

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

- North Link Station
- Potential BRT Station*

*ST2 Representative Alignment has 4 LRT Stations

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

Figure 3-5. BRT Concepts

3.3.5 TSM/Baseline Concept

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

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

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

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

3.3.6 I-5 Light Rail Concept

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

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

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

3.3.7 SR 99 Light Rail Concept

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

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

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

3.3.8 15th Avenue NE Light Rail Concept

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

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

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

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

3.3.9 I-5 BRT Concept

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

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

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

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

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

3.3.10 Multi-Corridor BRT Concept

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

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

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

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

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

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

3.4 INITIAL CONCEPT SCREENING RESULTS

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

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

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

3.4.1 15th Avenue NE Light Rail Concepts Screened Out

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

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

Table 3-4. Initial Concept Review and Screening Summary



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

Table 3-5. Recommended Level 1 Alternatives

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

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

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

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

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

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

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

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

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

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

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

3.4.3 SR 99 Light Rail Sub-Alternative Alignments Screened Out

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

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

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

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

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

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

3.5 LEVEL 1 ALTERNATIVES DEFINITION

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

3.5.1 Elements Common to All Alternatives

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

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

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

3.5.2 No Build Alternative

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

3.5.3 TSM/Baseline Alternative

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

3.5.4 L1: I-5 Light Rail Alternative

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

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

3.5.5 L2: SR 99 Light Rail Alternative

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

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

3.5.6 B1: I-5 BRT Alternative

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

3.5.7 B2: Multi-Corridor BRT Alternative

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

3.6 LEVEL 1 ALTERNATIVES EVALUATION

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

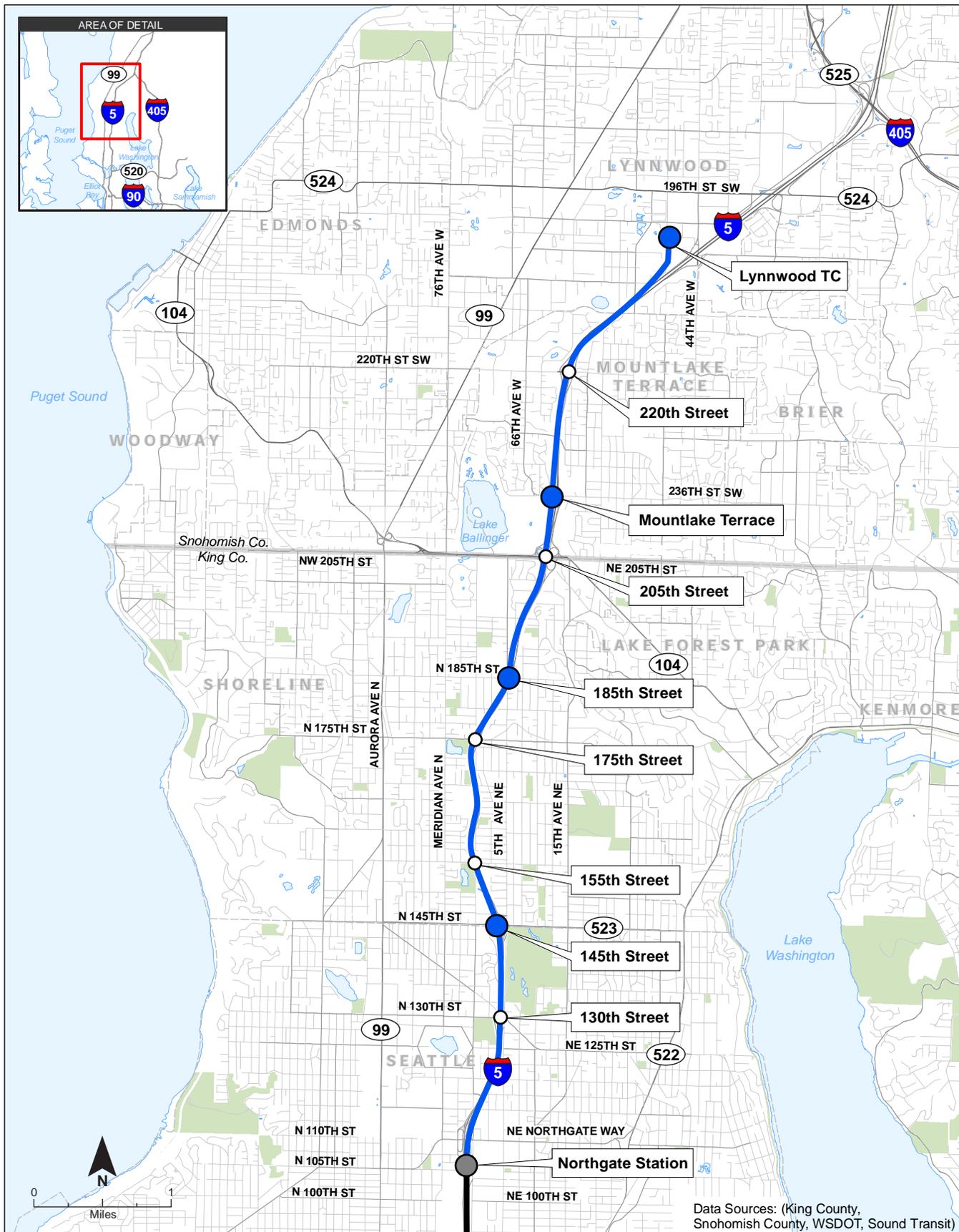
The North Corridor Transit Project's Purpose and Need can be summarized into six broad categories as follows:

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

3.6.1 Transportation Effectiveness

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

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



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

Light Rail Route



Proposed Light Rail Station*



Potential Light Rail Station Variation

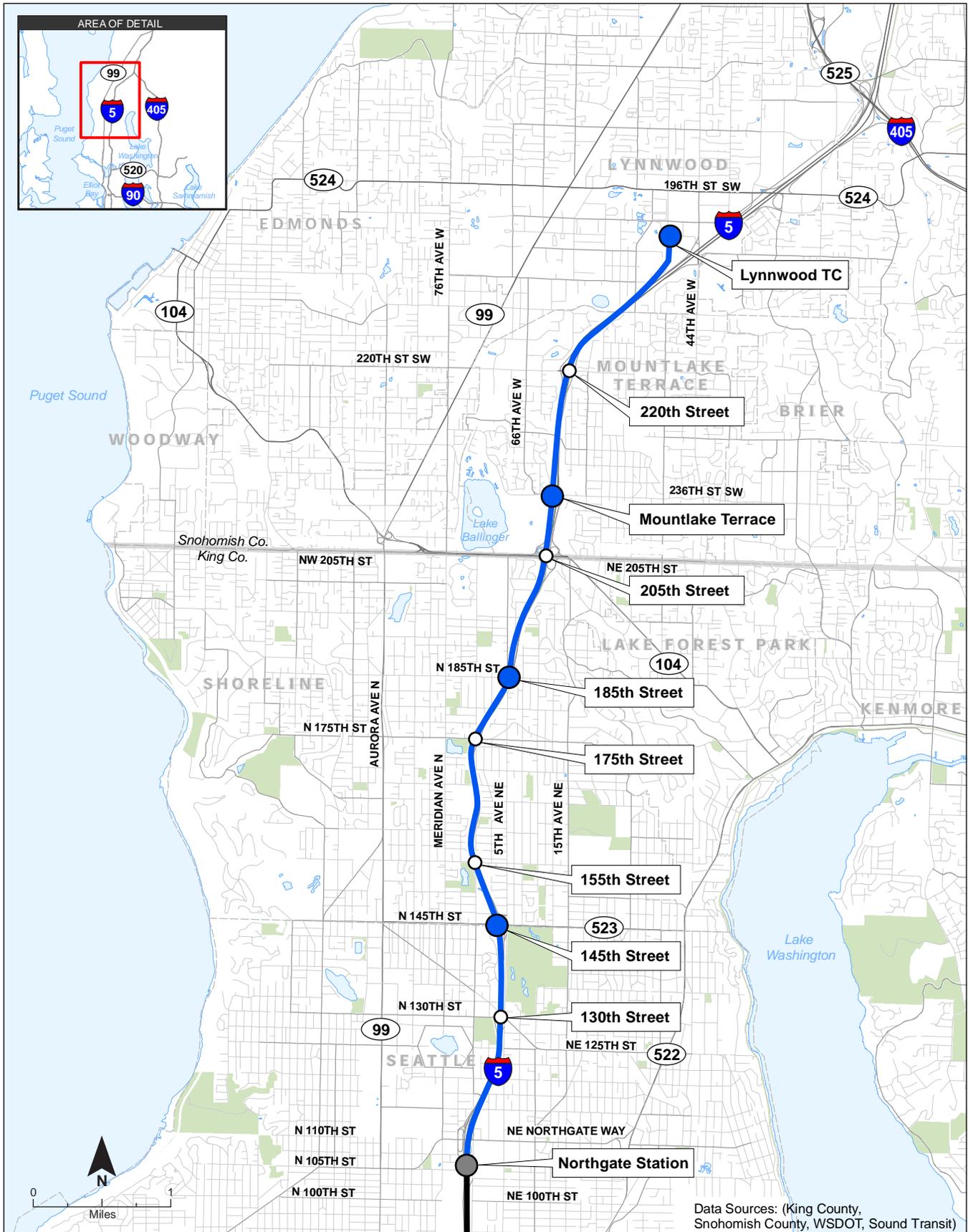
North Link Light Rail



North Link Station

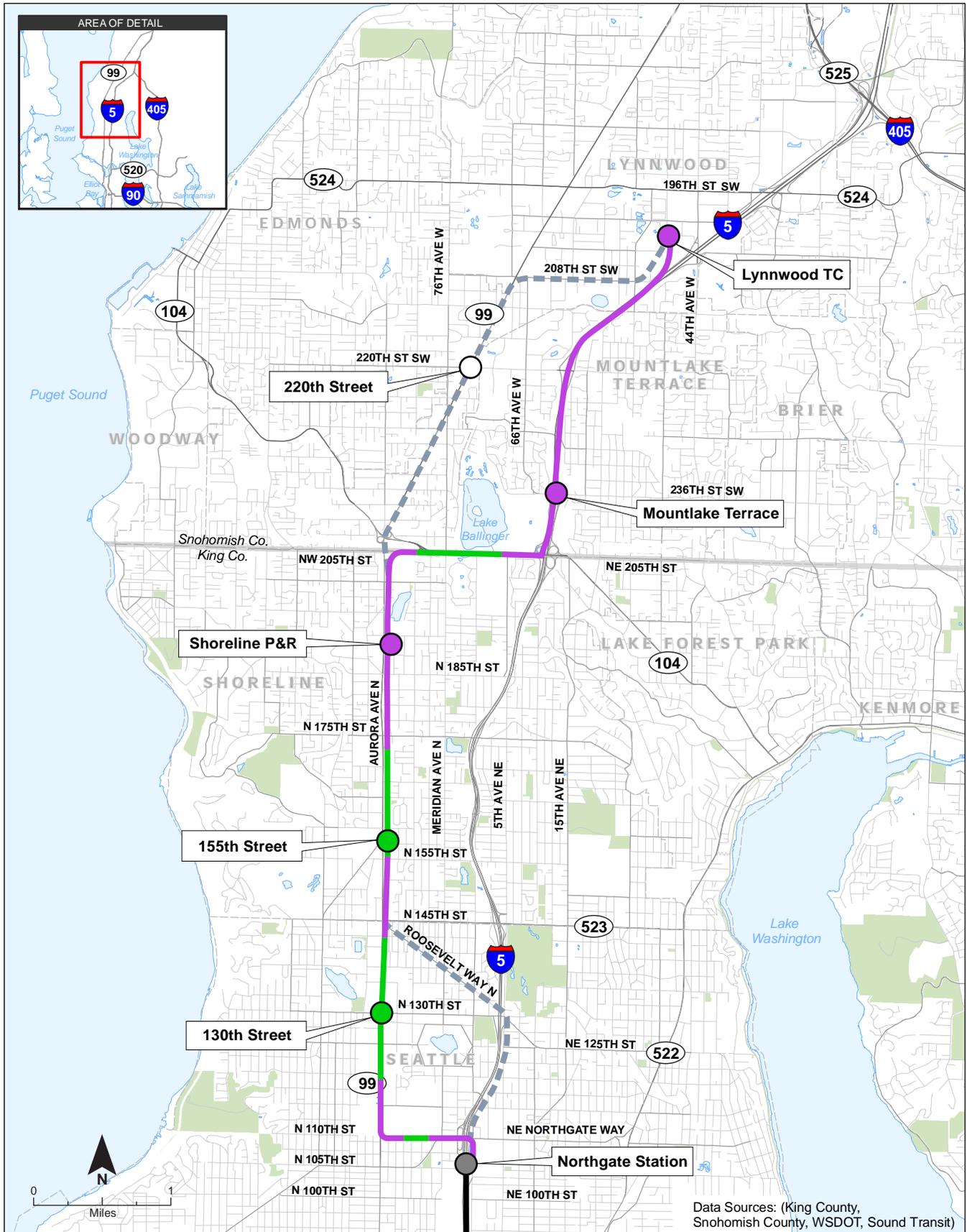
*ST2 Representative Alignment has 4 Light Rail Stations

Figure 3-6. L1: Level 1 I-5 Light Rail Alternative



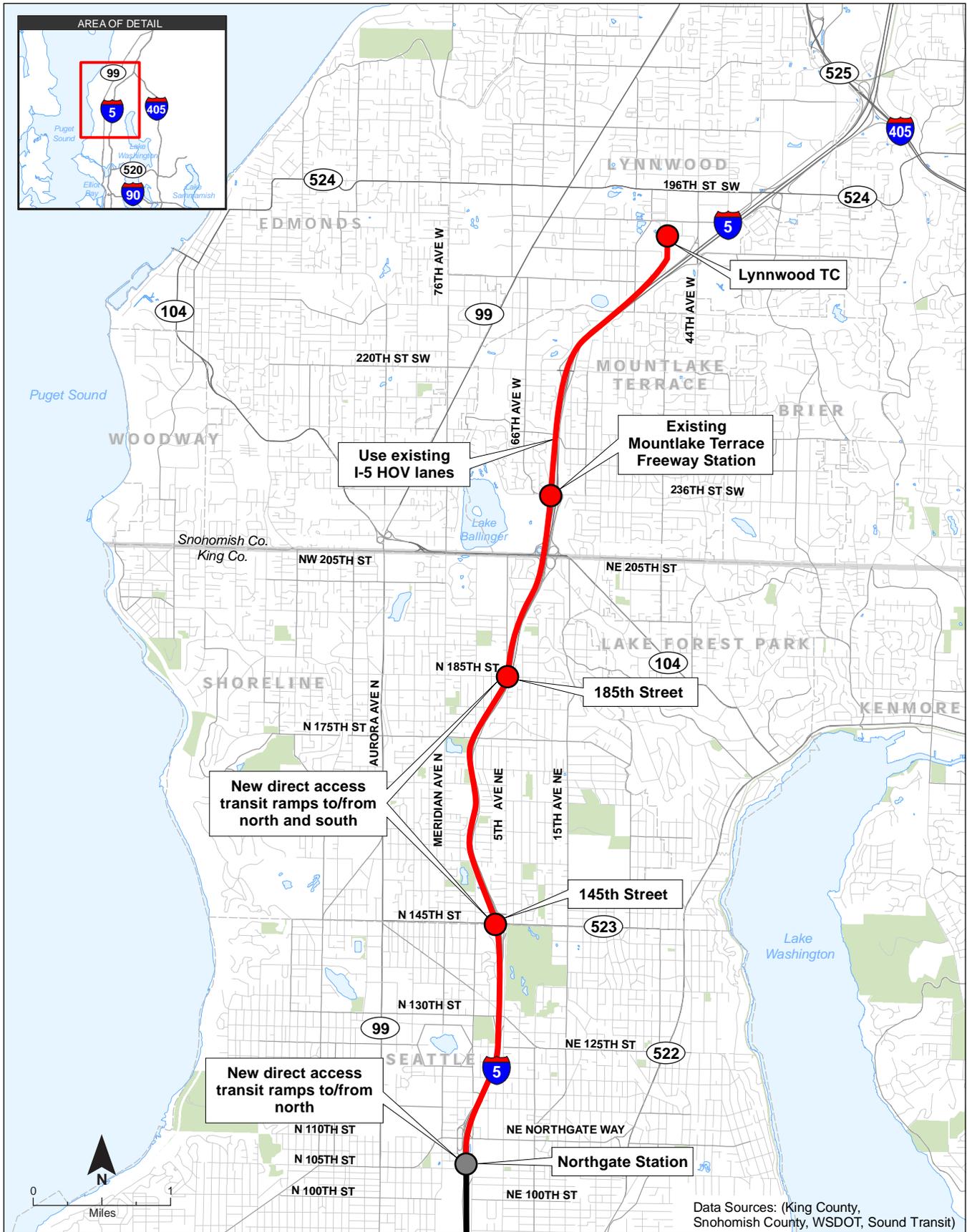
- Light Rail Route
- Proposed Light Rail Station*
- Potential Light Rail Station Variation
- North Link Light Rail
- North Link Station
- *ST2 Representative Alignment has 4 Light Rail Stations

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



- Elevated Light Rail
- Potential At-Grade Segment
- North Link Light Rail
- Elevated Light Rail Station
- Potential for At-Grade Station
- North Link Station
- - - Possible Sub-Alternatives (profile undetermined)
- Possible Sub-Alternatives Station (profile undetermined)

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



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

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

TRANSIT RIDERSHIP

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

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

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

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

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

* Compared to the No Build Alternative

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

ABILITY TO ACCOMMODATE DEMAND

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

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

Table 3-7. 2030 Practical Person-Carrying Capacity

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

TRANSIT TRAVEL TIMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TRANSIT RELIABILITY

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

Non-Exclusive Guideway

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

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

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

Number of At-Grade Signalized Intersections Traversed

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

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

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

3.6.2 Community Equity

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

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

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

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

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

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

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

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

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

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

3.6.3 Land Use and Economic Development

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

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

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

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

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

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

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

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

3.6.4 Environmental Performance

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

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

Table 3-17. Summary of Environmental Performance			
Alternative	Right-of-Way Effects	Community and Neighborhood Effects	Sensitive Resource Effects
TSM/Baseline	Low	Low	Low
L1: I-5 Light Rail	Low to Moderate	Low to Moderate	Moderate
L2: SR 99 Light Rail	High	Moderate to High	Low to Moderate
B1: I-5 BRT	Low	Low to Moderate	Low to Moderate
B2: Multi-Corridor BRT	Low	Low	Low

RIGHT-OF-WAY EFFECTS

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

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

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

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

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

EFFECTS ON COMMUNITIES AND NEIGHBORHOODS

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

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

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

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

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

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

EFFECTS ON SENSITIVE RESOURCES

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

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

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

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

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

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

3.6.5 Effects on Transportation System

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

Table 3-18. Summary of Transportation Effects

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

GENERAL PURPOSE TRAFFIC OPERATIONS

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

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

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

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

TRANSIT OPERATIONS

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

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

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

PEDESTRIAN AND BICYCLE ACCESSIBILITY AND MOBILITY

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

SAFETY

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

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

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

3.6.6 Cost and Constructability

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

CAPITAL COSTS

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

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

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

OPERATION AND MAINTENANCE COSTS

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

Table 3-20. 2030 Operation and Maintenance Cost Estimates

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

CONSTRUCTABILITY FACTORS

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

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

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

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

3.6.7 Consistency with Sound Transit’s Long-Range Vision

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

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

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

3.7 ALTERNATIVES CARRIED FORWARD INTO LEVEL 2 EVALUATION

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

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

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

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

3.7.1 TSM/Baseline Alternative

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

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

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

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

Table 3-22. Level 1 Alternatives Evaluation Summary

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

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

3.7.2 L1: I-5 Light Rail Alternative

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

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

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

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

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

3.7.3 L2: SR 99 Light Rail Alternative

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

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

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

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

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

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

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

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

3.7.4 B1: I-5 BRT Alternative

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

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

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

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

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

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

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

3.7.5 B2: Multi-Corridor BRT Alternative

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

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

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

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

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

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

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

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

3.7.6 Possible Future Changes to I-5 by WSDOT

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

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

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

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

4 DETAILED DEFINITION OF LEVEL 2 ALTERNATIVES

Based on the conclusions of the Level 1 alternatives evaluation, two light rail alternatives and one BRT alternative, along with the TSM/Baseline and No Build Alternatives, were advanced to the next level of development and evaluation. The findings of the Level 1 evaluation also resulted in recommended refinements and modifications to all of the build alternatives. This chapter summarizes the detailed definitions of the No Build, TSM/Baseline, and three build alternatives carried forward for Level 2 evaluation. Additional information and more detailed alignment and station illustrations are provided in the *Level 2 Definition of Alternatives Technical Memorandum* (Sound Transit 2011f).

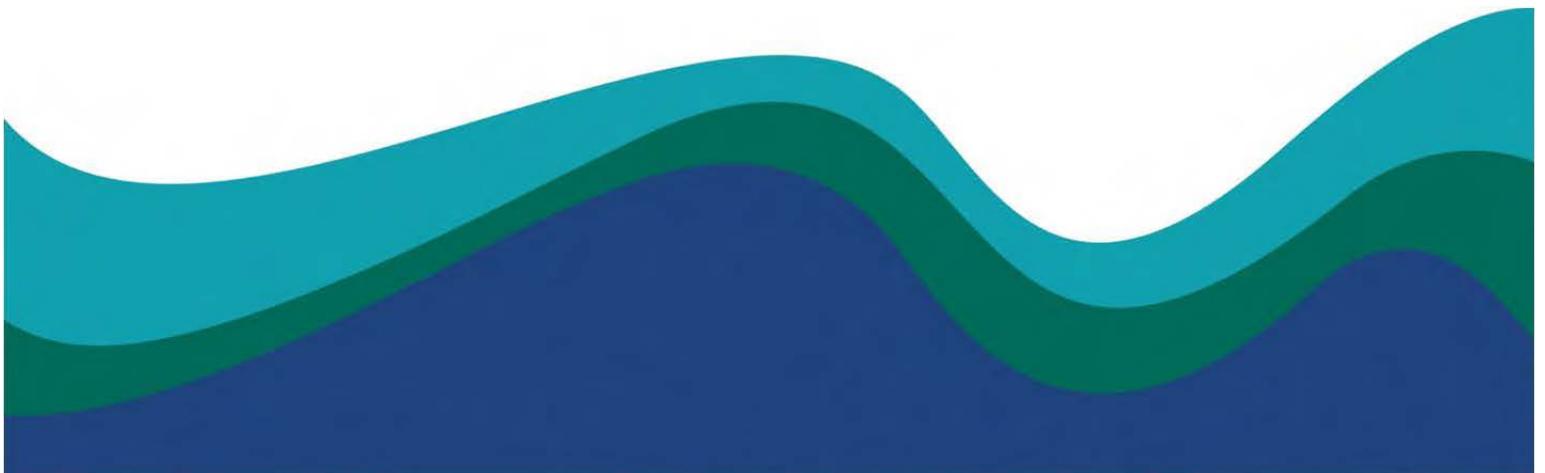
The assumptions and guiding principles for the development of the Level 2 alternatives remained the same as those described in Section 3.7.1 for the Level 1 alternatives.

4.1 NO BUILD ALTERNATIVE

The Level 2 No Build Alternative included only those improvements committed and funded for implementation by the transportation providers in the region. The Level 2 No Build Alternative was unchanged from that defined in Level 1.

4.1.1 Transportation Facilities

Only those physical improvements currently funded and committed as of fall 2010 are included in this alternative. Within the study area, these improvements include a number of minor lane additions and modifications to eliminate choke points along I-5, traffic management, and driver information improvements on I-5; and the completion of roadway, BRT, and intersection improvements to SR 99 in Shoreline. The most significant change from today in the study area included in the No Build Alternative is the assumption that light rail extends north to Northgate.



In addition, the balance of the 2008 voter-approved ST2 Plan, as shown in Figure 2-1, is assumed to be in place with light rail service running east to Overlake in Redmond and south to Redondo/Star Lake in Federal Way. By 2030 it is assumed that light rail service on the section between downtown Seattle and Northgate would operate at a combined 4-minute headway (the time between successive train or bus movements in a given direction) in each direction during peak periods and be served by two lines, one continuing east across Lake Washington and the other continuing south to Federal Way.

4.1.2 Bus Service Plan

Major changes in King County Metro bus service in the corridor will be made as a result of the extension of light rail to Northgate and the addition of the RapidRide E Line, a new BRT route serving SR 99 (Aurora Avenue) from Shoreline to downtown Seattle. No significant restructuring of Community Transit bus service between Snohomish County and the major destinations in King County was assumed.

The assumed changes to King County Metro routes at Northgate are based on routing developed in 2004 by King County Metro to respond to proposed light rail service reaching Northgate. Once light rail service extends to Northgate, the following King County Metro routes currently serving Northgate would be discontinued:

- Route 41 (Lake City/Northgate to Seattle): Replaced by Route 75 (Lake City to Northgate)
- Route 66 (Northgate to Seattle via Roosevelt/Eastlake)
- Route 68 (Northgate to the University District via 25th Avenue NE): Replaced by Routes 16/63

In addition to the changes related to Link light rail service to Northgate, the King County Metro RapidRide E Line will replace the existing Route 358 and run from the Aurora Village Transit Center at the county line along the length of SR 99 to downtown Seattle. Features of the E Line include enhanced stations, limited stops, BAT lanes, and transit signal priority—all of which will improve speed and reliability. The goal is for more frequent, fast, and reliable service than what is currently operated by King County Metro Route 358.

4.2 TSM/BASELINE ALTERNATIVE

The Level 2 TSM/Baseline Alternative is a modified version of the alternative evaluated during level 1 and described in Chapter 3. Based on the findings of the Level 1 evaluation of both the TSM/Baseline and the two BRT alternatives, a number of 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:

- 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.

- 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, serving a stop at 220th Street SW, an expanded Shoreline Park-and-Ride and Transit Center, a stop at North 175th Street/Meridian Avenue, and the existing NE 145th Street freeway flyer stop on I-5 along the way. This route would serve as an express service complementing the existing *Swift* and RapidRide Line E services. While sharing stations, facilities, and the BAT lanes, the latter two BRT services stop much more frequently than the new express line.
- 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.

4.2.1 Facility Design

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 traffic engineering, roadway, and signalization improvements at a modest cost to enhance the service additions. These are shown in Figure 4-1 and described in the following sections.

NORTHGATE STATION

The three additional routes serving the Northgate Transit Center and light rail station will require nine additional bus layover spaces at Northgate. In-service bus bay needs can be met by the existing facility.

TRANSIT SPEED AND RELIABILITY IN NORTHGATE AREA

Currently, buses providing service southbound on I-5 to Northgate must weave across several lanes on I-5 from the left-side HOV lane to the right-side exit ramp to eastbound Northgate Way. Buses then must turn right onto eastbound Northgate Way and then right again onto southbound 1st Avenue NE, often experiencing significant delays while making these movements. This alternative includes the addition of a transit-only lane extending from the beginning of the 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. The transit-only lane (Figure 4-2) would provide travel time savings and improved reliability for southbound bus service to Northgate. The bypass would be separated from the existing lanes with a center curb to prevent encroachment by general purpose traffic. 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. In addition to these improvements, transit signal priority strategies would be implemented at the traffic signals the buses pass through between the interchange and the transit center.

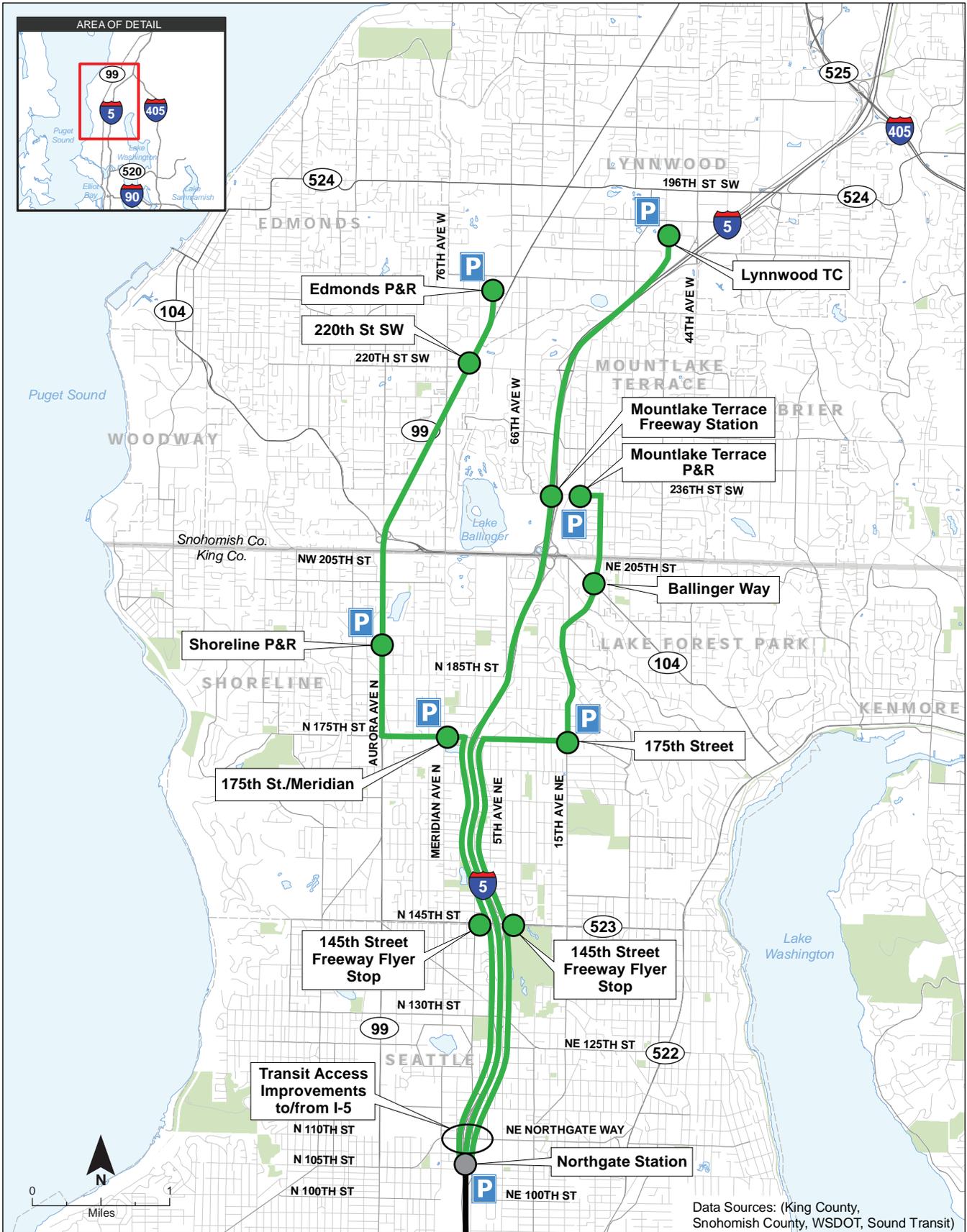


Figure 4-1. Level 2 TSM/Baseline Alternative



Figure 4-2. Northgate Area Transit Queue Bypass Improvement

SHORELINE PARK-AND-RIDE

The TSM/Baseline Alternative assumes that the transit terminus functionality of the Aurora Village Transit Center would be re-located to the Shoreline Park-and-Ride (currently with a parking capacity of 400 stalls), along with the existing 200-stall park-and-ride capacity of the Aurora Village Transit Center. An additional 150 stalls of new parking capacity would be provided, for a combined total of 750 park-and-ride stalls. The re-located transit center would consist of 16 bays for in-service and layover operations. These changes allow the new express BRT line to interface with both the *Swift* BRT line from the north and the RapidRide Line E service from the south without time-consuming deviation from SR 99. *Swift* BRT would be extended south to terminate at the Shoreline Park-and-Ride.

NORTH 175TH STREET/MERIDIAN AVENUE PARK-AND-RIDE

A new park-and-ride facility with 300 spaces would be constructed near the intersection of North 175th Street and Meridian Avenue. This would be served by the new express route from Edmonds Park-and-Ride to Northgate.

I-5/NE 145TH STREET PARK-AND-RIDE

The existing park-and-ride facility at I-5 and NE 145th Street would be expanded from 68 stalls to a total of 150 spaces. This would be served by two new express routes: Edmonds Park-and-Ride to Northgate and Mountlake Terrace to Northgate.

NE 175TH STREET/15TH AVENUE NE PARK-AND-RIDE

A new park-and-ride facility with 300 spaces would be constructed near the intersection of NE 175th Street and 15th Avenue NE. This would be served by the new Mountlake Terrace to Northgate express route.

EDMONDS PARK-AND-RIDE

The Edmonds Park-and-Ride to Northgate express route would terminate at the existing Edmonds Park-and-Ride. In-service and layover bus bay requirements for this route would be met with existing on-street space. An additional 100 spaces of parking capacity would be added to the park-and-ride facility for a total of 350 spaces.

MOUNTLAKE TERRACE PARK-AND-RIDE

The existing Mountlake Terrace Park-and-Ride facility would be served by the new Mountlake Terrace to Northgate express route. The existing 890-stall facility would provide in-service and layover bays for the new express route.

LYNNWOOD TRANSIT CENTER

The Lynnwood to Northgate express route would terminate at the Lynnwood Transit Center. This route would require seven additional layover spaces. In-service bus bay needs would be met by the existing facility. An additional 500 stalls of parking capacity would be added, for a total of approximately 1,900 park-and-ride stalls.

4.2.2 Service Plan

This alternative includes three new bus routes, as described earlier and shown in Figure 4-1, to connect the project area to the Link light rail station at Northgate. All three new routes would be subject to potential delays between the I-5 interchange and the Northgate Link Station, which can be substantial during morning and evening peak hours, as well as times of high shopping activity at the adjacent Northgate Mall regional shopping center complex. Priority treatments would help to mitigate these delays, but would not completely eliminate them. In addition, the new Edmonds to Northgate and Mountlake Terrace to Northgate routes would not be able to use the I-5 HOV lanes, because they would enter I-5 at 175th Street, stop at the existing 145th Street flyer stops, and exit at Northgate Way.

Express bus service on all three routes would be provided from 4:30 am to midnight (actual schedule would be timed for first inbound and last outbound trains at Northgate). Service frequencies were developed and refined to meet the projected ridership demand. Resulting headways were as follows:

- Lynnwood to Northgate route: 3.75 minutes during peak periods and every 15 minutes during off-peak periods
- Edmonds to Northgate route: 12 minutes during peak periods and every 15 minutes during off-peak periods
- Mountlake Terrace to Northgate route: 15 minutes during peak and off-peak periods

King County Metro Routes 301 and 303 would be replaced by the new Edmonds Park-and-Ride to Northgate Express route. Community Transit routes that now serve the Aurora Village Transit Center would be extended south on SR 99 to serve the new Shoreline Transit Center. Similarly, King County Metro routes that now serve the Aurora Transit Center would be truncated at the new Shoreline Transit Center.

4.3 L1: I-5 LIGHT RAIL ALTERNATIVE

The L1: I-5 Light Rail Alternative advanced to the Level 2 evaluation is similar to the L1: I-5 Light Rail Alternative assessed as part of the Level 1 evaluation. However, for Level 2 evaluation, the profile of this 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 the Mountlake Terrace Transit Center. Figure 4-3 provides an overview of the alternative, while Figures 4-4 through 4-7 provide more detail regarding alignment, profile, and station locations. Because of the topography along this section of I-5, much 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 station facilities and park-and-ride structures. These acquisitions may result in the displacement of some residences that are now located adjacent to I-5. The general scope of work includes:

- Capacity for new light rail fleet and O&M facility, as needed, to support the extension.
- Operation of up to four-car light rail trains between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes.

- New light rail stations at NE 145th Street, NE 185th Street, Mountlake Terrace Transit Center (I-5 at SW 236th Street), and Lynnwood Transit Center. All stations would be elevated, with the exception of the NE 185th Street Station, which would be at-grade.
- Five hundred new structured park-and-ride stalls at each of the North 145th Street, North 185th Street, and Lynnwood Transit Center Link stations, supplementing approximately 2,300 existing stalls along the alignment.
- Restructured bus services consistent with 2007 bus/light rail service integration work done by Sound Transit, Community Transit, and King County Metro for ST2 to address bus route changes compatible with light rail extended into south Snohomish County.
- Additional in-service and/or layover bus bays at new stations as needed to accommodate restructured bus services.

4.3.1 Facility Design

The proposed L1: I-5 Light Rail Alternative would be approximately 8.5 miles in length. 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.

Opportunities for locating stations are additional significant considerations in determining the alignment. An important station siting factor is to provide access to existing transit facilities such as transit centers and park-and-ride facilities to leverage investments where riders can connect to the regional system. The selection of station sites must also consider impacts on the alignment. If the location of stations frequently alternates from the east to the west side of I-5, this would require more structures to cross I-5, with more potential for impacts to I-5 and adjacent properties.

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 more land to site the station, guideway alignment, and a parking area, although some private properties would still be needed. The topography in the area is also better for siting the station, park-and-ride facility, and aerial guideway alignment. In addition, 5th Avenue NE provides an additional buffer separating the light rail alignment, the station, park-and-ride facility, and adjacent properties. By comparison, a station and guideway alignment on the west side would have a higher potential to affect existing water resources. In addition, the topography rises above I-5 making the station development more difficult without affecting a greater number of properties. Lakeside School, located west of I-5, and private residences on the north side of NE 145th Street could be affected with a station and park-and-ride facility. Additionally, Thornton Creek crosses I-5 at

NE 145th Street, and then runs parallel to I-5. A west side alignment would likely affect the creek and would also remove vegetated and forested areas that provide a buffer between I-5 and adjacent properties.

The NE 185th Street Station could be sited on either the east or west side of I-5, but the light rail guideway alignment would be more ideally located on the east side to serve the NE 145th Street and Mountlake Terrace stations that appear to be best located on the east side of the freeway. This configuration has resulted in a primary alignment with some station facilities to the west of I-5, but a light rail alignment and passenger platform to the east.

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. A light rail guideway alignment and station located on the west side of I-5 would have greater right-of-way impacts and require long pedestrian bridges across I-5 to access the existing transit center and parking garage. Right-of-way on the west side of the freeway is more constrained than on the east side due to the existing SR 104 and 236th Street SW freeway ramps. Avoiding these ramps would require placing light rail on or adjacent to a golf course that has both public and private ownership, as well as potential wetlands. The west side of I-5 opposite the existing Mountlake Terrace Transit Center also has steeper forested slopes immediately adjacent to I-5 and 236th Street SW, with residential properties nearby.

For these reasons, a “primary” alignment was chosen for the purposes of the Level 2 evaluation that 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 finally crossing 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. 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). The larger envelope assumed is primarily to account for additional width required for retained cut or fill. In most sections of the alignment, sufficient right-of-way exists to accommodate both the 84-foot freeway and 40-foot light rail envelopes. However, some sections would require partial acquisitions of multiple property parcels. It is possible that many of these could require full parcel acquisitions because they are either small parcels, or because access to them has been severed (which could occur if it is necessary to take part of a residential street next to the freeway). More details on potential right-of-way impacts will be evaluated in subsequent analyses. Figures 4-8, 4-9, and 4-10 show a typical cross-section of I-5 with light rail elevated and at-grade on the east side of the roadway, as well as in the median of the roadway, respectively.

The sections that follow describe the major components that form the light rail line along the I-5 alignment between Northgate Transit Center and Lynnwood Transit Center. Line segments and stations are included in these descriptions. Light rail vehicles and the O&M facility capacity to support the light rail line are not included in these descriptions and are the subject of a separate system-wide study that Sound Transit is now undertaking. As the design of the line is refined, requirements for passenger drop-off facilities, local bus transfers, and street and traffic signal improvements around the stations will be further investigated. Refinement of the pedestrian connectivity infrastructure will also need to be considered. For the purposes of developing conceptual cost estimates, it was also assumed there would be one track crossover in the vicinity of each station.

NORTHGATE TRANSIT CENTER TO NE 145TH STREET

The alignment begins at the north end of the planned Northgate Link station tail tracks in the Northgate Mall parking lot east of 1st Avenue NE. It continues north in a mix of elevated and at-grade profiles on the east side of I-5 to NE 145th Street, where it would arrive at an elevated light rail station at NE 145th Street. A center platform aerial station with a ground level plaza would be located above NE 145th Street, with station entrances on the south and north sides of NE 145th Street. The NE 145th Street Station would include the following:

- Park-and-ride garage of 500 parking spaces, representing a 430 space expansion over the existing small open lot
- Elevated pedestrian walkway between the parking garage and the light rail station
- Provisions for both on-street and possibly off-street bus bays and layover stalls to be determined

NE 145TH STREET TO NE 185TH STREET

The alignment for this segment begins north of the NE 145th Street Station. It would continue north in a predominantly at-grade profile on the east side of I-5 to the NE 185th Street Station, with short sections of elevated alignment over arterials crossing under I-5. An at-grade station would be located under a rebuilt NE 185th Street overpass. The NE 185th Street Station includes the following:

- Park-and-ride garage with 500 parking spaces located on the west side of I-5 across from the station
- Elevated pedestrian walkway across I-5 between the parking garage and the light rail station
- Two off-street in-service bus bays
- Two off-street layover bays

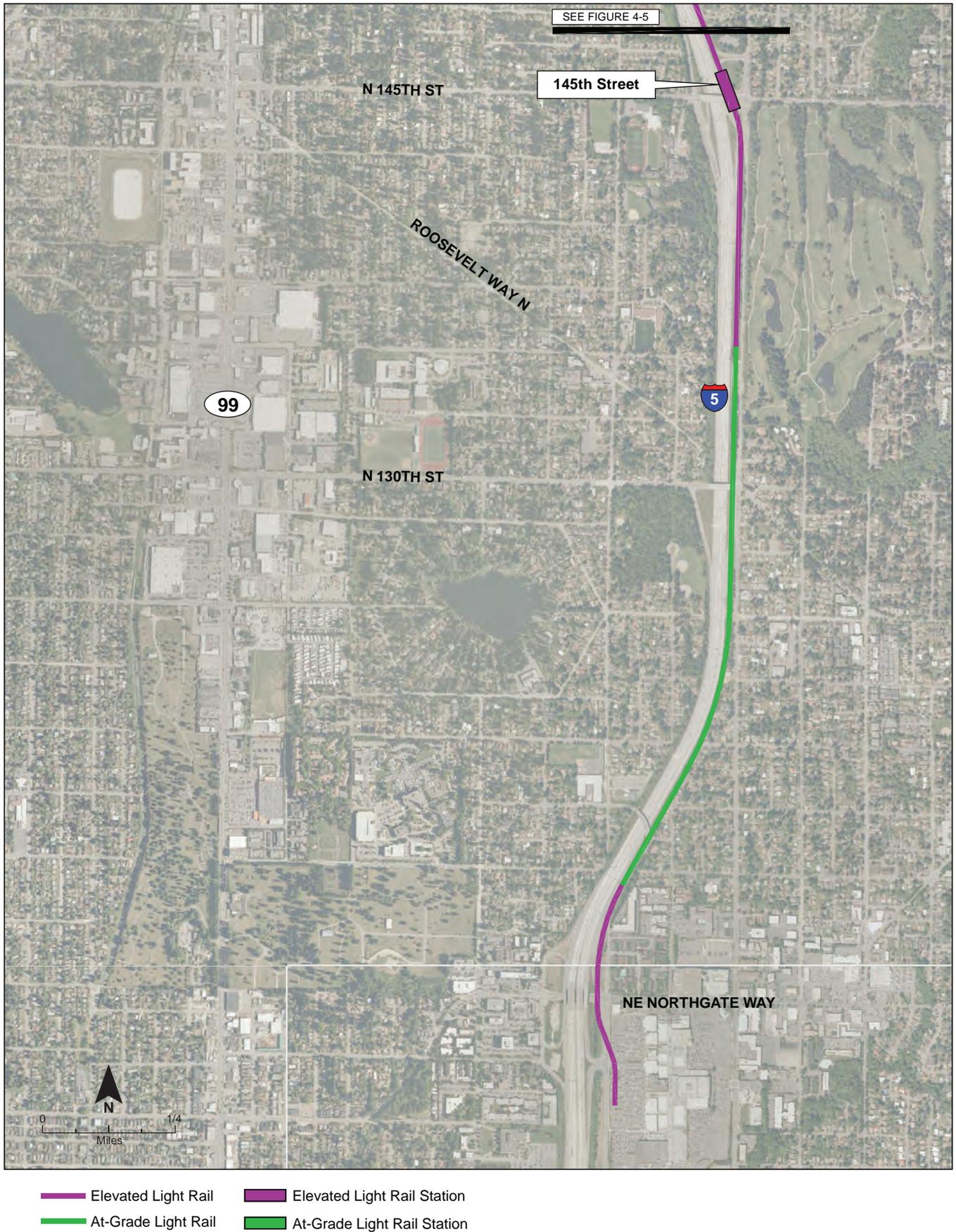


Figure 4-4. L1: Level 2 I-5 Light Rail Alternative Detail - 1 of 4

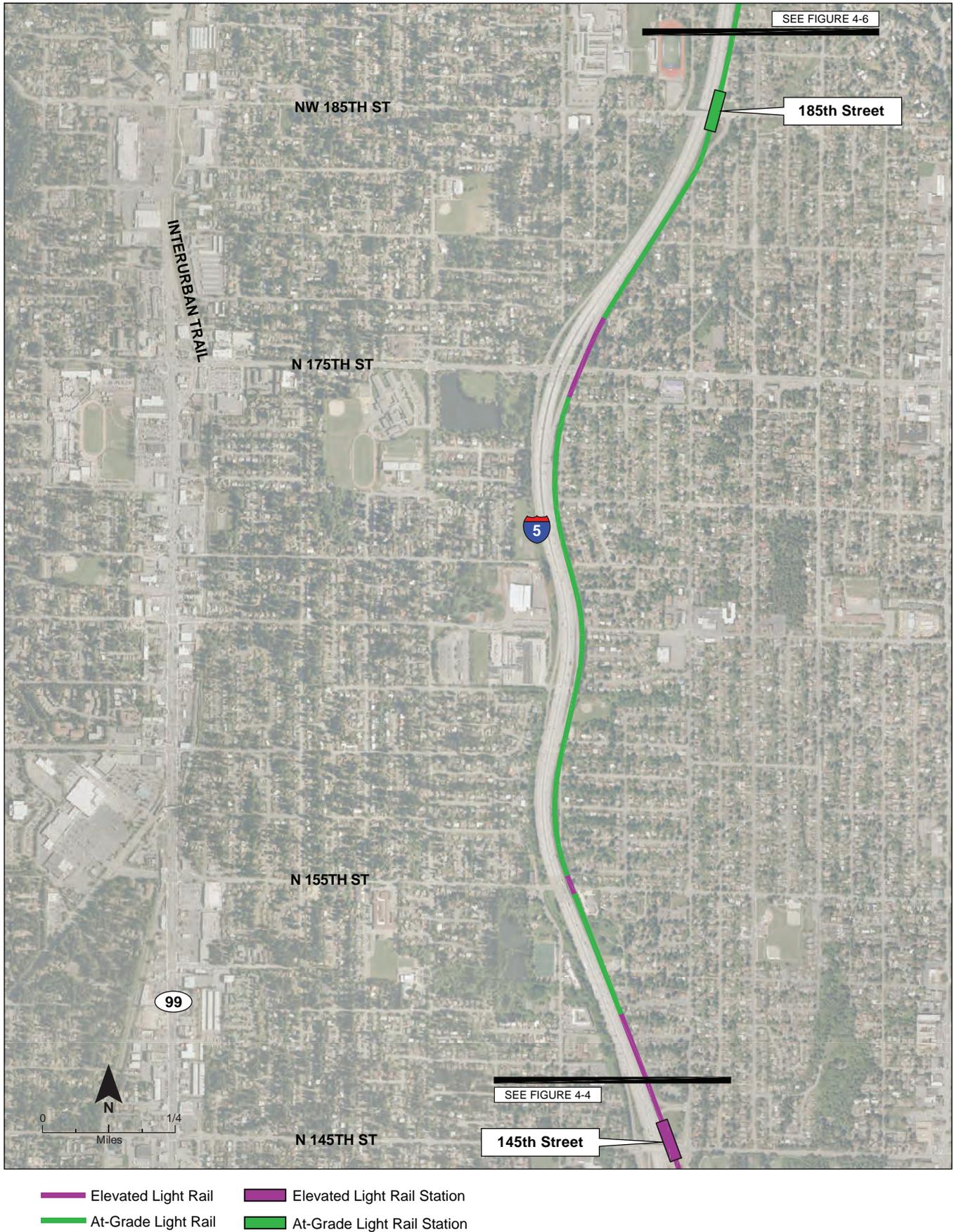
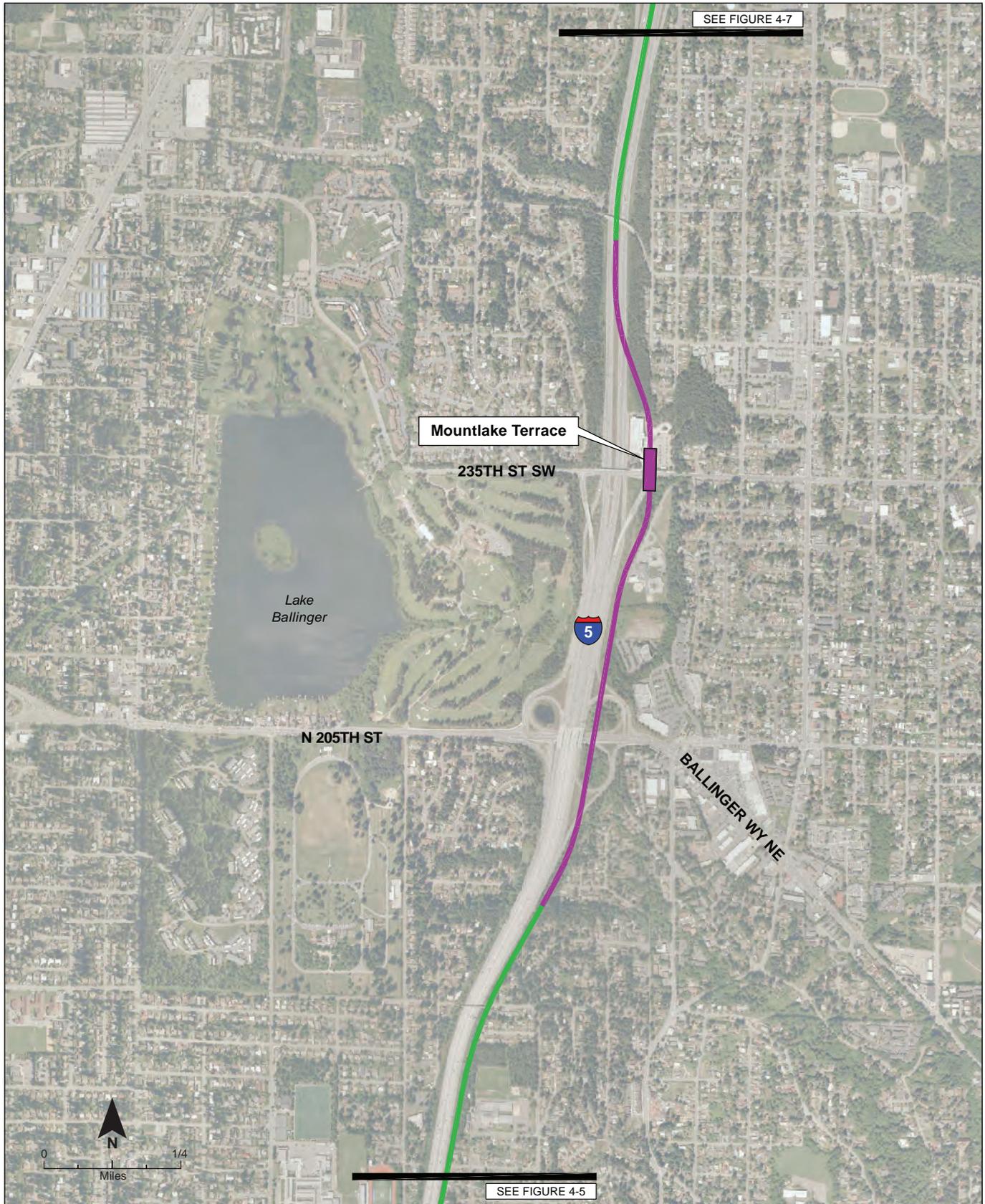
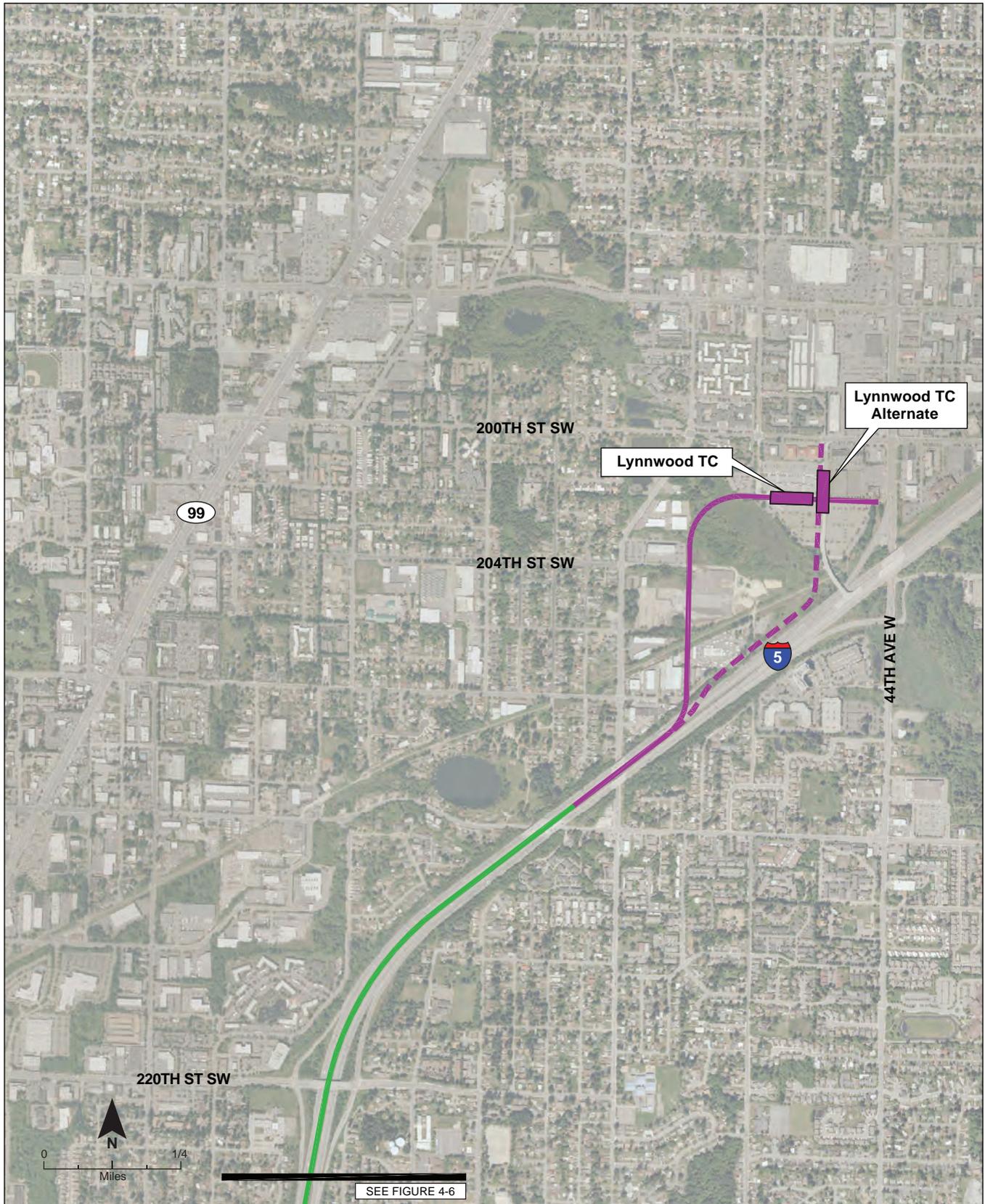


Figure 4-5. L1: Level 2 I-5 Light Rail Alternative Detail - 2 of 4



- Elevated Light Rail
- Elevated Light Rail Station
- At-Grade Light Rail
- At-Grade Light Rail Station

Figure 4-6. L1: Level 2 I-5 Light Rail Alternative Detail - 3 of 4



- Elevated Light Rail
- At-Grade Light Rail
- Elevated Light Rail Station
- At-Grade Light Rail Station

Figure 4-7. L1: Level 2 I-5 Light Rail Alternative Detail - 4 of 4

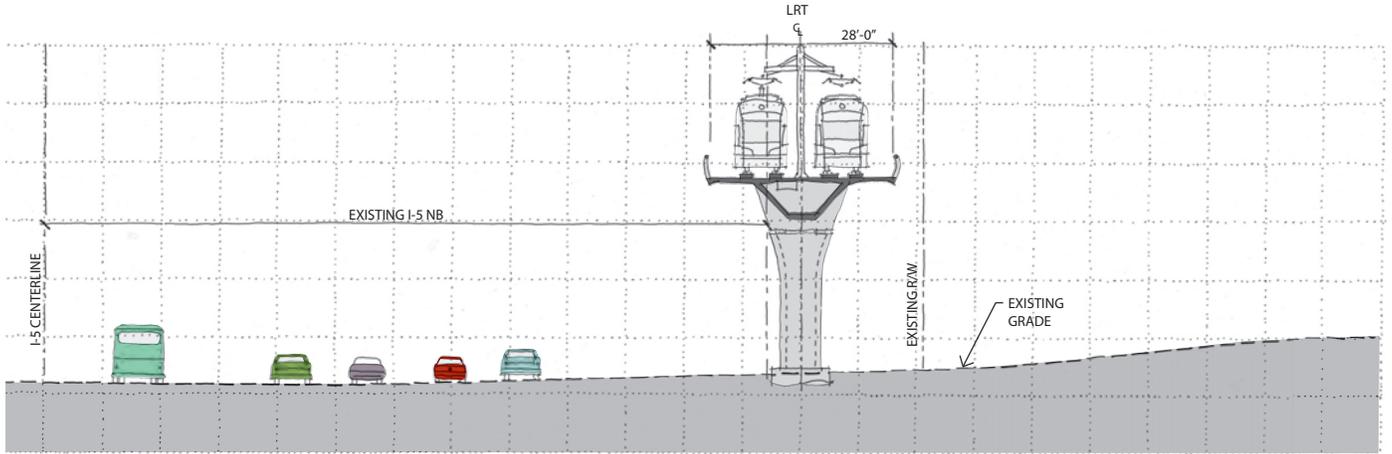


Figure 4-8. L1: I-5 Light Rail Alternative - Typical Cross-section of Elevated Rail on East Side of Roadway

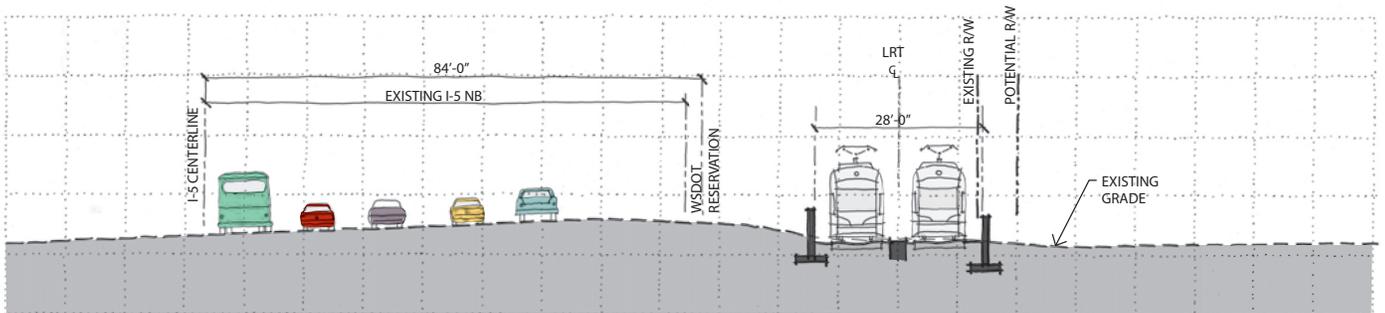


Figure 4-9. L1: I-5 Light Rail Alternative - Typical Cross-section of At-grade Rail on East Side of Roadway

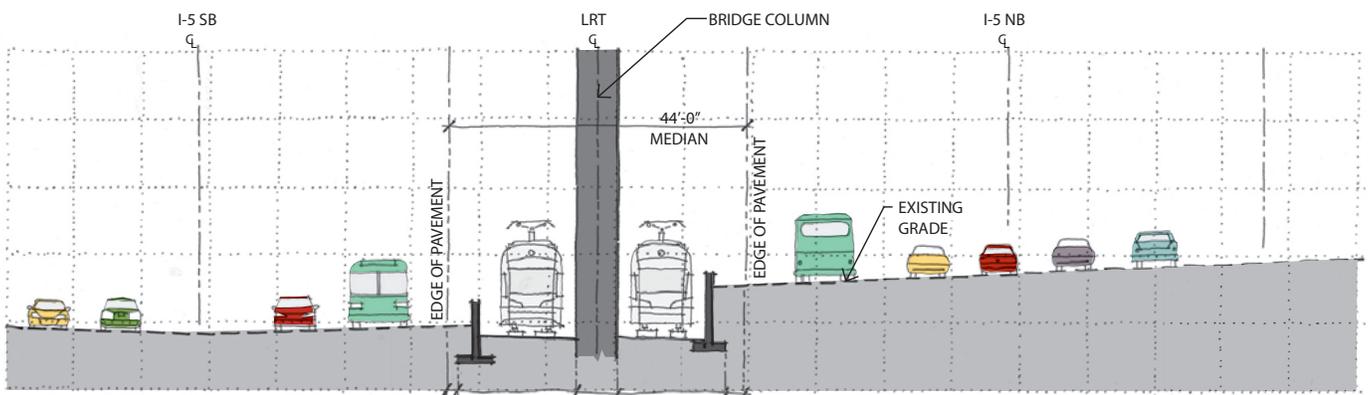


Figure 4-10. L1: I-5 Light Rail Alternative - Typical Cross-section of At-grade Rail in Median of Roadway

NE 185TH STREET TO MOUNTLAKE TERRACE TRANSIT CENTER

The alignment for this segment begins north of the NE 185th Street station. It would continue in a mix of elevated and at-grade profiles to 236th Street SW, where it would arrive at the Mountlake Terrace Transit Center. An aerial station would be located over 236th Street SW, with station entrances on the south and north sides of 236th Street SW, and would serve the Mountlake Terrace Transit Center, park-and-ride garage, and freeway station. The aerial station is assumed to be center platform with a ground-level plaza. The Mountlake Terrace Station includes the following:

- Two off-street in-service bus bays and six off-street layover bus bays at the Mountlake Terrace Transit Center
- To maintain the existing parking supply a new parking garage with approximately 230 parking spaces to replace existing surface parking that would be displaced by the expanded and relocated off-street transit center

MOUNTLAKE TERRACE TRANSIT CENTER TO LYNNWOOD TRANSIT CENTER

The alignment for this segment begins at the Mountlake Terrace Transit Center and continues north on an elevated structure, crossing over the northbound lanes of I-5, entering the freeway median, and dropping to grade. The alignment continues at-grade in the median of I-5 to just south of Lynnwood, where it transitions back to aerial structure and passes over the southbound freeway lanes to reach the existing Lynnwood Transit Center. An aerial station is located on the south side of the Lynnwood Transit Center oriented either east-west in the 202nd Street SW right-of-way or north-south in the 46th Avenue West right-of-way. This station is assumed to be center platform with a ground level plaza connecting to the Lynnwood Transit Center. The Lynnwood Transit Center Station includes the following:

- Additional park-and-ride garage of 500 spaces, for a total of approximately 1,900 spaces at the Lynnwood Transit Center
- Pedestrian bridge connection from the station to the east side of 44th Avenue West to access the city center area
- Two additional off-street layover bays
- A sufficient number of in-service bus bays

4.3.2 Service Plan

Light rail service includes operation of up to four-car trains serving stations at Northgate Transit Center, NE 145th Street, NE 185th Street, Mountlake Terrace Transit Center, and Lynnwood Transit Center. Service would be provided 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes. Headways were determined based on service levels required to meet estimated ridership demand.

No changes are proposed for Community Transit local routes except for minor adjustments to Route 112 to serve the Mountlake Terrace Transit Center. Local King County Metro routes in north King County would be adjusted to serve light rail. Existing routes would either be truncated or extended to serve the new light rail stations at NE 145th Street, NE 185th Street, and the Mountlake Terrace Transit Center. All of Community Transit's south Snohomish County commuter routes to the University of Washington and downtown Seattle would be restructured to terminate at the Lynnwood, Mountlake Terrace, or 185th Street light rail stations. None of the existing 800 or 400 series routes from south Snohomish County would continue south of 185th Street in Shoreline. North Snohomish County commuter routes would continue to operate unchanged from today's operations.

Most Sound Transit and Community Transit routes from south Snohomish County that operate to Seattle would terminate in Lynnwood where passengers would transfer to light rail. The exceptions are routes that currently originate in Edmonds and provide service to downtown Seattle and the University District. These routes would terminate at the Mountlake Terrace and Shoreline Park-and-Ride Stations where passengers would transfer to light rail.

King County Metro commuter routes connecting north King County with downtown Seattle, Overlake, and the University District (e.g., 242, 301, and 304) would be modified or discontinued and replaced with modified routes that would provide connections to the light rail stations at Northgate, NE 145th Street, and NE 185th Street.

4.4 L2: SR 99 MIXED PROFILE LIGHT RAIL ALTERNATIVE

The L2: SR 99 Mixed Profile Light Rail Alternative 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. This alternative would include a combination of elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with four intermediate stations. The general scope of work includes:

- Capacity for new light rail fleet and O&M facility, as needed, to support the extension
- New at-grade light rail stations located at North 130th Street and North 160th Street, as well as new elevated light rail stations at the Shoreline Park-and-Ride (North 192nd Street), Mountlake Terrace Transit Center, and Lynnwood Transit Center
- Five hundred new structured park-and-ride stalls at both the Shoreline Park-and-Ride and Lynnwood Transit Center, supplementing approximately 2,600 existing stalls along the alignment
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication of transit service on SR 99
- Relocation of the transit functionality of the Aurora Village Transit Center to the Shoreline Park-and-Ride, including 16 bays for in-service and layover operations

- Additional in-service and/or layover bus bays at the Mountlake Terrace Park-and-Ride and the Lynnwood Transit Center to accommodate restructured bus services

Early in the Level 2 alternatives development process, a major change was made to this alternative from the concept evaluated during Level 1. A decision was made to change from peak period operation of four-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.

The Level 1 evaluation had indicated some potential for traffic congestion along the at-grade sections of the SR 99 alignment, so work was undertaken early in the refinement of the Level 2 alternatives to better understand the possible impacts. At-grade light rail operating in the median of SR 99 would require trains to pass through a number of signalized intersections, exposing them to delays that would not occur with a completely grade-separated alignment. The affected SR 99 traffic signals can be timed to provide varying levels of priority for light rail, with the trade-off being the resulting delay to roadway traffic. Complete pre-emption of the signals for the train movements (i.e., the signals turn green to facilitate the train movement and stop all conflicting traffic) would result in significant impacts to conflicting traffic movements.

Sound Transit's experience on Martin Luther King Jr. Way in Seattle is that full signal pre-emption for median running light rail is not practical along a major arterial. Instead, at grade median running light rail typically operates with traffic signal *priority* as opposed to *pre-emption*, and trains would need to stop at some signals with some unpredictability. It is not known what the policies of the cities of Seattle and Shoreline and WSDOT will be toward the operation of SR 99, but given the high cross-street and left-turn traffic volumes, full pre-emption for light rail does not seem practical. Analysis of intersections along SR 99 indicates that many will be operating at LOS F (i.e., highly congested) by 2030. The traffic added as a result of the consolidation of left turns and other traffic relocations, along with the addition of a four-car train every 2 minutes, would further worsen these highly congested conditions. If trains are provided a high level of priority through these intersections severe traffic impacts would result, especially to cross-street and left-turn movements.

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 would result. These conditions would lead to a high probability of unpredictable train delays. When combined with the short train headways, schedule recovery from these delays would 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 4-11 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, the system would operate with two lines—one from Lynnwood to South 200th Street and one from Lynnwood to Overlake. Both lines would 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, which requires every train operating in the system to traverse the segment between Northgate and

Lynnwood. Ridership forecasting completed as part of the system plan development indicates that this level of service, at least south of Lynnwood, is needed to accommodate forecasted demand. As a result, any delays incurred in the segment between Northgate and Lynnwood would 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 configuration increases the headways along SR 99 to a more comfortable 8-minute operation.

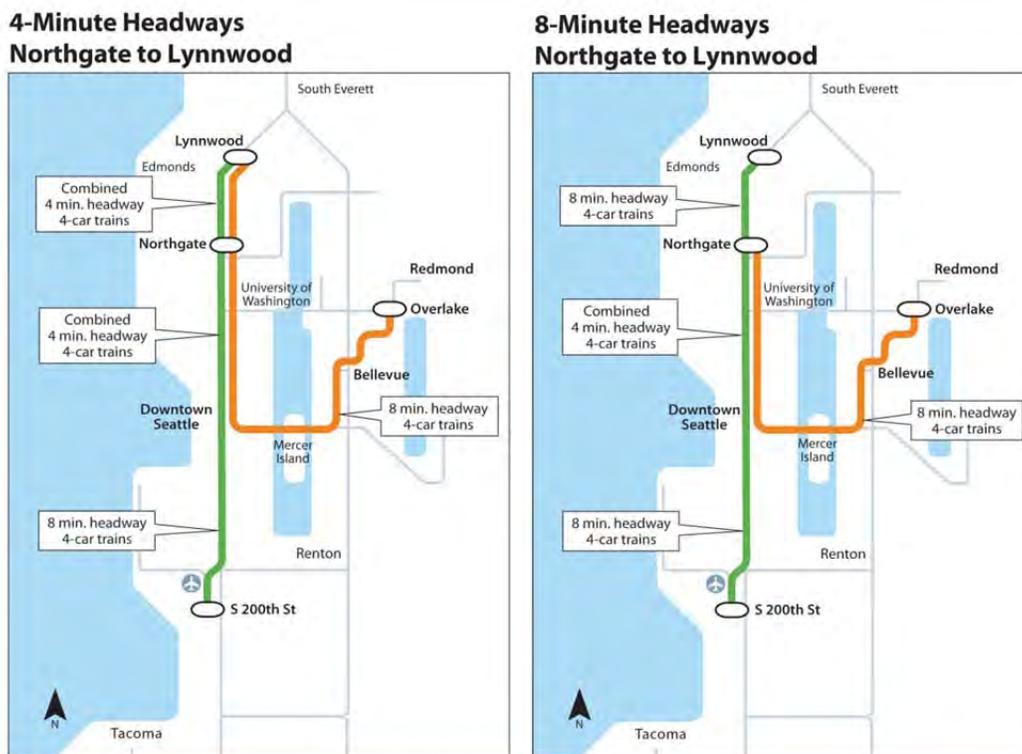


Figure 4-11. 4- and 8-Minute System Operating Plans

4.4.1 Facility Design

Figure 4-12 provides an overview of the alternative showing the primary alignment and two possible variations—one at the south and one at the north end. Figures 4-13 through 4-16 provide more detail regarding the alignment, profile, and station locations. The proposed L2: SR 99 Mixed Profile Light Rail Alternative is approximately 10.2 miles in length from the Northgate Transit Center to the Lynnwood Transit Center. Potential right-of-way acquisitions would be required along the majority of the alignment, and would be quite large for the at-grade sections and stations (50 to 90 feet of new right-of-way would be required). Because the at-grade alignment passes through intersections along SR 99, the conceptual design approach was to maintain traffic functionality and level of service existing in baseline conditions. This would require maintaining the existing through lanes and BAT lanes, as well as adding new left-turn lanes to accommodate consolidated left-turn volumes. This would result in dual left-turn lanes at many intersections. At station locations, the left-turn lanes are placed outside of the station platforms, resulting in a relatively extensive total roadway and trackway width (up to 190 feet). Figure 4-16 shows a typical cross-section of the existing SR 99 between North 110th Street and North 145th Street. Figures 4-17 and 4-18 illustrate typical examples of the resulting cross-sections for a mid-block at-grade rail guideway location and an at-grade rail station location, respectively. As the design of the line is refined, details for roadway improvements, as well as passenger drop-off facilities, local bus transfers, and street and traffic signal improvements around the stations will be further investigated. Refinement of the pedestrian connectivity infrastructure will also need to be considered. For the purposes of developing conceptual cost estimates, it was also assumed there would be one track crossover in the vicinity of each station.

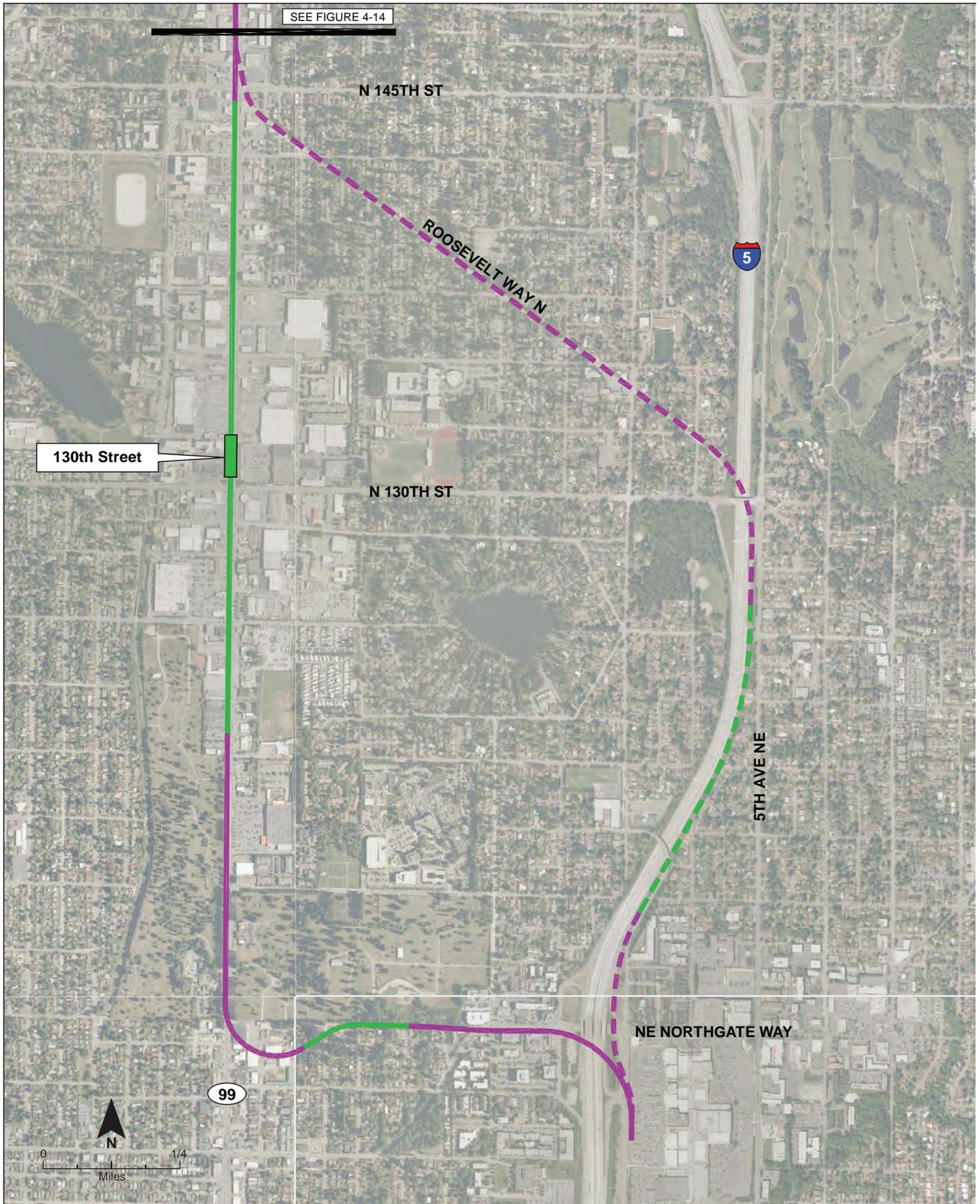
NORTHGATE TRANSIT CENTER TO NORTH 130TH STREET

The alignment begins at the north end of the planned Northgate Link station tail tracks in the Northgate Mall parking lot east of 1st Avenue NE. The aerial alignment continues north and then turns west, crossing over I-5, and continuing on aerial structure along the south side of Northgate Way. As Northgate Way turns southwest, the alignment would cross over the street and continue west generally along North 110th Street on the south edge of the Evergreen Washelli Cemetery. A section of this alignment may be at-grade, but most of it would be aerial. North 110th Street would be reconstructed to reconnect the local streets through this segment.

Near SR 99, the aerial alignment would curve to the south and then north to cross the northbound lanes and enter the median of SR 99. The aerial alignment would continue north in the median of SR 99 to about North 120th Street to minimize impacts to 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 to provide 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.

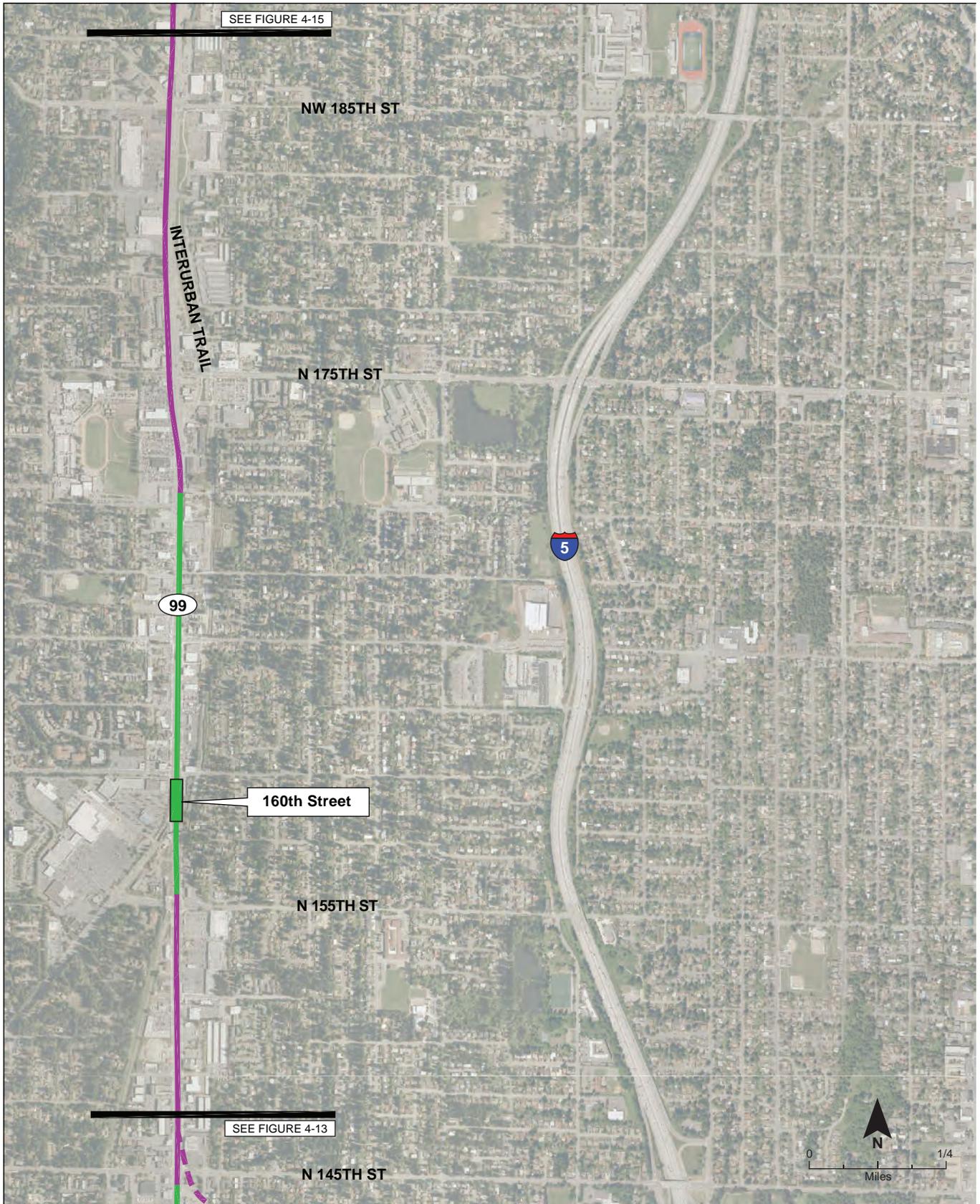


Figure 4-12. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative



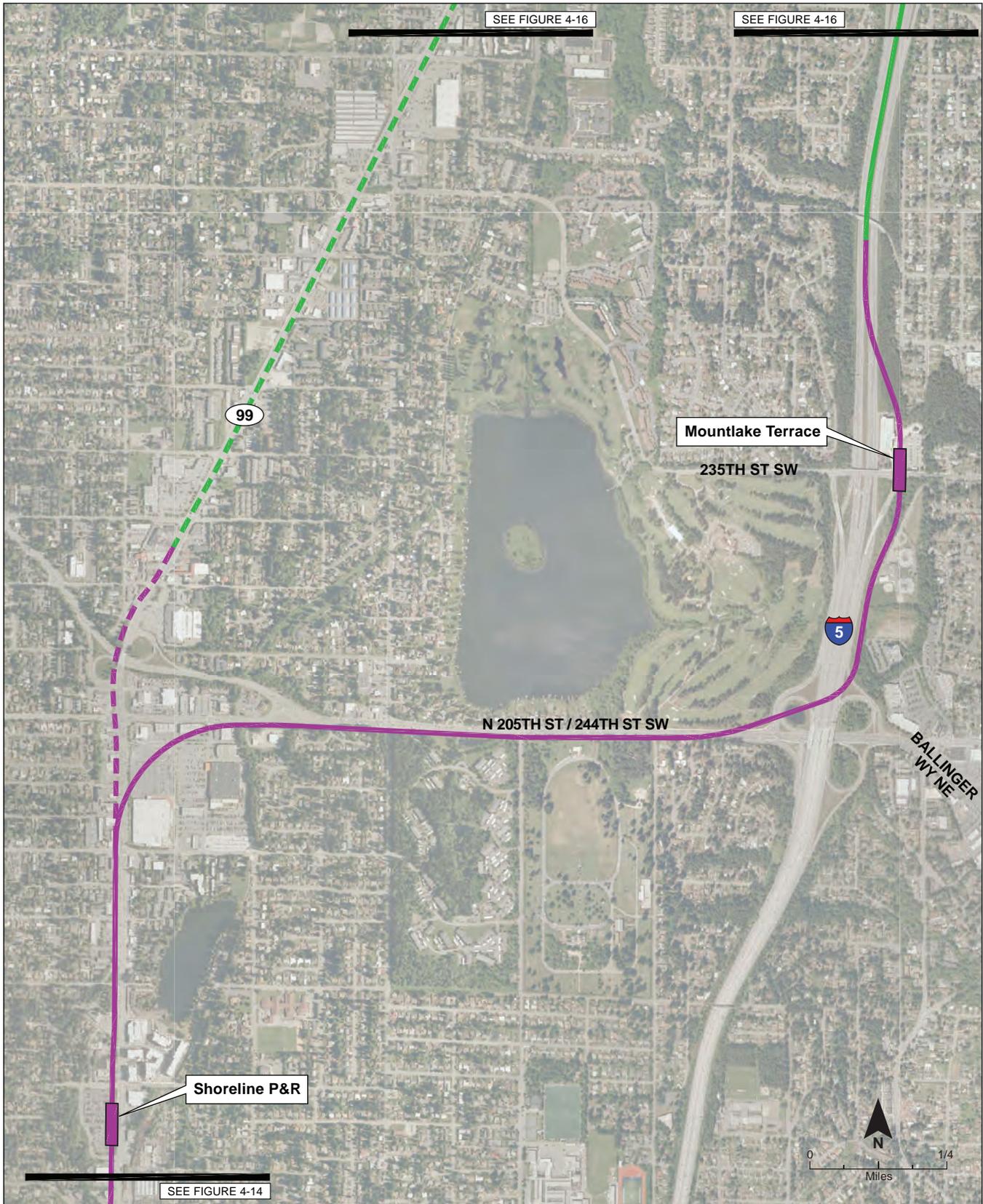
- | | | | | | |
|--|---------------------|--|-------------------------------|--|-----------------------------|
| | Elevated Light Rail | | Alternate Elevated Light Rail | | Elevated Light Rail Station |
| | At-Grade Light Rail | | Alternate At-Grade Light Rail | | At-Grade Light Rail Station |

Figure 4-13. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 1 of 4



- Elevated Light Rail
- At-Grade Light Rail
- - - Alternate Elevated Light Rail
- - - Alternate At-Grade Light Rail
- Elevated Light Rail Station
- At-Grade Light Rail Station

Figure 4-14. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 2 of 4



- Elevated Light Rail
- At-Grade Light Rail
- - - Alternate Elevated Light Rail
- - - Alternate At-Grade Light Rail
- Elevated Light Rail Station
- At-Grade Light Rail Station

Figure 4-15. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 3 of 4

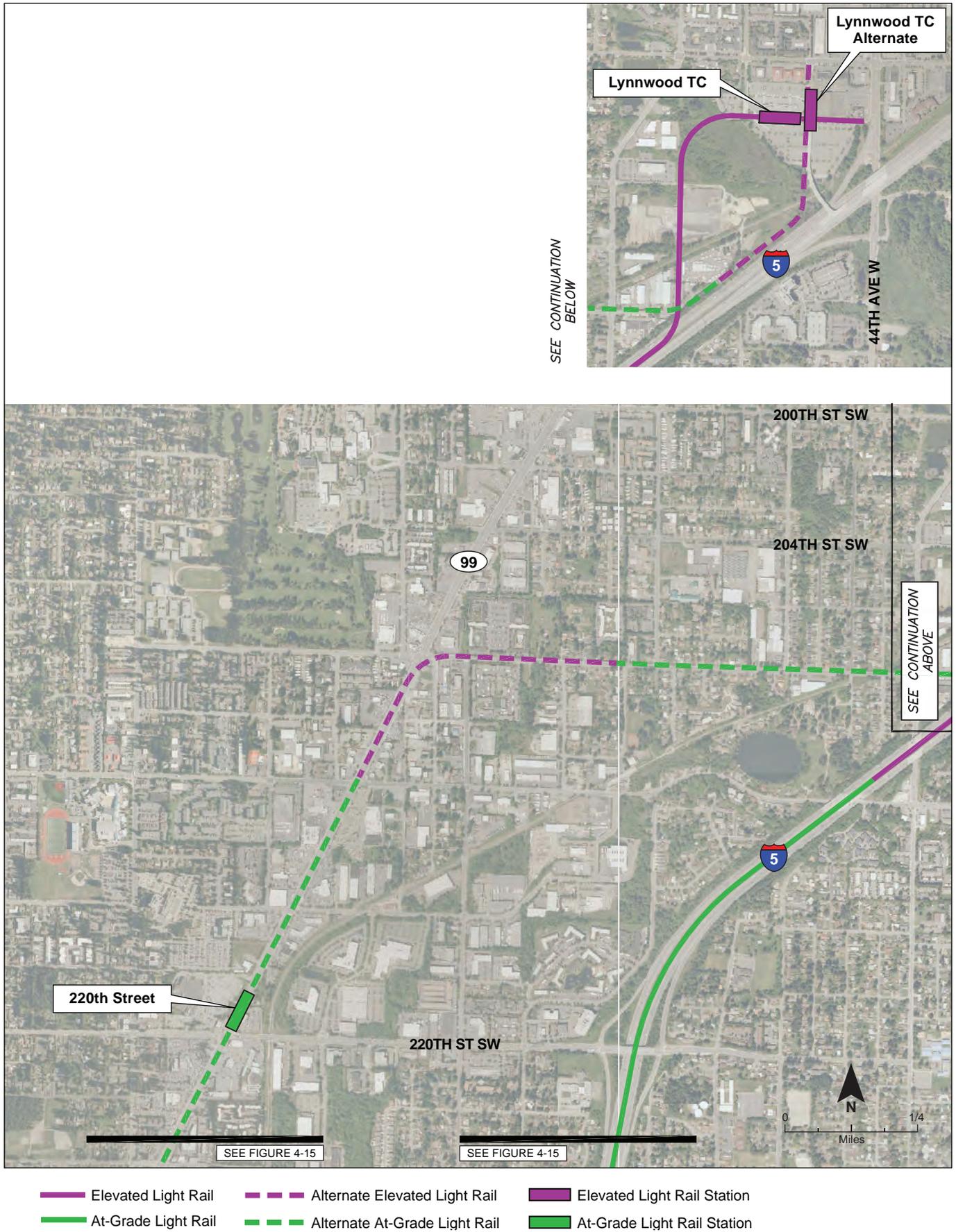


Figure 4-16. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 4 of 4

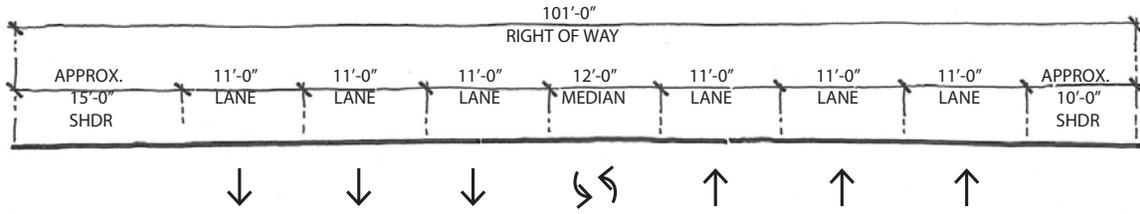


Figure 4-17. Existing SR 99 Typical Cross-section

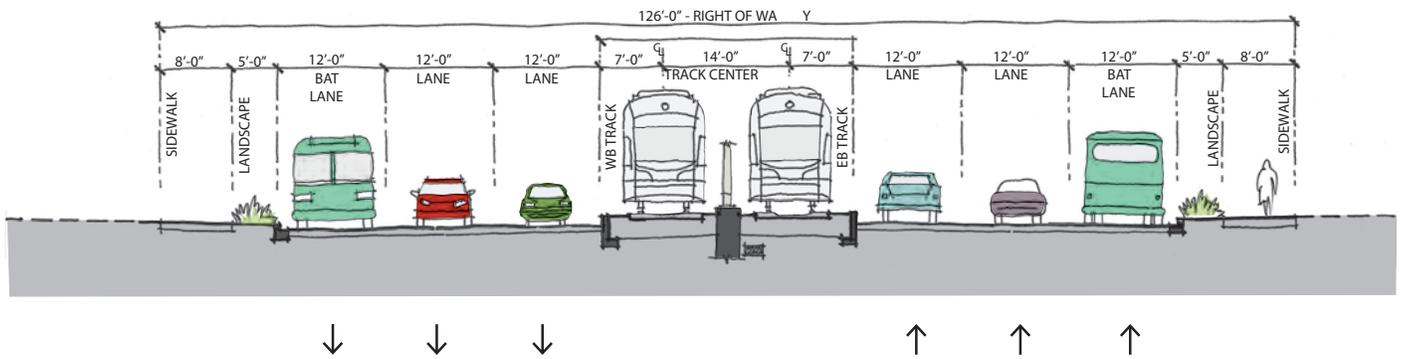


Figure 4-18. L2: SR 99 Mixed Profile Light Rail Alternative Typical At-grade Mid-block Cross-section

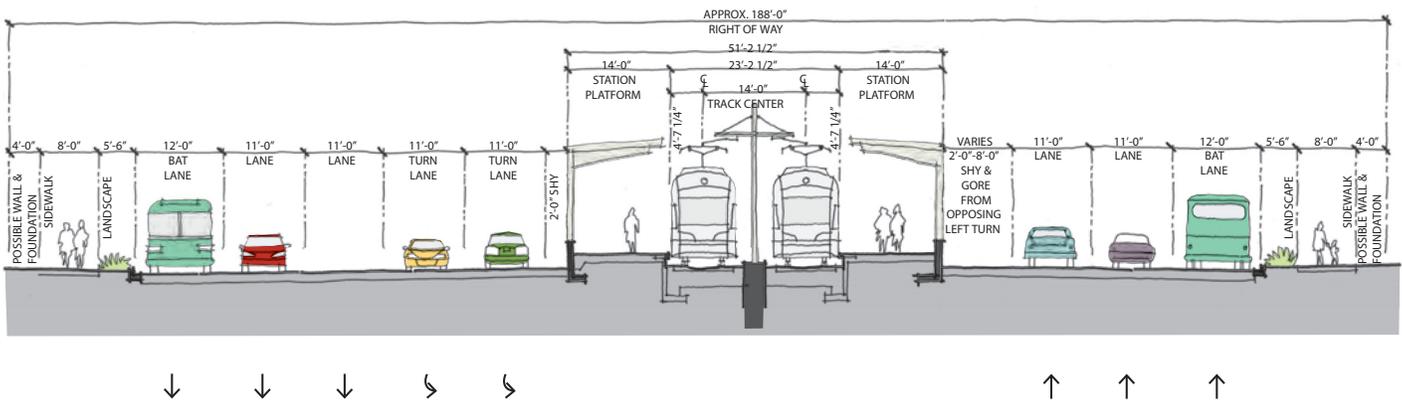


Figure 4-19. L2: SR 99 Mixed Profile Light Rail Alternative At-grade Cross-section at Intersection with Station

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 130TH STREET TO NORTH 160TH STREET

North of the 130th Street Station, the at-grade alignment continues 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. Portions of the Interurban Trail, including the pedestrian bridge over SR 99, would require reconstruction.

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.

NORTH 160TH STREET TO SHORELINE PARK-AND-RIDE

North of the 160th Street Station, the alignment continues at-grade in the SR 99 median to approximately North 173rd Street, where it transitions to an elevated structure. The elevated guideway crosses from the median to the west side of SR 99, passing over the high-volume intersections of North 175th Street and North 185th Street. The elevated guideway continues on the west side of SR 99 to an elevated station at the Shoreline Park-and-Ride (North 192nd Street). The light rail station at the existing Shoreline Park-and-Ride would include all of the functions now provided by the Aurora Village Transit Center. The latter would be re-located to the light rail station and the existing site of the Aurora Village Transit Center could be redeveloped. The Shoreline Park-and-Ride Station includes the following:

- Elevated pedestrian walkway between the existing Shoreline Park-and-Ride and the light rail station
- Sixteen bays for in-service and layover operations to replace the existing Aurora Village Transit Center
- An 1,100-stall parking garage to replace the existing 400 parking spaces at the Shoreline Park and Ride and the 200 existing spaces at the Aurora Village Transit Center, plus an additional 500 parking spaces

SHORELINE PARK-AND-RIDE TO MOUNTLAKE TERRACE TRANSIT CENTER

North of the Shoreline Park-and-Ride Station, the elevated alignment continues along the west side of SR 99. Near the King/Snohomish County line, the aerial structure turns east, and then crosses over SR 99 and the parking lots and commercial properties near the intersection of SR 99 and North 205th Street (SR 104). The alignment continues eastward along the south side of SR 104, crossing over Meridian Avenue, 1st Avenue NE, 5th Avenue NE, SR 104, and I-5. This route would cross I-5 in a straight alignment to simplify structural requirements, and then curve north through office and school properties south of 236th Street SW. An aerial station would be located

over 236th Street SW, with station entrances on the south and north sides of 236th Street SW. This aerial station would serve the Mountlake Terrace Transit Center, park-and-ride garage, and freeway station. The aerial station is assumed to be center platform with a ground-level plaza. The Mountlake Terrace Station includes the following:

- Two off-street in-service bus bays and six off-street layover bus bays at Mountlake Terrace Transit Center
- A new parking garage with approximately 230 parking spaces to replace existing surface parking that would be displaced by the expanded and relocated off-street transit center

MOUNTLAKE TERRACE TRANSIT CENTER TO LYNNWOOD TRANSIT CENTER

The alignment in this segment is identical to that described in Section 4.3.1 for the L1: I-5 Light Rail Alternative.

4.4.2 Alignment Variations

As shown in Figure 4-8, two alignment variations are under consideration for this alternative. The first provides an alternative connection between Northgate and SR 99. Instead of following Northgate Way and North 110th Street, the alternative alignment would continue along the east side of I-5 to approximately NE 130th Street, where it would cross over I-5 on an elevated structure and continue elevated along Roosevelt Way North to SR 99. This alignment alternative would preclude a station at North 130th Street. While a tunnel configuration also was given initial consideration for this section, the tunnel option was dropped following the Level 1 evaluation. As discussed in Chapter 3, with other non-tunnel alignments appearing to perform equal or better, further consideration of very costly tunnel alignments was dropped.

The second alignment variation would continue north of the King County/Snohomish County line at NW 205th Street/244th Street SW rather than turning east to follow SR 104 to I-5. From the station at the Shoreline Park-and-Ride, the alignment would continue elevated on the west side of SR 99, crossing over 244th Street SW and SR 104 before transitioning to at-grade in the median of SR 99 at approximately 240th Street SW. The alignment would then follow SR 99 at-grade to an at-grade station at 220th Street SW. At 208th Street SW, the alignment would transition to an elevated structure to cross over the northbound lanes of SR 99 and turn east onto 208th Street SW. On 208th Street SW, the alignment would transition from aerial back to at-grade in the median of the street and follow 208th Street SW to I-5. It would then transition back to aerial just prior to I-5 and turn northeast and continue along the west side of the I-5 right-of-way to Lynnwood Transit Center. Because of the constrained existing right of-way, this alignment would require substantial property acquisitions along the north side of 208th Street SW. In order to provide circulation and access to residents along the road, it is assumed that four signalized intersections allowing crossings of the rail guideway would be provided as well.

Finally, short sections of the former Interurban right-of-way that parallels SR 99 in King and Snohomish Counties might be crossed or used for the light rail alignment. While an alignment that requires continuous use of large segments of the Interurban right-of-way was dropped from consideration based on the findings from the initial screening (discussed in Chapter 3), it is

possible that using smaller portions of the right-of-way could be reconsidered if sections of a SR 99 route prove more difficult, but not as a major route alignment option.

4.4.3 Service Plan

Light rail service includes four-car trains serving stations at the Northgate Transit Center, North 130th Street, North 160th Street, Shoreline Park-and-Ride, Mountlake Terrace Transit Center, and Lynnwood Transit Center. Service would be provided 20 hours per day, with peak headways of 8 minutes and off-peak headways of 10 minutes.

Community Transit routes that now serve the Aurora Village Transit Center would be extended south on SR 99 to serve the new Shoreline Transit Center and light rail station. Similarly, King County Metro routes that now serve the Aurora Transit Center would be truncated at the new Shoreline Transit Center and light rail station.

Local King County Metro routes in north King County would be adjusted to serve light rail. Existing routes would either be truncated or extended to serve the new light rail stations at North 130th Street, North 160th Street, Shoreline Park-and-Ride, and Mountlake Terrace Transit Center.

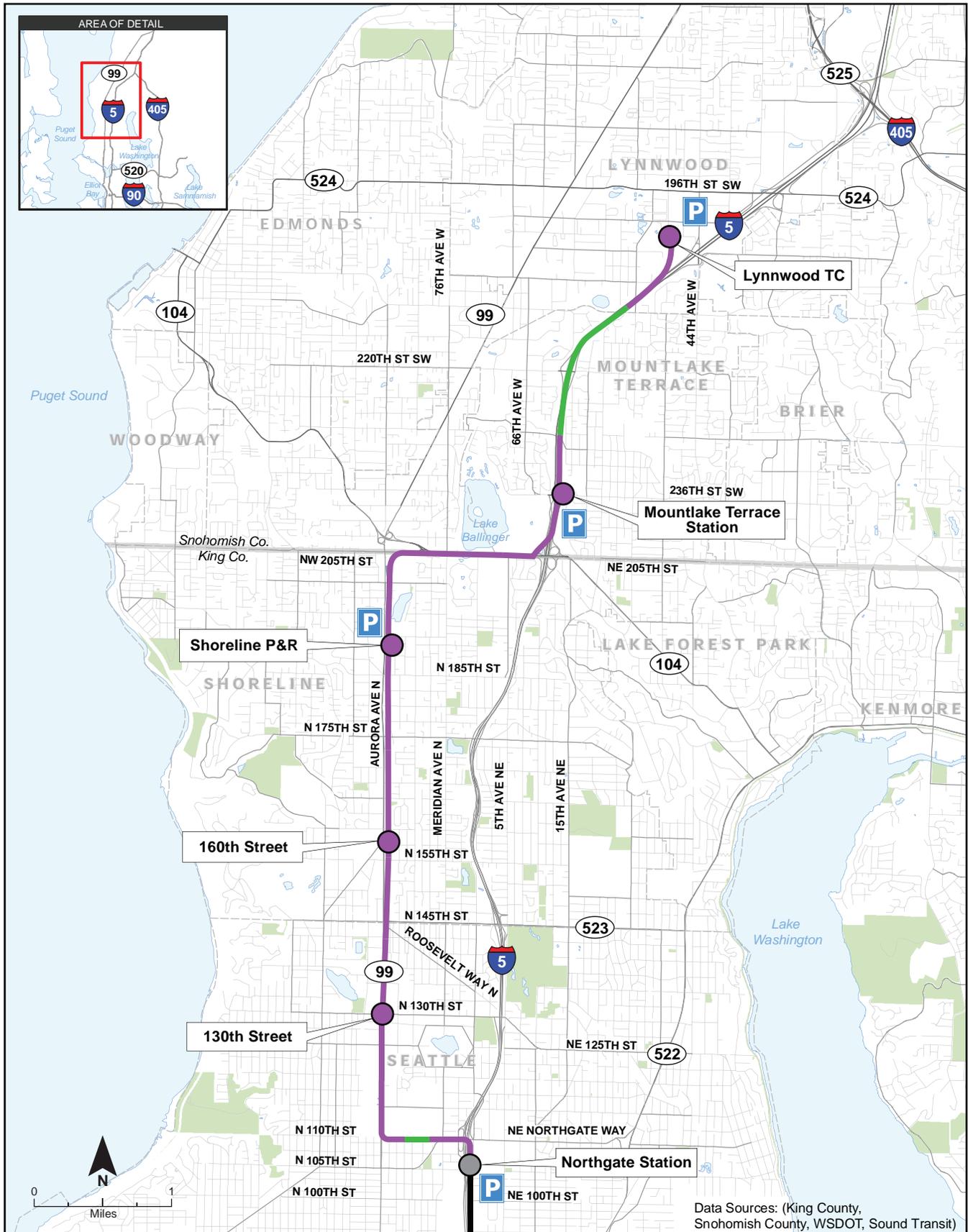
All Sound Transit routes from Snohomish County that operate to Seattle would terminate in Lynnwood, where passengers would transfer to light rail. Community Transit I-5 commuter routes connecting south Snohomish County to downtown Seattle and to the University of Washington would continue to operate as they do today, with the exception of routes currently connecting Edmonds with Seattle. These routes would terminate at the Mountlake Terrace and Shoreline Park-and-Ride stations where passengers would transfer to light rail. North Snohomish County commuter routes would continue to operate unchanged from today's configuration. King County Metro Route 301 would be discontinued and Route 304 would be truncated at the North 160th Street Station.

King County Metro RapidRide E Line BRT would interface with Community Transit's *Swift* BRT service at the Shoreline Park-and-Ride Station, which would be the terminus for both BRT services.

4.5 L3: SR 99 ELEVATED LIGHT RAIL ALTERNATIVE

The L3: SR 99 Elevated Light Rail Alternative has a similar alignment to the L2: SR 99 Mixed Profile Light Rail Alternative with the exception that the entire section of the alignment along SR 99 would be elevated. The difference between the L2 and L3 alignments occurs in the section between approximately North 120th Street and North 175th Street. Also, in contrast with the L2: SR 99 Mixed Profile Light Rail Alternative, the elevated alignment along SR 99 would allow for operations at 4-minute headways during peak periods. This alternative overall would include a combination of elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with four intermediate stations. Figure 4-20 provides an overview of the alternative showing the primary alignment and two possible variations—one at the south and one at the north end. Figures 4-21 through 4-24 provide more detail regarding the alignment, profile, and station locations. The general scope of work includes:

- Capacity for new light rail fleet and O&M facility, as needed, to support the extension
- New elevated light rail stations located at North 130th Street, North 160th Street, Shoreline Park-and-Ride (North 192nd Street), Mountlake Terrace Transit Center, and Lynnwood Transit Center
- Five hundred new structured park-and-ride stalls at both the Shoreline Park-and-Ride and Lynnwood Transit Center, supplementing approximately 2,600 existing stalls along the alignment
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication of transit service on SR 99
- Relocation of the transit functionality of the Aurora Village Transit Center to the Shoreline Park-and-Ride, including 16 bays for in-service layover operations
- Additional in-service and/or layover bus bays at Mountlake Terrace Park-and-Ride and Lynnwood Transit Center to accommodate restructured bus services



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

Figure 4-20. L3: Level 2 SR 99 Elevated Light Rail Alternative

4.5.1 Facility Design

The L3: SR 99 Elevated Light Rail Alternative is approximately 10.2 miles (Northgate Transit Center to the Lynnwood Transit Center) in length. The following subsections describe the major components that form a potential light rail line along the SR 99 alignment between the Northgate Transit Center and the Lynnwood Transit Center. Line segments and stations are included in these descriptions. Light rail vehicles and the O&M facility capacity to support the light rail line are not included in these descriptions and are the subjects of a separate system wide study that Sound Transit is now undertaking. As the design of the line is refined, requirements for these types of improvements, as well as passenger drop-off facilities, local bus transfers, and street and traffic signal improvements around the stations will be further investigated. Figure 4-25 shows a typical cross-section of the existing SR 99 between North 110th Street and North 145th Street. Figures 4-25 and 4-26 illustrate typical examples of the resulting cross-sections for a mid-block elevated rail guideway location and an elevated rail station location, respectively. Refinement of the pedestrian connectivity infrastructure will also need to be considered. Other design features assumed in the capital cost estimates include one track crossover in the vicinity of each station.

The L3: SR 99 Elevated Light Rail Alternative 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 consequences. An elevated guideway in the median of SR 99 would require significant 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.

A cursory evaluation suggests that there are not significant 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-Ride stations 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. However, analysis of this specific alignment for the Level 2 evaluation does not preclude future assessment of alignment variations.