections to improve affordability over an all-elevated concept and to reduce impacts and improve travel times of at-grade concept
SR 99 Light Rail (At-Grade)	<ul style="list-style-type: none"> • Fully at-grade has highest transportation system impacts of all alternatives • Fully at-grade has very large right-of-way impacts 	
15th Ave Light Rail (Elevated)	<ul style="list-style-type: none"> • Transportation effectiveness equal or worse than other light rail alternatives • High right-of-way impacts compared to other light rail alternatives • High community impacts compared to other light rail alternatives • Elevated guideway and stations along 15th would significantly alter the environment in the corridor and impact large numbers of residents and businesses 	Drop from further consideration
15th Ave Light Rail (At-Grade)	<ul style="list-style-type: none"> • Least effective from a transportation standpoint of all light rail alternatives • Travel times longer than Baseline • High right-of-way impacts compared to other light rail alternatives • High community impacts compared to other light rail alternatives • At-grade guideway and stations along 15th would significantly alter the environment and displace large numbers of residents and businesses 	Drop from further consideration
I-5 BRT	<ul style="list-style-type: none"> • Travel time slightly shorter than Baseline • Lower cost than light rail alternatives • Limited right-of-way, transportation, environmental impacts 	<ul style="list-style-type: none"> • Ridership forecasting analysis needed to distinguish between the 2 BRT options • Further work with WSDOT needed to determine design, cost, and impacts of I-5 BRT stations and direct access ramps
I-5 + SR 99 + 15th Ave NE BRT	<ul style="list-style-type: none"> • Proximity to a high number of activity centers • Shorter travel time than Baseline • Limited right of way, transportation, environmental impacts 	

In particular, the 15th Avenue NE Elevated Light Rail Concept does not meet the project's Purpose and Need related to supporting the region's adopted land use vision, promoting the well-being of people and communities, and preserving a healthy environment for the following reasons:

- High right-of-way impacts would occur to both residential and commercial properties. Right-of-way needs would affect approximately 175 to 300 properties with residential and neighborhood commercial uses, including approximately 75 to 100 full acquisitions. In station areas and at intersections, properties on both sides of the street could be removed.
- The scale of a roughly 30-foot-wide aerial guideway, with 400-foot-long and up to 60-foot-wide aerial stations placed on an arterial in the fabric of an existing mixed-use, built-up neighborhood, would have a high potential to affect neighborhood character and function.
- The alignment could adversely affect one or more parks, including the Jackson Park Golf Course, and some historic-era properties.
- The potential exists for noise impacts to a substantial number of residences and other sensitive receptors, including the Fircrest School for the Developmentally Disabled.
- Substantial traffic operations and access impacts would occur along 15th Avenue NE, requiring the limiting of left turns and major widening of several intersections.

An at-grade light rail along 15th Avenue NE, while avoiding some of the impacts of large aerial structures, would perform poorly from a transportation standpoint. Capacity is roughly half of that for the grade-separated light rail and travel times are the longest of all the concepts. At-grade light rail on 15th Avenue NE would be limited to the posted 30-mph speed limit and would be slower than the TSM Baseline Concept. Thus, the 15th Avenue NE At-Grade Light Rail Concept does not meet Purpose and Need related to providing reliable, rapid, and efficient two-way peak and off-peak transit service.

In addition, the concept would have the potential for substantial impacts to the local communities through which it would pass. In particular, the 15th Avenue NE At-Grade Light Rail Concept does not meet the project's Purpose and Need related to supporting the region's adopted land use vision, promoting the well-being of people and communities, and preserving a healthy environment for the following reasons:

- This concept would have the highest right-of-way impacts of all concepts considered, displacing a high number of both residential and commercial properties. Right-of-way needs require 40 to 70 additional feet along the existing roadway affecting at least 300 residential and neighborhood commercial properties, including approximately 175 to 200 full acquisitions.
- The alignment would affect one or more parks, including the Jackson Park Golf Course, and some historic-era properties.

- There is potential for noise impacts to a substantial number of residences and other sensitive receptors, including the Fircrest School for the Developmentally Disabled.
- Substantial traffic operations and access impacts would occur along 15th Avenue NE, requiring the limiting of left turns and major widening of several intersections.

3.4.2 SR 99 Fully At-Grade Light Rail Alignment Screened Out

A fully at-grade configuration along SR 99 between North 130th Street and the King/Snohomish County line does not adequately meet the project's Purpose and Need for the following reasons:

- Travel times from Lynnwood to Northgate would be similar to the TSM/Baseline Concept; however, this variation would require a substantial investment with respect to both infrastructure and right-of-way acquisition. The travel times also would be much longer than they would with an elevated light rail. As such, the fully at-grade variation would not perform well with respect to providing a relatively fast trip between regional centers.
- This variation would have multiple at-grade intersections to navigate, making it less reliable than fully grade-separated elevated options.
- This variation would have high right-of-way impacts in terms of property acquisitions needed for implementation.
- The impact on traffic at high-volume SR 99 intersections would be significant.

As a result, this variation was not carried forward as a stand-alone option. Instead, only the most feasible portions for using at-grade light rail were considered for integration into the Level 1 SR 99 Light Rail Alternative.

3.4.3 SR 99 Light Rail Sub-Alternative Alignments Screened Out

The 130th Street Tunnel and the Interurban Right-of-Way variations to the SR 99 Light Rail Concept also do not adequately meet the project's Purpose and Need and were not considered further.

130th Street Tunnel. The 130th Street Tunnel variation would not allow an at-grade station in the vicinity of North 130th Street and SR 99—a stated objective of the City of Seattle. Because both the North 110th Street and Roosevelt Way variations appear possible to construct without tunnels and perform equally or better, this variation was dropped from further consideration. However, should further conceptual design conclude that a tunnel alignment is required, the North 130th Street Tunnel may be reconsidered.

Former Interurban Right-of-Way. Development of a light rail alignment in the former Interurban right-of-way would require accommodating the existing and future electrical utility transmission line needs, as well as reconstruction of the newly constructed pedestrian and bicycle trail. Adding light rail would require legal agreements with the public power utilities.

These agreements are likely to be difficult to obtain given the utilities' competing needs for expansion and unconstrained access to their current and future electrical power infrastructure and their pre-existing primary public use of the right-of-way.

Although ownership of the trail varies along the trail's full course within King and Snohomish counties, the right-of-way is consistently owned by public entities, and it is presumed to qualify as a Section 4(f) resource. Section 4(f) is a regulation that restricts FTA's ability to approve projects with major uses of recreation and park lands, particularly when other reasonable alternatives are available. In addition to the likely impacts to the Interurban Trail and its bicycle and pedestrian uses, a number of other uses are immediately adjacent. Many of these are residential, and some portions of the right-of-way appear to have been developed with other commercial and residential uses, which increases the potential for property impacts, as well as noise, vibration, and visual impacts. Based on the concept screening analysis, maintaining all the current uses of the existing right-of-way would be challenging and would likely require the acquisition of substantial additional right-of-way.

Finally, following the Interurban right-of-way to Lynnwood would not allow stations at Mountlake Terrace along I-5 nor would it serve much of the SR 99 corridor; therefore, its mobility benefits would be much less than other alignments. As a result, given that other reasonable alignments that perform as well or better are available, an alignment that requires continuous use of large segments of the Interurban right-of-way was dropped from consideration based on the findings from the initial screening. It is possible that using smaller portions of the right-of-way could be reconsidered if sections of a SR 99 route prove more difficult, but not as a major route alignment option.

3.5 LEVEL 1 ALTERNATIVES DEFINITION

Following the screening of the long list of initial alternative concepts, two primary light rail alternatives and two primary BRT alternatives, along with the TSM/Baseline Alternative and the No Build Alternative, were identified for further development and evaluation in the Level 1 analysis. Each of the light rail and BRT alternatives include several sub-alternatives.

3.5.1 Elements Common to All Alternatives

The following assumptions and guiding principles were used in the development of the alternatives:

- Alternatives were defined for the design year 2030.
- Alternatives serve as transit extensions to the Link light rail system that will end at Northgate when the current committed projects are completed by Sound Transit. As such, the alternatives addressed the Northgate-Lynnwood project area only; no improvements for the existing and committed regional transit system south of Northgate were identified.

- Build alternatives focused on the same key travel markets, providing similar accessibility (stations, parking, and access) and levels of service (time span and headways) to make them as comparable as possible.
- Future operational changes to the HOV lanes on I-5 are subject to action by the Washington State Legislature and cannot be known. Therefore, the base assumption for all alternatives was continued 2+ HOV operation. However, *Transportation 2040* calls for eventual development of managed lanes along this portion of I-5. WSDOT is considering a number of options that could result in major reconstruction and tolling of portions of the freeway to include one or more managed lanes in each direction of I-5 between Northgate and Lynnwood. At this time the design, construction costs, right-of-way, transportation system, and environmental impacts of these improvements are not known. To assess how the performance of the I-5 BRT Alternative might be enhanced by these improvements, an option was tested that assumed the managed lanes would achieve an average speed of 45 mph.
- Community Transit and King County Metro bus service growth was assumed to be flat (except for a 0.5 percent per year increase for scheduled maintenance hours) between fall 2009 and 2030 due to service reductions caused by the 2008 to 2010 recession and slow recovery from that recession through 2030.

3.5.2 No Build Alternative

The No Build Alternative included only those improvements committed and funded for implementation by the transportation providers in the region. This alternative assumed that the light rail system extensions approved by voters in 2008 are completed to Northgate, Overlake, and Redondo/Star Lake. The most significant changes in existing transit services in the project area include King County Metro's planned revisions once light rail reaches Northgate and the implementation of RapidRide E Line, which will connect Shoreline with downtown Seattle in 2013 along SR 99. Chapter 4 includes a more detailed description of the No Build Alternative.

3.5.3 TSM/Baseline Alternative

The Level 1 TSM/Baseline Alternative is the same as the initial TSM/Baseline Concept. The intent of this alternative is to do the most that can reasonably be done to improve transit service in the project area with improved bus facilities and services without major new capital investment. The TSM/Baseline Alternative is described in more detail in the previous Section 3.3.5 and illustrated in Figure 3-3.

3.5.4 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative advanced to the Level 1 evaluation is the representative alignment that formed the basis of the project described in the ST2 Plan, and is the same as the L1: I-5 Light Rail Concept assessed as part of the initial concept screening. This alignment assumed a fully elevated double-track rail line from Northgate to the Lynnwood Transit Center

with intermediate elevated stations at NE 145th Street, NE 185th Street, and SW 236th Street. The L1: I-5 Light Rail Alternative assumed operation of light rail trains, with up to four cars, between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes. The alternative is described in more detail in the previous Section 3.3.6 and illustrated in Figure 3-6.

3.5.5 L2: SR 99 Light Rail Alternative

The L2: SR 99 Light Rail Alternative is a hybrid concept designed to reduce the right-of-way impacts and improve the speed of the fully at-grade concept, while lowering the costs of the fully elevated light rail concept initially studied. This alternative would operate within an exclusive right-of-way, which could be at-grade in some locations, while other locations require elevating the alignment through major intersections to reduce impacts to traffic operations. This alternative includes five new light rail stations—at-grade light rail stations located at 130th Street and 155th Street, and elevated light rail stations at the Shoreline Park-and-Ride (192nd Street), Mountlake Terrace Transit Center, and Lynnwood Transit Center. Figure 3-7 illustrates the L2: SR 99 Light Rail Alternative. Operation of light rail was assumed between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes, and off-peak headways of 10 minutes.

During concept development, a number of alignment sub-alternatives were identified for the L2: SR 99 Light Rail Alternative. Several were screened out while others were retained for possible consideration. Those retained are shown in Figure 3-7 and include one sub-alternative for connecting from the Link terminus at Northgate to SR 99 in Seattle and one sub-alternative for connecting from SR 99 back to the Lynnwood Transit Center. These sub-alternatives were assessed during initial screening and it was concluded that the primary alternative alignment shown in Figure 3-7 was the most promising and should be used as the representative alignment for the L2: SR 99 Light Rail Alternative during the Level 1 evaluation process.

3.5.6 B1: I-5 BRT Alternative

This alternative is the same as the I-5 BRT Concept, described in more detail in Section 3.3.9, which was assessed as part of the initial concept screening. The B1: I-5 BRT Alternative consists of a BRT line using the I-5 HOV lanes between the existing Northgate and Lynnwood Transit Centers. The BRT line would be designed to provide service similar to the rail extension, but with slight service modifications to take advantage of the greater routing flexibility possible with roadway-based transit service. As with the TSM/Baseline Alternative, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. Transit-only direct access ramps connecting new BRT stations to the I-5 HOV lanes would be built at Northgate, NE 145th Street, and NE 185th Street. Park-and-ride, feeder bus access, and other access improvements similar to those included in the I-5 Light Rail Alternative would be provided, including new 500-stall parking structures at the NE 145th Street, NE 185th Street, and Lynnwood Transit Center stations. The B1: I-5 BRT Alternative is shown in Figure 3-8.

3.5.7 B2: Multi-Corridor BRT Alternative

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving each of the major north-south roadways between the existing Northgate and Lynnwood Transit Centers. This alternative is the same as the Multi-Corridor BRT Concept assessed as part of the initial concept screening and described in greater detail in Section 3.3.10. Direct access ramps to and from the north would provide direct connections for transit between the Northgate Transit Center and the I-5 HOV lanes. Additionally, transit direct access ramps to and from the south connecting into the I-5 HOV lanes would be provided at NE 130th Street. As with the TSM/Baseline Alternative, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. The three proposed routes comprising this alternative are shown in Figure 3-9 and would run along SR 99, I-5, and 15th Avenue NE.

3.6 LEVEL 1 ALTERNATIVES EVALUATION

The Level 1 alternatives were evaluated based on criteria and performance measures derived from the project's Purpose and Need. Detailed results of this evaluation are contained in the *North Corridor Transit Project Level 1 Alternatives Analysis and Evaluation Report* (Sound Transit 2011a).

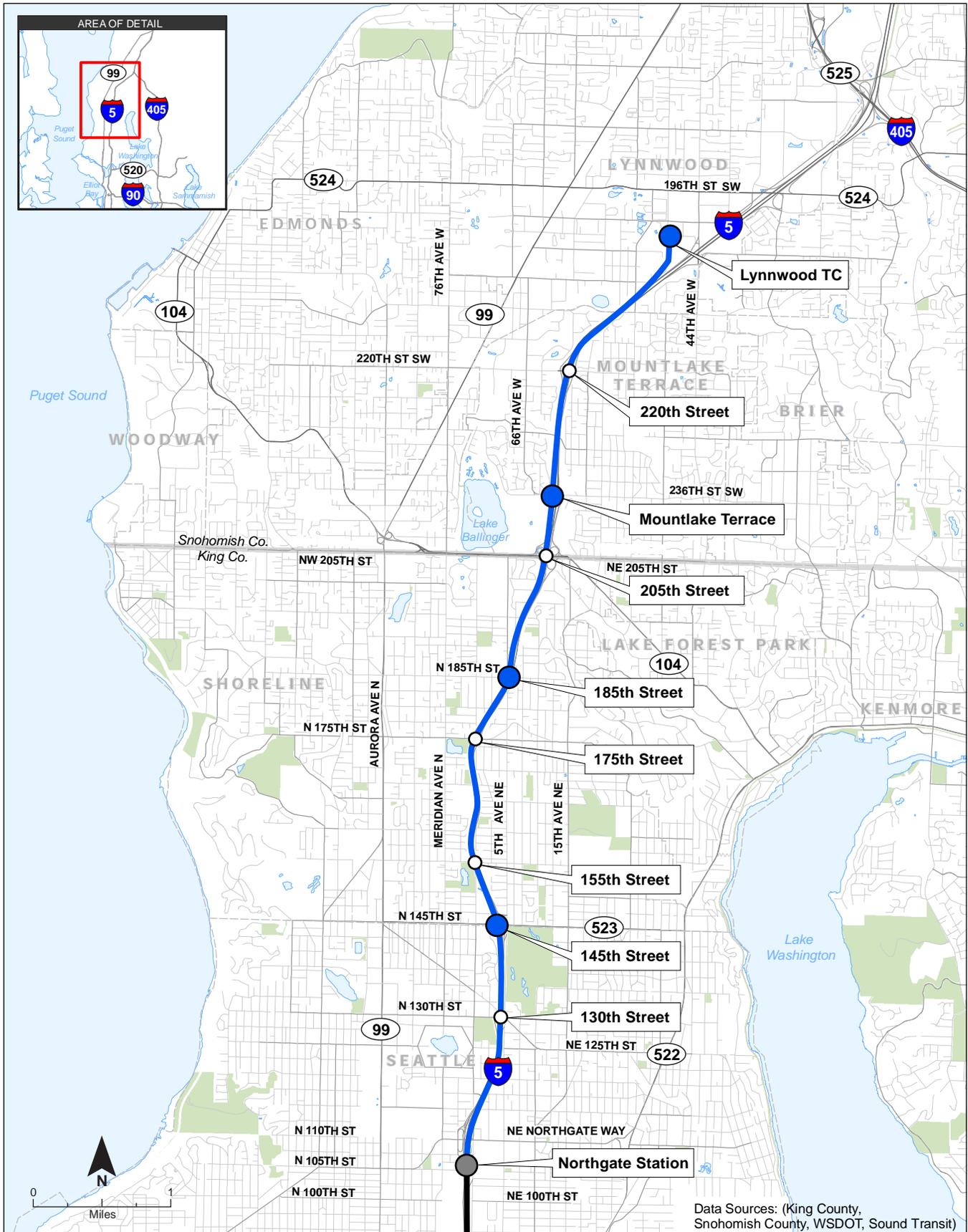
The North Corridor Transit Project's Purpose and Need can be summarized into six broad categories as follows:

- Transportation effectiveness
- Community equity
- Land use and economic development effects
- Environmental performance
- Cost and constructability
- Consistency with Sound Transit's long-range vision

3.6.1 Transportation Effectiveness

Transportation effectiveness was evaluated based on measures related to the following four overarching criteria:

- Transit ridership
- Ability to accommodate demand (passenger-carrying capacity)
- Transit travel times
- Transit trip reliability



- Light Rail Route
- Proposed Light Rail Station*
- Potential Light Rail Station Variation
- North Link Light Rail
- North Link Station
- *ST2 Representative Alignment has 4 Light Rail Stations

Figure 3-7. L1: Level 1 I-5 Light Rail Alternative

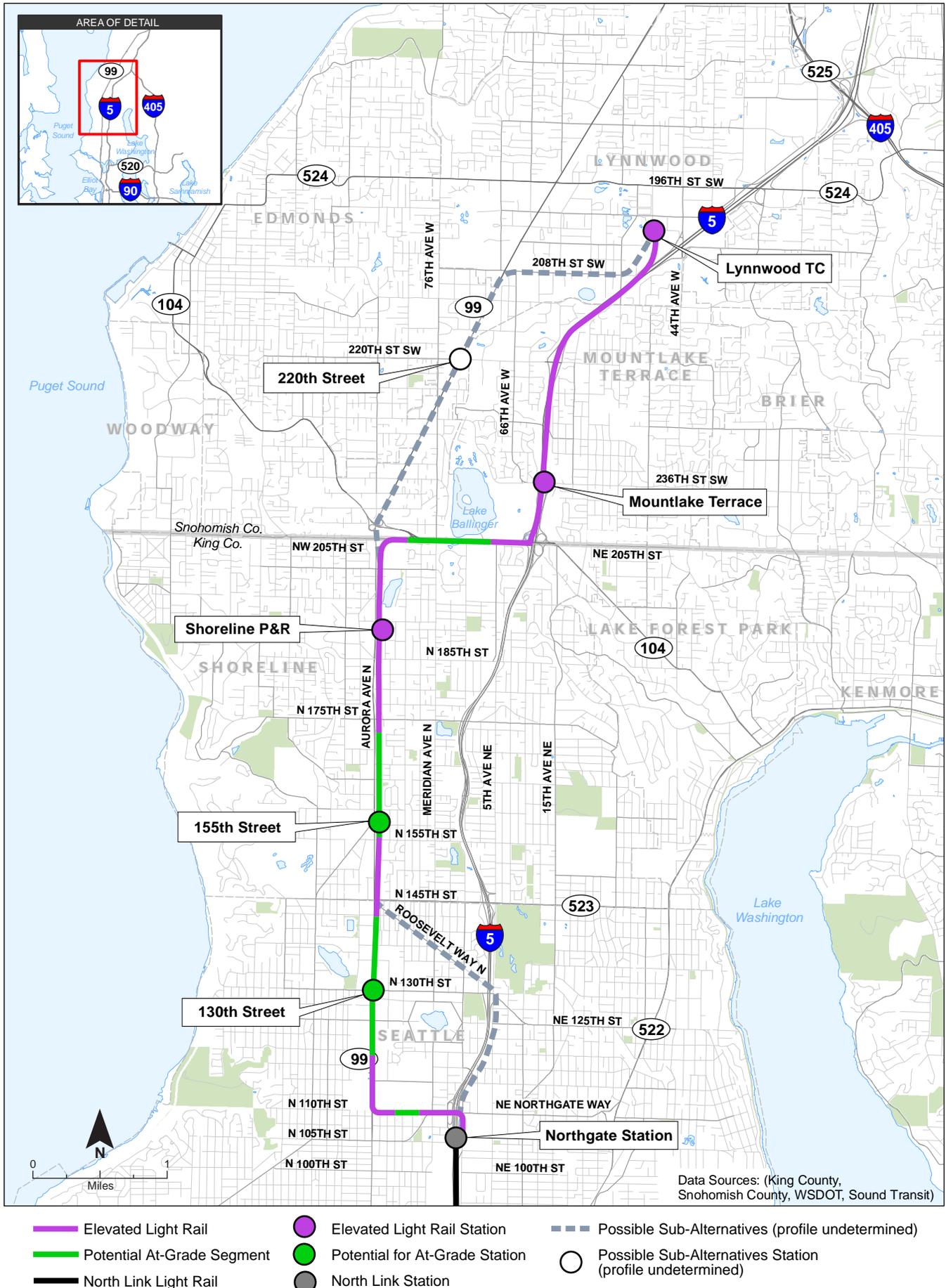
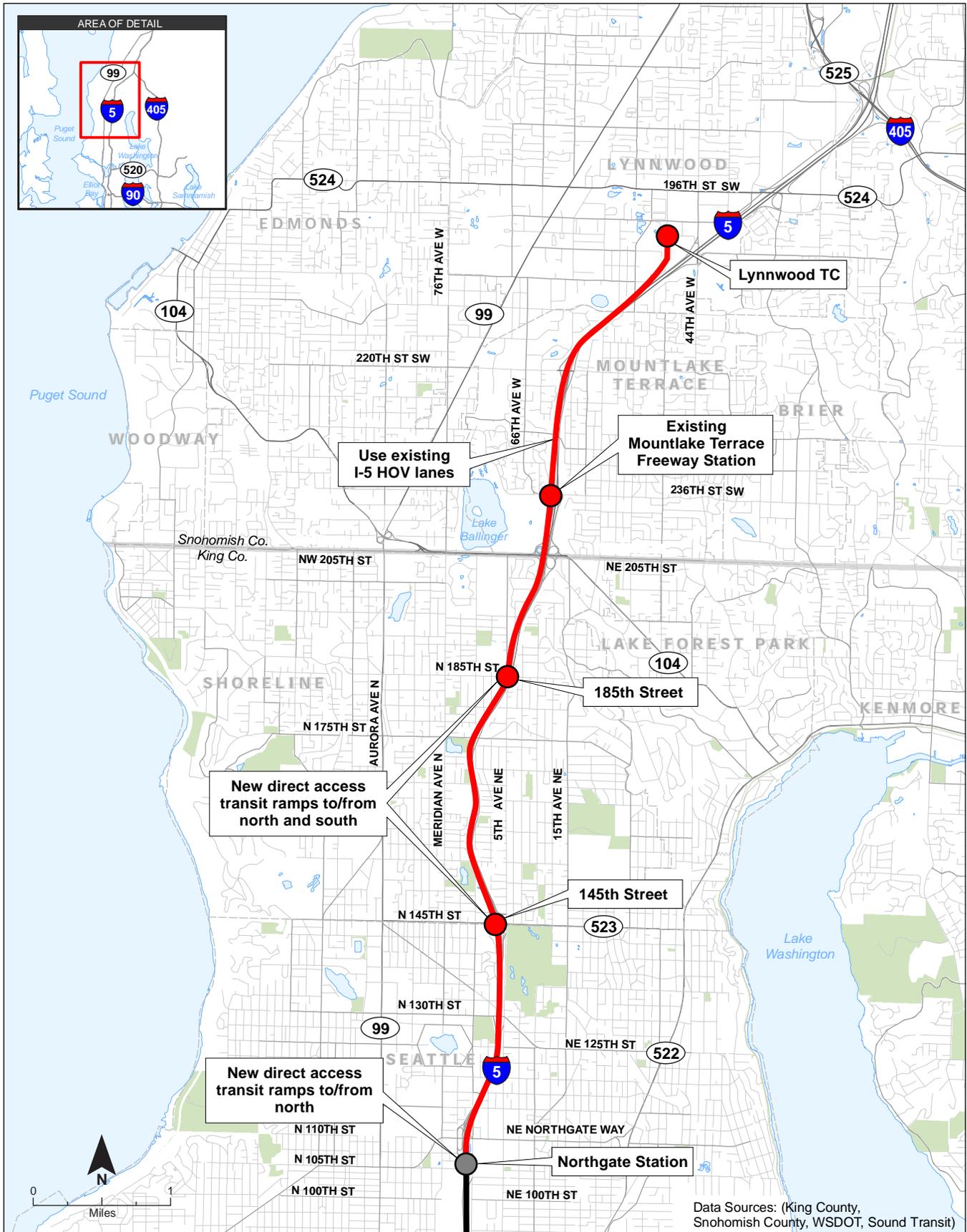


Figure 3-8. L2: Level 1 SR 99 Light Rail Alternative



Data Sources: (King County, Snohomish County, WSDOT, Sound Transit)

- BRT Service
- North Link Light Rail
- BRT Station
- North Link Station

Figure 3-9. B1: Level 1 I-5 BRT Alternative

TRANSIT RIDERSHIP

Sound Transit’s Regional Transit Ridership Forecasting Model was used to generate year 2030 forecasts of transit ridership, as well as annual new riders and user benefits as measured by annual hours of travel time savings (Sound Transit 2010d; Sound Transit 2010e).

All of the North Corridor Transit Project alternatives increase system-wide ridership over the Sound Transit model’s projection of 506,000 total daily transit trips in 2030 with the No Build Alternative. As shown in Table 3-6, the light rail alternatives show the highest increase in total system transit use, with L1: I-5 Light Rail Alternative being the highest, with approximately twice the ridership forecasted for the BRT alternatives. The result for the TSM/Baseline Alternative is half of that for the BRT alternatives.

Similar results, illustrated in Table 3-6, are seen for project daily riders, annual new riders, and user benefits, with the light rail alternatives showing more than double the ridership and user benefits as the BRT alternatives.

Table 3-6. 2030 Transit Ridership Forecasting Model Output Summary

Alternative	Project Average Weekday Riders	Annual System-wide New Riders*	User Benefits – Annual Hours of Travel Time Saved*
TSM/Baseline	13,400	0.98 million	0.83 million
L1: I-5 Light Rail	50,600	5.9 million	5.9 million
L2: SR 99 Light Rail	46,200	5.2 million	4.9 million
B1: I-5 BRT	20,800	2.2 million	1.9 million
B2: Multi-Corridor BRT	25,100	2.6 million	2.3 million

* Compared to the No Build Alternative

For the B1: I-5 BRT Alternative, a sensitivity analysis was undertaken to test the potential ridership impacts of improved I-5 operations assuming development of managed lanes capable of maintaining average operating speeds of 45 mph during peak periods. This is compared to an assumed 35 mph in the base case with the existing HOV lanes and additional direct access ramps. With the assumption of improved speed, the overall year 2030 average weekday regional transit ridership increases by about 1,700 trips compared to the base B1: I-5 BRT Alternative. This represents an annual increase of about 0.5 million new riders or about 24 percent over the 2.2 million annual new riders associated with the B1: I-5 BRT Alternative. Transit user benefits, which are a function of new riders, would also increase by about 24 percent.

ABILITY TO ACCOMMODATE DEMAND

The light rail alternatives provide the highest capacity of passengers per hour per direction. BRT alternatives provide more than twice the capacity of the TSM/Baseline Alternative, but only a quarter of the capacity of the light rail alternatives. A summary of approximate practical hourly passenger capacity by alternative is provided in Table 3-7. Light rail capacity is based on

the assumed peak hour headway of 4 minutes, with 4-car trains. Bus capacity is determined based on the capacity of the bus facilities at the Northgate Link light rail station.

Table 3-7. 2030 Practical Person-Carrying Capacity

Alternative	Passengers per Hour per Direction
TSM/Baseline Alternative	1,260
L1: I-5 Light Rail Alternative	8,840
L2: SR 99 Light Rail Alternative	8,840
B1: I-5 BRT Alternative	2,700
B2: Multi-Corridor BRT Alternative	2,700

TRANSIT TRAVEL TIMES

Estimated 2030 transit travel times from Lynnwood and Shoreline to representative Regional Growth Centers, as defined by PSRC, are shown in Tables 3-8 through 3-11. Estimated travel times shown in these tables include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. Also, where the travel time for the build alternative is greater than the No Build travel time, the No Build is assumed instead.

All of the alternatives provide shorter travel times compared to the No Build, with the shortest being the L1: I-5 Light Rail Alternative. Peak direction travel times from Lynnwood for Alternative L2: SR 99 Light Rail and the BRT alternatives are approximately 7 to 11 minutes longer than Alternative L1. Off-peak direction travel times, which are different for buses because of different expected travel speeds, are included because congestion in the North Corridor is known to exist in both directions during peak periods, particularly during the PM peak period. Light rail travel times, which are unaffected by traffic conditions, are the same between peak and off-peak periods.

Table 3-8. 2030 Transit Peak-Period, Peak-Direction Travel Times (minutes) from Lynnwood to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	60	41	52	43	88	49	68
TSM/Baseline	28	35	39	43	75	49	68
L1: I-5 Light Rail	14	21	25	29	61	49	68
L2: SR 99 Light Rail	21	28	32	36	68	49	68
B1: I-5 BRT	25	32	36	40	72	49	68
B2: Multi-Corridor BRT	24	31	35	39	71	49	68

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

Table 3-9. 2030 Transit Peak-Period, Off-Peak Direction Travel Times (minutes) from Lynnwood to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	55	51	77	44	89	55	81
TSM/Baseline	22	29	33	37	69	55	71
L1: I-5 Light Rail	14	21	25	29	61	52	63
L2: SR 99 Light Rail	21	28	32	36	68	55	70
B1: I-5 BRT	19	26	30	34	66	55	68
B2: Multi-Corridor BRT	18	25	29	33	65	55	67

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

Table 3-10. 2030 Transit Peak-Period, Peak-Direction Travel Times (minutes) from Shoreline to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	36	66	45	33	74	76	89
TSM/Baseline	32	39	43	33	74	70	81
L1: I-5 Light Rail	7	14	18	22	54	45	56
L2: SR 99 Light Rail	11	18	22	26	58	49	60
B1: I-5 BRT	15	22	26	30	62	53	64
B2: Multi-Corridor BRT	26	33	37	33	73	64	75

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

Table 3-11. 2030 Transit Peak-Period, Off-Peak Direction Travel Times (minutes) from Shoreline to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	41	71	79	42	87	92	81
TSM/Baseline	27	34	38	42	74	65	76
L1: I-5 Light Rail	7	14	18	22	54	45	56
L2: SR 99 Light Rail	11	18	22	26	58	49	60
B1: I-5 BRT	12	19	23	27	59	50	61
B2: Multi-Corridor BRT	23	30	34	38	70	61	72

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

TRANSIT RELIABILITY

Two measures were used as surrogates for reliability for the Level 1 evaluation—the miles of operation in non-exclusive right-of-way and the number of signalized intersections traversed.

Non-Exclusive Guideway

Both of the light rail alternatives operate on completely exclusive guideway, regardless of whether they are elevated or at-grade. The bus-based alternatives operate predominantly in non-exclusive right-of-way in the HOV lanes, BAT lanes, or along arterials. The B1: I-5 BRT Alternative involves less non-exclusive guideway compared with the TSM/Baseline Alternative, due to the use of transit-only direct access ramps. The B2: Multi-Corridor BRT Alternative operates on the greatest number of miles of non-exclusive guideway due to the combined length of its three routes. Although the I-5 HOV lanes and SR 99 BAT lanes are operating on a non-exclusive guideway, the lanes do offer a level of priority that provides some reliability benefit over general purpose lanes. Table 3-12 provides a summary of miles of non-exclusive guideway.

Table 3-12. Miles of Operation on Non-Exclusive Guideway

Alternative	Miles of Operation on Non-Exclusive Guideway
TSM/Baseline Alternative	14.0
L1: I-5 Light Rail Alternative	0
L2: SR 99 Light Rail Alternative	0
B1: I-5 BRT Alternative	8.3
B2: Multi-Corridor BRT Alternative	25.8

Number of At-Grade Signalized Intersections Traversed

The L1: I-5 Light Rail Alternative would not traverse any at-grade signalized intersections, while the L2: SR 99 Light Rail Alternative would traverse several at-grade intersections. The number of at-grade signalized intersections traversed for each alternative is provided in Table 3-13. With direct access into and out of the Northgate Transit Center, the B1: I-5 BRT Alternative would not traverse any at-grade intersections, while the B2: Multi-Corridor BRT Alternative includes 45 at-grade intersections traversed on the SR 99 and 15th Avenue NE corridors.

Table 3-13. Number of At-Grade Signalized Intersections Traversed

Alternative	Number of At-Grade Signalized Intersections Traversed
TSM/Baseline Alternative	9
L1: I-5 Light Rail Alternative	0
L2: SR 99 Light Rail Alternative	7
B1: I-5 BRT Alternative	0
B2: Multi-Corridor BRT Alternative	45

3.6.2 Community Equity

This evaluation measure assessed each alternative’s ability to avoid disproportionate impacts to low-income or minority communities, and to provide an equitable distribution of project or environmental benefits to these communities compared to the general population.

Tables 3-14 and 3-15 provide both the percentage and the estimated population counts of low-income and minority populations that would be considered likely to experience impacts or benefits (with all stations or alignment areas combined). The demographic characteristics of King and Snohomish counties were used as the baseline to evaluate whether a low-income or minority population in the station or alignment buffer areas had a higher level of representation than the general population.

Table 3-14. Year 2000 Low-Income and Minority Populations within 0.5 Mile of Alignments

Alternative	Estimated Total Population	Estimated Low-Income Population	Estimated Minority Population
Two-County Area	2,343,058	183,570 (8.0%)	562,733 (24.0%)
TSM/Baseline	37,909	3,266 (8.6%)	13,034 (34.4%)
L1: I-5 Light Rail	30,978	2,512 (8.1%)	10,832 (35.0%)
L2: SR 99 Light Rail	40,533	4,201 (10.4%)	14,315 (35.3%)
B1: I-5 BRT	30,978	2,512 (8.1%)	10,832 (35.0%)
B2: Multi-Corridor BRT	51,196	8,000 (15.6%)	26,879 (52.5%)

Source: 2000 Census data (U.S. Census Bureau 2000)

Table 3-15. Year 2000 Low-Income and Minority Populations within 0.5 Mile of Station Areas

Alternative	Estimated Total Population	Low-Income Population	Minority Population
Two-County Area	2,343,058	183,570 (8.0%)	562,733 (24.0%)
TSM/Baseline	17,697	1,426 (8.1%)	5,714 (32.3 %)
L1: I-5 Light Rail	13,080	884 (6.8%)	4,159 (31.8%)
L2: SR 99 Light Rail	14,925	1,235 (8.3%)	4,927 (33.0%)
B1: I-5 BRT	13,080	884 (6.8%)	4,159 (31.8%)
B2: Multi-Corridor BRT	60,736	6,270 (10.3%)	19,660 (32.4%)

Source: 2000 Census data (U.S. Census Bureau 2000)

The 2000 U.S. Census data were used for this analysis, which was completed in early 2001; as the project proceeds into later evaluations and the EIS, year 2010 Census information will be used as it becomes available. The demographic analysis found that the five alternatives being considered had generally similar percentages of low-income and minority populations along their alignments compared to the general population in King and Snohomish counties. However, a higher number of low-income and minority persons were found along the alignments for the L2: SR 99 Light Rail and B2: Multi-Corridor BRT Alternatives, largely because these areas are more heavily populated than areas along the I-5 alignment.

The estimated representation of low-income and minority populations in the alternative station areas show a similar pattern. Of the five alternatives, the B2: Multi-Corridor BRT Alternative would place stations near the greatest numbers of low-income and minority persons. This is because the alternative is composed of three alignments and 17 stations that would have some level of transit improvements; however, in percentage terms the representation of low-income and minority populations remain similar to the other alternatives. All five alternatives would have station areas that are near populations with a higher percentage of minority persons compared to the population of the two-county area.

3.6.3 Land Use and Economic Development

For the Level 1 evaluation, the measures related to land use and economic development were very general. To evaluate the extent to which each alternative may support land use and community livability goals, as well as local economic development and policy goals, the following measures were used:

- Extent to which the alternative supports regional long-range planning and growth management (based on PSRC’s VISION 2040 and Regional Economic Strategy)
- Extent to which the alternative supports current local comprehensive plans, land use, and zoning

- Support of local jurisdictions for transit-oriented growth in station areas (as described in adopted policies and plans)

While the analysis attempted to identify differences among the alternatives, clear conclusions could not be drawn from the results. This occurred both as a result of the level of development of the alternatives and the general measures used in the analysis. Table 3-16 summarizes the results of the analysis based on the three general criteria.

Table 3-16. Summary of Land Use and Economic Development Measures by Alternative

Alternative	VISION 2040 Support	Consistency with Comprehensive Plans, Land Use, and Zoning	Transit-Oriented Development Support at Stations (supported stations/total stations)
TSM/Baseline	Moderate	Moderate	3/5
L1: I-5 Light Rail	High (strong)	Moderate	2/4
L2: SR 99 Light Rail	High (strong)	High	4/5
B1: I-5 BRT	Moderate	Moderate	2/4
B2: Multi-Corridor BRT	Moderate	Moderate, but low along 15th Avenue NE	9/17

All alternatives connect two PSRC-designated Regional Growth Centers—Lynnwood and Northgate. The light rail alternatives, and particularly the L1: I-5 Light Rail Alternative, are the most supportive of VISION 2040 by connecting two Regional Growth Centers, providing the fastest transit service, and carrying the most people.

The other Level 1 land use and economic development measures were focused on the 0.5-mile area around potential stations. Although this is a reasonable approach regarding effects directly related to station area development, it can be misleading when comparing alternatives with varying modes, alignments, and several stations. For example, the light rail alternatives along SR 99 and I-5 include four or five stations, while the B2: Multi-Corridor BRT Alternative includes 17 stations. The L2: SR 99 Light Rail Alternative appears to have the highest consistency with existing land use and zoning plans and policies. However, the measures used during Level 1 were at a fairly high level and more detailed analysis will occur during the Level 2 evaluation. All jurisdictions have plans and policies supporting some degree of transit-oriented development near proposed station areas. Level 2 evaluation will include measures to determine the level of this support and methodology to compare this support across alternatives.

3.6.4 Environmental Performance

The information available at Level 1 allows general evaluation of typical right-of-way and vicinity impacts for a given alternative, but it does not yet take into account the potential for design treatments to avoid or minimize impacts. It also may not reflect the need for related facilities, such as widened intersections or lanes due to traffic impacts, or related facilities including retaining walls, noise walls, drainage, or stormwater treatment facilities. For the

analysis, three general criteria were used: right-of-way effects, effects on communities and neighborhoods, and effects on sensitive resources. The summary results are presented in Table 3-17 and discussed in the following sections.

Table 3-17. Summary of Environmental Performance

Alternative	Right-of-Way Effects	Community and Neighborhood Effects	Sensitive Resource Effects
TSM/Baseline	Low	Low	Low
L1: I-5 Light Rail	Low to Moderate	Low to Moderate	Moderate
L2: SR 99 Light Rail	High	Moderate to High	Low to Moderate
B1: I-5 BRT	Low	Low to Moderate	Low to Moderate
B2: Multi-Corridor BRT	Low	Low	Low

RIGHT-OF-WAY EFFECTS

The alternatives with the highest total right-of-way needs (new as well as existing public rights-of-way) were the light rail alternatives, with L2: SR 99 Light Rail followed by L1: I-5 Light Rail. The existing SR 99 right-of-way is about 80 to 100 feet wide and fully developed, while the I-5 right-of-way varies to over 200 feet in places and is not fully developed. Thus, the I-5 right-of-way includes areas outside the edge of the freeway pavement/shoulders or in a median, where light rail could potentially be accommodated. Light rail would typically require about 30 feet of right-of-way, and the Level 1 alignment assumed for I-5 light rail is largely within WSDOT’s right-of-way. Some locations along I-5 require additional right-of-way, but for most of the I-5 alignment, existing right-of-way could be used with WSDOT’s agreement. Based on the Level 1 concept layout, which is mostly elevated and mostly within WSDOT’s right-of-way, an I-5 light rail concept could affect up to an estimated 80 properties, and about half of these could be full acquisitions. Most of the impacts would be at station areas and along the King County portion of I-5, where the right-of-way is most limited.

By contrast, the SR 99 corridor right-of-way is already largely occupied by the roadway, sidewalk, and related improvements, including sections recently widened to accommodate additional lanes and BRT. Therefore, the L2: SR 99 Light Rail Alternative is likely to require more new rights-of-way than the L1: I-5 Light Rail Alternative. Based on the Level 1 concept layout, SR 99 light rail could affect up to an estimated 200 properties, and about half of these could be full acquisitions. The areas with the highest potential for acquisitions were the residential and commercial properties along NE 110th Street, the southern parts of SR 99, near major intersections and stations, and along SR 104.

The two BRT alternatives would use some existing facilities such as the I-5 HOV lanes, but also would require other physical improvements, including stations, modified freeway interchanges, and other direct access improvements. These improvements would have low right-of-way

requirements, most of which are due to sections of freeway that would need to be widened near each of the three new direct access facilities.

The TSM/Baseline Alternative focuses primarily on service-oriented improvements with few other capital facilities and would have the lowest right-of-way needs.

EFFECTS ON COMMUNITIES AND NEIGHBORHOODS

To identify potential adverse changes to communities and neighborhoods, the proximity and nature of project improvements to residential neighborhoods was assessed. In addition, applicable factors were examined such as the level of right-of-way acquisitions; the potential for noise, visual, or traffic impacts; intrusion into residential neighborhoods; restricted access; and major changes in neighborhood setting or community facilities.

The TSM/Baseline Alternative has a low potential to affect communities and neighborhoods because the alternative would involve mostly operational and service-related improvements, with few elements that would alter the physical features or functions of neighborhoods.

The L1: I-5 Light Rail Alternative has a low-to-moderate potential for impacts to communities and neighborhoods, because it would be developed largely within the I-5 right-of-way, with limited intrusions into neighborhoods. Assuming a largely elevated alignment, mostly on the east side of I-5, visual and noise impacts could still occur. Station areas that are outside the WSDOT right-of-way have more potential for effects on neighborhoods due to increased traffic, structures, and related displacements.

The L2: SR 99 Light Rail Alternative has a moderate-to-high potential to affect communities and neighborhoods, due to its higher levels of acquisitions as well as the street modifications that would be required, particularly when the alignment is at-grade. Property acquisitions for both the elevated and at-grade sections would involve major changes to the SR 99 corridor; however, the properties immediately along SR 99 are largely commercial with relatively few residential properties. Higher numbers of residential areas occur along east-west connections, including the assumed alignment segments connecting to SR 99 along NE 110th Street and SR 104.

The B1: I-5 BRT Alternative would have low-to-moderate potential for impacts to communities and neighborhoods. However, to provide for the direct access facilities at Northgate, 145th Street, and 185th Street, the alternative would widen sections of I-5 to provide space in the median for the transit ramps to enter and exit HOV lanes, affecting about 1.25 miles of freeway at each access location.

The B2: Multi-Corridor BRT Alternative would have more limited impacts, focusing primarily on the area around I-5 and 130th Street. About 1 mile of freeway widening to provide direct access ramps could be accommodated with limited property acquisitions, but this would bring freeway facilities closer to residences, and existing vegetation or buffer areas would be reduced. This action would increase the potential for noise, visual, and other vicinity impacts from about 120th Street to about 135th Street along I-5.

EFFECTS ON SENSITIVE RESOURCES

This measure examines the potential for effects on sensitive resources, including parks, historic sites, streams/lakes/wetlands, or endangered species habitat. At this stage of project development, this remains a qualitative measure based on the location of the alignments and likely impacts of right-of-way acquisitions.

The TSM/Baseline Alternative has a low potential for effects on sensitive resources because it features few changes to the physical environment.

The L1: I-5 Light Rail Alternative would have a moderate potential for natural environmental impacts, primarily related to the presence of wetlands, streams, and vegetated spaces along the current WSDOT right-of-way where much of the alignment would be located. There is a lower potential for effects on other resources such as parks and historic properties, in part because the alignment is expected to remain largely within WSDOT right-of-way. Property acquisitions would be limited; although some buildings near the alignment are within the historic era (50 years or older), the potential for historic resource impacts appears to be low.

The L2: SR 99 Light Rail Alternative includes at-grade and elevated sections along SR 99 and would have low-to-moderate potential for effects on natural resources. This is because much of the corridor is within previously developed areas, with relatively few open streams, water bodies, and vegetated spaces in the immediate area of likely impact. As the alignment crosses east from SR 99 toward the Mountlake Terrace Freeway Station area, it would be in the vicinity of Lake Ballinger and share the same potential for natural resource impacts as the northern portion of L1: I-5 Light Rail Alternative. These potential impacts would include crossing McAleer Creek and other minor creeks, as well as other areas along the highway that are vegetated and may contain wetlands. The effects on park resources are expected to be limited; however, the alignment does involve a higher level of right-of-way acquisitions than other alternatives. Moreover, some buildings near the alignment are within the historic era (50 years or older), including some properties along SR 99 that appear on Snohomish County and King County historic site inventories.

The B1: I-5 BRT Alternative would have a low-to-moderate potential for natural environmental or sensitive built environment impacts, mostly due to widening and related construction effects potentially affecting several miles of the freeway, including near Northgate, at NE 145th Street, and at NE 185th Street (where a new park-and-ride would also be located). This alignment could affect water resources by creating new impervious surfaces, and widening could affect wetlands and streams adjacent to the freeway. However, because the physical improvements needed for I-5 BRT are not expected to be continuous along the alignment, the level of effects would still be less than for the L1: I-5 Light Rail Alternative.

The B2: Multi-Corridor BRT would also have a low potential for natural environmental or sensitive built environment impacts, although widening and related construction could affect water resources by increasing impervious surfaces near NE 130th Street, where widening would affect more than 1 mile of the freeway, including areas near two public parks.

3.6.5 Effects on Transportation System

Transportation system benefits and impacts include four qualitative measures that address general purpose traffic operations, transit operations, pedestrian and bicycle accessibility and mobility, and safety. Table 3-18 and the sections that follow summarize the performance on these measures.

Table 3-18. Summary of Transportation Effects

Alternative	Traffic Operations Effects	Transit Operations Benefits	Pedestrian and Bicycle Benefits	Transportation Safety Impacts
TSM/Baseline	Low	Low	Low	None to Low
L1: I-5 Light Rail	Low	High	Moderate	None to Low
L2: SR 99 Light Rail	High	High	Moderate to High	Low to Moderate
B1: I-5 BRT	Low	Low to Moderate	Low	None to Low
B2: Multi-Corridor BRT	Low	Low to Moderate	Low	None to Low

GENERAL PURPOSE TRAFFIC OPERATIONS

Both the TSM/Baseline Alternative and the L1: I-5 Light Rail Alternative would have minimal effects on traffic operations (except possibly during construction for the L1: I-5 Light Rail Alternative).

The L2: SR 99 Light Rail Alternative involves both elevated and at-grade sections. On SR 99, the elevated light rail would affect general traffic operations because of the column support locations. Columns could also displace the median turn lanes, which would shift traffic to other intersections. When light rail travels through an intersection at-grade, signal phasing is typically affected, and the traffic signal system would require pre-emption or favorable progression to facilitate efficient light rail operations. With proposed headways of 3 to 4 minutes in each direction, the required signal cycle would result in loss of green signal time for both cross streets and SR 99 left-turns, with possible deterioration in level of service (LOS). At-grade segments would block crossing movements between major intersections, thereby eliminating left turns to driveways and minor cross streets, as well as crossing movements for minor cross streets that would adversely affect property access. The resulting consolidation of these movements at major intersections would likely adversely affect operations. This alternative is also expected to have more substantial impacts on traffic during construction.

For the B1: I-5 BRT Alternative, general purpose traffic operations on the freeway would not be affected. Transit-only direct access ramps may even be a slight benefit for general purpose traffic because they would remove bus weaving movements from the left-side HOV lane to the right-side general purpose off-ramp; therefore, reducing conflicts near interchanges. Some effects may occur on freeway and ramp operations, as well as local arterials during construction of the direct access ramps and BRT station facilities at Northgate, NE 145th Street, and NE 185th Street.

The freeway operations, impacts, and benefits of the B2: Multi-Corridor BRT Alternative would be the same as the B1: I-5 BRT Alternative. On the arterials there could be additional intersections with traffic signal priority for buses (which may affect overall operations for general traffic), but there would be little, if any, impact on LOS. As indicated in the property access discussion above, additional bus volumes in the BAT lanes under the BRT alternatives could have a slight impact on right-turning traffic. Some effects may occur on freeway and ramp operations, as well as local arterials during construction of the direct access ramps at Northgate and NE 130th Street.

TRANSIT OPERATIONS

The TSM/Baseline Alternative includes a relatively small increase in transit service in the corridor, as well as direct service to light rail at Northgate. However, this benefit would likely be marginalized over time as congestion in the HOV lanes continues to increase. The new Shoreline-to-Northgate express bus route would not use the I-5 HOV lanes due to the lack of direct access ramps and the limited distance it would travel on I-5; hence, its reliability would be worse than the I-5 route.

Both the L1: I-5 Light Rail and L2: SR 99 Light Rail Alternatives provide a high level of speed and reliability benefit, although the light rail in the I-5 corridor would have shorter travel times. With light rail in either the I-5 or SR 99 corridor, some modifications may be made to existing express bus service in the I-5 corridor. In addition, local bus service may be modified or enhanced to feed light rail stations. BRT operations on SR 99 (*Swift* and *RapidRide*) are not anticipated to be affected by light rail operations, although ridership on those lines could increase because they would provide feeder service to the new light rail stations.

For both the B1: I-5 BRT and B2: Multi-Corridor BRT Alternatives, transit service would be improved. Transit-only direct access ramps from I-5 would provide quick access for BRT and other buses to the transit stations. The 15th Avenue NE corridor would include stop consolidation to improve transit travel time.

PEDESTRIAN AND BICYCLE ACCESSIBILITY AND MOBILITY

The TSM/Baseline Alternative would have only minor benefits for pedestrian and bicycle mobility. Overall, pedestrian and bicycle accessibility and mobility would be improved with implementation of the light rail and BRT alternatives, particularly with improvements to the pedestrian and bicycling environment around stations. These improvements will be defined during the design phase consistent with Sound Transit policies. However, pedestrian crossings may be consolidated with the development of an at-grade light rail alignment, which would affect pedestrian and bicycle accessibility.

SAFETY

The safety assessment was based on the potential for increased conflicts among vehicles, pedestrians, and bicycles. There are no changes expected with regard to safety for the TSM/Baseline, B1: I-5 BRT, or B2: Multi-Corridor Alternatives. The L1: I-5 Light Rail Alternative

would result in fewer buses in the HOV lanes of I-5 and therefore fewer potential conflicts between buses and general purpose vehicles.

The L2: SR 99 Alternative includes significant sections of at-grade light rail. Because the median alignment on SR 99 provides more controlled access, particularly for mid-block locations, some types of vehicle collisions may be reduced, such as those involving left-turning vehicles. However, this option also could increase the potential for conflicts with pedestrians and vehicles with light rail vehicles at-grade. Along SR 104, side-running at-grade light rail would include gated crossings for safety at intersections with streets and driveways. Safety would be improved with an elevated light rail facility, which would reduce conflicts with both pedestrians and vehicles.

3.6.6 Cost and Constructability

Preliminary capital and O&M costs were estimated for the alternatives and major constructability issues were assessed.

CAPITAL COSTS

Capital costs were estimated based on the capital cost estimating methodology documented in the *Sound Transit 2 Planning Capital Cost Estimating Methodology* report (Sound Transit 2007b) and by methods and data from the *North Corridor Transit Project Level 1 Alternatives Capital and Operations Cost Estimating Methodology and Results* report (Sound Transit 2011d) and the *North Corridor Transit Project Unit Cost Library and Composite Section Costs Report* (Sound Transit 2011e). Table 3-19 shows cost ranges for the Level 1 alternatives.

Table 3-19. Capital Cost Ranges for Level 1 Alternatives

Alternative	Low (mid-2010 \$million)	High (mid-2010 \$million)
TSM/Baseline	\$100	\$120
L1: I-5 Light Rail	\$1,520	\$1,740
L2: SR 99 Light Rail	\$1,870	\$2,150
B1: I-5 BRT	\$580	\$670
B2: Multi-Corridor BRT	\$460	\$530

OPERATION AND MAINTENANCE COSTS

Estimated additional annual O&M costs for the Level 1 alternatives, above and beyond No Build Alternative, are provided in Table 3-20. These estimates are for the year 2030 and are expressed in mid-2010 dollars. For purposes of the Level 1 evaluation all bus O&M cost savings attributable to the introduction of light rail were assumed to be re-invested in feeder bus service.

Table 3-20. 2030 Operation and Maintenance Cost Estimates

Alternative	Annual O&M Cost (mid-2010 \$million)
TSM/Baseline	\$14
L1: I-5 Light Rail	\$21
L2: SR 99 Light Rail	\$26
B1: I-5 BRT	\$18
B2: Multi-Corridor BRT	\$36

CONSTRUCTABILITY FACTORS

Construction effects for the TSM/Baseline Alternative would involve minor traffic impacts associated with the off-ramp widening near Northgate and potentially at intersections where signal improvements may require new signals.

The L1: I-5 Light Rail Alternative involves significant construction along the I-5 corridor and would require traffic modifications to temporarily narrow the highway lanes and provide space for construction of the guideway. Temporary traffic closures could also occur where the guideway crosses traffic lanes. This situation would occur at the highway interchanges and where the guideway crosses I-5 from the east side to the west side. Careful construction would be necessary to minimize environmental impacts. Specifically, Thornton Creek near the NE 145th Street interchange and the wetlands near the Lynnwood Transit Center would require construction techniques to protect the sensitive areas. Because of the proximity to residential properties, noise regulations may impose limits on construction noise.

The L2: SR 99 Light Rail Alternative involves significant construction along SR 99 and would require reconstruction of the roadway, intersections, and utilities. Maintaining traffic and property access during construction would be required. Maintaining traffic LOS during peak hours may require that construction is performed during non-peak traffic hours. Temporary traffic closures could also occur where the guideway crosses traffic lanes. This situation would occur where an elevated guideway crosses over SR 99 and where the guideway crosses I-5. Night-time construction would likely be required so that traffic closures do not occur during peak traffic hours.

The B1: I-5 BRT and B2: Multi-Corridor BRT Alternatives require construction along the I-5 corridor and would involve traffic modifications to temporarily narrow the highway lanes and provide space for construction. The B1: I-5 BRT Alternative involves more locations along I-5 and would have greater impacts than the B2: Multi-Corridor BRT Alternative.

3.6.7 Consistency with Sound Transit’s Long-Range Vision

This measure addresses the extent to which alternatives support the long-range vision, goals, and objectives for transit service established by Sound Transit’s Long-Range Plan. Table 3-21 presents the results of the three criteria used to judge consistency with Sound Transit’s long-range vision. These include conformity with the definition of HCT contained in Washington State law, the miles of operation of the transit alternative in general purpose traffic, and consistency with Sound Transit’s Long-Range Plan. Based on these criteria, only the light rail alternatives meet all three tests of plan consistency. While the B1: I-5 BRT Alternative meets the state’s definition of HCT and operates exclusively on either HOV lanes or transit-only ramps, it does not conform to Sound Transit’s long-range vision or the ST2 Plan approved by voters in 2008, both of which call for light rail. Neither the TSM/Baseline Alternative nor the Multi-Corridor BRT Alternative is consistent with Sound Transit’s long-range vision based on these three criteria.

Table 3-21. Level 1 Evaluation Results—Consistency with Long-Range Plans

Alternative	Definition of High Capacity Transportation System	Miles of Operation in General Purpose Lanes	Consistent with Sound Transit’s Regional Transit Long-Range Plan
TSM/Baseline	No	4.7	No
I-5 Light Rail	Yes	0	Yes
SR 99 Light Rail	Yes	0	Yes
I-5 BRT	Yes	0	No
Multi-Corridor BRT	No	7.7	No

3.7 ALTERNATIVES CARRIED FORWARD INTO LEVEL 2 EVALUATION

This section provides a comparative analysis of the evaluation of the Level 1 Alternatives and the basis for the recommendations to continue development of the selected alternatives as Level 2 Alternatives. For each alternative, the findings on the key differentiating criteria are discussed followed by recommendations for the further development of the alternative in the Level 2 evaluation.

In general, all Level 1 alternatives meet the project’s overall Purpose and Need to some degree, based on the Level 1 alternatives definitions and the performance measures applied at this stage. However, the results indicate significant differences among the alternatives on many of the criteria. Primary distinguishing factors among the alternatives at this level of analysis include findings associated with performance measures related to the Purpose and Need criteria comprising transportation performance, consistency with Sound Transit’s Long-Range Plan, environmental performance, and cost and constructability.

Community equity, land use, and economic development were not major differentiators among the Level 1 alternatives at this level of development and analysis. These factors are likely to become more important as the alternatives are developed in greater detail and specific information is known about station locations, configurations, and the fit of the alternatives into the surrounding urban environment.

Table 3-22 summarizes the results of the Level 1 evaluation and the sections that follow discuss the results by alternative and make recommendations regarding the development of the Level 2 alternatives.

3.7.1 TSM/Baseline Alternative

The TSM/Baseline Alternative represents the most that can be done to improve the existing regional transit system to meet the project's Purpose and Need without major new capital investments. As would be expected, this alternative is the least effective of the build alternatives in meeting the principal transportation needs when compared to the major capital investments of the other alternatives. On the positive side, it is the least costly and has the fewest likely potential effects on both the natural and constructed environments.

From a transportation standpoint, the following are the key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 13,400, just over a quarter of the riders carried by the best performing alternative.
- Year 2030 annual new system riders of 0.98 million and 0.83 million hours of total travel time savings, roughly one-sixth of the new riders and travel time savings of the best performing alternative.
- Capacity to carry 1,440 passengers per hour per direction, roughly one-eighth of what the best performing alternatives can carry.
- Lynnwood-to-Northgate peak-period travel times of 28 minutes are twice the travel time of the best performing alternative.
- Based on the predominant operation on non-exclusive highly congested arterials and freeways, the TSM/Baseline Alternative has a high likelihood of much lower reliability than the alternatives that operate entirely on exclusive guideways.

The TSM/Baseline Alternative was one of two Level 1 alternatives judged to be inconsistent with Sound Transit's Long-Range Plan as a result of the predominance of operation in mixed traffic. Because this alternative has the least infrastructure investment and construction, it has the fewest potential impacts on the natural and man-made environment. Finally, with a range of capital investment of \$100 to \$120 million (mid-2010 dollars), it is by far the least costly of the Level 1 alternatives.

Table 3-22. Level 1 Alternatives Evaluation Summary

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> KEY TO RANKING  </div>					
	TSM TSM/Baseline	L1 I-5 Light Rail	L2 SR 99 Light Rail	B1 I-5 BRT	B2 Multi-Corridor BRT
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs					
Project Daily Riders	13,400	50,600	46,200	20,800	25,100
Annual New Riders	0.98 million	5.9 million	5.2 million	2.2 million	2.6 million
User Benefit Estimate— Annual Hours of Travel Time Saved	0.83 million	5.9 million	4.9 million	1.9 million	2.3 million
Practical Capacity (Directional Passengers/Hour)	1,260	8,880	8,880	2,700	2,700
Peak Transit Travel Time: Lynnwood to Northgate	28 minutes	14 minutes	21 minutes	25 minutes	24 minutes
Operations on Non-Exclusive Right-of-Way	14 miles	0 miles	0 miles	8.3 miles	25.8 miles
Number of At-Grade Signalized Intersections Traversed	9	0	7	0	45
Purpose and Need: Equitable Community Impacts and Benefits					
Not considered for Level 1 screening.					
Purpose and Need: Supportive Land Use and Economic Development Effects					
Level 1 measures show only minor differences among alternatives.					
Purpose and Need: Preservation of a Healthy Environment					
New Transportation Right-of-Way Requirements	Low	Low	Moderate	Low	Low
Impacts on General Purpose Traffic Operations	No change	• No change to freeway • Arterial impacts at stations	LOS, left turn and property access impacts on SR 99	• No change to freeway • Arterial impacts at stations	• No change to freeway • Arterial impacts at stations
Purpose and Need: Cost and Constructability					
Capital Cost (Millions of Mid-2010 Dollars)	\$100 to \$120	\$1,520 to \$1,740	\$1,870 to \$2,150	\$580 to \$670	\$460 to \$530
2030 Annual O&M Cost (Millions of Mid-2010 Dollars)	\$14	\$21	\$26	\$18	\$36 million
Purpose and Need: Consistency with Sound Transit Long-Range Vision					
Operations in General Purpose Traffic Lanes	4.7 miles	0 miles	0 miles	0 miles	7.7 miles
Consistency with Definition of HCT in Long-Range Plan	No	Yes	Yes	Yes	No
LEVEL 2 EVALUATION RECOMMENDATION					
⊖ = Advance ⊗ = Drop	⊖	⊖	⊖	⊗	⊖

In conclusion, it is recommended that the TSM/Baseline Alternative be modified and then carried forward into the Level 2 evaluation with changes to improve its performance in light of the findings from evaluating the two BRT alternatives. Based on the Level 1 development and evaluation of the two BRT alternatives, it is clear that a number of the lower-cost capital facility improvements and service additions are appropriate for inclusion in the TSM/Baseline Alternative during Level 2. These improvements are described in detail in Chapter 4, section 4.2. While this may result in some cost increase for the TSM/Baseline Alternative, it should improve its performance.

3.7.2 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative is essentially unchanged from the concept developed as the representative light rail alignment for the ST2 system planning work. In general, this Level 1 Alternative is the best performing as judged on transportation performance criteria, is the second most costly of the alternatives, and has the second highest potential for effects on the surrounding environment.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 50,600, nearly four times the riders carried by the TSM/Baseline Alternative and over 4,000 daily riders more than the next best performing L2: SR 99 Light Rail Alternative.
- Year 2030 annual system new riders of 5.9 million and 5.9 million total hours of travel time savings, roughly six times the new riders and travel time savings of the TSM/Baseline Alternative and 10 to 20 percent better than the next best performing L2: SR 99 Light Rail Alternative.
- Capacity to carry 8,880 passengers per hour per direction, roughly 8 times the capacity of the TSM/Baseline Alternative and equal to the L2: SR 99 Light Rail Alternative.
- Lynnwood-to-Northgate peak-period travel times of 14 minutes are the shortest of all the alternatives. The next best performing alternative is 50 percent longer.
- Based on exclusive operation on a fully grade-separated guideway, the L1: I-5 Light Rail Alternative is the most reliable of all the alternatives studied in Level 1.

The L1: I-5 Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive, grade-separated guideway. Because this alternative involves major infrastructure investment and construction along its entire length, it has the second greatest potential for impacts on the natural and constructed environment. Only the L2: SR 99 Light Rail Alternative, which would require substantially greater amounts of new transportation right-of-way, has greater possible impacts. Finally, with a capital cost range of \$1,520 to \$1,740 million (mid-2010 dollars), it is the second most costly of the alternatives considered in Level 1.

In conclusion, it is recommended that the L1: I-5 Light Rail Alternative should be carried forward into the Level 2 evaluation. Conceptual design work is needed to refine the alignment plan and profile as well as locate and configure stations and supporting access infrastructure. Many sub-alternatives are possible in terms of the rail line location to the east, west, or within the median of the I-5 roadways; the rail guideway profile with a mix of at-grade, aerial, and underpass sections; and station locations and configurations. In addition, work needs to be undertaken with WSDOT to develop more detail on the integration of the light rail infrastructure into I-5 as well as surrounding communities. This additional work is needed to more fully analyze the potential cost and impacts of the L1: I-5 Light Rail Alternative and develop a better understanding of the relative performance of this alternative as it relates to land use and economic development around the potential station locations.

3.7.3 L2: SR 99 Light Rail Alternative

The L2: SR 99 Light Rail Alternative consists of a hybrid of two early concepts, combining both at-grade and elevated alignments along portions of SR 99 through the cities of Seattle and Shoreline. In addition, it includes sub-alternatives involving alternative alignments to connect to Northgate at the south and the Lynnwood Transit Center at the north. In general, this alternative is the second best performing of the Level 1 alternatives as judged on transportation performance criteria, and it is the most costly of the alternatives. Further, it has the highest potential effects on the surrounding environment because of the relatively large amounts of new transportation right-of-way needed compared to the other alternatives.

While the analysis completed to date is not definitive, it appears that the L2: SR 99 Light Rail Alternative may have the most proportionate beneficial land use and economic development effects around the proposed stations of all the alternatives studied in Level 1. A definitive conclusion will require more detailed analysis during the Level 2 evaluation.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 46,200, the second highest of the alternatives studied and roughly 10 percent fewer than the best performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 5.2 million and 4.9 million total hours of travel time savings, which is the second best performing of the alternatives and roughly 10 to 15 percent lower than the best performing L1: I-5 Light Rail Alternative.
- Capacity to carry 8,880 passengers per hour per direction, roughly 8 times the capacity of the TSM/Baseline Alternative and equal to the L1: I-5 Light Rail Alternative.
- Lynnwood-to-Northgate morning peak-period travel times of 21 minutes are 7 minutes longer than the L1: I-5 Light Rail Alternative but faster than any of the other build alternatives.

- Based on fully exclusive guideway operation with limited at-grade crossings, the L2: SR 99 Light Rail Alternative is the second most reliable of all the alternatives. Only the fully grade-separated exclusive guideway of the L1: I-5 Alternative is more reliable.

The L2: SR 99 Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive guideway. Because this alternative involves the longest rail alignment (roughly 2 miles longer with one additional station compared to the L1: I-5 Light Rail Alternative) and the largest amount of new transportation right-of-way, it has the greatest potential for impacts on the natural and constructed environment of all the Level 1 alternatives. Finally, with a range of \$1,870 to \$2,150 million (mid-2010 dollars) it is the most costly of the Level 1 alternatives considered, roughly \$200 to \$300 million (mid-2010 dollars) more than the next most costly L1: I-5 Light Rail Alternative.

During concept screening and the Level 1 evaluation, a number of sub-alternatives were studied for the connection from Northgate Transit Center to SR 99, the SR 99 portion, and the connection back to the Lynnwood Transit Center. In the case of the connection from Northgate to SR 99, it is recommended that the tunnel sub-alternatives, both to 130th Street and along Roosevelt Way, be dropped from further study. This decision is based on the conclusion that at least two other possible alignments that do not require tunnels appear to perform equally or better. Along SR 99 itself, continuous use of significant sections of the parallel former Interurban right-of-way is also recommended to be dropped, as discussed in more detail in Section 3.4.3. This decision is based on the serious and probably unresolvable conflicts between a light rail alignment and the existing utility, trail, and private property access uses of the right-of-way. The power distribution line conflicts, in particular, do not appear solvable to the satisfaction of the affected utilities and could result in the need to acquire substantial new right-of-way to address their maintenance, expansion, and security concerns. Because other alignments along SR 99 appear to perform equal or better, use of the former Interurban right-of-way for light rail development is probably limited to short segments or crossings only, where the conflicts could be more easily addressed. Finally, only two options appear workable for the connection back to the Lynnwood Transit Center. These are the SR 104/I-5 and the SR 99/208th Street SW alignments.

In conclusion, it is recommended that the L2: SR 99 Light Rail Alternative should be carried forward into the Level 2 evaluation. Conceptual design work is needed to refine the alignment plan and profile as well as locate and configure stations and supporting access infrastructure. Work also needs to be completed to develop a better understanding of several sub-alternatives, and refine the integration of the alignment and stations into SR 99 and the surrounding communities. Finally, the Level 1 evaluation did not fully address the impacts of traffic and transit operations on light rail trains operating at-grade at 4-minute headways, as well as the implications of other operating scenarios. This additional work is needed to more fully analyze the potential cost and impacts of the L2: SR 99 Light Rail Alternative and develop a better understanding of the relative performance of this alternative as it relates to land use and economic development around the potential stations.

3.7.4 B1: I-5 BRT Alternative

The B1: I-5 BRT Alternative consists of a BRT line connecting the Lynnwood Transit Center to the Link light rail terminus station at the Northgate Transit Center. This alternative includes the development of new intermediate stations at NE 185th and 145th Streets and associated bus-only direct access ramps to and from the I-5 HOV lanes, as well as service levels designed to closely replicate the L1: I-5 Light Rail Alternative. The B1: I-5 BRT Alternative does not include any other changes to the configuration or operation of the I-5 HOV lanes between Lynnwood and Northgate.

In general, this alternative has slightly lower overall transportation performance compared to the B2: Multi-Corridor BRT Alternative, performing better than the latter only on the reliability criteria. However, it is the most costly Level 1 bus alternative and has the potential for higher impacts on the surrounding environment compared to the B2: Multi-Corridor BRT Alternative. The B1: I-5 BRT Alternative falls well short, however, of the performance of the light rail alternatives while having significantly fewer potential impacts and substantially lower capital costs than the light rail alternatives.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 20,800, the second highest of the bus alternatives studied but nearly 20 percent less than the B2: Multi-Corridor BRT Alternative, and only 40 percent of the ridership on the best performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 2.2 million and 1.9 million total hours of travel time savings, which is the second best performing of the bus alternatives and roughly 30 to 40 percent of the best performing L1: I-5 Light Rail Alternative.
- Capacity to carry 2,700 passengers per hour per direction, which is highest of the bus alternatives but less than one third of the capacity of the light rail alternatives.
- Lynnwood-to-Northgate morning peak-period travel times of 25 minutes are 11 minutes longer than the L1: I-5 Light Rail Alternative and only 3 minutes faster than the TSM Alternative.
- Based on the extensive use of the HOV and transit-only direct access ramps and full operation in the I-5 HOV lanes, the B1: I-5 BRT Alternative is the most reliable of the Level 1 bus alternatives. However, given peak-period congestion levels in the I-5 HOV lanes, the B1: I-5 BRT Alternative would be significantly less reliable than the light rail alternatives.

The B1: I-5 BRT Alternative is consistent with the definition of HCT as a result of full operation on facilities not shared with general purpose traffic, but does not conform with the voter-approved ST2 Plan, which calls for light rail. Because this alternative involves more construction of new roadway and structures compared to other bus or BRT alternatives, it would have the greatest potential for impacts on the natural and constructed environment of the Level 1 bus

alternatives; however, these impacts would be substantially less than those of any of the light rail alternatives. Finally, with a capital cost range of \$580 to \$670 million (mid-2010 dollars), it is the most costly Level 1 bus alternative considered, although significantly lower in cost than the light rail alternatives.

Based on the findings from evaluating the two Level 1 BRT alternatives, it is recommended that the B1: I-5 BRT Alternative be dropped and only a modified version of the B2: Multi-Corridor BRT Alternative be carried forward. The primary reason for this recommendation is that the B2: Multi-Corridor BRT Alternative performs better from a transportation standpoint and has substantially lower costs.

3.7.5 B2: Multi-Corridor BRT Alternative

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving the project corridor between Lynnwood and the Link light rail terminus at Northgate. This alternative includes three alignments: 1) an I-5 BRT line that connects the Lynnwood Transit Center to the Northgate Transit Center with an intermediate stop at the Mountlake Terrace Freeway Station; 2) a line serving north Seattle and Shoreline in the SR 99 corridor that connects to I-5 at NE 130th Street; and 3) a line serving the 15th Avenue NE corridor from Mountlake Terrace through Shoreline and north Seattle to an I-5 connection at NE 130th Street. This alternative takes greatest advantage of the BRT infrastructure that already exists in both the SR 99 and I-5 corridors and adds transit-only I-5 HOV lane direct access ramps at NE 130th Street and Northgate to and from the south only.

In general, this alternative has the best overall transportation performance of the bus alternatives. It is less costly to implement than the B1: I-5 BRT Alternative and has fewer potential impacts as a result of less roadway additions. However, the B2: Multi-Corridor BRT Alternative falls well short of the performance of the light rail alternatives, while having significantly fewer potential impacts and substantially lower capital costs than the light rail alternatives.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 25,100, the highest of the bus alternatives studied but roughly 50 percent of the ridership on the best performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 2.6 million and 2.3 million total hours of travel time savings, which is the best performing of the bus alternatives and roughly 40 to 45 percent of the best performing L1: I-5 Light Rail Alternative.
- Capacity to carry 2,700 passengers per hour per direction, the highest of the bus alternatives but less than one third of the capacity of the light rail alternatives.
- Lynnwood-to-Northgate morning peak-period travel times of 24 minutes are 10 minutes longer than the L1: I-5 Light Rail Alternative but faster than any of the other bus alternatives.

- Because the B2: Multi-Corridor BRT Alternative includes a line on 15th Avenue NE that operates totally in mixed traffic until it reaches I-5 at NE 130th Street, as well as a line on SR 99 that operates in mixed traffic between SR 99 and I-5, it is not as reliable as the B1: I-5 BRT Alternative and significantly less reliable than the light rail alternatives.

The B2: Multi-Corridor BRT Alternative is not consistent with Sound Transit's Long-Range Plan as a result of the significant segments of mixed traffic operations of the 15th Avenue NE and SR 99 BRT lines. Because this alternative has fewer additional roadway improvements than the B1: I-5 BRT Alternative, it would have comparatively reduced potential impacts on the natural and man-made environment. Finally, with a capital cost range of \$460 to \$530 million (mid-2010 dollars) it is less costly by more than \$120 to \$140 million (mid-2010 dollars) than the B1: I-5 BRT Alternative.

Based on the findings from evaluating the two Level 1 BRT alternatives, it is recommended that a single concept with the best performing elements of the B2: Multi-Corridor BRT Alternative should be carried forward into the Level 2 evaluation. The large investment in direct access ramps and new stations adjacent to I-5 at NE 145th and 185th Streets in the B1: I-5 BRT Alternative add very little ridership compared to the combination of a new BRT line running express on I-5 through these areas and SR 99 and 15th Avenue NE BRT lines making stops to serve the same areas. The I-5 BRT freeway stations and ramps are costly to construct and have potential impacts on both the natural and constructed environments.

As a result, an alternative that includes the I-5, SR 99, and 15th Avenue BRT routes and infrastructure of the B2: Multi-Corridor BRT Alternative is recommended for further development in Level 2.

3.7.6 Possible Future Changes to I-5 by WSDOT

A final consideration for the evaluation of Level 2 alternatives relates to possible future changes to I-5 that are contemplated by WSDOT. The region's long-range plan calls for eventual development of managed lanes along the portion of I-5 in the North Corridor Transit Project area. WSDOT is considering a number of options that could result in reconstructing and tolling portions of the freeway to include one or more managed lanes in each direction of I-5 between Northgate and Lynnwood.

At this time the design, construction costs, and right-of-way requirements are not known, including the transportation system and environmental impacts from these improvements. Also, the project is not a part of the analysis of alternatives to meet the Purpose and Need of the North Corridor Transit Project. However, if implemented and successfully managed, these improvements should reduce average peak-period travel times by as much as 5 minutes between Lynnwood and Northgate and provide better reliability for buses operating in this section of I-5.

The sensitivity test undertaken as part of the Level 1 forecasting work concluded that ridership effects on the I-5 BRT line would be minor. While increasing peak-period running speeds to 45 mph would increase overall ridership on I-5 compared to the baseline B1: I-5 BRT Alternative,

nearly all the benefits would accrue to Community Transit's express routes to downtown Seattle and the University District. This effect occurs because, unlike Community Transit's express routes, the BRT line must exit and re-enter the managed lanes numerous times to serve stations between Lynnwood and Northgate.