



North Corridor Transit Project  
**Alternatives Analysis Report**  
and SEPA Addendum

SEPTEMBER 2011

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*This Alternative Analysis report also serves as an addendum to Sound Transit's Supplemental EIS on the Regional Transit Long-Range Plan (Sound Transit 2005b). It adds information and analysis regarding the North Corridor transit alternatives and their environmental impacts. This addendum is issued pursuant to the State Environmental Policy Act (SEPA) rules, WAC 197-11-600(4)(c) and WAC 197-11-625.*

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## ACRONYMS AND ABBREVIATIONS

AA	Alternatives Analysis
BAT	business access and transit
BRT	bus rapid transit
CBD	central business district
CFR	Code of Federal Regulations
CO <sub>2</sub> e	carbon dioxide equivalent
CWA	Clean Water Act
DAHP	Washington State Department of Archaeology and Historic Preservation
DSTT	Downtown Seattle Transit Tunnel
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	geographic information system
HCT	high capacity transit
HOV	high-occupancy vehicle
I-5	Interstate 5
ITWG	Interagency Technical Working Group
LOS	level of service
LPA	Locally Preferred Alternative
LWCF	Land and Water Conservation Fund
mph	miles per hour
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration

NRHP	National Register of Historic Places
O&M	operation and maintenance
PAC	Policy Advisory Committee
PE	Preliminary Engineering
pphd	passengers per hour per direction
PSRC	Puget Sound Regional Council
RCW	Revised Code of Washington
ROD	Record of Decision
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SEPA	State Environmental Policy Act
Sound Transit	Central Puget Sound Regional Transit Authority
SR	State Route
ST2	Sound Transit 2
ST2 Plan	Sound Transit 2 Plan
TOD	transit-oriented development
TSM	transportation systems management
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
v/c	volume to capacity
VHT	vehicle hours traveled
VMT	vehicle miles traveled
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

# North Corridor Transit Project Alternatives Analysis Report

## SUMMARY



### S.1 INTRODUCTION

The Central Puget Sound Regional Transit Authority (Sound Transit) intends to expand regional transit service in the North Corridor, connecting the existing regional transit system from the planned interim terminus of Link light rail in the Northgate neighborhood of Seattle to the city of Lynnwood in southern Snohomish County. Construction is currently underway on a light rail extension from downtown Seattle to the University of Washington, which is scheduled to open in 2016, followed by service to Northgate, which is targeted to open in 2021. Approved by voters as part of the Sound Transit 2 (ST2) Plan in 2008, the North Corridor Transit Project would extend regional transit service northward to serve north Seattle, Shoreline, Mountlake Terrace, and Lynnwood.

#### What is the Sound Transit 2 (ST2) Plan?

On Nov. 4, 2008, voters of the Central Puget Sound region approved the Sound Transit 2 (ST2) ballot measure, which will add regional express bus and commuter rail service while building 36 additional miles of light rail to form a 55-mile regional system. ST2 will expand the existing light rail system to serve three major travel corridors – extending from North Seattle into Snohomish County (the North Corridor project), across Lake Washington into East King County, and south of SeaTac International Airport to Federal Way. ST2 will also expand Sounder commuter rail and ST Express regional bus service significantly.



The North Corridor Transit Project is an incremental step in implementing the Puget Sound Regional Council's (PSRC's) VISION 2040 Regional Plan and the Sound Transit 2005 Regional Transit Long-Range Plan. Both call for the eventual extension of high-capacity transit (HCT) service north to Everett. Figure S-1 shows the Regional Transit System Plan map.

The North Corridor Transit Project relies on receiving federal assistance to complete the project. In accordance with federal regulations and guidelines for fixed guideway projects that seek New Starts grant funds from the Federal Transit Administration (FTA), Sound Transit has completed an Alternatives Analysis (AA) to evaluate a range of potential alternatives for addressing mobility needs in the North Corridor, including routes, stations, and operating features.

The purpose of the AA is to define the transportation needs in the corridor; identify, evaluate, and narrow alternatives that would address the needs of the corridor; and help Sound Transit select a preferred transit mode and route for implementation. While an AA is a local process, FTA provides general guidelines for how to conduct it. These include four major steps: study initiation, development and refinement of alternatives and technical methodologies, analysis and evaluation, and selection of the Locally Preferred Alternative (LPA) or proposed action.

### What is PSRC's VISION 2040 Regional Plan?

VISION 2040, adopted in April 2008, is a regional strategy for accommodating the additional 1.7 million people and 1.2 million new jobs expected to be in the region by the year 2040. It is the result of a process undertaken by the region's elected officials, public agencies, interest groups, and individuals to establish a common vision for the future of the region. VISION 2040 contains an environmental framework, a regional growth strategy, policies to guide growth and development, implementation actions, and measures to monitor progress. One of the key elements of the vision is to concentrate population and employment growth in regionally designated growth centers that are well connected by major transportation corridors and high capacity transit.

### What is High Capacity Transit (HCT)?

High capacity transit or HCT is defined in Sound Transit's enabling legislation as a system of public transportation services within an urbanized region operating principally on exclusive rights-of-way, and the supporting services and facilities necessary to implement such a system. HCT can also include interim express services and high occupancy vehicle lanes. Taken as a whole, HCT elements provide a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways. *(Definition included in Sound Transit's enabling legislation (RCW 81.104.015 (2))*



Northgate Transit Center



Lynnwood Transit Center



**Figure S-1. Sound Transit 2 Regional Transit System Plan Map and North Corridor**

The North Corridor AA includes a public and agency outreach program and state and federal environmental review processes consistent with both the National Environmental Policy Act (NEPA) and

Washington's State Environmental Policy Act (SEPA) requirements. Because the project has the potential to cause environmental impacts, the project will require an Environmental Impact Statement (EIS).

## S.2 NORTH CORRIDOR PURPOSE AND NEED

Sound Transit is proposing the North Corridor project to improve regional transit service from Seattle, north into Snohomish County. The North Corridor area is part of the region's most heavily traveled corridor that links the cities of Tacoma, Seattle, and Everett. Figure S-2 shows the geographic setting for the North Corridor as well as its relationship to the Link light rail system. The project has been initiated in response to the public vote in November 2008 authorizing local funding for the North Corridor project as part of the ST2 Plan.

Sound Transit's legislative mandate is to improve public transportation and mobility in the central Puget Sound region by developing an HCT system. This system would operate principally on exclusive

rights-of-way and provide a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways.

The corridor currently has express bus service operating in the Interstate 5 (I-5) high-occupancy vehicle (HOV) lanes, utilizing HOV direct access and freeway transit station facilities at Lynnwood and Mountlake Terrace, respectively. This service has reliability problems because the HOV system is incomplete and is highly congested during peak periods; as a result, the express bus system does not adequately meet the growing transit needs of the corridor. The highest demand for the service is during

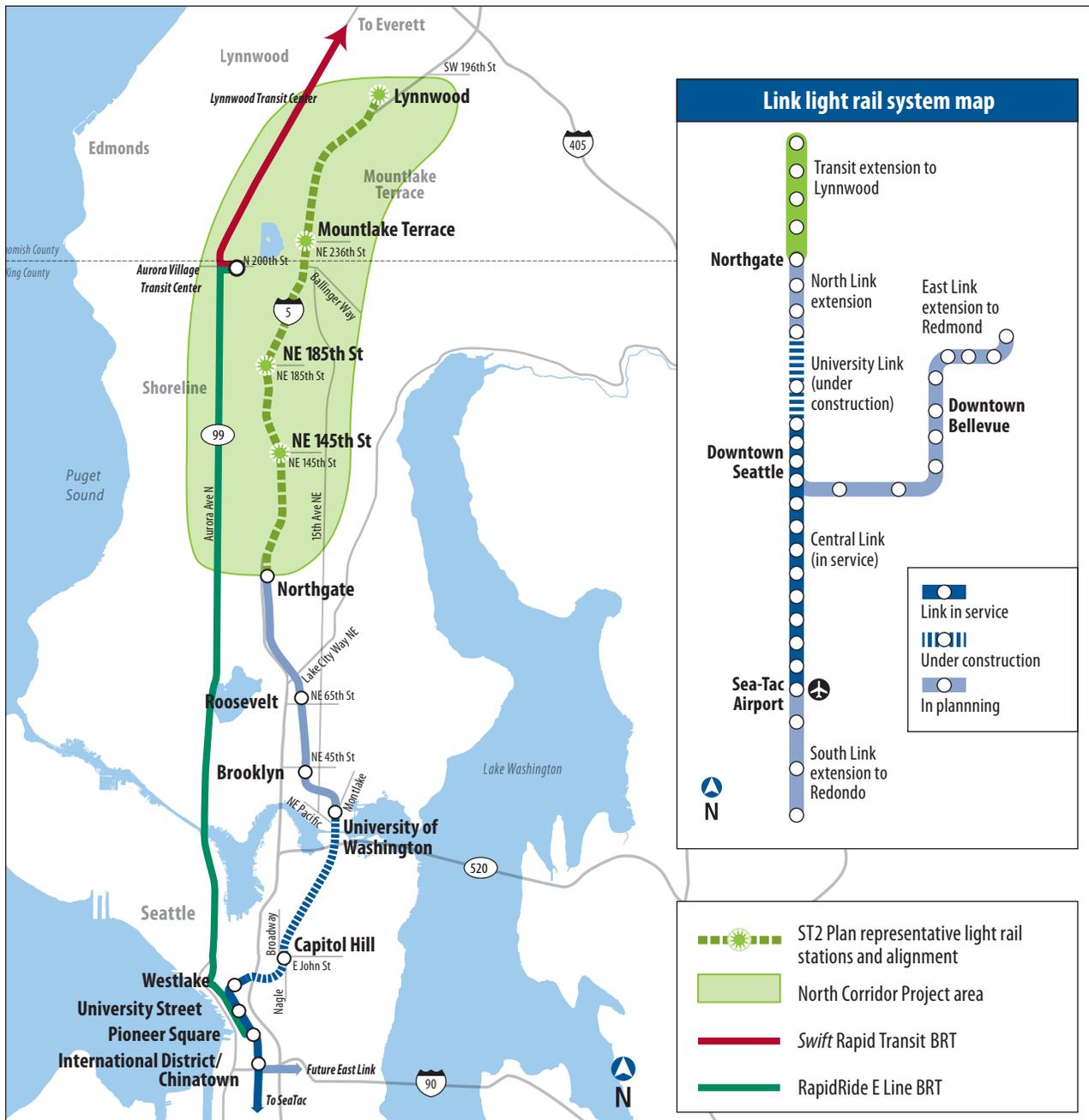


I-5 north of Northgate in Seattle

the congested peak commute periods, as travelers from residential areas in King and Snohomish counties travel south to major job centers in Seattle and east King County, or north toward Everett.

To guide decision-making during the AA and through the project's state and

federal environmental processes, Sound Transit has developed a statement of the project's purpose and need. An earlier draft statement was presented for public review and comment during an early scoping and public comment period held in September and October 2010, and was refined based on comments received.



**Figure S-2. North Corridor Project Area and Relation to Link Light Rail System**

## The Purpose of the North Corridor Transit Project

Improve 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;
2. Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system;
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; and
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 North Corridor Transit Project is Needed to:

- 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 the PSRC's VISION 2040 and Transportation 2040, as well as related county and city comprehensive plans.
- 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.
- Address overcrowding facing current and future North Corridor transit riders due to insufficient capacity of the current transit system.
- 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.
- 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.
- 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.
- 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.
- 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).

### S.3 DEVELOPMENT, SCREENING, AND EVALUATION OF ALTERNATIVES

The alternatives development, screening, and evaluation process consists of the stages illustrated in Figure S-3 and summarized below:

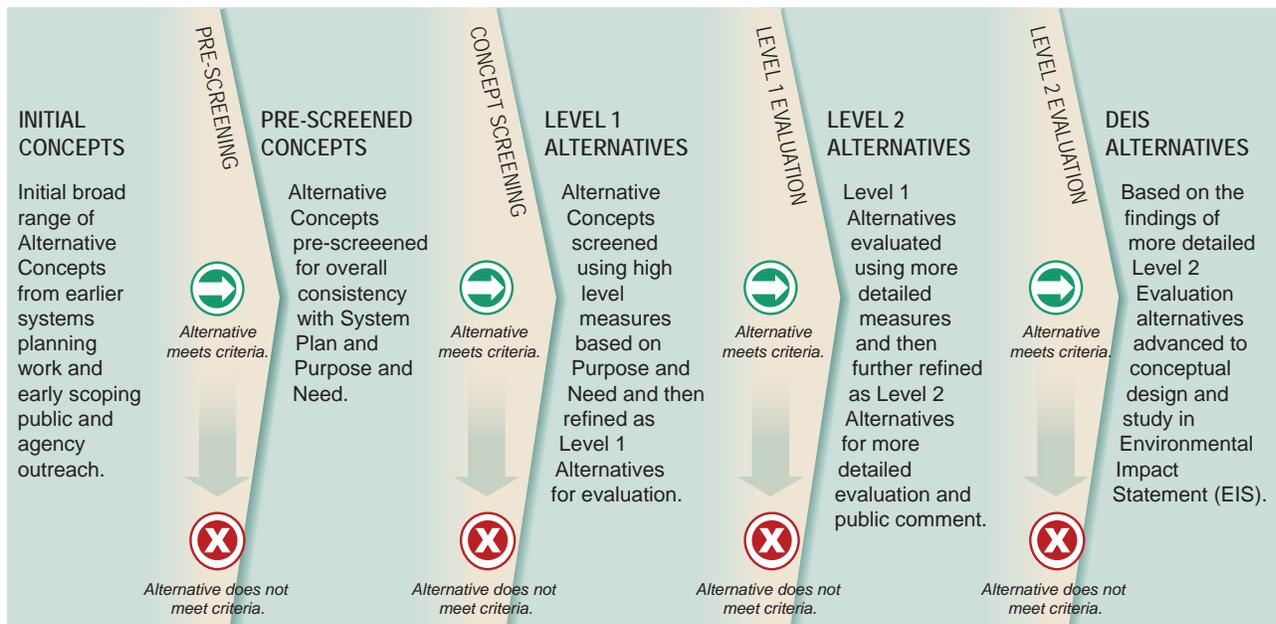
**Pre-Screening:** Before the start of the concept development, pre-screening was conducted to assess whether concept ideas were consistent with the definition of the North Corridor as identified in Sound Transit’s 2005 Regional Transit Long-Range Plan and whether they met the project’s purpose and need. Those concept ideas that failed this pre-screening were dropped from further development.

**Initial Concept Screening and Alternatives Development:** The concept ideas that survived pre-screening were developed further and then screened against a set of general criteria based on the project’s purpose and need. The surviving concepts were then refined to form the Level 1 alternatives.

**Level 1 Alternatives Evaluation:** The Level 1 evaluation employed quantitative and qualitative assessments of benefits, impacts, and costs of a refined set of alternatives. The best performing alternatives were carried forward, modified, and refined for the Level 2 evaluation. Poorly performing alternatives were dropped from further consideration.

**Level 2 Alternatives Evaluation:** The Level 2 evaluation involved detailed analysis of further refined alternatives using more quantitative information. Based on this evaluation, the most promising alternatives may be evaluated in the formal NEPA/SEPA environmental review process.

The purpose and need was used to develop the screening and evaluation criteria and measures; these criteria are grouped by six broad categories each related to a portion of the purpose and need statement, as illustrated in Figure S-4.



➡ Alternative advances.      ❌ Alternative does not advance.

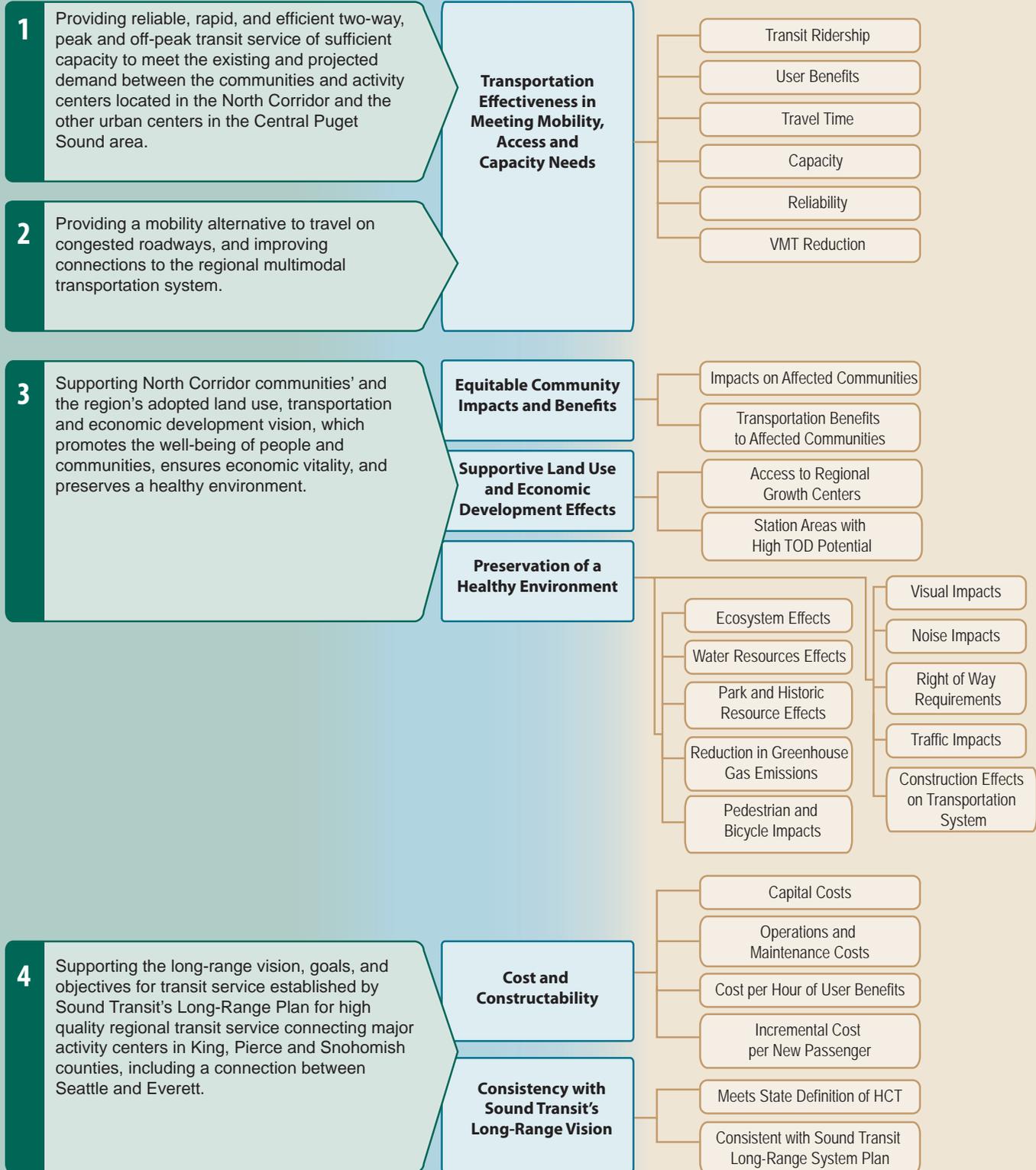
**Figure S-3.** Alternatives Analysis Evaluation Framework

**PURPOSE AND NEED**

The purpose of the North Corridor Transit Project is to improve regional mass transit service from Seattle north into Snohomish County by:

**EVALUATION CATEGORIES**

**EVALUATION CRITERIA**



**Figure S-4. Relationship of Purpose and Need to Evaluation Categories and Criteria**

## S.4 EARLY PUBLIC AND AGENCY INVOLVEMENT

Sound Transit undertook a substantial 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. Sound Transit and FTA undertook early scoping to engage the public and stakeholders in the AA process, before defining formal alternatives that would be evaluated in the AA. 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 also 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,



Project open house

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.

### KEY THEMES

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 State Route (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 trade-offs and impacts of the project. Some expressed concerns about how the project would be affected by Sound Transit's current financial situation and trade-offs being explored by the Sound Transit Board.

## S.5 CONCEPT DEVELOPMENT AND SCREENING

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 the Washington State Department of Transportation (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 ST2 system planning and other previous studies, as well as input from agency staff and the public through early scoping, were the basis for the development of the initial alternative concepts.

Adopted plans in the region 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 service, high speeds, and reliability) necessary for this critical connection between Everett and Seattle.

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. As a result, alternative concepts were developed to provide a high level of service to these activity centers, both in terms of capacity and speed. Ideally, this is accomplished by providing a one-seat ride on the regional transit system to both downtown Seattle and the University District from the North Corridor. 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,



*Bus traveling in I-5 HOV lanes in Mountlake Terrace*



*Link Light Rail in downtown Seattle*

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.

The concept development process resulted in the identification of a large number of bus and light rail concepts to meet the identified transportation needs in the corridor.

### S.5.1 Concepts Eliminated in Pre-screening

Before the start of initial concept screening, a pre-screening was conducted to assess

whether the concepts were consistent with the definition of the North Corridor Transit Project as identified in Sound Transit's 2005 Regional Transit Long-Range Plan and whether the concepts would contribute to the project's purpose and need. Most concepts considered passed this pre-screening step. The following concepts did not:

**Lake City Way/SR 522 Corridor:** 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.

**Light Rail in Mixed Traffic:** For this concept, light rail would be located at-grade on SR 99 or 15th Avenue NE, operating in mixed general purpose traffic or mixed with buses in business access and transit (BAT) lanes. Earlier system planning concluded that surface light rail



Example of light rail mixed with traffic in Portland, Oregon

operating in mixed traffic would have insufficient capacity, slow average speeds, and low reliability, and thus would not provide the kind of regional service called for in Sound Transit's Long-Range Plan. Light rail in mixed traffic does not meet the project's purpose and need related to transportation effectiveness and was eliminated from further consideration.

## S.5.2 Concepts Carried Forward for Development and Screening

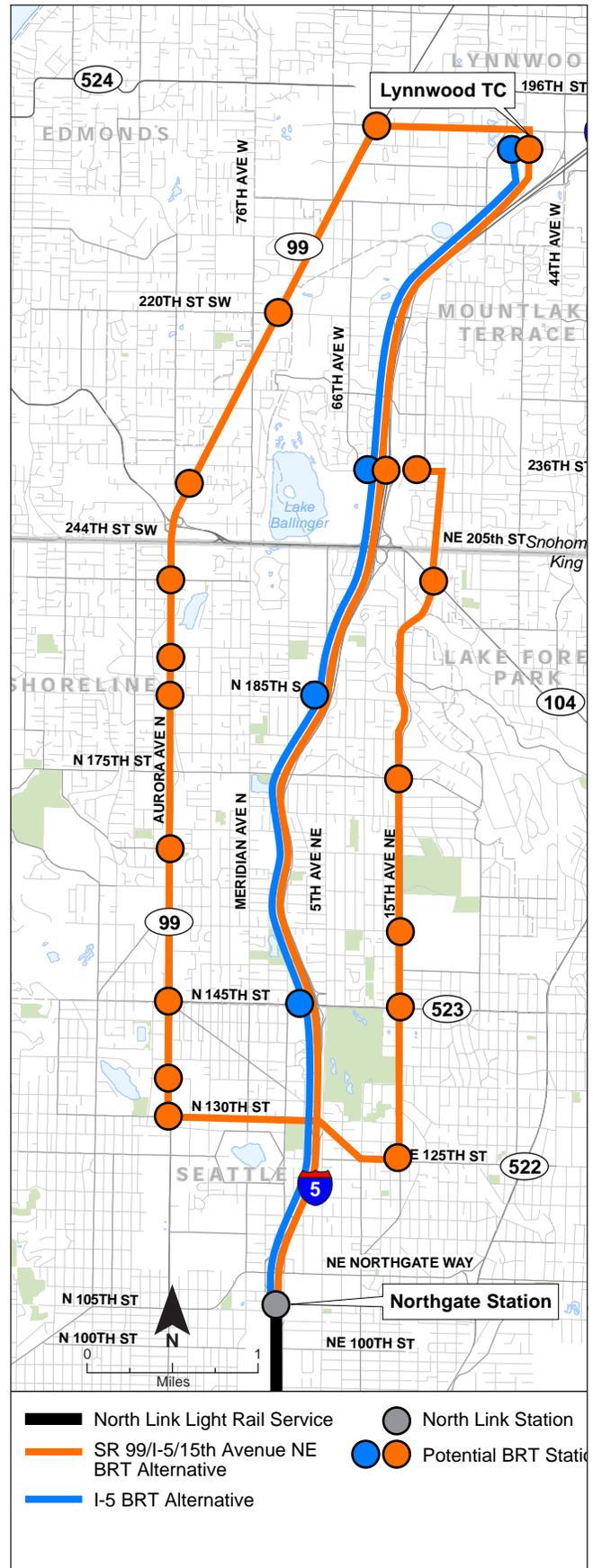
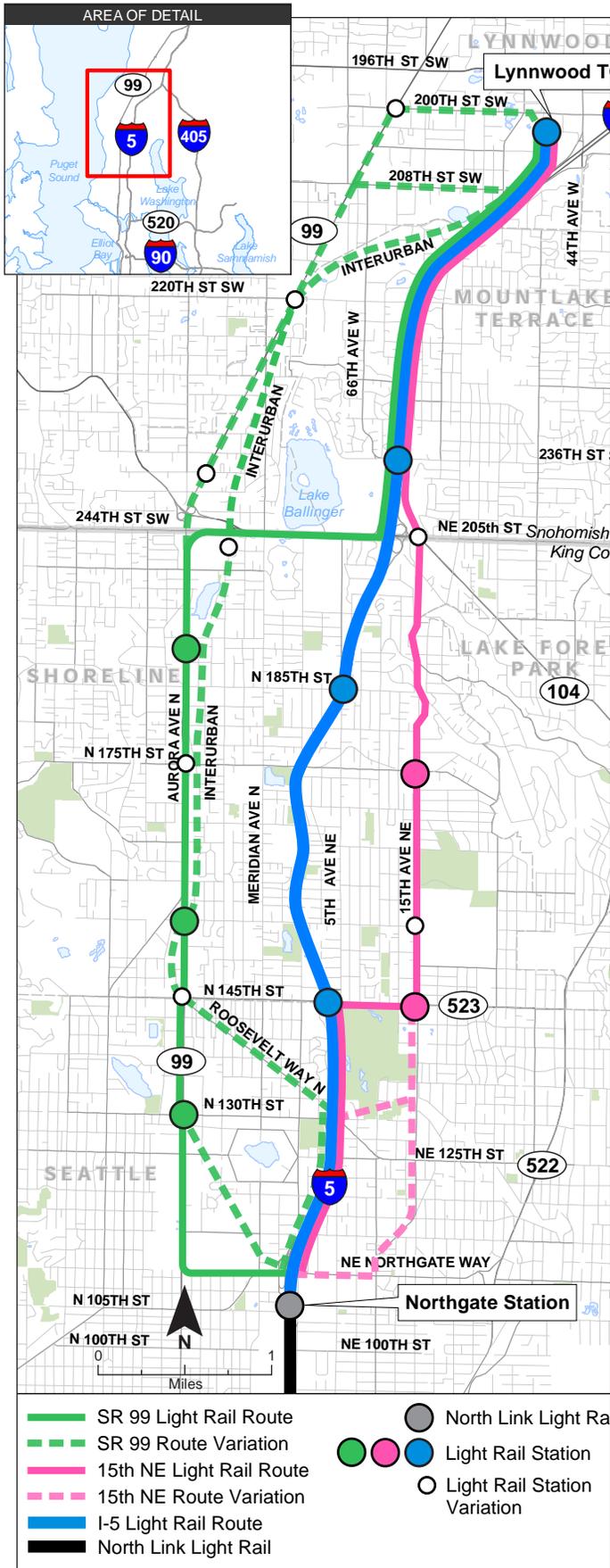
In addition to a No Build Alternative and a Transportation Systems Management (TSM)/Baseline Concept, seven build concepts were judged promising enough to be screened as part of the development of Level 1 alternatives. The initial light rail concepts are shown in Figure S-5 and the bus rapid transit (BRT) concepts are shown in Figure S-6. The initial alternatives 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 improves the regional transit system in the project area to the greatest extent possible without making a major new capital investment.

**Light Rail Concepts:** 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 an elevated structure), and two concepts along 15th Avenue NE (one at-grade and one on an elevated structure).

**BRT Concepts:** 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.



**Figure S-5. Light Rail Concepts**

**Figure S-6. BRT Concepts**

### S.5.3 Concept Screening

These eight concepts were initially screened using criteria based on the project's purpose and need. This process resulted in a further refinement of the eight concepts down to five concepts that were then developed in detail as the Level 1 alternatives. During this process, the two concepts utilizing segments of 15th Avenue NE were screened from further consideration, the two concepts utilizing portions of SR 99 were refined to a single hybrid Level 1 alternative with variations, and the I-5 light rail and two BRT concepts were refined and retained for further analysis as Level 1 alternatives.

#### 15TH AVENUE NE LIGHT RAIL CONCEPTS SCREENED OUT

The 15th Avenue NE corridor was initially considered because it is one of only three major existing north-south transportation corridors in what is a highly urbanized study area. However, unlike the other two corridors (I-5 and SR 99), 15th Avenue NE is not continuous in the study area and ends at SR 104 just south of Snohomish County. In addition, the street has a narrow right-of-way (generally 60 feet, compared to the much wider 100- to 200-foot rights-of-way for SR 99 and I-5). It is lined with numerous single and multi-family residential structures built close to the street, it operates as a neighborhood arterial, and it has been the focus of a "road diet" (narrowing) by the City of Shoreline. Based on the initial concept screening, both the elevated and at-grade concepts for light rail in 15th Avenue NE were dropped from further consideration as discussed below.

#### 15th Avenue NE Elevated Light Rail

**Concept:** While an elevated light rail concept along 15th Avenue NE could meet some of the project's purpose and need related to rider benefits and transit capacity, it has no clear transportation advantages over either I-5 or SR 99 because its accessibility is more limited. In addition, the concept would have

#### How the No Build Alternative was used in the AA Process

The No Build Alternative is defined to include those transportation facilities and services that are likely to exist in the forecast year. It provides the baseline against which the TSM and all build alternatives are compared in the AA process and establishes much of the information needed for development of the project's stated purpose and need. It is also the baseline for establishing the environmental impacts of the alternatives. All elements of the No Build Alternative are incorporated into each of the other alternatives except where an alternative replaces services or facilities inside the corridor.

#### Role of TSM/Baseline in the New Starts Process

The TSM/Baseline represents the best that can be done for mobility in the corridor without a major capital investment (e.g., constructing a new transit guideway). It provides an appropriate baseline against which the proposed transit build alternatives are compared during the New Starts rating and evaluation process and provides a "level playing field" with other transit projects competing for New Starts funds across the country.

#### Definition of BRT

The term bus rapid transit (BRT) covers a range of bus service operations that are, at a minimum, faster than traditional local bus or even express bus services and that, at a maximum, include grade-separated bus operations. The fundamental features of BRT systems are bus priority, faster passenger boarding, faster fare collection, all day frequent service, and a system image that is distinctly recognizable. BRT may improve mobility at relatively low cost through incremental investment in a combination of bus infrastructure, equipment, operational improvements, and technology.

potentially serious impacts on the local communities through which elevated light rail would pass. 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, which considers the following:

- High right-of-way impacts would occur to both residential and commercial properties. In station areas and at intersections, structures on both sides of the street could be removed.
- The alignment could adversely affect one or more parks, including the Jackson Park Golf Course, and numerous historic-era properties.
- The potential would exist for noise impacts to a substantial number of residences and other sensitive receptors, including the Fircrest School for the Developmentally Disabled.
- The scale of a roughly 30-foot-wide elevated guideway and up to 60-foot-wide, 400-foot-long elevated stations placed in the urban fabric of an existing mixed-use, built-up, narrow neighborhood arterial would have a high potential to affect neighborhood character and function, and would also include the removal of existing homes and neighborhood businesses.

### 15th Avenue NE At-Grade Light Rail

**Concept:** The at-grade light rail concept along 15th Avenue NE, while avoiding the impacts of large elevated structures, performs poorly from a transportation standpoint. Capacity is roughly half of that for the grade-separated alternatives, 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-mile-per-hour (mph) speed limit and 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 transit service of sufficient capacity. This concept would have similar impacts to the 15th Avenue NE Elevated Light Rail Concept.

### 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 and much longer than they would



15th Avenue NE in north Seattle

be with 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 substantial.

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

### 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.** This variation would connect light rail to SR 99 via a tunnel under the Haller Lake neighborhood and would not allow an at-grade station in the vicinity of SR 99 and North 130th Street. Because variations via North 110th Street or Roosevelt Way North perform equally or better and appear possible to construct without tunnels, this variation was dropped from further consideration.

#### **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 reconstructing the relatively new pedestrian and bicycle trail. Adding light rail would require legal agreements with the public power utilities, which may 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



SR 99 in Shoreline



Former Interurban Railway



Today's Interurban Trail

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 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 a station at Mountlake Terrace along I-5, missing this major transit node and the adjacent city center; 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. Using smaller portions of the right-of-way may be possible if sections of an SR 99 route prove more difficult, but not as a major route alignment option.

## S.6 LEVEL 1 ALTERNATIVES DEVELOPMENT AND EVALUATION

Five general concepts for meeting the project's purpose and need were developed further in the Level 1 evaluation. Besides a No Build Alternative, the Level 1 alternatives include a TSM/Baseline Alternative, two BRT alternatives, and two light rail alternatives, each of which includes numerous sub-alternatives.

### S.6.1 Level 1 Alternatives

The Level 1 alternatives included the following:

**No Build Alternative:** This alternative includes 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 important 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 the RapidRide E Line, which will connect Shoreline with downtown Seattle along SR 99.

**TSM/Baseline Alternative:** This alternative improves the regional bus system in the study area to the greatest extent possible short

of making a major new capital investment. Included are new express bus services connecting the Link light rail terminus at Northgate to Lynnwood, Mountlake Terrace, Shoreline, and North Seattle. Low-cost traffic engineering improvements to improve bus travel times and reliability as well as additional park-and-ride capacity are also added.

**L1: I-5 Light Rail Alternative:** This alternative extends light rail from Northgate to the Lynnwood Transit Center, generally in the existing I-5 right-of-way and includes four new stations, as well as supporting park-and-ride facilities and other station access improvements. This alternative includes a number of sub-alternatives for the placement of the light rail guideway and stations.

**L2: SR 99 Light Rail Alternative:** This alternative extends light rail from Northgate to the Lynnwood Transit Center via SR 99 through portions of Seattle, Shoreline, and Snohomish County. Two potential alignments for the southern connection through Seattle between Northgate and SR 99 are identified, as well as two options for connecting back to the Lynnwood Transit Center in Snohomish County. The portion of the light rail guideway along SR 99 would be a combination of at-grade and elevated structures (mixed profile). Five stations along with supporting park-and-ride facilities and access improvements are included in this alternative, with numerous sub-alternatives for the locations of these stations.

**B1: I-5 BRT Alternative:** This alternative replicates the I-5 light rail line using BRT service. Included in this alternative is the supporting infrastructure to allow BRT deployment using the HOV lanes of I-5 between the Lynnwood Transit Center and Northgate. This option includes new bus-only direct access ramps and BRT stations at 185th Street and 145th Street, along with bus-only ramps to connect the I-5 HOV lanes with an expanded transit center at Northgate. Supporting park-and-ride facilities and station access improvements are included

## LEVEL 1 ALTERNATIVES ASSUMPTIONS AND GUIDING PRINCIPLES

The following assumptions and guiding principles were used in the development and refinement 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.
- 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.



Mountlake Terrace Freeway Station

## Headway

Headway refers to the scheduled time between train or bus movements in a given direction. A headway of four minutes means that a train or bus is scheduled to arrive every four minutes in the given direction of travel.

and BRT service levels are similar to those included in the L1: I-5 Light Rail Alternative. This alternative also tests the possible effect on BRT operations if WSDOT eventually develops managed lanes capable of maintaining reliable 45-mph speeds along this section of I-5.

**B2: Multi-Corridor BRT Alternative:** This alternative includes three BRT routes to meet the travel needs of three corridors within the broader North Corridor. Routes include an I-5 Lynnwood-to-Northgate route that uses the I-5 HOV lanes and serves only the Mountlake Terrace Freeway Station; an SR 99 route that operates between Lynnwood and Northgate using the existing BAT lanes on SR 99 and accessing the I-5 HOV lanes via new bus-only direct access ramps at NE 130th Street; and a 15th Avenue NE line that begins in Mountlake Terrace and also accesses I-5 at NE 130th Street. All three routes would use new bus-only ramps connecting the I-5 HOV lanes with an expanded transit center at Northgate. Supporting park-and-ride facilities and station access improvements are also included. 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 at Northgate Station to and from the south only.



Link Light Rail along I-5 in Tukwila

## S.6.2 Level 1 Alternatives Evaluation and Findings

The TSM/Baseline and four Level 1 build alternatives were further developed and evaluated based on a more refined set of criteria designed to measure their effectiveness in meeting the project's purpose and need. This evaluation included measures of effectiveness in meeting the North Corridor's transportation needs, including ridership potential using forecasts from Sound Transit's forecasting model. The criteria also measured each alternative's ability to support land use and economic development goals and their environmental performance. Other criteria included estimates of capital and operation and maintenance (O&M) costs.

Primary distinguishing factors among the alternatives at this level of analysis include transportation performance, consistency with the Sound Transit Long-Range Plan, environmental performance, and cost and constructability. The review found that all alternatives generally met the purpose and need's objectives for community equity, land use, and economic development and were not major differentiators among the Level 1 alternatives. These factors are likely to become more important as the alternatives are developed in greater detail and more information is known, in particular about station locations, configurations, and the fit of the alternatives into the surrounding urban environment.

### TSM/BASELINE ALTERNATIVE

As would be expected, this alternative is the least effective of the alternatives in meeting the principal transportation needs when compared to the major capital investments of other alternatives. It has the lowest ridership, travel time savings, and capacity of all the build alternatives. On the positive side, it is the least costly and has the fewest likely potential impacts on the environment.

The TSM/Baseline Alternative was carried forward into the Level 2 evaluation because a refined version is needed as the baseline for the New Starts rating process used by FTA. However, as a result of the evaluation findings of the BRT alternatives, a number of additional capital facility and service improvements were added to improve the performance of the Level 2 TSM/Baseline Alternative.

### L1: I-5 LIGHT RAIL ALTERNATIVE

In general, this alternative performs best judged on transportation performance criteria, with the highest ridership, shortest travel times, and greatest capacity, and it would be the most reliable of all the build alternatives. Because this alternative involves major infrastructure investment and construction along its entire length, it has the second greatest potential for impacts on the environment and is the second most costly. Only the L2: SR 99 Light Rail Alternative, which requires substantially greater amounts of new transportation right-of-way, has greater possible impacts and costs.

The L1: I-5 Light Rail Alternative was carried forward into the detailed Level 2 evaluation. Work was undertaken in consultation with WSDOT to refine the guideway concept as well as to locate and configure stations and supporting access infrastructure.

### L2: SR 99 LIGHT RAIL ALTERNATIVE

In general, this alternative was the second best performing as judged on transportation performance criteria. 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 largest amount of new transportation right-of-way, it has the greatest potential to affect its surroundings and is the most costly. Finally, the initial traffic and rail operations analysis raised concerns about the reliability



*I-5 HOV direct access ramp in Lynnwood*

of trains operating every 4 minutes in each direction through a number of intersections along the alignment.

The L2: SR 99 Light Rail Alternative was carried forward into the detailed Level 2 evaluation. Conceptual design work was undertaken to refine the alignment plan and profile as well as locate and configure stations and supporting access infrastructure. In addition, more work was undertaken related to traffic and train operations along the SR 99 at-grade segments.

### B1: I-5 BRT ALTERNATIVE

In general, this alternative has similar overall transportation performance to the B2: Multi-Corridor BRT Alternative, but attracts fewer riders and has less travel time savings compared to B2. However, it is the most costly of the Level 1 bus alternatives 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 of the performance of the light rail alternatives

while having fewer potential impacts and substantially lower capital costs than the light rail alternatives.

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 adds very little ridership compared to the combination of a new BRT line running express on I-5 through these areas and an SR 99 BRT line 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.

Because of its performance and cost characteristics, the B1: I-5 BRT Alternative was dropped in favor of a refined B2: Multi-Corridor BRT Alternative.

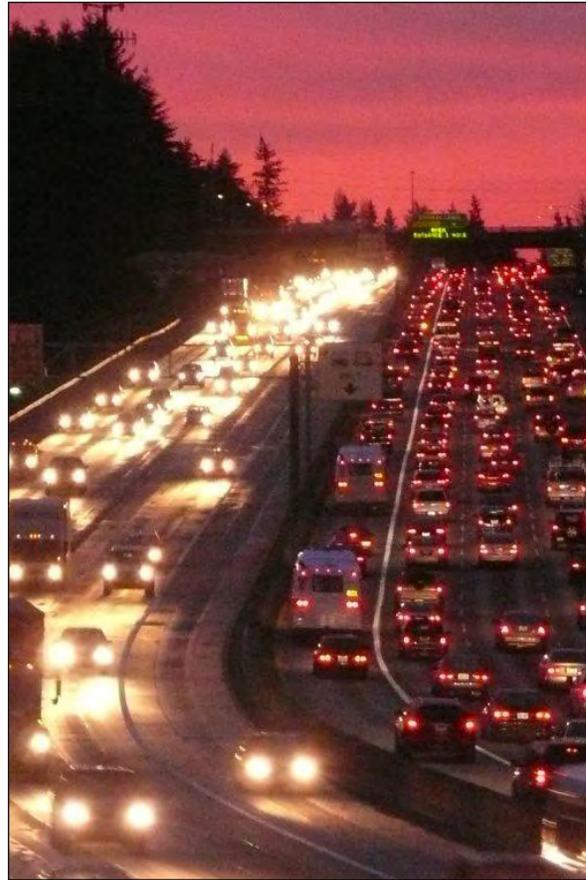
## **B2: MULTI-CORRIDOR BRT ALTERNATIVE**

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

Based on the Level 1 evaluation findings, a single BRT alternative with the best performing elements of the BRT alternatives evaluated so far was carried forward for detailed Level 2 evaluation.

## **POSSIBLE FUTURE CHANGES TO I-5 BY WSDOT**

An additional consideration for the evaluation of Level 1 alternatives relates to possible future changes to I-5 that are contemplated by WSDOT. The state's and region's long-range



*I-5 in Shoreline*

transportation plans call 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 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 and the project is not a part of the alternatives developed to meet the purpose and need of the North Corridor Transit Project. However, if implemented and successfully managed, these improvements could 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.

A sensitivity test undertaken as part of the Level 1 forecasting work concluded that the impacts to ridership on the I-5 BRT line would be minor. Although increasing peak-period running speeds to 45 mph would increase overall transit ridership on I-5 compared to the B1: I-5 BRT Alternative, nearly all the benefits would accrue to Community Transit's express routes to downtown Seattle and the University District rather than the Lynnwood to Northgate BRT line. This 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.

### What are Managed Lanes?

Managed lanes can be defined as highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions. They differ from traditional forms of lane management strategies in that they involve ongoing monitoring and active management, and may involve using more than one operational strategy. Operational strategies typically involve one or a combination of the following: pricing (e.g., tolled lanes), vehicle eligibility (e.g., high-occupancy toll (HOT) lanes or bus only facilities), and/or access control (e.g., reversible express lanes with limited access points). WSDOT is currently studying these types of strategies for providing mobility options in the I-5 corridor.

## S.7 LEVEL 2 ALTERNATIVES

In addition to the No Build and TSM/Baseline Alternatives, light rail in the I-5 and SR 99 corridors and BRT in the I-5, SR 99, and 15th Avenue NE corridors were carried forward into Level 2. The No Build Alternative remained unchanged from Level 1, but further concept development work resulted in the development of a more robust TSM/Baseline Alternative, two light rail alternatives on SR 99 (one fully elevated and one with a mixed profile similar to the Level 1 alternative), a more refined mixed profile alternative on I-5, and a more refined Multi-Corridor BRT Alternative. The primary elements of these alternatives are shown in Figures S-7, S-8, S-9, S-11, and S-12 and discussed in the following sections.

### S.7.1 TSM/Baseline Alternative

The Level 2 TSM/Baseline Alternative is a modified version of the alternative evaluated during Level 1, as summarized in Figure S-7. Based on the findings of the Level 1 evaluation of the TSM/Baseline Alternative and the two BRT alternatives, a number of

### Level of Detail of the Alternatives

For the purposes of comparison in AA, alternatives are developed at a general conceptual level sufficient to determine major trade-offs in performance, costs and possible impacts. At this level it is not possible to account for possible impact avoidance or mitigation. In general, even at Level 2 alternatives represent a family of concepts with many possible variations. Those alternatives judged most promising at each stage of the AA are developed in greater detail, but it is not until later design phases, following more detailed studies of sub-alternatives, that specific design elements are determined.

service changes and low-cost improvements appear promising and were added to the former. The primary elements of the Level 2 TSM/Baseline Alternative are three new express bus routes:

**I-5:** A route via I-5 connecting the existing Lynnwood Transit Center with the Link light

rail station at Northgate, with a stop at the existing Mountlake Terrace Transit Center freeway station.

**SR 99:** A route connecting the existing Edmonds Park-and-Ride with the Link light rail station at Northgate via SR 99, North 175th Street, and I-5. The route includes stops at 220th Street SW in Edmonds, an expanded Shoreline Park-and-Ride and Transit Center, North 175th Street and Meridian Avenue, and the existing NE 145th Street freeway flyer stop on I-5. This route would serve as an express service complementing the existing *Swift* and RapidRide BRT services. While sharing stations, facilities, and the BAT lanes, *Swift* and RapidRide services have much more frequent stops than the new express line.

**15th Avenue NE:** A route connecting the existing Mountlake Terrace Park-and-Ride and Transit Center with Northgate via 236th Street SW, 56th Avenue West, 19th Avenue NE, 15th Avenue NE, NE 175th Street, and I-5, with stops at Ballinger Way, NE 175th Street/15th Avenue NE, and the NE 145th Street freeway flyer stop.

In addition to the new express bus routes, the TSM/Baseline Alternative includes a number of new park-and-ride facilities; improvements and expansions at existing stations and park-and-ride facilities; as well as a number of modest cost traffic engineering, roadway, and signalization improvements to enhance the service additions. Also, the TSM/Baseline Alternative includes improvements in the Northgate area to provide buses with a shorter and more reliable route between I-5 and the Link light rail station. These improvements include the addition of a transit-only lane extending from the beginning of the I-5 southbound off-ramp to the intersection of Northgate Way, and then eastbound under the I-5 mainline in an added transit-only lane to the intersection of Northgate Way/1st Avenue NE, and then southbound for a short distance along 1st Avenue NE.

Similarly, a new northbound transit-only left-turn lane to supplement the existing left-turn lane at the intersection of 1st Avenue NE and the I-5 northbound on-ramp would provide travel time savings and improved reliability for northbound bus service accessing I-5.



Metro RapidRide Station



Mountlake Terrace Transit Center

## FEATURES AND SERVICE

### Three new express bus routes

Daily Service: 19.5 hours

#### Edmonds Park and Ride to Northgate:

Route connects Edmonds Park and Ride with Northgate Light Rail Station  
Intermediate Stops: 4  
Headways (Peak Hours): 12 minutes  
Headways (Off-peak Hours): 15 minutes

#### Lynnwood to Northgate: I-5 route connects

Lynnwood Transit Center with Northgate Light Rail Station  
Intermediate Stops: 1  
Headways (Peak Hours): 3.75 minutes  
Headways (Off-peak Hours): 15 minutes

#### Mountlake Terrace to Northgate: Route

connects the existing Mountlake Terrace Park and Ride and Transit Center with Northgate Station  
Intermediate Stops: 3  
Headways (Peak Hours): 15 minutes  
Headways (Off-peak Hours): 30 minutes

**Park and Rides:** New facilities, plus improvements and expansions at existing stations and park and ride facilities

**Transit Access:** Improvements to/from I-5 at Northgate

**Roadway and signalization improvements**

## CHANGES TO EXISTING SERVICE

- King County Metro Routes 301 and 303 replaced by Edmonds Park and Ride to Northgate Express Route
- Community Transit routes serving Aurora Village Transit Center extended south to Shoreline P&R
- King County Metro routes serving Aurora Village Transit Center truncated at the Shoreline P&R

## Transit Access Improvements To/From I-5

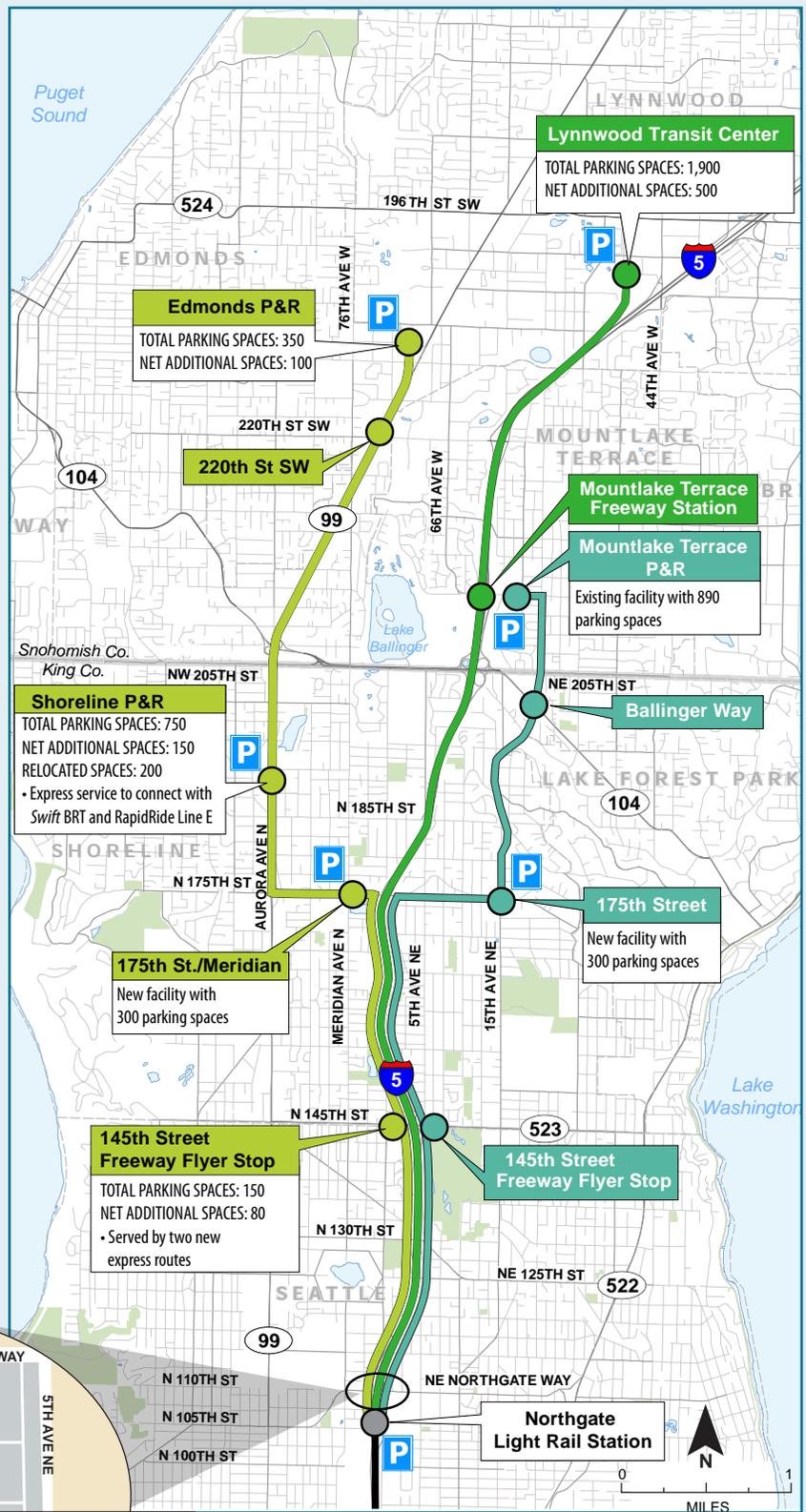
### Transit-only lane

Provides travel time savings and improved reliability for southbound bus service



### Transit-only left turn lane

Provides travel time savings and improved reliability for northbound bus service



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

- New Express Bus Route
- Express Bus Stop
- P Parking Available at Station
- North Link Light Rail
- North Link Station

Figure S-7. TSM/Baseline Alternative

## 5.7.2 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative advanced to Level 2 evaluation is similar to the alternative assessed during Level 1 evaluation. However, for Level 2 evaluation, the alignment was refined to take advantage of opportunities to place both the guideway and stations at ground level.

In general, placing the rail line at the same level as I-5, where possible, based on available right-of-way, topography, and other conditions, has numerous advantages over placing the line on aerial structure. In addition to reducing costs, ground-level placement has the potential to minimize visual and noise impacts on adjacent land uses and provides easier access for maintenance.

The alignment refinement resulted in a combination of an elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with intermediate stations at NE 145th Street, NE 185th Street, and SW 236th Street as shown in Figure S-8. Because of the topography along this section of I-5, many of the light rail ground-level sections would be in retained cut-and-fill sections adjacent to the freeway. Much of the line can be located within the existing freeway right-of-way, but there are a number of locations where

additional property would need to be acquired either for the guideway or for station facilities and park-and-ride structures.

The line starts at the Link light rail station at Northgate on the east side of I-5, which is now in final design and scheduled to open for service in 2021, and ends at the existing Lynnwood Transit Center on the west side of I-5. Because of the difficulties, impacts, and costs of crossing the freeway, the approach to alignment development at this stage was to minimize the number of times that the alignment crosses I-5. For the sections through Seattle and Shoreline, little if any space is available in the I-5 median, so the only alignments that avoid major roadway reconstruction are along the east or west side of the freeway. In Snohomish County, the I-5 median is wide enough to become a possible location for the light rail infrastructure without needing to rebuild the freeway.

The North 145th Street Station is best located on the east side of I-5, where an existing park-and-ride lot and other available right-of-way provide land to site the station, guideway, and a parking structure. The NE 185th Street Station could be sited on either the east or west side of I-5, but the light rail guideway is more ideally located on the east side to serve



*Elevated light rail*



*Light rail in retained cut*

### FEATURES AND SERVICE

Profile: Approximately 8.5 miles of elevated and ground-level double-track light rail

Service: Light Rail

Maximum Number of Vehicles: 4



Daily Service: 20 hours

Headways (Peak Hours): 4 minutes

Headways (Off-peak Hours): 10 minutes

Intermediate Stations: 3

### CHANGES TO EXISTING SERVICE

- Community Transit Route 112 to serve the Mountlake Terrace Station
- Local King County Metro routes in north King County would be adjusted to serve light rail
- All of Community Transit's south Snohomish County commuter routes to the University of Washington and downtown Seattle reallocated to provide feeder service to the Lynnwood, Mountlake Terrace, or 185th Street stations
- All Sound Transit routes from Snohomish County to Seattle terminate at Lynnwood Transit Center
- King County Metro commuter routes connecting with downtown Seattle, Overlake, and the University District (e.g., 242, 301, and 304) replaced with modified routes connecting to the light rail stations

#### Typical At-grade Cross-section

East Side of I-5

EXISTING I-5 NORTHBOUND



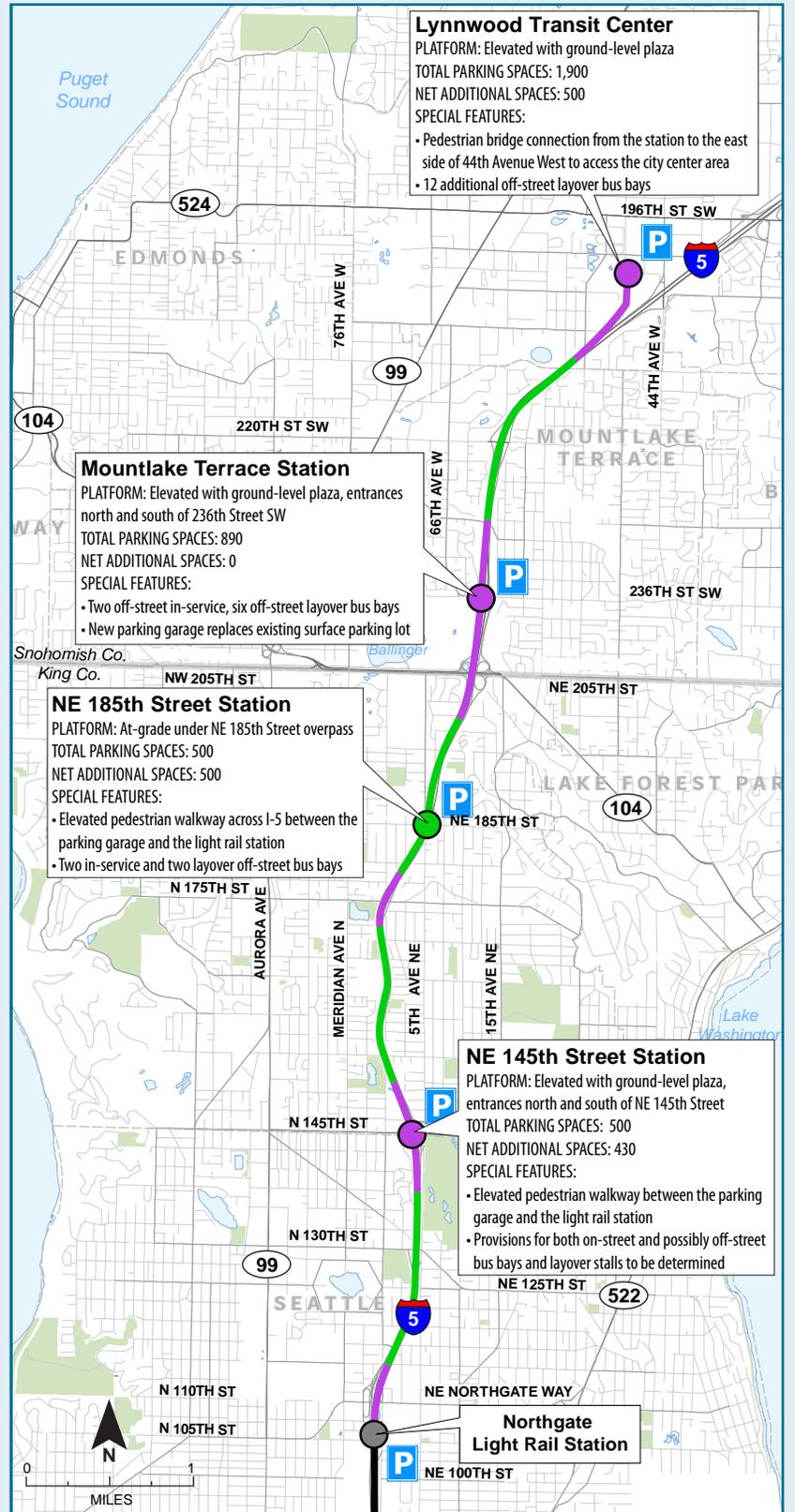
#### Typical Elevated Cross-section

East Side of I-5

EXISTING I-5 NORTHBOUND



Conceptual. Not to scale.



- Elevated Light Rail
- At-Grade Light Rail
- Elevated Light Rail Station
- At-Grade Light Rail Station
- North Link Light Rail
- North Link Station
- P Parking Available at Station

**Figure S-8. L1: I-5 Light Rail Alternative**

the NE 145th Street and Mountlake Terrace stations that appear to be best located on the east side of the freeway. This results in an alignment at 185th Street with the guideway and passenger platform located on the east side of I-5, but parking located on the west side connected by a pedestrian bridge over the freeway.

The Mountlake Terrace Station is best located either in the median of the freeway or the east side to take advantage of the existing transit infrastructure and minimize new transportation right-of-way requirements. For these reasons, the alignment chosen for the purposes of the Level 2 evaluation runs along the east side of I-5

from Northgate to Mountlake Terrace, crosses the I-5 northbound lanes north of Mountlake Terrace, then runs in the freeway median until it finally crosses the southbound lanes to reach the Lynnwood Transit Center.

In developing the I-5 light rail alignment, ongoing coordination with WSDOT led to a determination that the light rail infrastructure should be located so as to not unduly constrain future modifications to the freeway. In partnership with WSDOT, it was determined that this need could be satisfied by preserving an 84-foot-wide envelope extending from the current freeway centerline to a future eastern edge of pavement along the northbound lanes of I-5 between interchanges.



*Light rail transitions from elevated to at-grade*

The conceptual alignment developed is based on preserving this 84-foot-wide envelope between interchanges and assumes an additional 40-foot envelope for light rail operation at freeway level (i.e., at-grade, in retained cut or retained fill), which is generous in comparison to typical width requirements for at-grade rail on level ground (e.g., 30 feet).

### S.7.3 L2: SR 99 Mixed Profile Light Rail Alternative

The L2: SR 99 Mixed Profile Light Rail Alternative that advanced to the Level 2 evaluation is similar in concept to the L2: SR 99 Light Rail Alternative assessed as part of the Level 1 evaluation. It includes a combination of elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with four intermediate stations. Figure S-9 provides an overview of the alternative showing the primary alignment and two possible variations—one at the south and one at the north end.

The L2: SR 99 Mixed Profile Light Rail Alternative alignment begins on aerial structure at the Northgate Link Station, continues north and then turns west, crossing over I-5, and



*At-grade light rail at South Trenton Street*

### FEATURES AND SERVICE

Profile: Approximately 10.2 miles of elevated and ground-level double-track light rail

Service: Light Rail

Maximum Number of Vehicles: 4



Daily Service: 20 hours

Headways (Peak Hours): 8 minutes

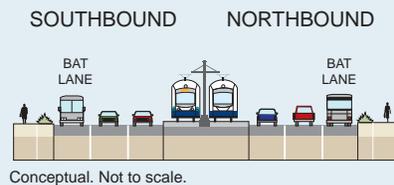
Headways (Off-peak Hours): 10 minutes

Intermediate Stations: 4

### CHANGES TO EXISTING SERVICE

- Community Transit and King County Metro: Routes to Aurora Village Transit Center extended to new Shoreline P&R
- Local north King County Metro routes truncated or extended to light rail stations
- All Sound Transit routes from Snohomish County to Seattle terminate at Lynnwood Transit Center
- Community Transit I-5 commuter routes connecting Edmonds with Seattle terminate at the Mountlake Terrace and Shoreline stations
- King County Metro Route 301 discontinued, and Route 304 truncated at the North 160th Street Station
- King County Metro RapidRide E Line BRT would interface with Community Transit's *Swift* BRT service at Shoreline P&R

#### SR 99 Typical At-grade Cross-section



- Elevated Light Rail
- At-Grade Light Rail
- Elevated Light Rail Sub-Alternative
- At-Grade Light Rail Sub-Alternative

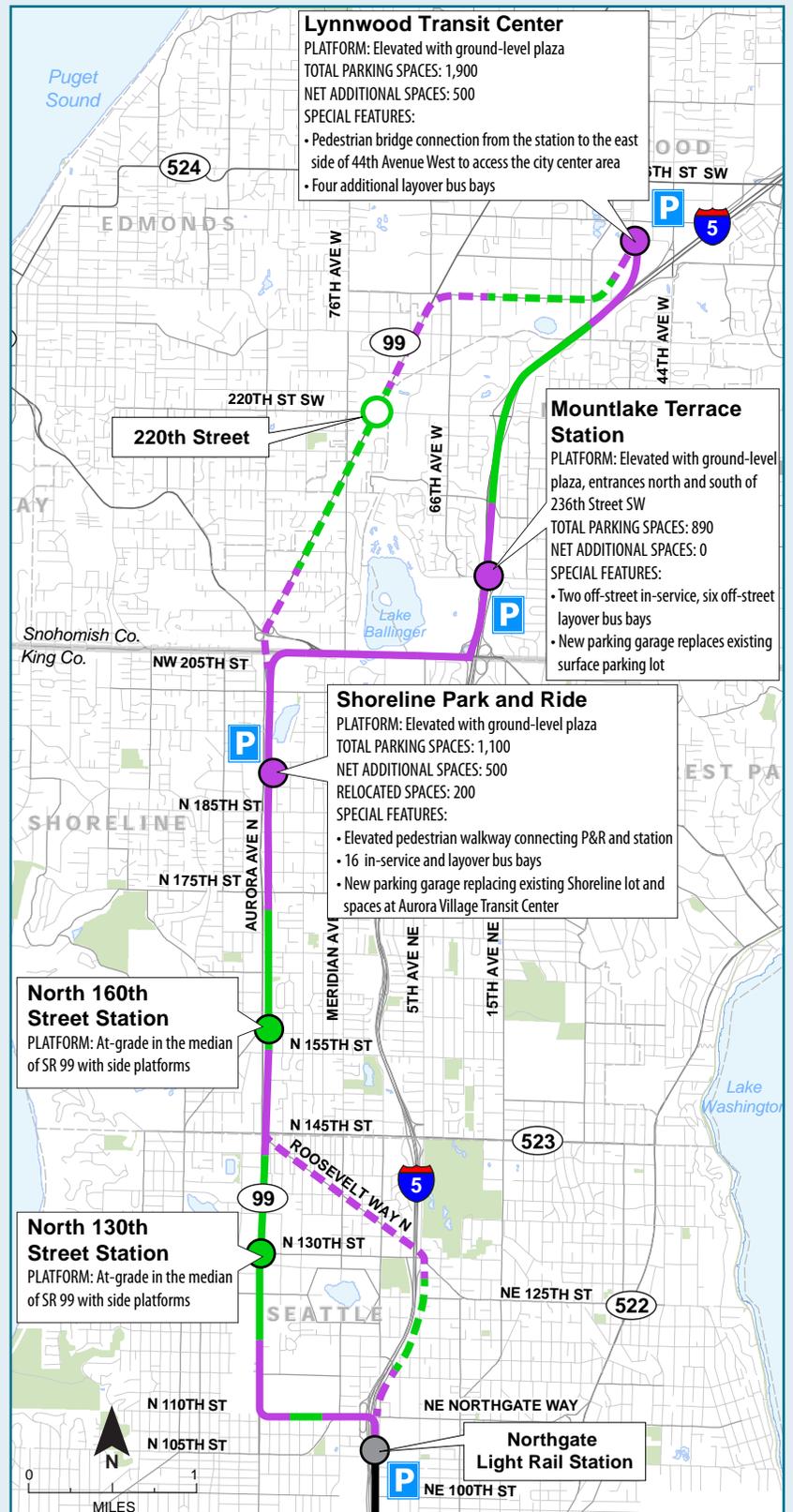


Figure S-9. L2: SR 99 Mixed Profile Light Rail Alternative

continues along Northgate Way and North 110th Street to SR 99. The aerial alignment would enter the median of SR 99 and continue north, to about North 120th Street, to minimize impacts on the adjacent cemetery. Throughout this section, the existing SR 99 roadway lane configuration would be maintained, with the exception of the center two-way left-turn lane that would be used for the column supports and for left-turn pockets for business access. North of North 120th Street, the alignment would transition to at-grade, and SR 99 would be widened to the east to provide space for the guideway in the median. An at-grade station would be located just north of North 130th Street. The station would be located in the median of SR 99 with side platforms and have a

total width of approximately 60 feet and length of approximately 380 feet.

North of the 130th Street Station, the at-grade alignment would continue in the center of SR 99 to approximately North 143rd Street, where it would transition to an elevated guideway to cross over the heaviest traffic intersections at North 145th Street and North 155th Street. The alignment would then shift back to at-grade just north of North 155th Street, where a station would be located at North 160th Street. The at-grade station at North 160th Street would be located in the median of SR 99 with side platforms, and have a total width of approximately 60 feet and length of approximately 380 feet.



Elevated light rail



SR 99 in Shoreline

North of the 160th Street Station, the alignment would continue at-grade in the SR 99 median to approximately North 173rd Street, where it would transition to an elevated structure. The elevated guideway would cross from the median to the west side of SR 99 and continue on the west side of SR 99 to an elevated station at the Shoreline Park-and-Ride (North 192nd Street). The functions now provided by the Aurora Village Transit Center would be relocated to the new Shoreline Park-and-Ride light rail station, creating a new multimodal facility supporting transfers among light rail, *Swift* and RapidRide BRT, park-and-ride lots, and local bus services.

North of the Shoreline Park-and-Ride Station, the elevated alignment would continue along the west side of SR 99. Near the King/ Snohomish County line, the aerial structure turns east crossing over SR 99 and continues along the south side of SR 104 until it nears I-5. It then crosses over SR 104 and I-5 and curves north to an elevated station straddling 236th Street SW. Station entrances would be located on both sides of the street to serve the Mountlake Terrace Transit Center, park-and-ride lot and freeway station. From this point northward to the Lynnwood Transit Center, the alignment is the same as the L1: I-5 Light Rail Alternative.

## Operating Considerations for At-Grade Light Rail on SR 99

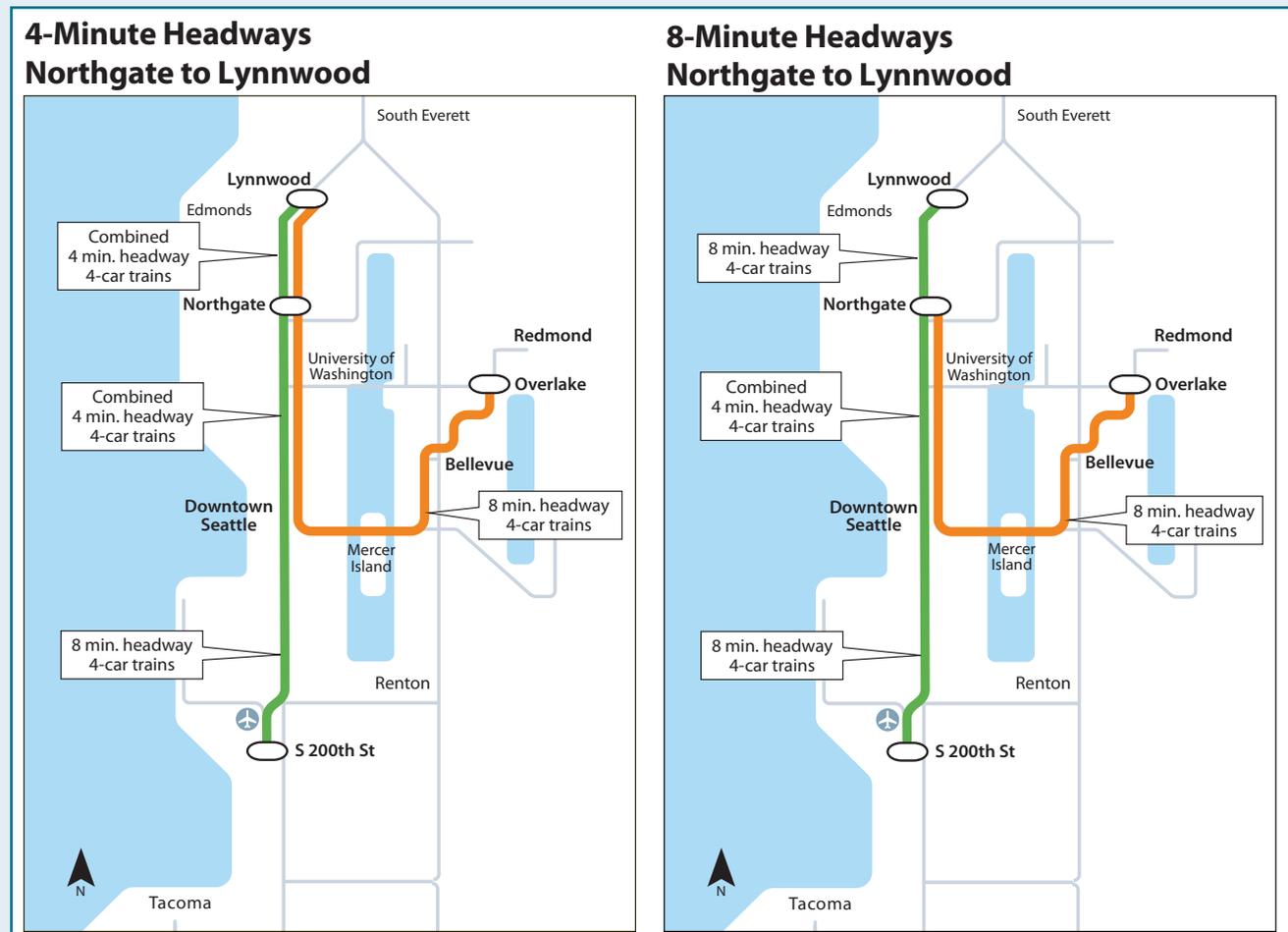
Early in the Level 2 alternatives development process, a decision was made to change from peak-period operation of 4-car trains at 4-minute headways to peak operation at 8-minute headways. This decision was based on analysis of traffic operations along SR 99 and the lessons learned to date as a result of at-grade median light rail operations along Martin Luther King Jr. Way in the city of Seattle.

Early work had indicated some potential for traffic congestion along the at-grade sections of the SR 99 alignment, so work was undertaken to better understand the possible impacts. At-grade light rail operating in the median of SR 99 will require trains to pass through a number of signalized intersections, exposing them to delays that will not occur with a completely grade-separated alignment. At-grade median-running light rail typically operates with traffic signal priority, and trains will need to stop at some signals with some unpredictability. Micro-simulation traffic modeling of SR 99 indicates that, while light rail operations could be fine-tuned to work with 4-minute headways, highly congested and unstable traffic conditions will result. These conditions will lead to a high probability of unpredictable train delays. When combined with the short train headways, schedule recovery from these delays will be difficult.

Another factor in determining the train headways that can be reliably maintained is how this segment fits within the regional rail network.

Figure S-10 illustrates the planned light rail system configuration once extensions are completed east to Overlake in Redmond, south to South 200th Street in SeaTac, and north to Lynnwood. As can be seen in Figure S-10, the system will operate with two lines, one from Lynnwood to South 200th Street and one from Lynnwood to Overlake. Both lines will operate at 8-minute peak-period headways resulting in 4-minute peak headways between the junction at the south end of the Seattle CBD and Lynnwood, and requiring every train operating in the system to traverse the segment between Northgate and Lynnwood. Ridership forecasting indicates that this level of service, at least south of Lynnwood, will be needed to accommodate forecasted demand in the future. As a result, any delays incurred in the segment between Northgate and Lynnwood will affect the operation of the entire light rail system. This problem becomes worse when the system is eventually built north to Everett, south to Tacoma, and east to downtown Redmond.

As a result, it was determined that 4-minute headway operation through signalized intersections along this portion of SR 99 was neither prudent nor practical. Instead, a decision was made to turn back the Overlake trains at Northgate and only continue the South 200th Street trains on to Lynnwood. This increases the headways along SR 99 to a more comfortable 8-minute operation.



**Figure S-10. 4- and 8-Minute System Operating Plans**

### S.7.4 L3: SR 99 Elevated Light Rail Alternative

The reduction of service levels necessitated in the L2: SR 99 Mixed Profile Light Rail Alternative led to the development of another SR 99 light rail alternative. The L3: SR 99 Elevated Light Rail Alternative evaluated in the Level 2 evaluation has a similar alignment to the L2: SR 99 Mixed Profile Light Rail Alternative with the exception that the entire section along SR 99 would be elevated, as shown in Figure S-11. The differences between the L2 and L3 alternatives occur between approximately North 120th Street and North 175th Street. This fully grade-separated alignment along SR 99 would allow for operations at 4-minute headways during peak periods.



*Elevated light rail*

The L3 alignment assumes the elevated guideway is located on the west side of SR 99, north of North 120th Street.

Alternatively, the alignment could be located either in the median or on the east side of SR 99, though either one would have drawbacks. An elevated guideway in the median of SR 99 would require major roadway reconstruction and widening to accommodate left-turn demand at each signalized intersection.

Median placement would result in traffic impacts because the current two-way left-turn lane would be removed to make space available for column placement. All left turns and U-turns would be consolidated at the signalized intersections, adding to the amount of roadway reconstruction. The cost and complexity of stations would also increase because either a mezzanine level or street level plaza would be required in the median below the passenger platform. For these reasons, a median elevated guideway was not used in this analysis.

Initial evaluation suggests that there are not major differences in the guideway impacts if it is located on the east side instead of the west side. However, both the 160th Street and Shoreline Park-and-Rides appear to be better situated on the west side of SR 99. At 160th Street, existing commercial and high-density residential land uses are located on the west side. The existing Shoreline Park-and-Ride provides a location on the west side that can be redeveloped with an expanded transit center. For these reasons, a primary alignment was chosen for the purposes of the Level 2 evaluation that runs along the west side of SR 99.

### S.7.5 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. As shown in Figure S-12, included are 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; a line serving north Seattle and Shoreline in the SR 99 corridor that connects to I-5 at NE 130th Street; and 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 at the Northgate Station. 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 signal priority improvements would be provided 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 in order to use them. The BRT service mostly would use existing Community Transit *Swift* or King County Metro RapidRide stations. Real-time operating information, CCTV, and off-board fare collection would be

incorporated at BRT stations. Five new BRT stations would be required. Four of these stations are in the 15th Avenue NE corridor, with one in the SR 99 corridor, as follows:

- Ballinger Way NE/19th Avenue NE
- NE 175th Street/15th Avenue NE
- NE 145th Street/15th Avenue NE
- NE 125th Street/15th Avenue NE
- SR 99/North 160th Street

The I-5 BRT route would use the existing direct access ramps at Lynnwood, the HOV lanes on I-5, as well as the Mountlake Terrace Freeway Station. New HOV direct access ramps would be constructed to and from the south at North 130th Street to allow the SR 99 and 15th Avenue NE routes to access the I-5 HOV lanes there. New transit-only ramps would be constructed to and from the north near Northgate to serve all three BRT routes. The existing HOV lanes would be used with no modifications except as needed for the new direct access ramps. The existing configuration of I-5 has very little to no median space between Northgate and 236th Street SW. In addition, most of the HOV lanes along this segment of I-5 do not have shoulders that meet current WSDOT standards. Any modifications to the HOV lanes and ramps to the HOV lanes would require widening I-5 to accommodate the proposed ramps and possibly standard shoulder widths.



Lynnwood HOV direct access ramp



Swift station on SR 99



## S.8 LEVEL 2 ALTERNATIVES EVALUATION

### S.8.1 Summary Evaluation

Table S-1 provides a summary of the Level 2 evaluation findings organized by category of the North Corridor Transit Project's Purpose and Need Statement. The purpose and need is summarized into six broad categories of evaluation measures that were applied to the alternatives. The six categories include those of local importance as well as FTA guidance on recommended factors to be considered in an AA. The findings summary in Table S-1 for the build alternatives shows the change in performance compared to the No Build Alternative for each performance measure. The color shadings run from dark green to light green in tones that indicate the performance of the alternatives going from best performing to worst performing. Red shading indicates where an alternative fails to meet the project's purpose and need related to that specific measure. The TSM/Baseline Alternative is shown in grey because this alternative is developed solely for the purposes of the FTA New Starts criteria comparisons.



Existing Lynnwood Transit Center

### S.8.2 Key Findings by Purpose and Need Category

The sections that follow highlight the key findings of the Level 2 evaluation organized by elements of the Purpose and Need Statement.

#### TRANSPORTATION EFFECTIVENESS

Thirteen criteria were used to assess the transportation performance of the alternatives using 2030 as the design year. The L1: I-5 Light Rail Alternative was the best performing on 8 of the 13 criteria and equal in performance to the next best performing L3: SR 99 Elevated Light Rail Alternative on 4 of the other measures. The L2: SR 99 Mixed Profile Light Rail Alternative was substantially lower on 11 of the 13 criteria compared to the other light rail alternatives. In addition, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to be at 95 percent of capacity in 2030, while the fully grade-separated light rail alternatives have substantial capacity to carry additional riders. The B2: Multi-Corridor BRT Alternative was the poorest performing of the build alternatives, generally ranking last on most measures. Findings by key category include the following:

**Annual New Riders:** This measure counts travelers who previously did not ride transit but are attracted by the project's new facilities and services. Annual new riders are highest for the L1: I-5 Light Rail Alternative, followed by the L3: SR 99 Elevated Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative has only half the new riders of the best performing L1: I-5 Light Rail Alternative; the B2: Multi-Corridor BRT Alternative is last with under one quarter of the new riders of the best performing L1: I-5 Light Rail Alternative.

**Annual Hours of Travel Time Saved:** Travel time savings over the entire transit system as a result of the project is the key measure of user

benefit assessed in the analysis. The pattern of performance of the alternatives is very similar to the performance on the new riders measure. The L1: I-5 Light Rail Alternative saves the most travel time at 4.6 million hours annually, followed by the L3: SR 99 Elevated Light Rail Alternative at 3.8 million hours annually. Savings for the L2: SR 99 Mixed Profile Light Rail Alternative are substantially less at 2.4 million, and the B2: Multi-Corridor BRT Alternative saves the fewest hours at 1 million annually.

**Passenger Capacity:** Both directional carrying capacity and the share of total capacity that would be filled in the 2030 design year were determined. The latter measure provides information about how much growth—beyond target year ridership—the system could accommodate, and also whether the system would have room for additional riders if it were extended north to Everett, as envisioned in Sound Transit’s Long-Range Plan.

Both the L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative have capacity of 8,880 passengers per hour per direction. By 2030 it is estimated that 72 percent of the L1: I-5 Light Rail Alternative’s capacity and 62 percent of the L3: SR 99 Elevated Light Rail Alternative’s capacity would be required to meet peak hour demand, with the excess capacity available for continued growth in ridership in the project area and for additional demand if the system is extended north to Everett. The L3: SR 99 Elevated Light Rail Alternative has slightly greater excess capacity in the year 2030 than the L1: I-5 Light Rail Alternative since SR 99 forecast ridership is lower but its capacity is the same as I-5.

The L2: SR 99 Mixed Profile Light Rail Alternative has half the capacity of L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative, because it operates on 8-minute rather than 4-minute headways. The factors constraining the L2: SR 99 Mixed Profile Light Rail Alternative headways are the five signalized intersections that would be traversed in this

alternative. As a result, the L2: SR 99 Mixed Profile Light Rail Alternative would operate at 95 percent capacity in 2030 with virtually no capacity for ridership growth in the corridor or for extending the system to Everett.

The B2: Multi-Corridor BRT Alternative has the lowest directional capacity of the build alternatives and is estimated to operate at 86 percent of its capacity by 2030. The primary limiting factor for this alternative is the capacity of the expanded Northgate Transit Center to accommodate buses transferring riders to the North Link light rail line.

**Travel Time:** The speed advantage of the L1: I-5 Light Rail Alternative is reflected in travel time differences for specific individual trips. Light rail in the L1: I-5 Light Rail Alternative cuts peak-period transit travel time between Lynnwood and Northgate in half, compared to the bus in the TSM/Baseline Alternative, and is 20 minutes faster than by automobile. The L3: SR 99 Elevated Light Rail Alternative is the next best performer, but 4 minutes slower than the L1: I-5 Light Rail Alternative. This is



Sound Transit light rail station

**Table S-1. Level 2 Alternatives Evaluation Summary****KEY TO RANKING**

	<b>TSM</b> TSM/Baseline	<b>L1</b> I-5 Light Rail	<b>L2</b> SR 99 Mixed Profile Light Rail	<b>L3</b> SR 99 Elevated Light Rail	<b>B2</b> Multi-Corridor BRT
<b>Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs</b>					
2030 Project Daily Riders	21,000 <i>Daily Riders</i>	52,000 <i>Daily Riders</i>	41,000 <i>Daily Riders</i>	48,000 <i>Daily Riders</i>	24,000 <i>Daily Riders</i>
2030 Annual New Riders	0.64 million <i>New Riders</i>	4.5 million <i>New Riders</i>	2.5 million <i>New Riders</i>	3.9 million <i>New Riders</i>	1.1 million <i>New Riders</i>
2030 Annual Hours of Travel Time Saved	0.59 million <i>Hours Saved</i>	4.6 million <i>Hours Saved</i>	2.4 million <i>Hours Saved</i>	3.8 million <i>Hours Saved</i>	1 million <i>Hours Saved</i>
2030 New Weekday Transit Trips to Regional Centers	1,500 <i>More Trips</i>	10,400 <i>More Trips</i>	5,300 <i>More Trips</i>	8,400 <i>More Trips</i>	2,500 <i>More Trips</i>
Capacity in passengers per hour per direction (pphpd)	1,680 <i>pphpd</i>	8,880 <i>pphpd</i>	4,440 <i>pphpd</i>	8,880 <i>pphpd</i>	3,600 <i>pphpd</i>
2030 Peak Hour Passenger Demand/Capacity	At capacity	72%	95%	62%	86%
2030 Peak Transit Travel Time: Lynnwood to Northgate	30 minutes	14 minutes	21 minutes	18 minutes	24 minutes
2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Northgate)	4 minutes <i>FASTER than Auto</i>	20 minutes <i>FASTER than Auto</i>	13 minutes <i>FASTER than Auto</i>	16 minutes <i>FASTER than Auto</i>	10 minutes <i>FASTER than Auto</i>
2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Downtown)	6 minutes <i>SLOWER than Auto</i>	10 minutes <i>FASTER than Auto</i>	3 minutes <i>FASTER than Auto</i>	6 minutes <i>FASTER than Auto</i>	Similar to Auto
Operations on Non-Exclusive Right-of-Way	23.8 miles	0 miles	0 miles	0 miles	25.8 miles
Signalized Intersections Traversed	30 <i>Intersections</i>	0 <i>Intersections</i>	5 <i>Intersections</i>	0 <i>Intersections</i>	50 <i>Intersections</i>
Number of Transfers to Reach Major Destinations	1 <i>Transfer</i>	0 <i>Transfers</i>	0 <i>Transfers</i>	0 <i>Transfers</i>	1 <i>Transfer</i>
2030 Reduction in Weekday VMT	16,900 <i>Fewer Miles</i>	191,500 <i>Fewer Miles</i>	85,200 <i>Fewer Miles</i>	160,700 <i>Fewer Miles</i>	33,100 <i>Fewer Miles</i>
<b>Purpose and Need: Equitable Community Impacts and Benefits</b>					
Impacts on Affected Communities	Low	Moderate	High	Moderate to High	Low
Transportation Benefits to Affected Communities	Low	High	Moderate	Moderate to High	Low
<b>Purpose and Need: Supportive Land Use and Economic Development Effects</b>					
Access to Regional Growth Centers	Low	High	Moderate	Moderate to High	Low
Station Areas with High TOD Potential	Not Applicable	1 <i>of 4 Station Areas</i>	2 <i>of 5 Station Areas</i>	2 <i>of 5 Station Areas</i>	2 <i>of 10 Station Areas</i>

**Table S-1. Level 2 Alternatives Evaluation Summary (continued)**

**KEY TO RANKING**



	<b>TSM</b> TSM/Baseline	<b>L1</b> I-5 Light Rail	<b>L2</b> SR 99 Mixed Profile Light Rail	<b>L3</b> SR 99 Elevated Light Rail	<b>B2</b> Multi-Corridor BRT
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**Purpose and Need: Preservation of a Healthy Environment**

*At this level of concept development and analysis, measures do not account for possible impact avoidance and mitigation.*

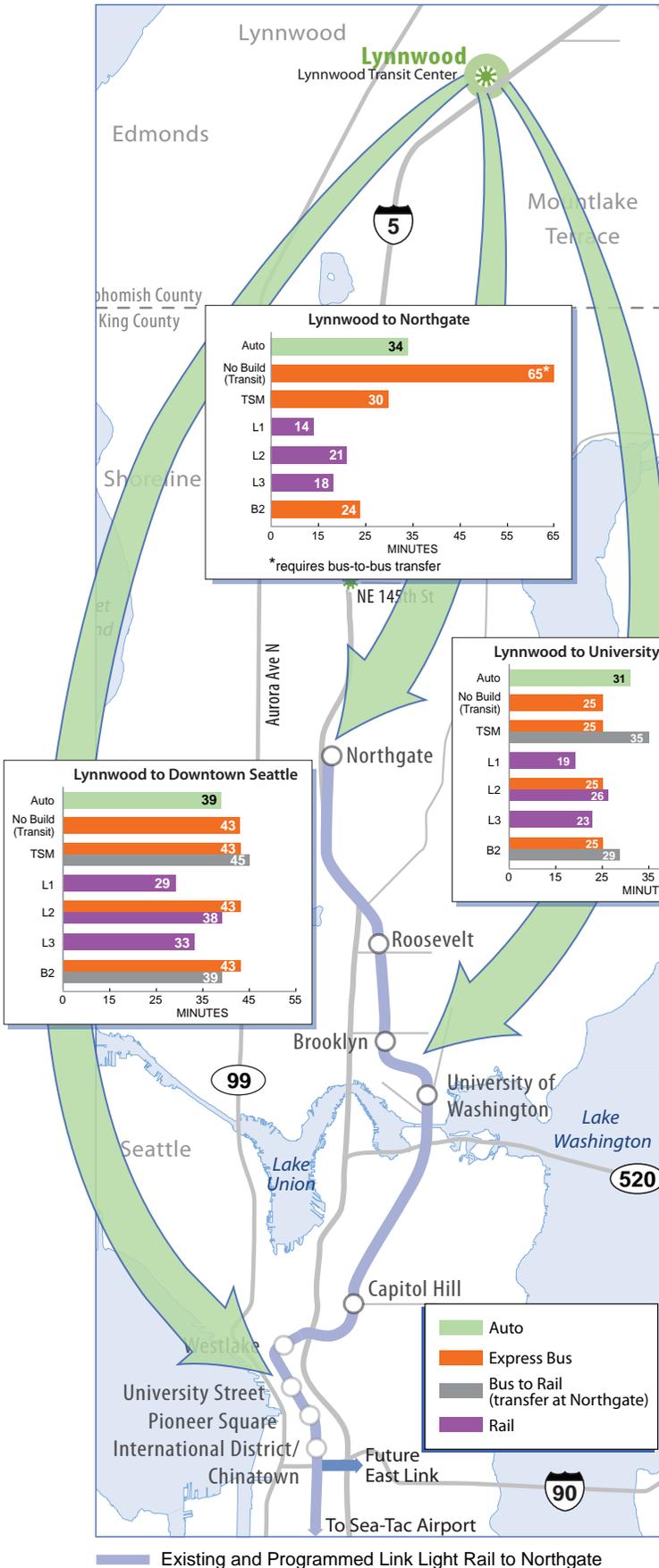
Ecosystem Effects	Low	Possible High Effects on Several Sensitive Areas	Possible High Effects on Several Sensitive Areas	Possible High Effects on Several Sensitive Areas	Possible Moderate Effects on Several Sensitive Areas
Water Resources Effects	Low	Moderate	Low to Moderate	Low to Moderate	Low
Potential Park or Historic Resources Effects, Including Section 4(f) Properties	Low	Low to Moderate	Low to Moderate	Low to Moderate	Low
Daily Reduction in Greenhouse Gas Emissions	Similar to No Build	235 tons	33 tons	223 tons	Similar to No Build
Visual Impacts	Low	Moderate, with Localized High	Moderate, with Localized High	Moderate, with Localized High	Low
Potential for Noise Impacts Requiring Mitigation	Low	Moderate to High	Moderate to High	Moderate to High	Low
New Transportation Right-of-Way Required	5 Acres 0 to 5 Parcels	22 Acres 140 to 170 Parcels	44 Acres 320 to 370 Parcels	40 Acres 200-230 Parcels	8 Acres 20-30 Parcels
Traffic Impacts	Minimal	Minor Corridor-wide Improvements	Minor Degradation at SR 99 Intersections	Minimal	Minimal
Pedestrian and Bicycle Travel	Minimal	Improvements Possible Over Time Near Stations	Improvements Possible Over Time Near Stations	Improvements Possible Over Time Near Stations	Minimal
Construction Effects on Transportation System	Low Impacts	Low to Moderate Impacts over Long Duration	High Impacts over Long Duration	Moderate Impacts over Long Duration	High Localized Impacts

**Purpose and Need: Cost and Constructability**

Capital Costs (Millions of Mid-2010 Dollars)	\$200 to \$230	\$1,420 to \$1,640	\$1,830 to \$2,100	\$2,010 to \$2,310	\$640 to \$730
2030 Net Annual Operations and Maintenance Costs (Millions of Mid-2010 Dollars)	\$17.6	\$11.0	\$10.4	\$14.6	\$33.6
Cost per Hour of 2030 User Benefits (Mid-2010 Dollars)	\$60 to \$64	\$25 to \$28	\$61 to \$69	\$42 to \$48	\$91 to \$99
Incremental Cost per 2030 New Passenger (Mid-2010 Dollars)	\$55 to \$59	\$25 to \$29	\$58 to \$67	\$41 to \$46	\$83 to \$90

**Purpose and Need: Consistency with Sound Transit's Long-Range Vision**

Meets State Definition of HCT	No	Yes	Yes	Yes	No
Consistent with ST Long-Range System Plan	No	Yes	No	Yes	No



followed by the L2: SR 99 Mixed Profile Light Rail Alternative, which is 7 minutes slower than light rail in the L1: I-5 Light Rail Alternative. Finally, the bus in the B2: Multi-Corridor BRT Alternative is 10 minutes slower than light rail in the L1: I-5 Light Rail Alternative. Similar results can be seen in travel times between Lynnwood and other regional centers (Figure S-13) where the L1: I-5 Light Rail Alternative has the shortest AM peak hour travel times to both the University District and to downtown Seattle for all alternatives, and is 10 to 12 minutes faster than by automobile.

**Measures of Reliability:** Miles of operation on non-exclusive right-of-way and the number of at-grade signalized intersections traversed are indicators of potential sources of variable travel delays and resulting unreliable travel times. In many respects the reliability of trip times are as important to riders as actual travel times. On these measures, both the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative result in the most reliable travel times because both operate on fully exclusive, grade-separated guideways. The L2: SR 99 Mixed Profile Light Rail Alternative would be less reliable because it includes five signalized intersections; the B2: Multi-Corridor BRT Alternative would be the least reliable because of the mixed traffic and HOV lane operations.

**Impacts to Existing Transit Service:** Both the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail alternatives would replace the existing I-5 Community Transit express bus routes that connect Snohomish County to destinations in Seattle. Because of the slower rail travel times and lower capacity these bus routes would continue to operate on I-5 with the L2: SR 99 Mixed Profile Light Rail Alternative. While light rail on either the I-5 or SR 99 corridor would affect ridership on King County Metro’s RapidRide BRT and Community Transit’s *Swift* BRT lines operating along SR 99, the SR 99 light rail alternatives would more directly

**Figure S-13. Year 2030 Auto and Transit AM Peak Hour Travel Times**

connect to and compete with those services. Metro's RapidRide E line could experience lower ridership as some riders choose instead to use light rail along SR 99, while Community Transit's *Swift* line could see increased ridership prompted by a direct connection to light rail in Shoreline not provided by light rail running along I-5. The B2: Multi-Corridor BRT Alternative would have impacts to existing transit services similar to the L2: SR 99 Mixed Profile Light Rail Alternative.

### EQUITABLE COMMUNITY IMPACTS AND BENEFITS

Community equity looks at potential adverse and beneficial effects on minority and low income populations and communities, generally categorized as "environmental justice communities." Considerations include construction effects, effects on community cohesion and interaction, effects on community facilities, and displacement of residences and businesses. Community benefits include long-term mobility improvements, improvements in travel times, and increased access to employment opportunities.

All of the alternatives are located in an area where there are higher percentages of low income and minority populations compared to the rest of King County or Snohomish County. Many of these communities are located in the band between SR 99 and I-5 and extend from Northgate to Lynnwood.

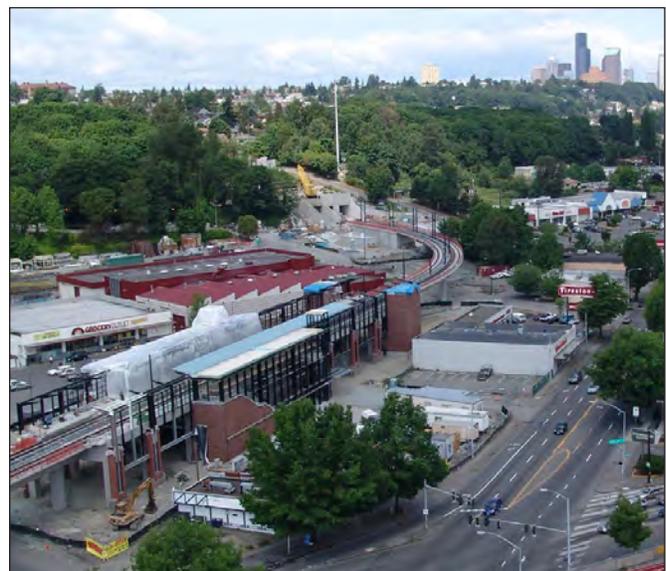
Impacts on affected communities for the B2: Multi-Corridor BRT Alternative are low because new facilities would be limited. Community impacts are moderate for the L1: I-5 Light Rail Alternative, high for the L2: SR 99 Mixed Profile Light Rail Alternative, and moderate to high for the L3: SR 99 Elevated Light Rail Alternative. The L1: I-5 Light Rail Alternative would be constructed along the freeway with fewer potential effects on identified environmental justice communities than either of the SR 99

alternatives, which are built in new right-of-way along a fully developed arterial highway.

Community benefits are higher for the L1: I-5 Light Rail Alternative because it attracts more riders and provides faster service, moderate to high for the L3: SR 99 Elevated Light Rail Alternative, and moderate for the L2: SR 99 Mixed Profile Light Rail Alternative. Community benefits for the B2: Multi-Corridor BRT Alternative are low because it attracts the fewest riders and has the longest travel times.

### SUPPORTIVE LAND USE AND ECONOMIC DEVELOPMENT EFFECTS

Two key categories were used to assess land use and economic development performance: access to regional growth centers and station areas with high transit-oriented development (TOD) potential. The first measure addresses the fundamental question of how well each alternative serves the region's adopted growth management and economic development strategies, while the second addresses TOD potential near individual stations within the project area.



Sound Transit light rail station

**Access to Regional Growth Centers:** The North Corridor Transit Project connects two of the PSRC-designated VISION 2040 regional growth centers (Lynnwood and Northgate) to each other and the other segments of the regional transit system. By this measure, the L1: I-5 Light Rail Alternative performs best, followed by the L3: SR 99 Elevated Light Rail Alternative, the L2: SR 99 Mixed Profile Light Rail Alternative, and finally the B2: Multi-Corridor BRT Alternative. This ranking and relative performance is the result of the quality, as measured by ridership and travel time, and quantity, as measured by capacity, of transportation that is provided.

**Transit-Oriented Development Potential:** On TOD potential, however, the alternatives are distinguished from each other in a different order. The L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative perform best on this measure because the three stations along SR 99 would provide more opportunities for TOD—where there is already a mix of supportive land uses and density—than would the two stations along I-5 in King County, which are in predominantly single-family dwelling residential neighborhoods. The three light rail alternatives share common stations at

Northgate, Mountlake Terrace, and Lynnwood. The B2: Multi-Corridor BRT Alternative also outperforms the L1: I-5 Light Rail Alternative, again because of TOD opportunities that would be created in already existing centers, but it does not rank as high as the SR 99 light rail alternatives (L2 and L3) because of less favorable station locations.

## PRESERVATION OF A HEALTHY ENVIRONMENT

Environmental measures focus on the range of effects on the natural environment including water, air, endangered and protected species, and sensitive lands, as well as on the human environment including aesthetics, noise, historic and archaeological resources, property, and existing traffic, transit, pedestrian, and bicycle travel. While there are areas where environmental impacts are anticipated, none of the alternatives is expected to have impacts that would prevent an alternative from being implemented. At this level of concept development and analysis, the environmental measures do not yet reflect the impact of avoidance and mitigation measures that the project would incorporate through further design and environmental efforts. Despite these qualifications, there are some differences in the level of impacts among the alternatives, including:

**General Effects:** The light rail alternatives would construct the largest amounts of new transportation infrastructure and would require more right-of-way dedicated to transportation in the corridor. This would result in more effects on the environment. The L2: SR 99 Mixed Profile Light Rail Alternative would have the greatest effects followed by the L3: SR 99 Elevated Light Rail Alternative, the L1: I-5 Light Rail Alternative, and then the B2: Multi-Corridor BRT Alternative.

**Reduction in Greenhouse Gas Emissions:** Reductions in these emissions are a function of the reductions in vehicle miles traveled (VMT) and roadway congestion. While the



*Link light rail near SeaTac*

forecasts are made at a regional level, several of the alternatives would result in notable reductions in vehicle emissions, providing environmental benefits. The L1: I-5 Light Rail Alternative is forecasted to result in the largest emission reductions, followed by the L3: SR 99 Elevated Light Rail Alternative. Emission reductions for the L2: SR 99 Mixed Profile Light Rail Alternative would be roughly 15 percent of those resulting from the L1: I-5 Light Rail Alternative, while the B2: Multi-Corridor BRT would be similar to the No Build Alternative.

**Noise:** The light rail alternatives would all be near a large number of noise-sensitive properties and have the potential for noise impacts requiring mitigation. Mitigation for the L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative could be more complex, particularly for the at-grade sections of SR 99. Noise walls would be less effective given the nature of the uses fronting the arterial and the need for frequent driveway and street access. The elevated sections also have the potential to create noise impacts at greater distances. Mitigation would likely involve noise barriers along the elevated sections, which would increase the visual prominence of the guideway.

For the L1: I-5 Light Rail Alternative, there are also a large number of noise-sensitive properties nearby including many single-family homes, but there are more opportunities to avoid impacts through guideway placement (for example, below the existing I-5 cut slopes) or mitigate them with noise walls. As with SR 99, the elevated guideway sections on I-5 would have the potential to cause noise impacts. Potentially affected sensitive receptors would be substantially fewer for the B2: Multi-Corridor BRT Alternative.

**Acquisitions and Displacements:** The light rail alternatives require continuous construction of new transportation facilities for the length of the alignment, and therefore have the greatest

potential impacts. Acquisitions are greatest for the L2: SR 99 Mixed Profile Light Rail Alternative because the existing SR 99 right-of-way is already fully developed and adding light rail requires all new rights-of-way. This is followed by the L3: SR 99 Elevated Light Rail Alternative, which requires slightly less new transportation right-of-way than the L2: SR 99 Mixed Profile Light Rail Alternative because of the smaller ground footprint of the elevated sections. The L1: I-5 Light Rail Alternative, which uses portions of unused I-5 WSDOT right-of-way, requires roughly half the new transportation right-of-way required by the L2: SR 99 Mixed Profile Light Rail Alternative. The B2: Multi-Corridor BRT Alternative requires substantially less new right-of-way in more localized areas than the light rail alternatives.

## COST AND CONSTRUCTABILITY

Project affordability was evaluated based on capital costs and annual O&M costs, and on cost-effectiveness measures, including the cost per unit of user benefit and cost per new rider. Key findings on these measures include the following:

**Capital Costs (mid-2010 dollars):** These vary greatly among the alternatives. With a range of \$2,010 to \$2,310 million, the



*Elevated light rail*

L3: SR 99 Elevated Light Rail Alternative would be the most costly to build. The L2: SR 99 Mixed Profile Light Rail Alternative is nearly as costly with an estimated range of \$1,830 to \$2,100 million. This is followed by the L1: I-5 Light Rail Alternative at a total capital cost of \$1,420 to \$1,640 million, which is roughly \$400 to \$500 million less than the range for the L2: SR 99 Mixed Profile Light Rail Alternative and \$600 to \$700 million less than the L3: SR 99 Elevated Light Rail Alternative. At \$640 to \$730 million in total, the B2: Multi-Corridor BRT Alternative would be substantially less costly than the rail alternatives, and at \$200 to \$230 million the TSM/Baseline Alternative would be the least costly to build.

**Net Annual O&M Costs in 2030 (mid-2010 dollars):** These costs include savings in Sound Transit express regional bus services that would no longer be needed. Both King County Metro and Community Transit also are likely to see operating cost savings as a result of bus services that will no longer be needed with implementation of some of the light rail alternatives. These potential savings, however,

are not included in the estimates, as they would accrue to those agencies, not Sound Transit, and will not be available to offset Sound Transit costs.

In general, the bus alternatives have very high service levels to meet the high travel demand in the North Corridor. This results in very high labor costs for both the TSM/Baseline and B2: Multi-Corridor BRT Alternatives and proportionately high O&M costs compared to the light rail alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative would be the least costly at \$10.4 million per year, followed closely by the L1: I-5 Light Rail Alternative at \$11.0 million annually, and the L3: SR 99 Elevated Light Rail Alternative at \$14.6 million. The TSM/Baseline Alternative would be next at \$17.6 million and the B2: Multi-Corridor BRT Alternative would be the most expensive at \$33.6 million annually.

**Cost per Hour of User Benefits in 2030 (mid-2010 dollars):** This is a measure of the annualized capital and year 2030 O&M costs divided by the year 2030 annual hours of travel time savings. While an abstract number, the results are useful for making comparisons among alternatives to determine the relative costs of user benefits—a measure of cost effectiveness. The L1: I-5 Light Rail Alternative is by far the best performing on this measure, at roughly 60 percent of the cost per hour of user benefit of the next best performing L3: SR 99 Elevated Light Rail Alternative. This cost measure for both the L2: SR 99 Mixed Profile Light Rail and TSM/Baseline Alternatives are over twice that for the L1: I-5 Light Rail Alternative. The B2: Multi-Corridor BRT Alternative is the least cost effective based on this measure.

**Incremental Cost per New Passenger in 2030 (mid-2010 dollars):** This is another measure of cost effectiveness and calculates the annualized capital and year 2030 O&M costs divided by the year 2030 annual new transit riders. The cost per new rider calculation shows a pattern



Northgate Transit Center

similar to the travel time savings calculations. The L1: I-5 Light Rail Alternative performs substantially better than the other alternatives, followed by the L3: SR 99 Elevated Light Rail Alternative, the TSM/Baseline Alternative, the L2: SR 99 Mixed Profile Light Rail Alternative, and the B2: Multi-Corridor BRT Alternative in that order.

### CONSISTENCY WITH SOUND TRANSIT'S LONG-RANGE PLAN VISION

The final Purpose and Need Statement category addresses whether the project is consistent with Sound Transit's Long-Range Plan, which requires it to meet the state's definition of HCT and be able to eventually extend the service north to Everett. Key findings include the following:

**Consistency with State Definition of HCT:** As explained in the text box on page S-2, Sound Transit's Washington State enabling legislation defines HCT as being located in exclusive rights-of-way and providing substantially higher levels of service in terms of capacity, speed, and frequency than traditional public transportation systems operating on general purpose roadways. Express buses operating in HOV lanes are recognized as an interim form of HCT service. Under this definition, only the L1: I-5 Light Rail, L2: SR 99 Mixed Profile Light Rail, and L3: SR 99 Elevated Light Rail Alternatives meet the definition of permanent HCT. The bus routes included in the B2: Multi-Corridor BRT Alternative operate in either mixed traffic or in shared HOV or BAT lanes. While the B2: Multi-Corridor BRT Alternative includes the addition of transit only ramp connections at Northgate, its bus service does not operate principally on exclusive rights of way as required by Sound Transit's Washington State enabling legislation.

**Consistency with Sound Transit's Long-Range Plan:** Only the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail

Alternative are consistent with Sound Transit's Long-Range Plan for regional transit because they are the only alternatives that provide capacity for future extensions to Everett. In addition, the L1: I-5 Light Rail Alternative would have substantially shorter travel times between Lynnwood and Northgate compared to any of the other alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative is constrained by the limitations of the at-grade segments and crossings of five major intersections and provides half the capacity of the L1: I-5 Light Rail Alternative. As a result, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to be near capacity in 2030 with little capability to absorb growth or the riders added by extending the line north of Lynnwood.

### S.8.3 Findings by Alternative

The sections that follow discuss the overall conclusions for each build alternative. The section begins with a brief discussion of the conclusions regarding the TSM/Baseline Alternative, which, while not a build alternative, will be carried forward as the basis for comparison in the New Starts process.



Othello Link light rail station

## TSM/BASELINE ALTERNATIVE

The TSM/Baseline Alternative is a requirement of the FTA New Starts planning process and it will serve as the basis for the measures of cost effectiveness that will be used to judge the performance of the build alternatives and ultimately the preferred alternative later in the project development process. This alternative is not very effective in meeting the principal transportation needs identified in the corridor. The TSM/Baseline Alternative is not designed to be consistent with either the definition of HCT or Sound Transit's Long-Range Plan vision of extending the regional transit system north to Everett. It also is the least costly and has the fewest likely potential impacts on the surrounding environment. The TSM/Baseline Alternative has evolved through the AA process, beginning with an early concept of a single new express bus route to now include a comprehensive program of service changes and improvements, along with a number of low-cost transit facility, roadway, and traffic engineering enhancements.

## L1: I-5 LIGHT RAIL ALTERNATIVE

The L1: I-5 Light Rail Alternative has evolved from the concept originally developed as the representative light rail alignment during the ST2 system planning work. The initial alternative, based on the ST2 concept, included a fully elevated trackway from Northgate to Lynnwood, running primarily along the east side of I-5, and four new elevated stations. As a result of additional discussions with WSDOT and further concept refinements, it was determined that major sections of the trackway and at least one of the stations could be placed at-grade adjacent to the freeway. The at-grade sections include multiple locations along the east side of I-5 through Seattle and Shoreline and in the median of I-5 in Snohomish County. These changes have the potential to reduce the cost and impacts of this alternative as well as improve its performance.

In general, the L1: I-5 Light Rail Alternative is the best performing in terms of the transportation criteria. Among the light rail alternatives, it is the least costly and has the least potential for impacts on the surrounding environment.



Computer simulation of Northgate Link Light Rail Station

The L1: I-5 Light Rail Alternative is one of two alternatives studied in Level 2 that is capable of supporting Sound Transit's Long-Range Plan vision of extending the regional system north to Everett. 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, and conforms to the definition of HCT. In addition, extending light rail from Northgate to Lynnwood in a configuration that allows reliable operation of trains at 4-minute peak-period headways is necessary to support eventual extension of the line north to Everett. At headways longer than 4 minutes in this segment, supplemental express bus service could be required to serve the resulting passenger demand.

Because this alternative involves major infrastructure investment and construction along its entire length, it has the potential for affecting the natural and human environment. Overall, the levels of environmental effects of L1: I-5 Light Rail Alternative are judged to be less than those of the L3: SR 99 Elevated Light Rail Alternative and substantially less than those of the L2: SR 99 Mixed Profile Light Rail Alternative.

From a land use and economic development standpoint, the L1: I-5 Light Rail Alternative does the best at improving access to and from the two PSRC-designated regional growth centers in the project area (Northgate and Lynnwood) by providing the most people-moving capacity and the shortest travel times. However, the transit-oriented development potential for the L1: I-5 Light Rail Alternative at stations between Northgate and Lynnwood is lower than for the intermediate stations served by the L2: SR 99 Mixed Profile Light Rail, L3: SR 99 Elevated Light Rail, and the B2: Multi-Corridor BRT Alternatives. This occurs because the L1: I-5 Light Rail Alternative serves only a single station area (Lynnwood) that has high potential for transit-oriented development compared to two highly-rated station areas (Lynnwood and North 130th Street) for the other alternatives. All alternatives connect to

Northgate Station, a station with existing transit oriented land uses and high development potential that could increase with the transit infrastructure investment to Lynnwood.

With a capital cost range of \$1,420 to \$1,640 million (mid-2010 dollars), it is the least costly of the light rail alternatives considered. From a cost-effectiveness standpoint, the L1: I-5 Light Rail Alternative is by far the best performing, with costs per user benefit and new riders of 60 percent of the next best performing L3: SR 99 Elevated Light Rail Alternative, 40 percent of those for the L2: SR 99 Mixed Profile Light Rail and TSM/Baseline Alternatives, and 30 percent of those for the B2: Multi-Corridor BRT Alternative. Based on an available budget of \$1,540 million in Sound Transit's current financial plan, the L1: I-5 Light Rail Alternative is affordable at the low end of its cost range.



*At-grade light rail station in median*

## L2: SR 99 MIXED PROFILE LIGHT RAIL ALTERNATIVE

The L2: SR 99 Mixed Profile Light Rail Alternative is a hybrid based on two earlier concepts studied during the Level 1 evaluation. It combines both at-grade and elevated alignments along portions of SR 99 through the cities of Seattle and Shoreline, then elevated on the south side of SR 104 along the county line between Shoreline and Mountlake Terrace, and finally elevated and at-grade along I-5 to Lynnwood.

Analysis of traffic and train operation through the at-grade intersections along SR 99 concluded that reliable operation of trains at 4-minute headways in both directions was not practical. Instead, 8-minute headways were determined to be the best that could be achieved with partial at-grade operations. This operation requires that one of the two light rail lines serving the Northgate Station be turned back at Northgate and only one of the lines continue on to Lynnwood. As a result of the lower capacity on the SR 99 link and slower speeds, Community Transit express bus operations from Snohomish County to downtown Seattle and the University District would continue to operate on I-5 and would not be truncated at the light rail stations as in the L1: I-5 Light Rail Alternative.



*Elevated light rail*

With longer headways, lower capacity, and longer travel times, the L2: SR 99 Mixed Profile Light Rail Alternative does not perform as well as the L1: I-5 Light Rail Alternative or L3: SR 99 Elevated Light Rail Alternative from a transportation standpoint. The L2: SR 99 Mixed Profile Light Rail Alternative is consistent with the definition of HCT in the Long-Range Plan, but the 8-minute headways and resulting capacity and travel times do not support Sound Transit's Long-Range Plan vision of eventually extending the regional system north to Everett. Ridership forecasts show that the line to Lynnwood would operate near its practical capacity in 2030 and could not accommodate much growth or the additional riders it would attract if it were extended north to Everett.

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 affecting the environment of all the alternatives.

From a land use and economic development perspective, the L2: SR 99 Mixed Profile Light Rail Alternative serves the most station areas with the highest potential for transit-oriented development of all the alternatives. However, its lower capacity and longer travel times mean that it does not perform as well as the L1: I-5 Light Rail Alternative or the L3: SR 99 Elevated Light Rail Alternative from the perspective of access to the PSRC-designated regional growth centers of Northgate and Lynnwood.

The L2: SR 99 Mixed Profile Light Rail Alternative will require lengthy reconstruction of substantial portions of the SR 99 roadway in King County, including those sections through Shoreline which have been rebuilt recently. Placement of the light rail guideway at-grade in the median will require the reconstruction and widening of the entire roadway cross section,

with the greatest effects at major signalized intersections and light rail stations.

With a capital cost range of \$1,830 to \$2,100 million (mid-2010 dollars), the L2: SR 99 Mixed Profile Light Rail Alternative is the second most costly of the alternatives considered, roughly \$400 to \$500 million (mid-2010 dollars) more than the L1: I-5 Light Rail Alternative. From a cost-effectiveness standpoint, the L2: SR 99 Mixed Profile Light Rail Alternative is similar to the TSM/Baseline Alternative and better than the B2: Multi Corridor BRT Alternative, but still nearly two and one-half times the cost per hour of user benefit and cost per new rider compared to the best performing L1: I-5 Light Rail Alternative. Based on an available budget of \$1,540 million in Sound Transit's current financial plan, the L2: SR 99 Mixed Profile Light Rail Alternative is not within Sound Transit's financial capacity to fund.

### **L3: SR 99 ELEVATED LIGHT RAIL ALTERNATIVE**

The L3: SR 99 Elevated Light Rail Alternative alignment is similar to the L2: SR 99 Mixed Profile Light Rail Alternative except that the at-grade running sections and two at-grade stations along SR 99 of the latter are replaced with elevated facilities running along the west side of SR 99. These changes address the capacity and reliability problems found with the L2: SR 99 Mixed Profile Light Rail Alternative and allow operation of 4-car trains at 4-minute headways similar to the L1: I-5 Light Rail Alternative.

From a transportation standpoint, the L3: SR 99 Elevated Light Rail alternative does not perform as well on most measures as the best performing L1: I-5 Light Rail Alternative. However, the L3: SR 99 Elevated Light Rail Alternative is consistent with and conforms to the definition of HCT and would provide capacity for eventual extension to Everett.

Because this alternative involves major infrastructure investment and construction

along its entire length, it has the second greatest potential for affecting the environment. Overall, the levels of effects are judged to be greater than those of the L1: I-5 Light Rail Alternative, but less than those of the L2: SR 99 Mixed Profile Light Rail Alternative.

From a land use and economic development perspective, the L3: SR 99 Elevated Light Rail and L2: SR 99 Mixed Profile Light Rail Alternatives serve the most station areas with the highest potential for transit-oriented development of all the alternatives. However, the slightly longer travel times of the L3: SR 99 Elevated Light Rail Alternative mean it does not perform as well as the L1: I-5 Light Rail Alternative from the perspective of access to the PSRC-designated regional growth centers of Northgate and Lynnwood.

The L3: SR 99 Elevated Light Rail Alternative will require reconstruction of portions of the SR 99 roadway in King County, including those sections through Shoreline which have been rebuilt and widened recently. With the majority of the aerial guideway assumed to be located along the west side of SR 99, construction effects will be concentrated to the west of the existing roadway, and will be substantially less than the full roadway reconstruction associated with the L2: SR 99 Mixed Profile Light Rail Alternative.

With a capital cost range of \$2,010 to \$2,310 million (mid-2010 dollars), the L3: SR 99 Elevated Light Rail Alternative is the most costly of the alternatives considered, roughly \$200 million (mid-2010 dollars) more than the next most costly L2: SR 99 Mixed Profile Light Rail Alternative and \$600 to \$700 million more than the L1: I-5 Light Rail Alternative. From a cost-effectiveness standpoint, the L3: SR 99 Elevated Light Rail Alternative is the second best performing alternative, but still over 60 percent more costly than the best performing L1: I-5 Light Rail Alternative. Based on an available budget of \$1,540 million in Sound Transit's current financial plan, the L3: SR 99

Elevated Light Rail Alternative is well outside Sound Transit’s financial capacity to fund.

## B2: MULTI-CORRIDOR BRT ALTERNATIVE

Over the course of the AA, different BRT alternatives have been identified, evaluated, and substantially refined and modified to address shortcomings. In general, the B2: Multi-Corridor BRT Alternative’s transportation performance is better than the TSM/Baseline Alternative but falls well short of the performance of the light rail alternatives. The B2: Multi-Corridor BRT Alternative is not consistent with the definition of HCT as a result of the long segments of mixed traffic operations of the 15th Avenue NE and SR 99



Swift station

BRT lines. In addition, the use of the I-5 HOV lanes, while meeting the definition of interim HCT services, does not meet the definition of permanent HCT services. The B2: Multi-Corridor BRT Alternative is also not consistent with the Long-Range Plan vision for the extension of service north of Lynnwood to Everett because it is estimated to be near capacity in the year 2030.

The B2: Multi-Corridor BRT Alternative would likely have fewer effects on the environment than any of the rail alternatives because it includes substantially less new infrastructure

and transportation right-of-way. Its estimated capital costs are much lower at \$640 to \$730 million (mid-2010 dollars). On measures of cost effectiveness, however, the B2: Multi-Corridor BRT Alternative performs the worst of all the alternatives, with costs per hour of user benefits and cost per new rider substantially higher than the TSM/Baseline Alternative.

The B2: Multi-Corridor BRT Alternative evolved to its final configuration at the conclusion of the Level 1 evaluation based on the analysis of a number of BRT concepts. The key elements of this alternative were to provide enhanced bus service and associated transit infrastructure investments along three parallel alignments (SR 99, I-5, and 15th Avenue NE) within the larger North Corridor. This proved more effective from both a cost and rider benefit standpoint than focusing all BRT service and infrastructure in the I-5 alignment. This conclusion was based in part on the difficulties of providing fast and highly reliable bus service using the existing I-5 HOV lanes and the very high cost of building new direct access ramps to and from these lanes.

After much work at the end of the Level 2 evaluation, it is apparent that not much more can be done to address the failings of the BRT options to meet the project’s purpose and need in three critical areas—transportation effectiveness, cost and constructability, and consistency with Sound Transit’s Long-Range Plan vision. From a transportation effectiveness



Sound Transit Regional Express

standpoint, the B2: Multi-Corridor BRT Alternative falls well short of the performance of the rail alternatives on every performance measure and is only marginally better than the TSM/Baseline Alternative on many. The weak transportation benefits, combined with the relatively large capital and O&M costs,

result in very unfavorable cost-effectiveness performance for the B2: Multi-Corridor BRT Alternative, falling well short of the performance of the TSM/Baseline Alternative.

## S.9 TRADE-OFFS AMONG THE ALTERNATIVES

Figure S-14 shows the alternatives screening and evaluation process. The AA process started with the identification of both bus and light rail concepts and numerous alignment and corridor variations, progressed through a pre-screening step and concept screening step, and then moved through two levels of detailed evaluation. The AA process identified a single BRT alternative and three primary light rail alternatives that showed the greatest promise for meeting the project's purpose and need. These alternatives were studied in greater detail as part of the Level 2 evaluation, resulting in the following conclusions about the performance and trade-offs among alternatives:

**Mode:** Light rail transit is the only mode that can satisfy the North Corridor Transit Project's purpose and need related to transportation effectiveness in meeting the corridor's mobility, access, and capacity needs, as well as consistency with Sound Transit's Long-Range vision.

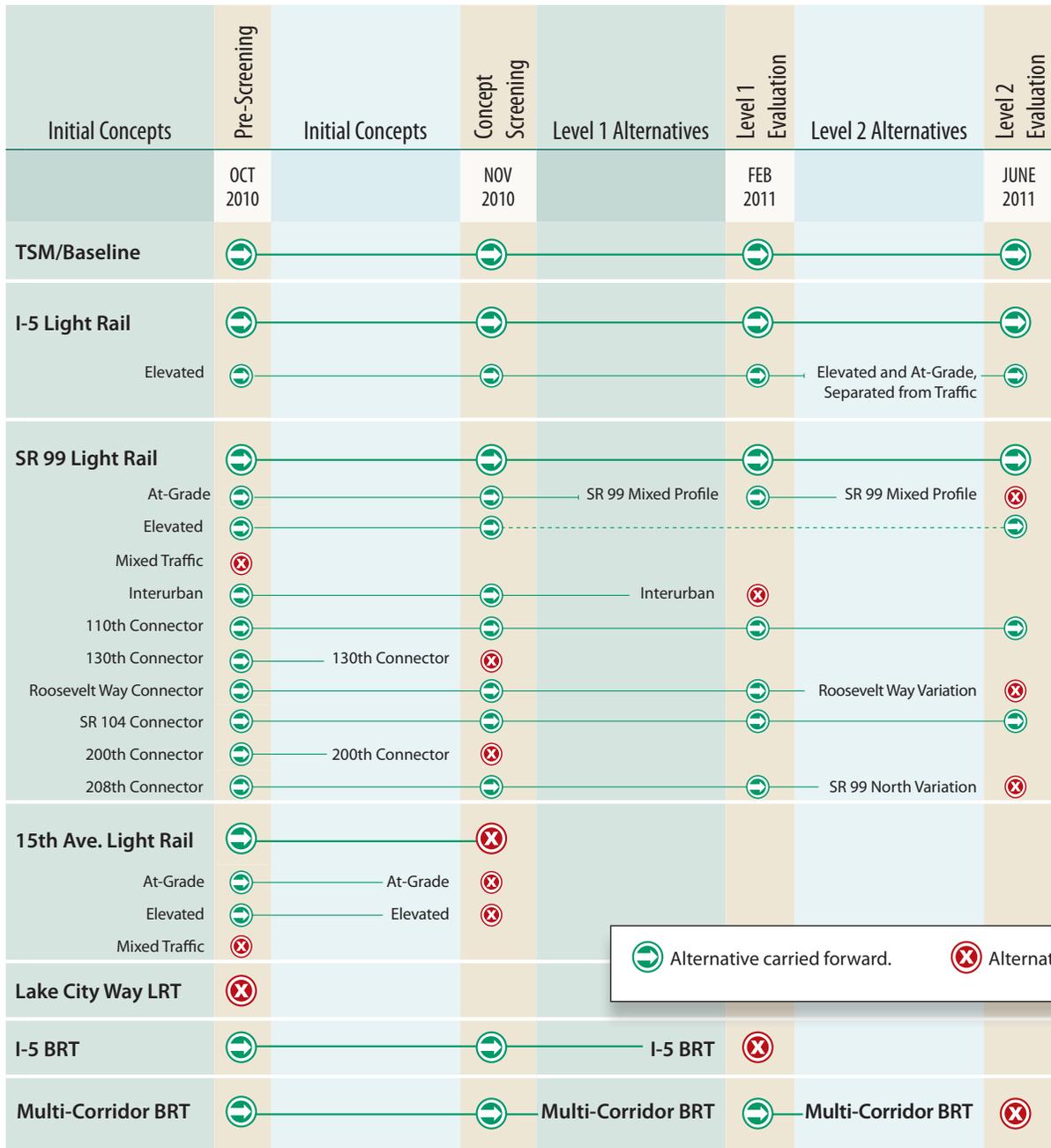
**Grade Separation:** Fully grade-separated light rail alternatives (L1 and L3) markedly outperform the alternative that includes at-grade crossings (L2) in satisfying purpose and need related to transportation effectiveness in meeting the corridor's mobility, access, and capacity needs. Moreover, fully grade-separated light rail alternatives are the only alternatives that meet purpose and need related to consistency with Sound Transit's Long-Range Plan. The L2: SR 99 Mixed Profile Light Rail Alternative is not consistent

with the project's purpose and need in this regard, since the longer 8-minute headways of this alternative provide little capacity for ridership growth beyond the year 2030 or for expansion northward to Everett.

**Transportation Performance:** From a transportation effectiveness standpoint, the L1: I-5 Light Rail Alternative is the best performing of all the alternatives when it comes to ridership, travel times, overall user benefits, capacity, and reliability.

**Balance of Benefits:** The fully grade-separated light rail alignments along I-5 and SR 99 also provide the best balance of transportation benefits while accomplishing other elements of the North Corridor Transit Project's purpose and need. These elements include community equity, supportive land use and economic development effects, and consistency with Sound Transit's Long-Range Plan.

**Costs and Cost Effectiveness:** The L1: I-5 Light Rail Alternative is substantially less costly than a fully grade-separated alignment on SR 99 (L3). In addition, the transportation performance of the L1: I-5 Light Rail Alternative is superior or equal to the L3: SR 99 Elevated Light Rail Alternative on all measures. As a result, the L1: I-5 Light Rail Alternative's cost effectiveness is substantially better than the L3: SR 99 Elevated Light Rail Alternative on measures related to the cost per new rider and cost per unit of user benefit.



**Figure S-14. Summary of Alternatives Development, Screening, and Evaluation Process**

**Affordability:** Given the \$1,540 million (mid-2010 dollars) currently budgeted for North Corridor Transit Project capital costs in Sound Transit’s current financial plan, the SR 99 light rail alternatives (L2 and L3) would both be well outside of Sound Transit’s existing financial capacity to fund. The L1: I-5 Light Rail Alternative, however, is affordable within that capacity at the low end of its capital cost range.

**Economic Development and Land Use:** The SR 99 light rail alternatives have greater economic development and TOD potential in the intermediate station areas in the cities of Seattle and Shoreline than does the L1: I-5 Light Rail Alternative, although the latter alternative does better at serving the primary designated regional growth centers in the corridor of Northgate and Lynnwood.

**Risks:** The L1: I-5 Light Rail Alternative takes advantage of portions of the I-5 right-of-way that are currently not developed in roadway. While WSDOT has indicated that this right-of-way can be made available to Sound Transit for light rail development, until a specific agreement is reached, this

is an area of cost and impact risk. Use of the I-5 right-of-way reduces the likely level of potential environmental effects and risk compared to the SR 99 light rail alternatives, which require roughly twice the amount of new transportation right-of-way.



## S.10 NEXT STEPS

Based on the results of the North Corridor Transit Project AA, Sound Transit plans to move forward in developing a major transit capital investment in the corridor between Northgate and Lynnwood. The next step is to share the findings of the AA with the public and elicit agency and public feedback through formal environmental scoping. Following scoping, Sound Transit will decide which alternatives to carry forward for further development, analysis, and environmental review under NEPA and SEPA guidance, including the possible identification of a Locally Preferred Alternative (LPA). Sound Transit plans to make these decisions late this year after consideration of public and agency scoping comments.

The potential impacts of the North Corridor Transit Project are such that a NEPA/SEPA Environmental Impact Statement (EIS) will be prepared. Work on the Draft EIS will start early in 2012 and take approximately

12-18 months to complete. The No Build Alternative will be carried forward to provide the basis for comparison of the impacts and benefits of the build alternative(s). The TSM/Baseline Alternative, however, will move forward in its current form only as the basis for the FTA New Starts comparisons, but not as a build alternative. If Sound Transit does not identify an LPA prior to the start of the Draft EIS then multiple build alternatives will be developed further and studied as part of the Draft EIS, with the LPA choice deferred to the end of the Draft EIS. Following public review and comment on the Draft EIS, Sound Transit will complete preliminary engineering for the LPA and develop a Final EIS. Based on the Final EIS, the Sound Transit Board will select the project to be built and operated, FTA will issue a Record of Decision (ROD), and the project will then move into final design, followed by construction, start-up and testing and ultimately operation. Service is planned to begin in 2023.

# 1 INTRODUCTION

## 1.1 CONTEXT OF THE ALTERNATIVES ANALYSIS

The Central Puget Sound Regional Transit Authority (Sound Transit) intends to expand regional transit service in the North Corridor, connecting the existing regional transit system from the planned interim terminus of Link light rail in the Northgate neighborhood of Seattle to the city of Lynnwood in southern Snohomish County. Approved by voters as part of the Sound Transit 2 (ST2) Plan in 2008 (Sound Transit 2007a), the North Corridor Transit Project would connect to and build on the Link light rail line that opened for service between downtown Seattle and Sea-Tac Airport in 2009, and would extend northward to serve north Seattle, Shoreline, Mountlake Terrace, and the city of Lynnwood in southern Snohomish County. Construction is currently underway on a light rail extension to the University of Washington scheduled to open in 2016, followed by service to Northgate targeted in 2021. Voter-approved additions over the next few years will bring 36 new miles of service to the north, south, and east, creating a 55-mile light rail system serving the region.

The North Corridor project connecting Northgate to Lynnwood is an incremental step in the implementation of the Puget Sound Regional Council's (PSRC's) VISION 2040 (PSRC 2009) and the Sound Transit 2005 *Regional Transit Long-Range Plan* (Sound Transit 2005a), both of which call for the eventual extension of high capacity transit (HCT) service north to Everett. Figure 1-1 shows the Regional Transit System plan map adopted by Sound Transit in 2008 as well as the North Corridor.

The North Corridor Transit Project relies on receiving federal assistance to complete the project. In accordance with federal regulations and guidelines for fixed guideway projects that seek New Starts grant funds from the Federal Transit Administration (FTA), Sound Transit has completed an Alternatives Analysis (AA) to evaluate a range of potential alternatives for addressing mobility needs in the North Corridor, including routes, stations, and operating features for the North Corridor Transit Project. This is the first step in the FTA's New Starts Project Planning and Development process.



## 1.2 PURPOSE AND OVERVIEW OF THE ALTERNATIVES ANALYSIS

The purpose of the AA is to define the transportation needs in the corridor, identify reasonable alternatives that would address the identified needs of the corridor, and provide information to help Sound Transit identify a preferred transit mode and route for implementation. While an AA is a local process, FTA provides general guidelines for how to conduct it. These include four major steps: study initiation; development and refinement of alternatives and technical methodologies; analysis and evaluation; and identification of the Locally Preferred Alternative (LPA) or proposed action.

During the AA study initiation phase, the roles and responsibilities of participating agencies are established, issues to be addressed in the study are defined, and the availability of data and models for addressing these issues is determined. The study initiation phase also develops a detailed work plan, a problem statement and purpose and need, evaluation measures to guide the subsequent analysis, and a conceptual definition of alternatives to be included in the study. For the North Corridor Transit Project, these steps are documented in the *Revised Draft Alternatives Analysis Initiation Report*, May 2010. Chapter 2: Purpose and Need documents the problem statement and purpose and need.

Once the AA study has been initiated, the next step is to further refine the alternatives and analysis methods. This step is designed to ensure that all participants in the process are in general agreement with the alternatives and analysis methods before the alternatives are further developed and evaluated in greater detail. This step often includes a preliminary analysis to screen out those alternatives that clearly cannot satisfy the purpose and need or show the least amount of promise. For the North Corridor Transit Project, these steps are summarized in Chapter 3: Development and Screening of Alternatives and documented in more detail in the *Final Level 1 Alternatives Analysis and Evaluation Report*, February 2011.

The third step includes the more detailed development of the most promising alternatives followed by the analysis and evaluation of these alternatives. This step constitutes the main work of the AA study. This step includes applying the methodologies developed for each of the study's evaluation measures to assess the transportation, environmental, and financial impacts of each alternative. The third step in the AA study is documented in Chapter 4: Detailed Definition of Alternatives, Chapter 5: Analysis of Alternatives, and Chapter 7: Comparative Evaluation of Alternatives.



Figure 1-1. Sound Transit 2 Regional Transit System Plan Map and North Corridor

Once the comparative analysis is completed and reviewed and a recommendation is reached, the next step is the preparation of a Draft Environmental Impact Statement (EIS). Two approaches are possible at this stage depending on the timing of the identification of a locally preferred transit mode and alignment. This action, known as the identification of a Locally Preferred Alternative (LPA), can occur prior to the start of the DEIS or following the public review and comment on the DEIS.

Following both federal and local review of the findings and conclusions of the AA, Sound Transit plans to decide on which alternatives to carry forward for further development and study in the NEPA and SEPA environmental process, including the possible identification of a Locally Preferred Alternative (LPA). Chapter 8: Conclusions and Next Steps summarizes the findings of the AA and provides an overview of the next steps in the New Starts project development process.

### 1.3 RELATIONSHIP TO THE ENVIRONMENTAL PROCESS

The North Corridor Transit Project AA was conducted with a public and agency outreach program supporting NEPA and Washington's State Environmental Policy Act (SEPA) requirements. Chapter 6: Public and Agency Involvement and Coordination documents those efforts undertaken as part of this AA study. Because the project has the potential for causing environmental impacts, the project will require an EIS. However, because the AA is establishing many key elements of the project, including its purpose and need and the range of EIS alternatives to be considered, Sound Transit and FTA decided to conduct early scoping at the start of the AA in 2010. This optional step in the state and federal environmental review processes allowed Sound Transit and FTA to receive comments from the public, agencies, and other stakeholders as they developed the project alternatives that would lead to more detailed engineering and environmental study.

The early scoping process for the North Corridor Transit Project occurred in September and October 2010, and included public and agency meetings. This information was used to refine the purpose and need and define conceptual alternatives including alignments and modes. Based on the recommendations of the AA, Sound Transit and FTA will initiate project-level environmental scoping, announcing the type of environmental document they will prepare and offer further opportunities for public and agency involvement.

## 1.4 ORGANIZATION OF THE REPORT

This report presents findings from three levels of screening, including initial concept screening, Level 1 evaluation, and Level 2 evaluation. After the Summary, the report is organized into eight chapters:

- Summary
- Chapter 1: Introduction
- Chapter 2: Purpose and Need
- Chapter 3: Development and Screening of Alternatives
- Chapter 4: Detailed Definition of Level 2 Alternatives
- Chapter 5: Analysis of Alternatives
- Chapter 6: Public and Agency Involvement and Coordination
- Chapter 7: Comparative Evaluation of Alternatives
- Chapter 8: Conclusions and Next Steps

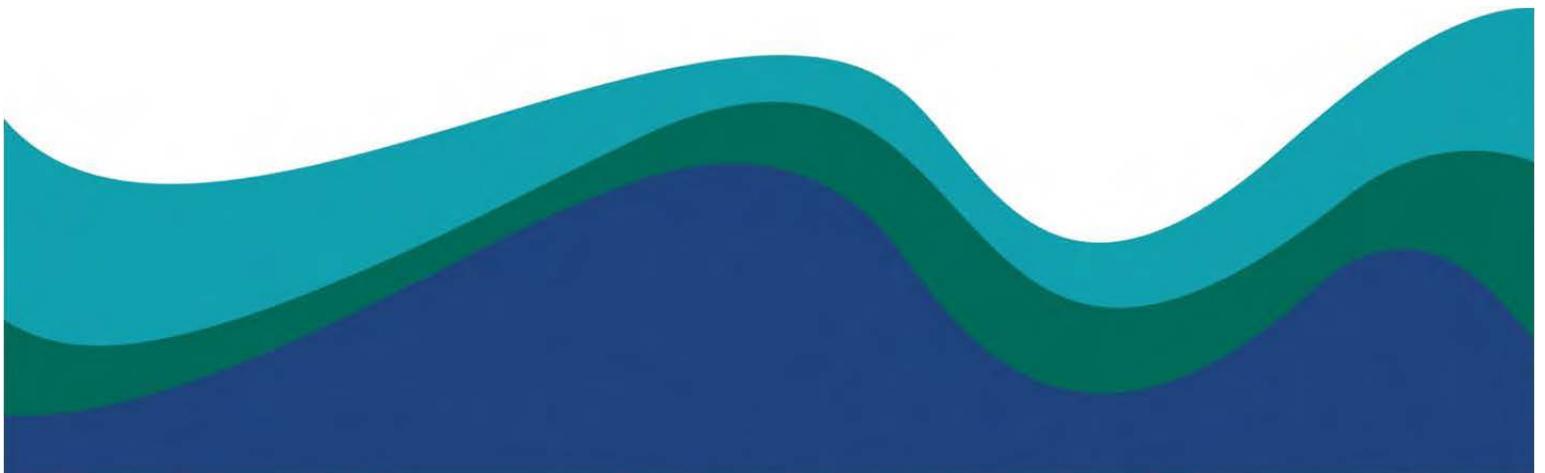
## 2 PURPOSE AND NEED

A purpose and need statement is required under NEPA, describing the reasons why the project is being proposed. The purpose and need statement is used to guide decisions about alternatives based on their ability to satisfy the purpose and need for the project, not only during the AA phase, but through the overall environmental process.

### 2.1 PURPOSE AND NEED STATEMENT

Sound Transit is proposing the North Corridor project to improve regional transit service from Seattle north into Snohomish County in one of the region's most heavily traveled corridors linking the cities of Tacoma, Seattle, and Everett. The project is in response to a public vote in November 2008 authorizing the funding for the North Corridor project as part of the ST2 Plan. Sound Transit's legislative mandate is to improve public transportation and mobility in the central Puget Sound region by developing an HCT system operating principally on exclusive rights-of-way and providing a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways (State High-Capacity Transportation Systems Act Chapter 81.104 of the Revised Code of Washington [RCW]). The corridor currently has express bus service operating in the Interstate 5 (I-5) high-occupancy vehicle (HOV) lanes utilizing HOV direct access and freeway transit station facilities at Lynnwood and Mountlake Terrace, respectively. This service, however, already has reliability problems because the HOV system is incomplete and is highly congested during peak periods; as a result, the express bus system does not adequately meet the growing transit needs of the corridor. In addition, the highest demand for the service is during the congested peak commute periods as travelers from residential areas in King and Snohomish counties travel south to major job centers in Seattle and east King County, or north toward Everett.

To guide decision-making during the AA phase and through the project's state and federal environmental processes, Sound Transit has developed the following statement of the project's Purpose and Need.



### 2.1.1 The Purpose of the North Corridor Transit Project

The purpose of the project is to improve 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;
2. Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system;
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; and
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.

### 2.1.2 The Need for the Project

The project is needed to:

- 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 the PSRC's VISION 2040 and *Transportation 2040*, as well as related county and city comprehensive plans.
- 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.
- Address overcrowding facing current and future North Corridor transit riders due to insufficient capacity of the current transit system.
- Provide an alternative to automobile trips on I-5 and State Route (SR) 99, the two primary highways serving the corridor, which are unreliable and over capacity throughout significant portions of the day.
- 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.

- 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.
- 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.
- 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).

## 2.2 THE NORTH CORRIDOR

The North Corridor covers about an 8.5 mile distance between Northgate and Lynnwood, and generally follows I-5, which is the major north-south route through the state and serves a large commuter market traveling between Snohomish and King counties and the city of Seattle. The corridor is within a geographically constrained urbanized area that lies between Puget Sound to the west and Lake Washington to the east, which limits transportation options. This is one of the most densely developed urbanized areas in the Pacific Northwest and is part of a longer north-south corridor connecting Lakewood in Pierce County to Tacoma, Seattle, and Everett. Roadways in the North Corridor experience high levels of congestion throughout significant portions of the day, which affect mobility and reliability. This north-south corridor also comprises one of the region's most productive markets for transit, and has seen continuous and significant investments in public transit infrastructure and service over the past 40 years.

As a result of this investment, about 20,000 daily boardings occur on bus routes currently operating along this stretch of I-5, and nearly 30,000 occur in the overall corridor (i.e., on I-5, SR 99, and 15th Avenue NE combined). However, while the transit agencies that provide these services constantly endeavor to match service supply to demand, overloads do occur on some trips and are exacerbated as ridership demand rises in response to stimuli such as rising gasoline prices. For example during spring 2009, over one-quarter of all inbound and almost half of all outbound trips on Community Transit's express bus trips between Lynnwood Transit Center and downtown Seattle carried passenger loads that exceeded 90 percent of seat capacity at least 25 percent of the time. Eight percent of inbound and 13 percent of outbound trips exceeded capacity over 50 percent of the time (Community Transit 2010). This means many trips regularly had standees from Lynnwood to Seattle, a trip that can routinely take upwards of 40 minutes. Standees occurred even more often during 2008 when ridership was higher due to high gas prices. The transit agencies are regularly challenged to provide adequate service, a trend that has become markedly worse in recent years as operating costs have risen and revenues (predominantly sales tax) have fallen as the economy entered a severe recession.

Ridership forecasts done for the ST2 Plan between 2004 and 2008 consistently show strong ridership potential for fixed guideway investment in this corridor. Although the purpose of the AA is to consider a broad range of alternatives tailored to address the growing demands of the North Corridor, a recent 2030 forecast (Sound Transit 2010a) estimated that a prototypical light rail alignment along the I-5 corridor, as part of the larger system expansion included in ST2, would carry daily bi-directional rider volumes ranging from almost 32,000 at a screenline south of Lynnwood, to over 46,000 at a screenline just north of Northgate. PM peak direction volumes would range from 9,000 to almost 15,000 riders. Station boardings in 2030 could reach almost 16,000 per day at Lynnwood. This AA explores a range of modal options and potential alignments for the North Corridor, including light rail service, and compares their effectiveness in addressing the purpose and need for transit improvements in the North Corridor.

The North Corridor project would provide expanded regional transit service connecting to the Central Link light rail system at Northgate, as shown in Figure 2-1, in order to serve the large and growing travel market between Lynnwood, Snohomish County, and north King County and the other major activity and/or urban growth centers to the south at Northgate, the University of Washington, Capitol Hill, downtown Seattle, South Seattle, Tukwila, and SeaTac, as well as Bellevue and Redmond to the east.

## 2.3 PLANNING HISTORY

Transit has been part of the development of the North Corridor communities since the Interurban Railway began operating in the corridor in 1910, connecting Seattle to Everett. North Seattle, Shoreline, Mountlake Terrace and Lynnwood developed around the Interurban through 1938, when the line ceased operation. Buses operating along SR 99 became the primary mode of transit until I-5 opened in the early 1960s.

The region has recognized the need to provide HCT service between Seattle and Lynnwood for more than 40 years. The "Forward Thrust" regional transit system proposals of the late 1960s and early 1970s included fixed guideway transit between Seattle and Lynnwood, but funding for these regional plans was defeated at the polls. Since then, a largely commuter-oriented system of express bus services has developed to serve rapid population and employment growth along the I-5 corridor, helping to connect Snohomish County suburban residents to jobs in Seattle.

The region renewed its efforts to develop HCT service connecting Seattle and Snohomish County in the 1990s. In 1993, the Central Puget Sound Regional Transit Authority was created, and in 1995 the North Corridor was part of a large proposal for developing regional light rail connecting King, Pierce, and Snohomish counties; however, the voters did not approve that program. The following year, voters approved a scaled-back program known as *Sound Move* that included light rail in King County, along with improved bus services, commuter rail, and related facilities elsewhere in the system, including the North Corridor. The *Sound Move* program has been largely completed and is now in operation or under construction.



Figure 2-1. North Corridor Project Area and Relation to Link Light Rail System

### 2.3.1 PSRC High Capacity Transit Corridor Assessment

In 2004, PSRC conducted a *High Capacity Transit Corridor Assessment* (PSRC 2004), which applied regional demand forecasts to determine the relative potential of the corridor to support HCT. The study examined a range of HCT technologies including Enhanced Bus, Bus Rapid Transit (BRT), Light Rail, Monorail, Sky Train, and Diesel Multiple Units, and considered their capacity, speed, and reliability performance. The assessment also used an Independent Technical Review Committee consisting of public transit industry professionals from other regions to review the data analysis. The study (PSRC 2004) concluded an HCT extension between Northgate and Lynnwood was well supported in terms of travel demand, stating: "...the connection between Northgate and the Lynnwood CBD should be a priority for high capacity transit implementation in this corridor, given the land use activity and travel demand projected in that segment. This

link has the highest total transit demand and highest percentage of transit trips of all the study corridor segments.”

### 2.3.2 Regional Transit Long-Range Plan

The Regional Transit Long-Range Plan was most recently adopted by Sound Transit in July 2005, updating and modifying the region’s earlier regional transit long-range plan adopted in 1996. The Long-Range Plan represents Sound Transit’s goals, policies, and strategies to guide the long-term development of the HCT system as it is developed through 2030 and beyond. Before adopting the plan, Sound Transit conducted an extensive public outreach program, including an environmental review of the Long-Range Plan elements in compliance with SEPA, culminating with the publication of the *Regional Transit Long-Range Plan Supplemental Final Environmental Impact Statement* in June 2005 (Sound Transit 2005b).

The Long-Range Plan provided the basis for the current ST2 Plan, and defined the vision for developing HCT throughout the region, including the North Corridor. The long-range planning effort comprised planning, engineering, and environmental studies, as well as public outreach throughout the region, including the North Corridor. As the Long-Range Plan was being considered for adoption by the Sound Transit Board in 2005, Sound Transit developed a series of issue papers focusing on HCT in the North Corridor. The papers evaluated rail and BRT as potential modal technologies for the corridor. They concluded that an HOV/BRT system would likely be less expensive to construct and operate, but light rail would carry more riders and provide faster travel times and more reliability. The issue papers also compared alignment options along I-5, SR 99, and 15th Avenue NE.

### 2.3.3 ST2 Plan Development

Between 2005 and 2008, Sound Transit developed a second phase system plan known as ST2. In 2008, the Sound Transit Board approved Resolution 2008-10, which adopted ST2 as Sound Transit’s high-capacity transportation system plan, and identified the North Corridor Transit Project from Northgate to Lynnwood as one of the plan’s major elements. Voters subsequently approved a November 2008 ballot measure that authorized local funding for ST2, including the North Corridor project.

### 2.3.4 Population and Employment in the North Corridor Communities

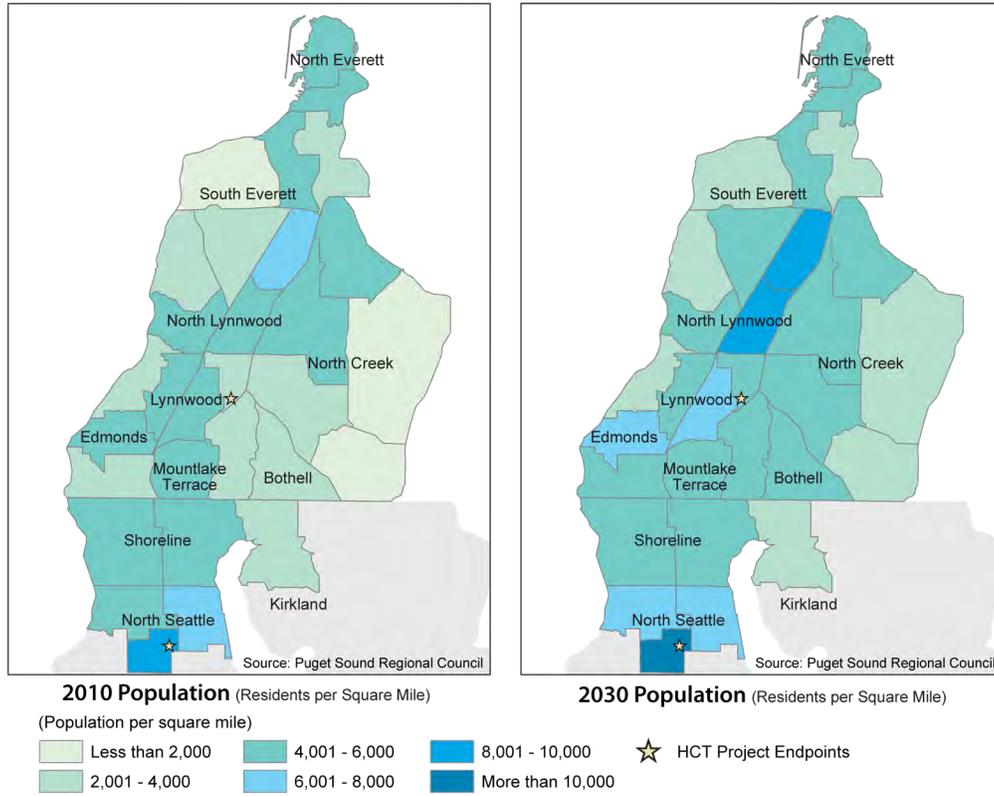
The North Corridor is home to established communities that are redeveloping and growing denser. The compact nature of these communities is reinforced by the geographic constraints of Puget Sound to the west and Lake Washington to the east. The region’s largest and highest density city, Seattle, is to the south. Land use in the North Corridor is largely residential, but is anchored by the major regional commercial centers at Northgate and Lynnwood, with town centers and other activity centers located in between. The 2008 estimated population of Seattle, Shoreline, Mountlake Terrace and Lynnwood was over 700,000 (PSRC 2008) and employment was estimated at almost 550,000.

Regional and local plans anticipate higher levels of growth within the corridor through 2030, although the corridor is largely developed and already has a substantial population base today. Figures 2-2 and 2-3 show the forecasted growth densities expected in the corridor. Population near the corridor (defined as the set of forecast analysis zones immediately surrounding I-5 and Highway 99 between Northgate and Lynnwood) is forecasted to grow 21 percent by 2040. Employment over the same period is forecasted to grow by 39 percent. Most of the growth would be through redevelopment to higher densities in areas that are identified in regional and local plans as activity centers and regional growth centers. Figure 2-3 shows employment estimates by area districts for 2010 and 2030. High levels of growth have occurred and will occur in the North Corridor travel market area, including in the Everett, Lynnwood, North Seattle, and downtown Seattle districts.

## 2.4 DEMOGRAPHICS IN THE NORTH CORRIDOR COMMUNITIES

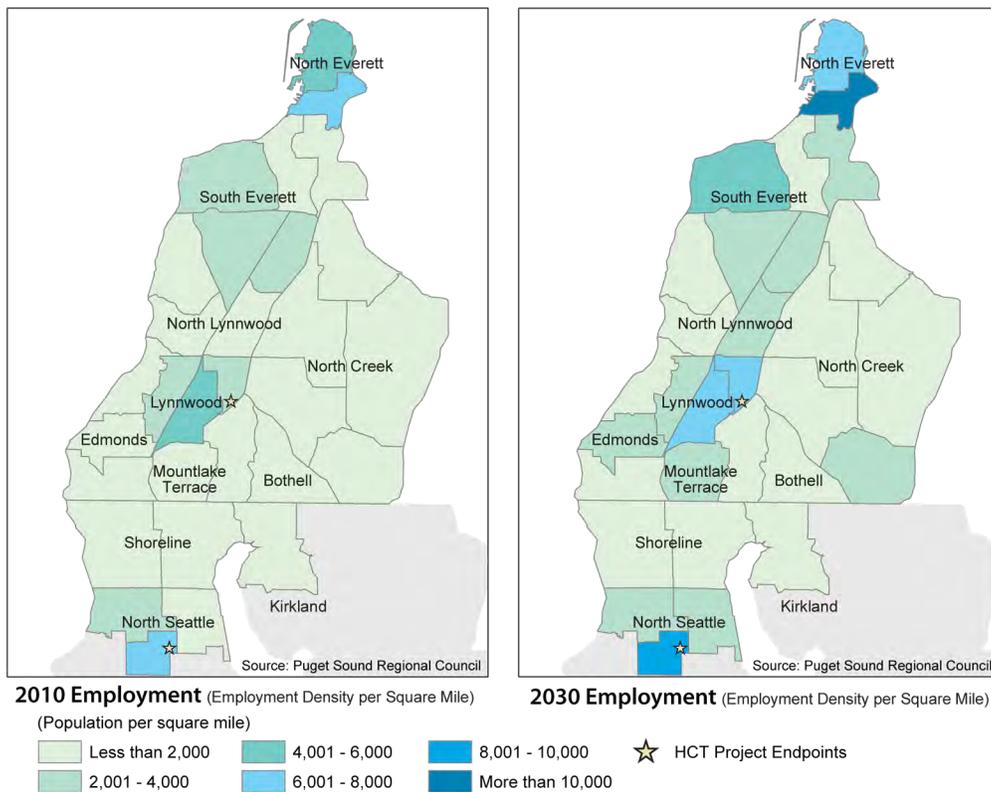
The U.S. Census data for the region are currently being updated to the year 2010, but demographic estimates are available through 2008 based on the 2000 Census with additional data from the American Community Survey. The 2008 estimates show Snohomish County with a population of nearly 674,000 and King County with 1,817,000. Cities within the corridor vary considerably in population as well as geographic size, with Lynnwood at 34,000, Mountlake Terrace at 20,000, and Shoreline at 51,000. Seattle's population was nearly 548,000 (U.S. Census Bureau 2000).

King and Snohomish counties share a similar racial composition, with 74 to 75 percent of the population identified as White, 12 percent as Black or African American, and Asian at 4 percent. People identifying as Hispanic or Latino (of any race) made up 15 percent of the population of the counties. At the local jurisdiction level, the demographic patterns were similar to those shown for their respective counties. These include household incomes that are 10 to 15 percent above the statewide average, an overall population that is younger than the statewide average, and a median household size that is slightly above the statewide average.



**Figure 2-2. 2010 and 2030 Population Density Forecasts - North Corridor**

North Corridor Transit Project | Alternatives Analysis Report



**Figure 2-3. 2010 and 2030 Employment Density Forecasts - North Corridor**

North Corridor Transit Project | Alternatives Analysis Report

## 2.5 REGIONAL PLANS FOR MANAGING GROWTH

The Puget Sound region, which includes urbanized King, Pierce, Snohomish, and Kitsap counties, has a coordinated series of regional, county, and local plans and policies that are guiding how the region is managing its growth. The primary plans at the regional level are the PSRC's VISION 2040 (PSRC 2009) and *Transportation 2040* (PSRC 2010a). Sound Transit's Long-Range Plan serves as the HCT element of *Transportation 2040*. These plans share land use, growth management, and transportation policies that assume the regional HCT system will link the urban centers where the region's growth will be focused. County and local city comprehensive plan policies in the North Corridor and throughout the region reinforce the need for HCT investments to support new population and employment developments, as well as provide for vibrant urban communities that offer alternatives to the automobile.

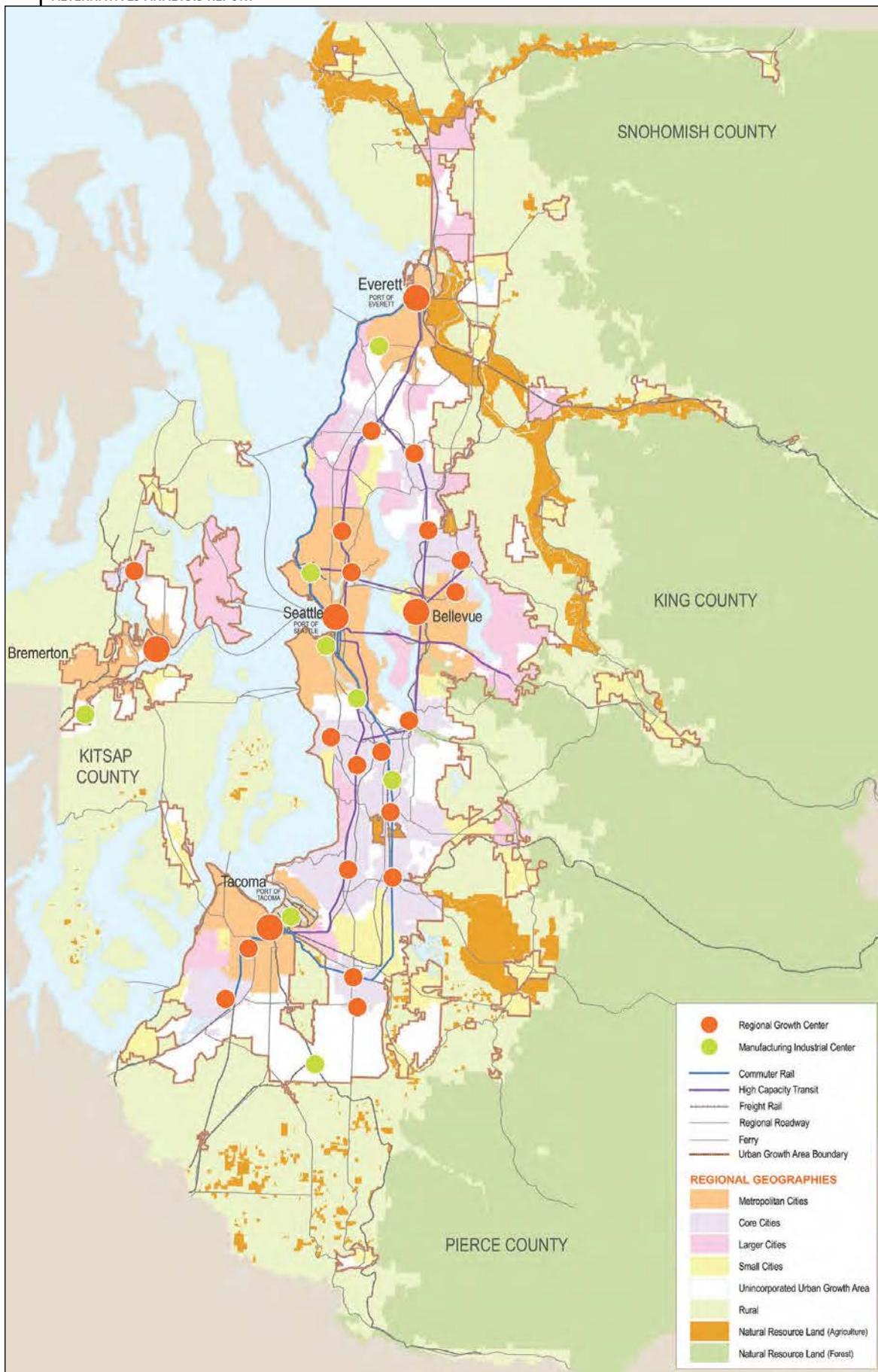
### 2.5.1 VISION 2040

VISION 2040, adopted by PSRC in May 2008, is the region's integrated, long-range vision for how and where the region should accommodate approximately 1.5 million people for a total population of 5 million, as well as 1.2 million new jobs for a total employment of nearly 3 million. VISION 2040's goals are to maintain a healthy region, promote the well-being of people and communities, ensure economic vitality, and preserve a healthy environment.

VISION 2040 identified regional growth centers (Figure 2-4), building upon urban centers concept that was originally established by VISION 2020. Northgate and Lynnwood are both designated as regional growth centers in VISION 2040. By 2030, the area surrounding the Northgate Link station is forecasted to have a density greater than 10,000 persons per square mile, and Lynnwood anticipates a population density between 5,000 and 10,000 persons per square mile near its city center.

### 2.5.2 Transportation 2040

*Transportation 2040*, which was adopted by PSRC in May 2010, is the region's metropolitan transportation plan and one of the key action plans to implement the VISION 2040 strategy over the next 30 years. The region's growth in jobs and population is expected to boost demand for travel within and through the region by about 40 percent. *Transportation 2040* outlines a long-term template for how this region should invest in transportation to accommodate rising travel demand. Sound Transit's North Corridor project is included in *Transportation 2040*.



Source: Puget Sound Regional Council VISION 2040

Figure 2-4. VISION 2040 Regional Centers

## 2.6 TRANSPORTATION SYSTEM

### 2.6.1 Highway Facilities

The North Corridor encompasses I-5 and SR 99—the two primary north/south highway facilities serving travel through the areas between Lake Washington and Puget Sound. I-5 is the most heavily traveled highway facility in the state, serving regional and interstate movements of both people and goods.

I-5 and SR 99 are the region's only continuous routes for the north/south movement of people and goods in the entire portion of the large urban area between Lake Washington and Puget Sound. While both transportation routes are highly used and highly congested for long periods of the day, I-5 is the most heavily used, carrying from 164,000 to 190,000 vehicles on an average day in the North Corridor (WSDOT 2009). SR 99 carries from 29,000 to 35,000 vehicles daily.

In addition to I-5 and SR 99, several other state highways, including SR 104, provide important east-west connections. The corridor's transportation network includes local streets; an extensive series of bus routes; transit centers and park-and-ride facilities; and HOV facilities, including direct access ramps. To the west of the North Corridor along Puget Sound is the Edmonds ferry terminal, as well as a major railroad line serving freight and Sounder commuter rail operations. The area also has a non-motorized system that includes the Interurban Trail, which serves north/south bicycle and pedestrian trips.

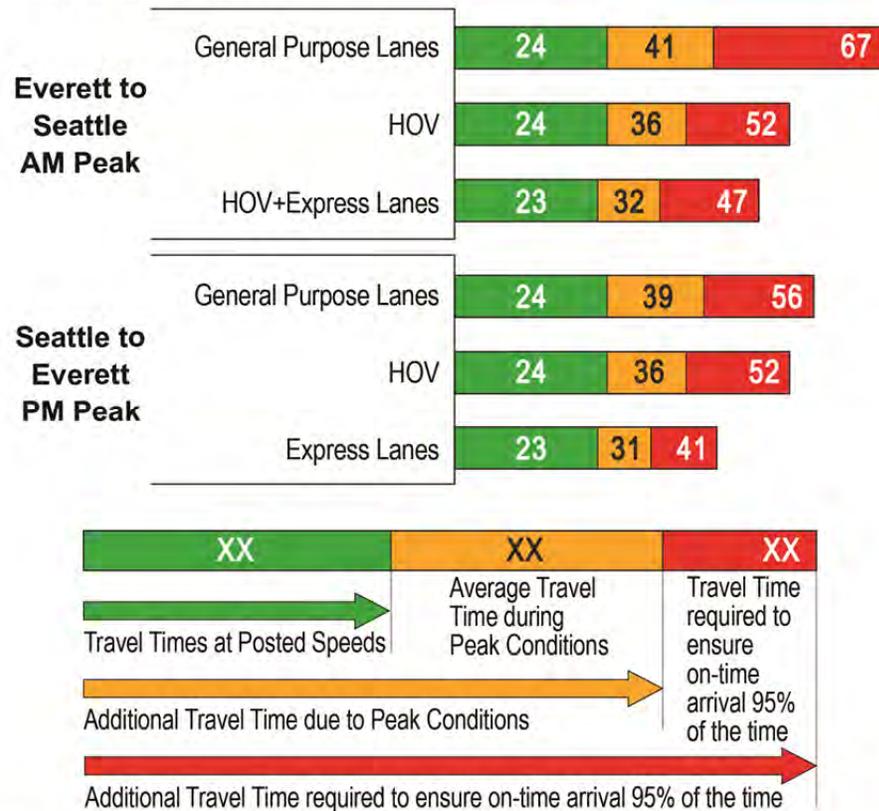
Physical and environmental constraints limit the addition of more highway capacity in the corridor; *Transportation 2040* does not include major expansions of highway capacity in the corridor. Current high levels of travel demand are expected to continue to grow, and congestion and unreliability for travelers on I-5 and SR 99 will increase through 2040 (PSRC 2010b).

Washington State Department of Transportation (WSDOT) has unfunded plans to make operational improvements to I-5 in the future, such as short segments of new auxiliary lanes between interchanges as they rebuild the over 40-year-old pavement along the corridor during the next decade. Active traffic management systems such as variable speed lane management signage are also planned. At the state level and regionally, policymakers are discussing further traffic management measures such as tolling, but no decisions have yet been made about tolling on any portions of I-5.

### TRANSPORTATION SYSTEM PERFORMANCE

As a result of the high volume of travel and limited facilities in the North Corridor, peak-period travel is consistently congested and travel times are unreliable. For example, as shown in Figure 2-5, WSDOT's time reliability calculator shows a trip from Everett to Seattle at free-flow speeds should take about 24 minutes on I-5 (WSDOT 2009).

**Travel times (minutes) at posted speeds, peak travel times, and 95% reliable travel times**  
*Central Puget Sound area, 2008*



**Figure 2-5. Travel-Time Reliability for the Everett-to-Seattle Commute via I-5**

Because of the high levels of congestion and unpredictability in delays, a commuter must allow 67 minutes for the trip during the AM peak hour to ensure arriving on time 95 percent of the time. Reverse commute trips are also unreliable. For example, afternoon southbound traffic on I-5 regularly backs up into Shoreline because the express lanes are unavailable (they operate northbound in the afternoon) and because of congestion related to the I-5/SR 520 merge south of the project area.

Unreliable travel on I-5 HOV lanes during the peak period is a problem because that is when most transit service occurs. The WSDOT-adopted HOV lane policy is that HOV lanes must maintain an average speed of 45 miles per hour (mph) or greater at least 90 percent of the time during the morning and afternoon rush hour. Data show that the I-5 HOV lanes in the North Corridor do not currently meet this performance standard. In 2007, HOV lane speeds in the southbound direction fell below the 45-mph threshold up to 65 percent of the time in the AM peak period, and northbound HOV lanes fell below the threshold nearly 50 percent of the time in the PM peak period.

HOV lane reliability is also affected by the operation of the adjacent general purpose lanes. Travel on HOV lanes is often slowed when there is nearby slow traffic in the general purpose lane (i.e., "lane friction"). Drivers in the HOV lane are often reluctant to travel at speeds that are

significantly greater than the speed of vehicles in the adjacent lane. Also, when HOV drivers need to leave the HOV lane and enter a congested general purpose lane, they often slow down to wait for a gap in the adjacent lane to enter, blocking traffic on the HOV lane. All these factors play roles in creating the overall experience of delay and unreliability in the I-5 HOV lanes.

## 2.6.2 Transit System

The corridor has an extensive network of bus routes, most traveling generally north and south to connect the North Corridor communities and neighborhoods to job centers in King County and north to Everett. Thirty-six weekday bus routes provided by three transit agencies operate through the corridor along I-5, connecting North Corridor communities to downtown Seattle, the First Hill and Capitol Hill employment areas to the east of downtown Seattle, the University of Washington, and the growing employment centers east of Lake Washington. The majority of the routes are peak-period, peak-direction, point-to-point services linking south Snohomish County, north King County neighborhoods, and park-and-ride lots to major employment centers in King County. However, about one-third of all daily bus trips are provided on four two-way, all-day routes, and nearly one-sixth of the trips are made southbound on I-5 between 6:30 and 7:30 am—with an average frequency of one bus every 38 seconds during this 1-hour period.

Many of the routes begin in residential neighborhoods but make their way to I-5 interchanges via local arterial streets. Once on I-5, HOV lanes are located in the center of the freeway between Lynnwood to Northgate. However, as bus routes continue south toward downtown Seattle, the HOV system transitions to limited access reversible express lanes at Northgate. The express lanes help accommodate peak direction flows at different times of day (inbound to Seattle in the morning, outbound in the afternoon), but delays and bottlenecks are frequent. Transit and HOVs in the off-peak direction must use the general purpose lanes between downtown Seattle and Northgate, which can experience substantial congestion. In downtown Seattle, dedicated ramps for transit and HOV provide access to and from the express lanes, but the express lanes are open to all users and are frequently congested. Transit priority lanes are also provided on several downtown streets to help speed buses through the downtown core, and the Downtown Seattle Transit Tunnel (DSTT) provides exclusive right-of-way for joint light rail and bus operations. (Two rush-hour only bus routes serving the North Corridor study area currently use the tunnel.) There are no transit priority treatments on surface streets between I-5 and the University of Washington campus; moreover, no direct access/HOV ramps serve the Northgate Transit Center from the I-5 HOV lanes to and from the north.

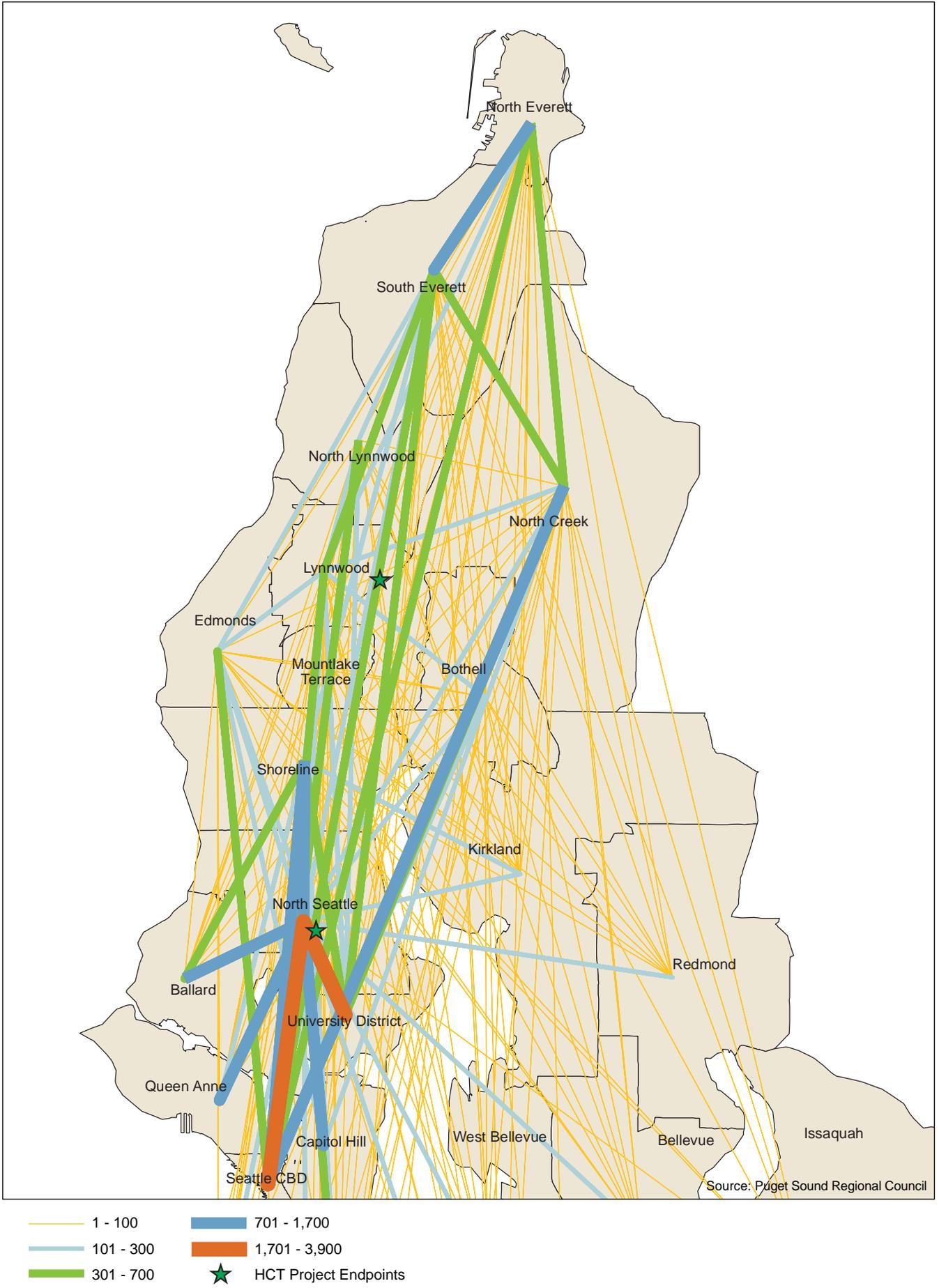
Several sections of the North Corridor feature investments to help improve transit speed and reliability. I-5 has continuous inside HOV lanes from Everett south to Northgate. Business access transit lanes are on SR 99 from NE 115th Street to NE 160th Street, and again from SR 104 (just north of the King County/Snohomish County line) north to Everett. A “Texas T” HOV direct access ramp connects the Lynnwood Transit Center to the center HOV lanes. In addition, a center in-line freeway transit station with ramps to and from the HOV lanes was completed in 2011 at the Mountlake Terrace Transit Center near the Snohomish County/King County line. An outside freeway station is available at NE 145th Street, but buses must weave across general

purpose lanes from and to the inside HOV lanes to serve it. Consequently, most peak period bus routes bypass this station. Ramp metering and HOV bypass lanes are also used on most interchange ramps to help control the flow of traffic onto the freeway.

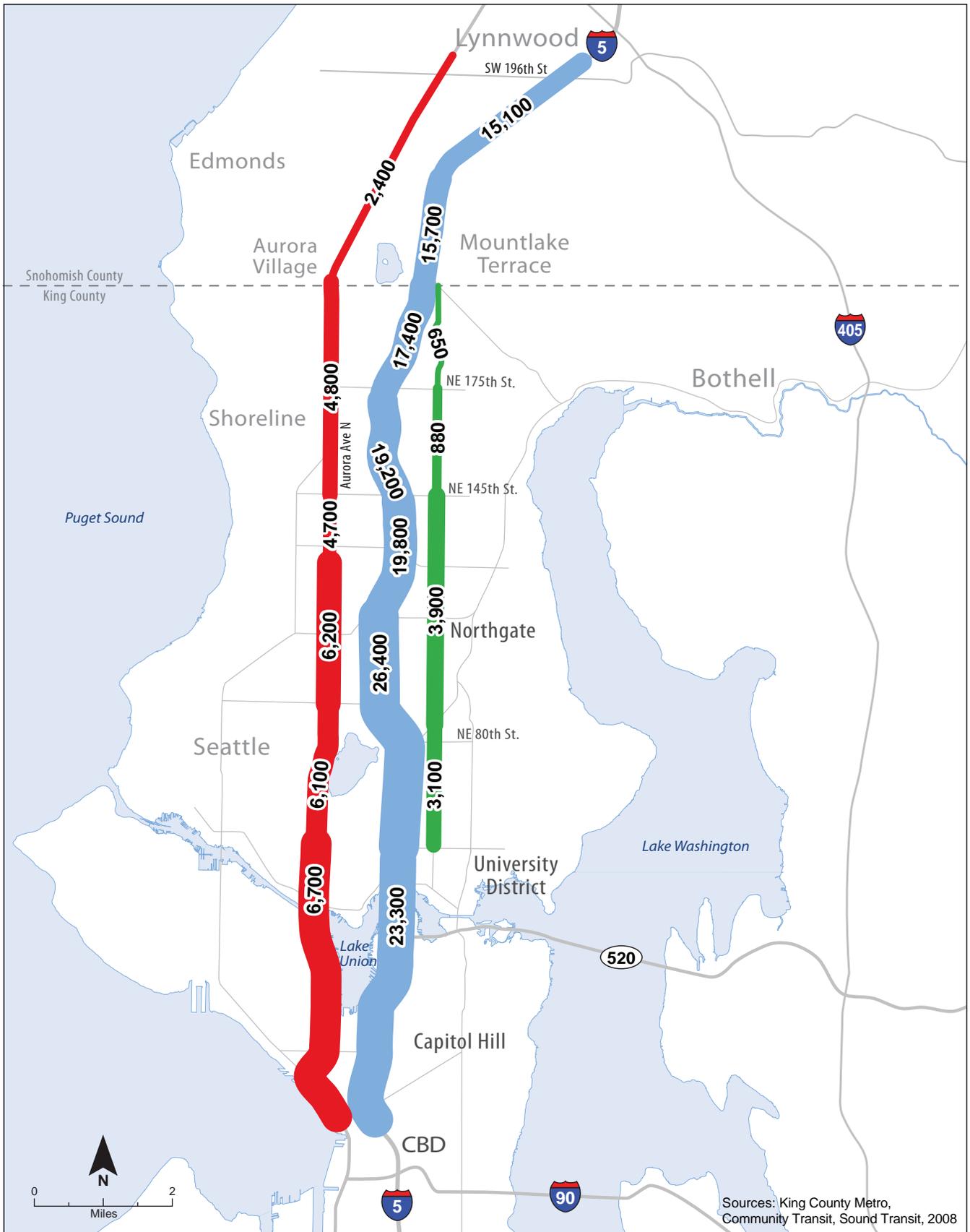
### 2.6.3 Transit Travel Patterns

Figure 2-6 shows the pattern of trips made by transit in the North Corridor, as represented in Sound Transit’s forecasting model for 2010 conditions. Figure 2-7 shows 2008 transit trips using I-5, SR 99, and 15th Avenue NE covering the section between Lynnwood and Seattle. Much of this travel consists of commuters from north King County and south Snohomish County destined for downtown Seattle and the University District—two major employment centers in the region.

As of 2008, daily transit ridership on I-5 ranged from 26,400 riders per day just south of Northgate to 15,100 riders per day at Lynnwood (Sound Transit 2010b). SR 99 carries a substantial amount of transit riders as well, though only about a quarter of what I-5 carries. The primary transit routes along SR 99 are Community Transit’s *Swift* BRT service between the Everett Station and the Aurora Village Transit Center, and King County Metro’s Route 358 between the Aurora Transit Center and downtown Seattle. While these routes carry some longer distance trips (e.g., from Aurora Village to downtown Seattle), much of the market served is shorter trips to/from destinations within the corridor. In 2008, combined transit ridership on I-5, SR 99, and 15th Avenue NE was 36,500 daily trips just south of Northgate and 17,500 trips at Lynnwood.



**Figure 2-6. Distribution of 2010 Daily Transit Trips to/from North Corridor**



Transit Ridership

SR 99

15th Ave NE

I-5

**Figure 2-7.** Existing Daily Transit Ridership for the North Corridor

# 3 DEVELOPMENT AND SCREENING OF ALTERNATIVES

## 3.1 OVERVIEW

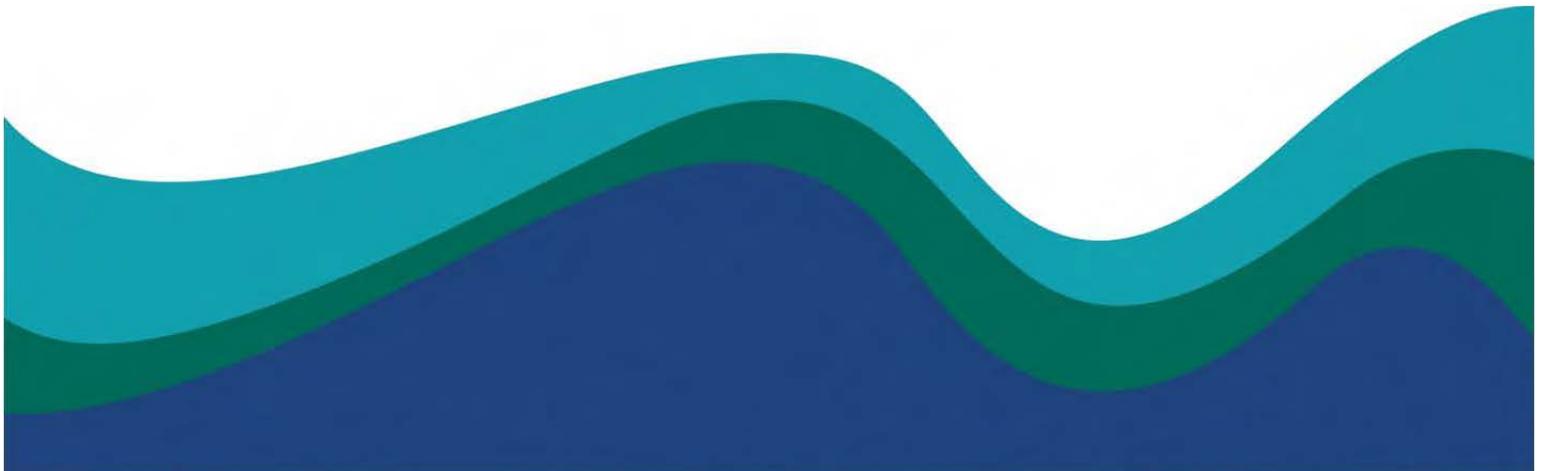
This chapter provides a summary of the process used to develop the detailed alternatives that are described in Chapter 4 and evaluated in Chapter 5. The alternatives development and evaluation process consists of three stages as summarized in Figure 3-1: initial concept development and screening, Level 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

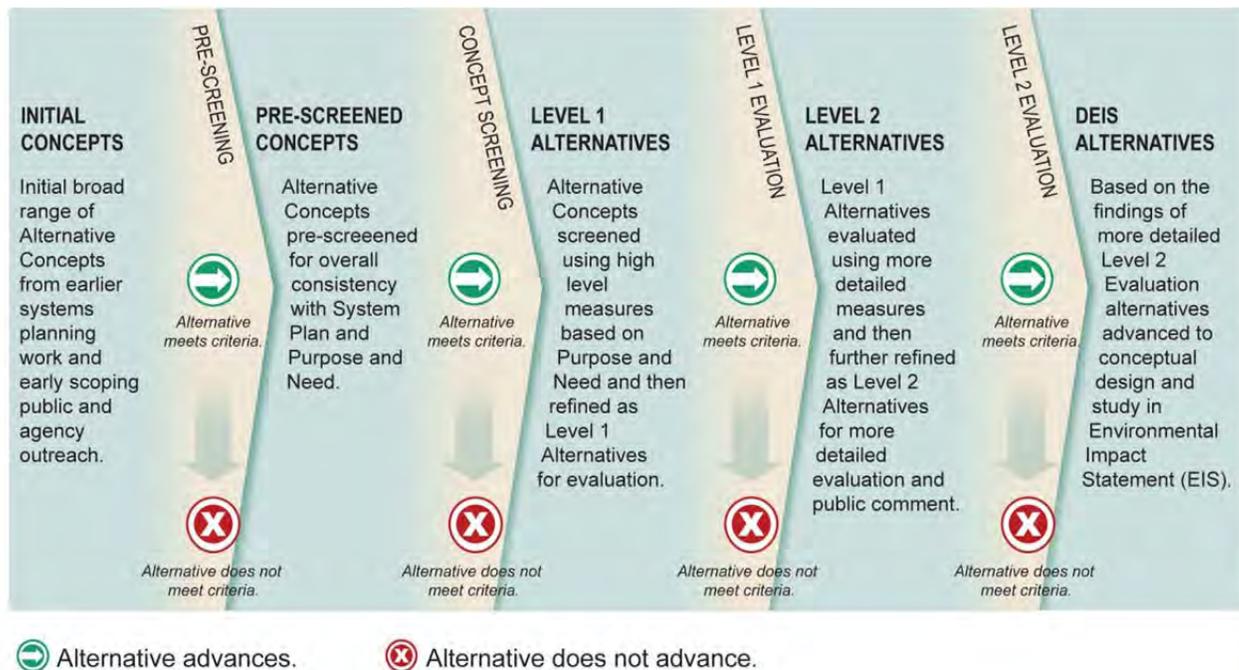
### 3.2.1 Basis in Purpose and Need

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).

<b>Table 3-1. Initial Concept Development Review Screening Criteria and Measures</b>	
<b>Screening Criteria</b>	<b>Measures</b>
<b>Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs</b>	
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
<b>Purpose and Need: Equitable Community Impacts and Benefits</b>	
<i>Not used for initial concept development review</i>	
<b>Purpose and Need: Supportive Land Use and Economic Development Effects</b>	
Land Use and Economic Development Potential	Number of identified existing and future activity centers within 0.5 mile of alignment
<b>Purpose and Need: Preservation of a Healthy Environment</b>	
Environmental Considerations	General requirements for new right-of-way and associated implications
	Qualitative impacts on existing transportation systems
<b>Purpose and Need: Cost and Constructability</b>	
Cost Considerations	Major cost factors associated with each concept
<b>Purpose and Need: Consistency with Sound Transit’s Long-Range Plan</b>	
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
<b>Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs</b>	
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
<b>Purpose and Need: Equitable Community Impacts and Benefits</b>	
<i>Not considered for Level 1 screening.</i>	Impacts to Affected Communities Transportation Benefits to Affected Communities
<b>Purpose and Need: Supportive Land Use and Economic Development Effects</b>	
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
<b>Purpose and Need: Preservation of a Healthy Environment</b>	
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
<b>Purpose and Need: Cost and Constructability</b>	
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
<b>Purpose and Need: Consistency with Sound Transit’s Long-Range Plan</b>	
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%
<b>Total</b>	<b>93.4%</b>	<b>Total</b>	<b>6.7%</b>

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.

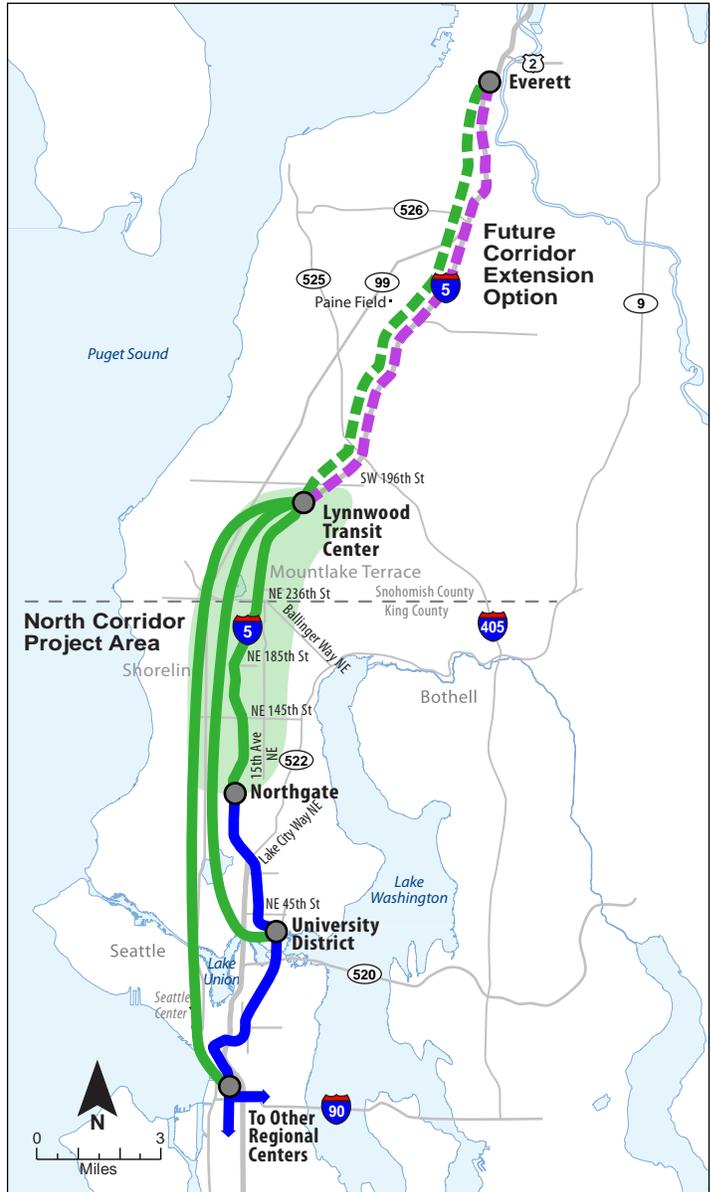
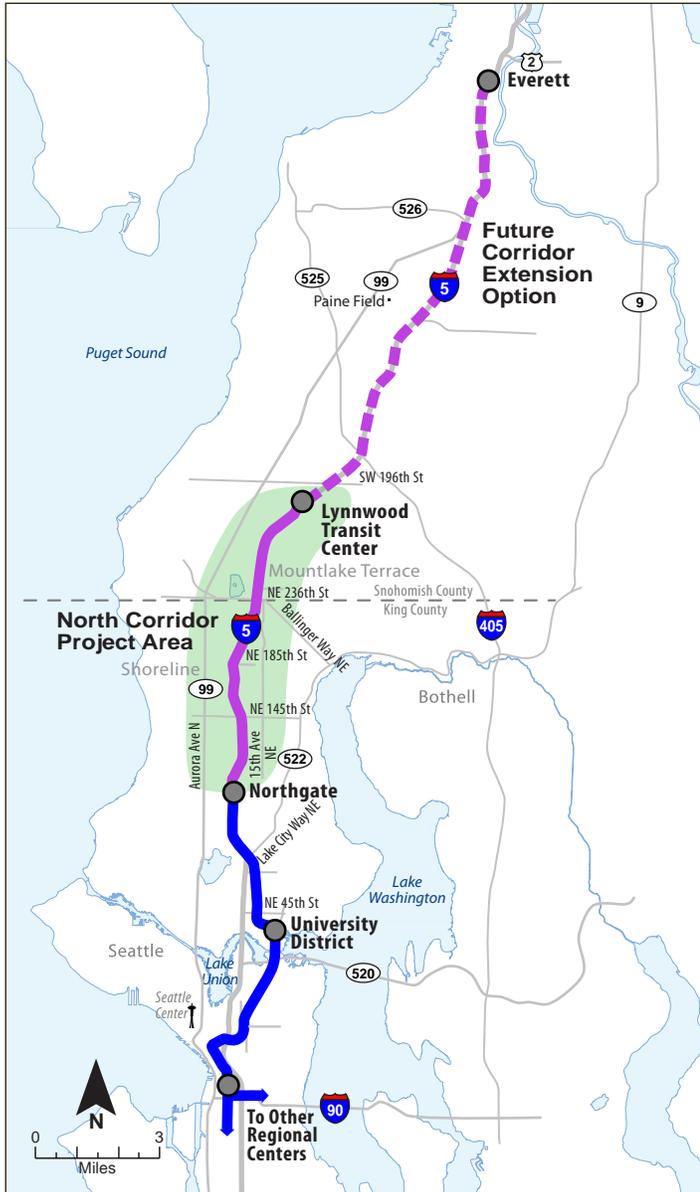
#### LAKE CITY WAY/SR 522 ALIGNMENT

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.



