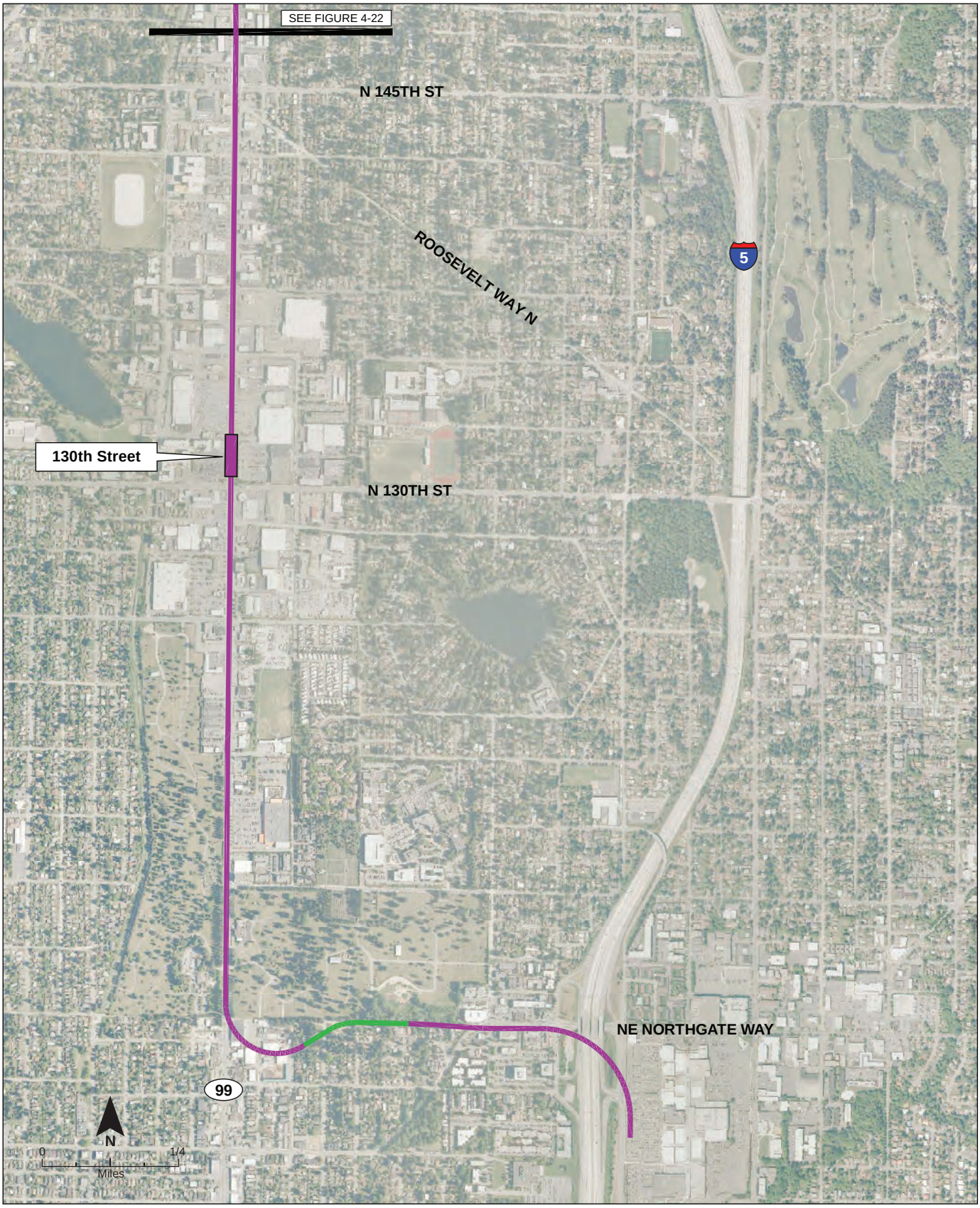


Figure 4-21. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 1 of 4

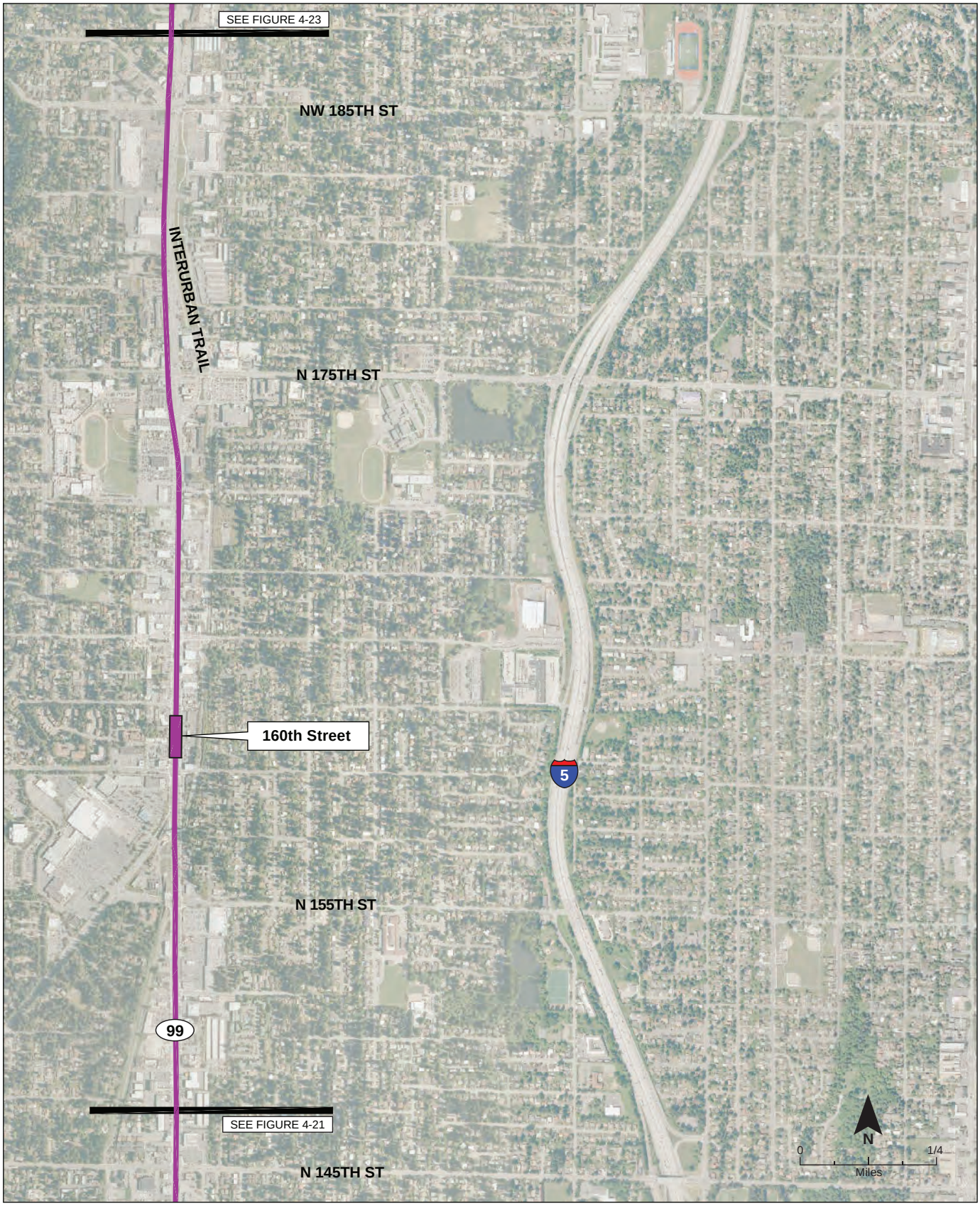


Figure 4-22. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 2 of 4

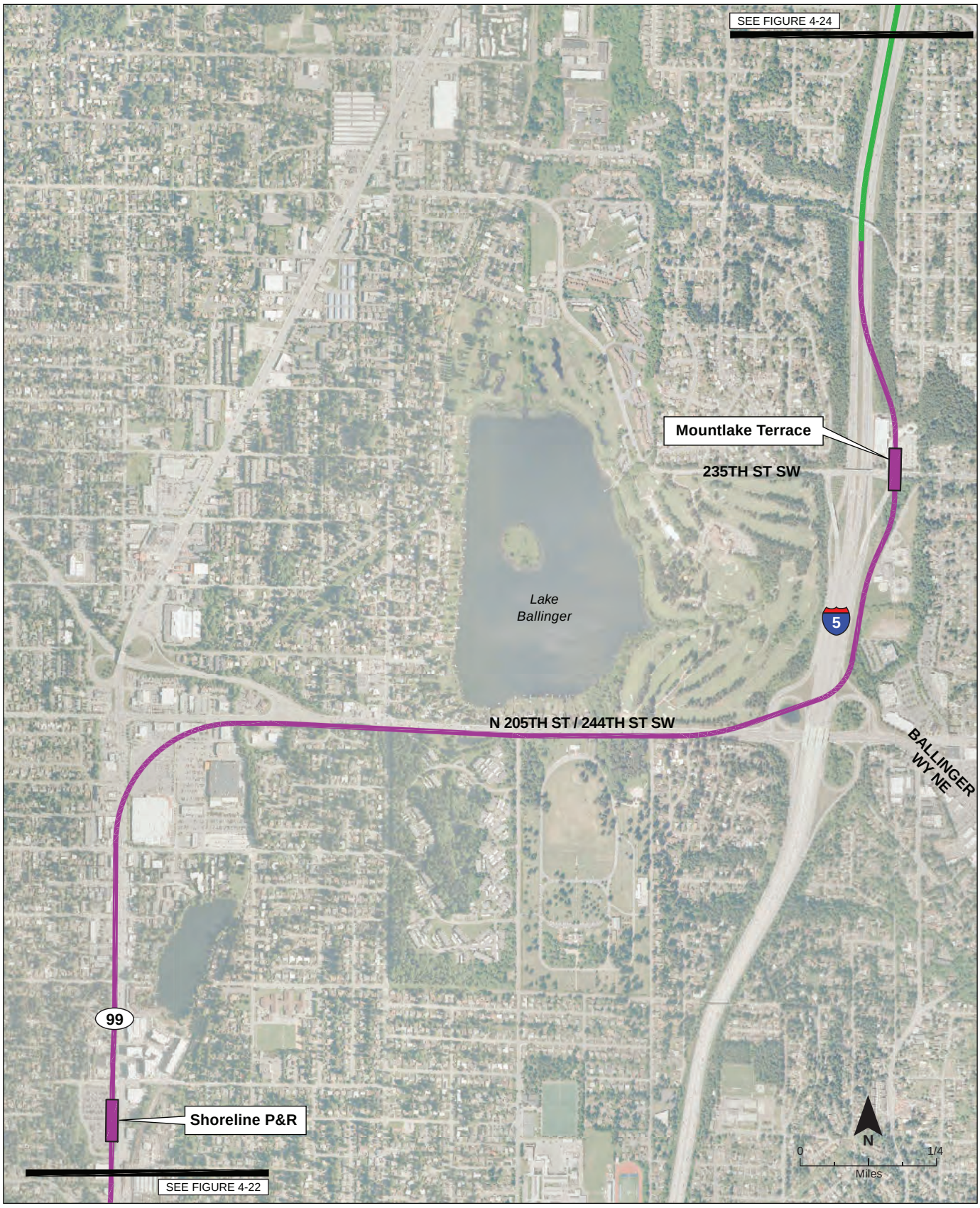


Figure 4-23. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 3 of 4

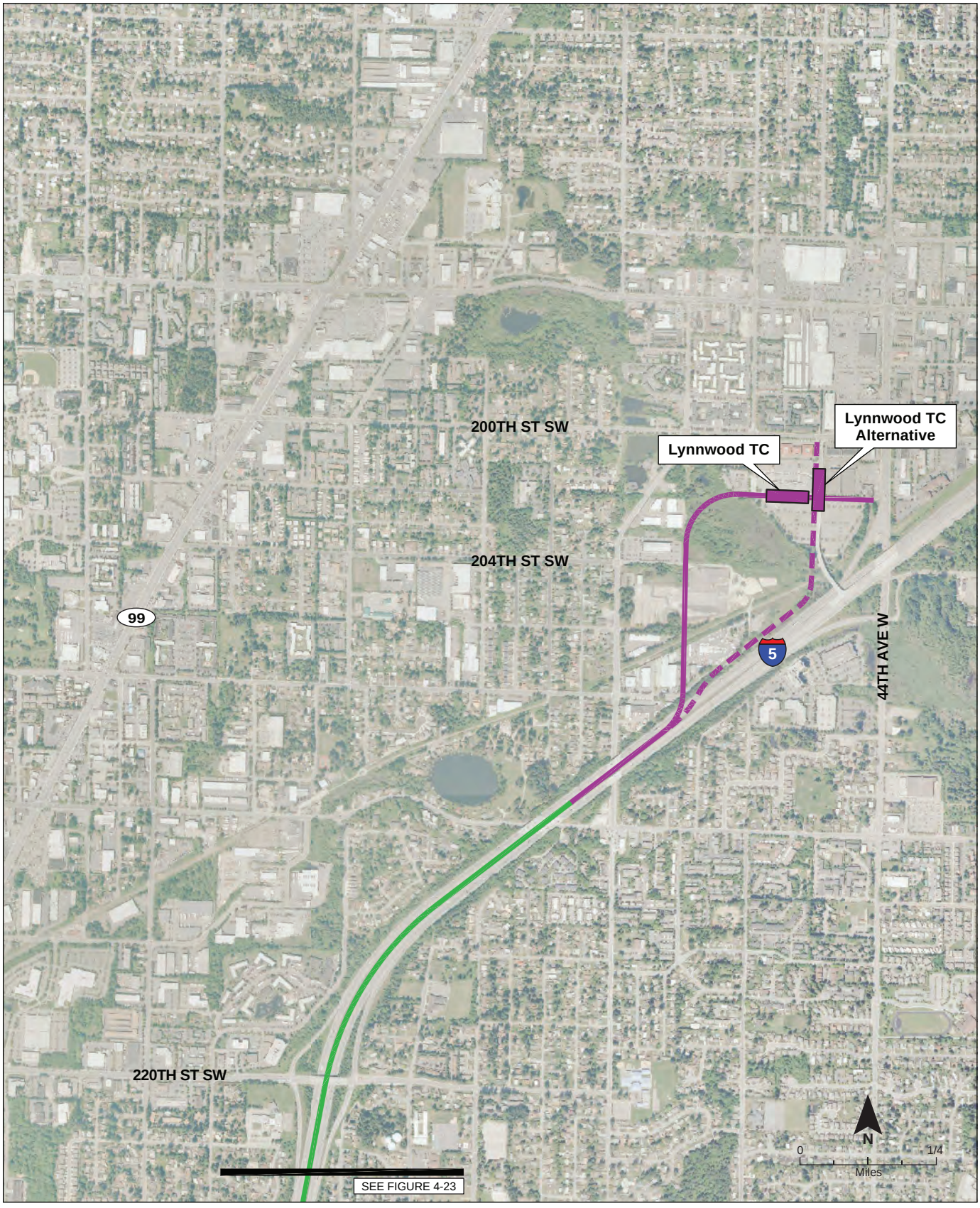


Figure 4-24. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 4 of 4

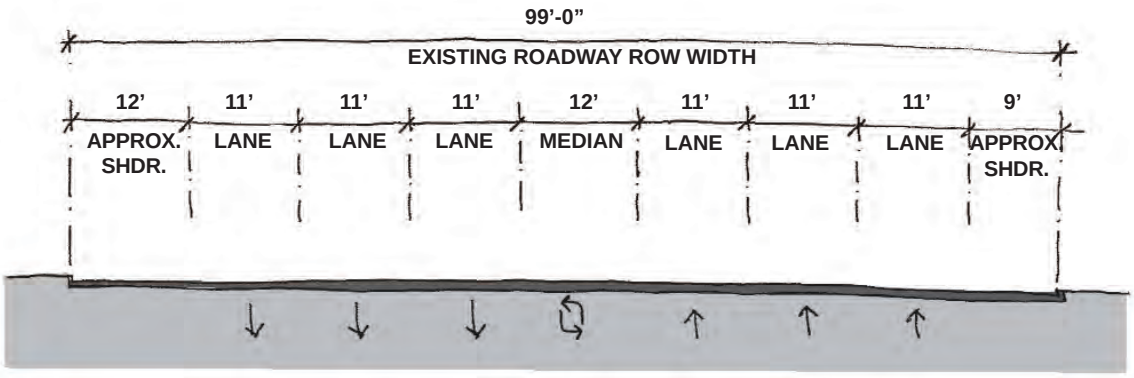


Figure 4-25. Existing SR 99 Typical Cross-section

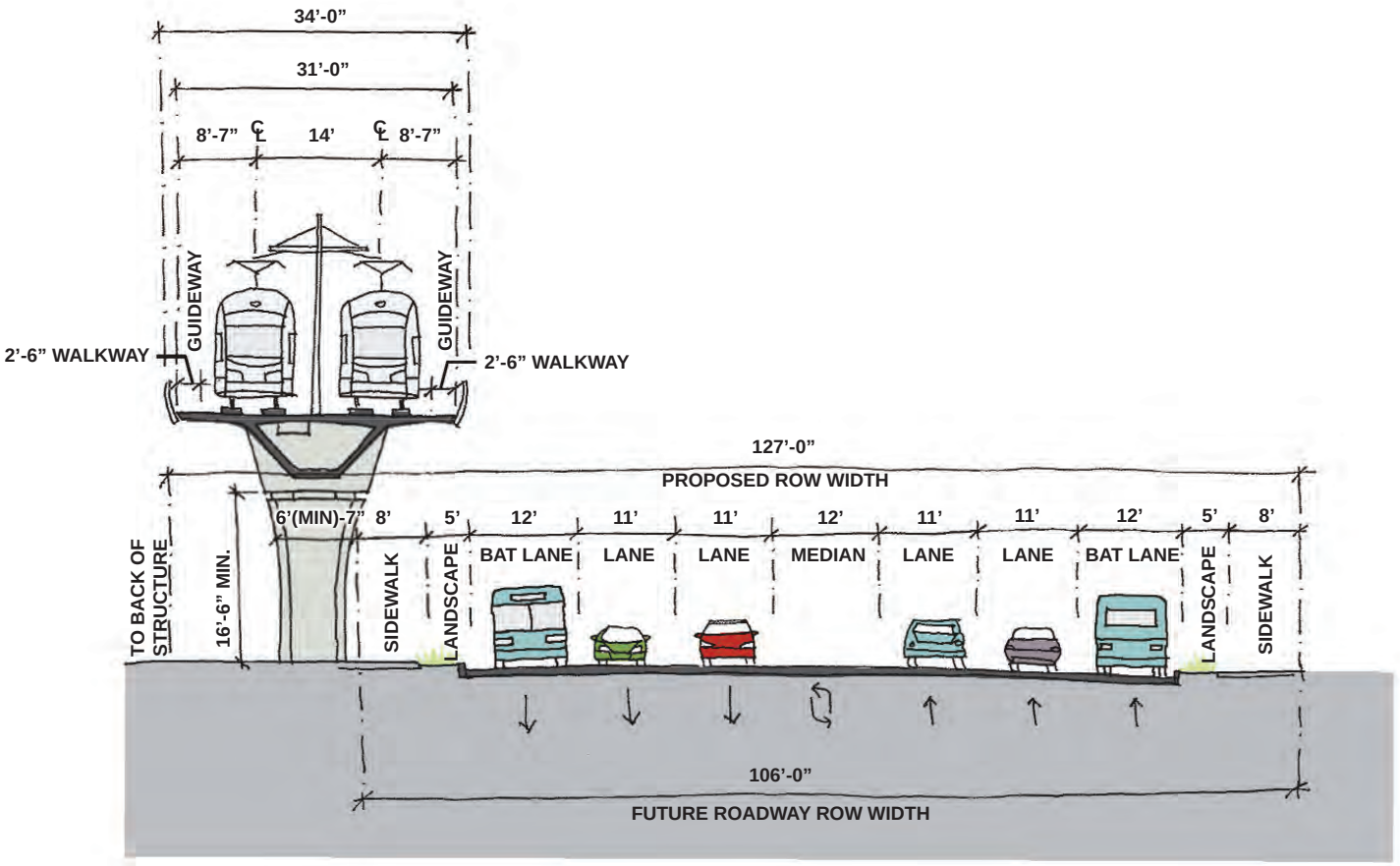


Figure 4-26. L3: SR 99 Elevated Light Rail Alternative Typical Cross-section

NORTHGATE TRANSIT CENTER TO NORTH 130TH STREET

The alignment would begin at the north end of the planned Link station tail tracks at Northgate Mall between 1st Avenue NE and the existing Northgate Transit Center. This alternative would have the same alignment as the L2: SR 99 Mixed Profile Light Rail Alternative between Northgate and approximately North 120th Street. The aerial alignment would continue north out of the station and then turn west, crossing over I-5, and continue along the south side of Northgate Way as an aerial guideway. An additional 15 to 20 feet of right-of-way would be required along Northgate Way.

As Northgate Way turns southwest, the alignment would continue west generally along the North 110th Street alignment. 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. This long curve would require acquisition of new right-of-way to the south of North 110th Street in order to avoid affecting the adjacent cemetery. The aerial alignment would continue north in the median of SR 99 with a design that minimizes right-of-way impacts on the cemetery. At approximately North 120th Street, the alignment would cross over to the west side of SR 99 where 15 to 20 feet of additional right-of-way may be required for the elevated guideway. The aerial alignment would continue north along the west side of SR 99 to an aerial station located on the north side of North 130th Street. The station would feature a center platform and a ground-level plaza, requiring at least 60 feet of additional right-of-way.

NORTH 130TH STREET TO NORTH 160TH STREET

Continuing north of the 130th Street Station, the aerial alignment would continue along the west side of SR 99 to an aerial station located at North 160th Street. The station would feature a center platform and a ground-level plaza. The alignment would require modifications to the Interurban Trail where the pedestrian bridges cross North 155th Street and SR 99. Fifteen to 20 feet of additional right-of-way may be required for the elevated guideway and at least 60 feet required at the station location.

NORTH 160TH STREET TO SHORELINE PARK-AND-RIDE

North of the 160th Street Station, the alignment would continue on the west side of SR 99 in an aerial alignment to an elevated station at the Shoreline Park-and-Ride (North 192nd Street). The alignment matches back with the L2: SR 99 Mixed Profile Light Rail Alternative alignment at approximately North 175th Street. North of this point both alignments are the same. Fifteen to 20 feet of additional right-of-way may be required for the elevated guideway. The station would be located within the existing park-and-ride facility.

An elevated center platform station with a mezzanine would be located at the Shoreline Park-and-Ride. The station would have the following characteristics:

- 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
- A parking garage to replace the existing 600 parking spaces at the Shoreline Park and Ride (approximately 400 spaces) and the Aurora Village Transit Center (approximately 200 spaces), plus an additional 500 parking spaces for a total of 1,100 parking spaces

SHORELINE PARK-AND-RIDE TO MOUNTLAKE TERRACE TRANSIT CENTER

North of the Shoreline Park-and-Ride Station, the elevated alignment would continue along the west side of SR 99. Near the King/Snohomish County line, the aerial structure would turn east, crossing over SR 99 and the parking lots and commercial properties near the intersection of SR 99 and North 205th Street. The alignment would continue eastward along the south side of SR 104, crossing over Meridian Avenue, 1st Avenue NE, 5th Avenue NE, then across SR 104, and I-5. This route would cross over to the east side of I-5 and curve north toward the east side of the existing Mountlake Terrace parking garage.

The assumed station at Mountlake Terrace would be the same as the one defined for the L1: I-5 Light Rail Alternative. 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 also would have the following characteristics:

- 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 bus layover bays

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.

4.5.2 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 the Lynnwood Transit Center. Service would be provided 20 hours per day, with peak headways of 4 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 the Mountlake Terrace Transit Center.

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. North Snohomish County commuter routes would continue to operate unchanged from today's operations. 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.

4.6 B2: MULTI-CORRIDOR BUS RAPID TRANSIT 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. 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, direct access ramps to and from the south connecting into the I-5 HOV lanes would be provided at NE 130th Street for transit and HOVs. 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 4-27 and would run along SR 99, I-5, and 15th Avenue NE. BRT vehicles and supporting maintenance facility capacity would be included. Physical improvements to facilitate the BRT service would include the following:

Transit Signal Priority: Transit signal priority improvements would be 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 in order to use them.

Stations: The BRT service would use existing Community Transit *Swift* and King County Metro RapidRide stations along SR 99 and the existing Lynnwood Transit Center and Mountlake Terrace Freeway Station. Five new BRT stations would be required. Four of these stations are in the 15th Avenue NE corridor, with one in the SR 99 corridor, as follows:

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

Rider Amenities: Real-time operating information, closed-circuit television, and off-board fare collection would be incorporated at BRT stations.

4.6.1 Facility Design

The proposed I-5 BRT route would use the existing HOV direct access ramps at Lynnwood, the HOV lanes on I-5, and the Mountlake Terrace Freeway Station. New HOV direct access ramps would be constructed to and from the south at North 130th and new transit-only ramps to and from the north at Northgate Transit Center to serve all three BRT routes. The Northgate ramps would connect directly into the transit center adjacent to the Link light rail station. The existing HOV lanes would be used with no modifications except at as needed for the new direct access ramps. The existing configuration of I-5 has very little to no median space between Northgate and North 130th Street. In addition, most of the HOV lanes along this segment of I-5 do not have shoulders that meet current WSDOT standards. Any modifications to the HOV lanes and ramps to the HOV lanes would require widening of I-5 to accommodate the proposed ramps and possibly standard shoulder widths.

The layout of the BRT system includes the following assumptions:

- The Northgate direct access ramp would be bus only; HOVs would be prohibited since the only access would be to the transit center, where private vehicles are prohibited.
- The North 130th Street direct access ramp would accommodate transit and HOVs. WSDOT has indicated that with the potential future development of managed lanes in this section of I-5, a new access here would need to provide for HOV and possibly toll paying vehicles as well as buses.
- Transit-only ramps would be approximately 35 feet wide, providing two-way bus operations with no median barrier. HOV ramps would be designed to meet full interstate freeway standards.
- I-5 would be widened to WSDOT standards within the areas affected by the direct access ramps. This work could include repaving and upgrading drainage and utilities for the existing portions of those sections of freeway.

Figure 4-27. B2: Level 2 Multi-Corridor BRT Alternative

NORTHGATE STATION

Northgate would be the southern terminus of the three new BRT lines where riders transfer to the light rail system. The existing transit center would be reconstructed as a two-level station—the bottom level serving local buses and the top level serving the BRT vehicles. Center passenger platforms would be built with stairs and elevators connecting the two levels. A pedestrian connection between the bus station and the light rail station would accommodate transfers between the two systems. This preliminary concept may evolve with more detailed design work.

Bus bay and layover requirements at the Northgate Transit Center include the following:

- The I-5 BRT service would require one bay for drop-off and one bay for pick-up, sized for articulated buses, and layover space for at least three articulated buses. Route 510/513 would require one in-service bay and one layover bay designed for articulated buses. The total bay requirements for the package of changes associated with the I-5 BRT service are three in-service bays and four layover bays.
- The 15th Avenue NE BRT service would require one bay for drop-off and one bay for pick-up for one articulated bus, and layover space for up to two articulated buses.
- The SR 99 BRT service would require one bay for drop-off and one bay for pick-up for one articulated bus, and layover space for up to two articulated buses.
- The total new bay requirements at Northgate Transit Center are seven in-service bays and eight layover bays. These would be located in the new second level of the Northgate Transit Center.

Bus-only direct access ramps to and from the north would connect the HOV lanes to the top level of the transit center as shown in Figure 4-28. These ramps would connect into the median of I-5 north of the express lanes terminus and have an S-curve layout between I-5 and the transit center. A 30-mph design speed is proposed. The ramps would pass over I-5, 1st Avenue NE, and NE 103rd Street, and pass under the light rail station tail tracks. The facility would connect to the local arterial street network to provide access for buses via a driveway and surface improvements adjacent to NE 103rd Street within the Northgate Mall parking lot.

To accommodate the bus ramps in the I-5 median, the southbound lanes of the freeway would be moved approximately 30 feet to the west and some reconstruction of the existing ramps would be required. This widening would extend approximately 0.3 mile to the north to accommodate the vertical profile of the ramps and the acceleration and deceleration lengths required for connections into the HOV lanes. Additional widening of northbound I-5 would be required, including the widening of the structure over Northgate Way, to provide the merge gap acceptance length required by WSDOT standards. This widening cannot be provided within the current median space. The northbound mainline must be widened to the east, which would affect the on-ramps from the Northgate Mall and NE Northgate Way. The widening associated with these ramps then would affect the frontage road and 117th Street flyover bridge. The total length of I-5 modifications would be approximately 0.9 mile and would extend

to meet the mainline widening that would be required to accommodate the proposed BRT improvements for the 130th Street direct access ramp. The proposed BRT station and ramps are shown in Figure 4-28. Additional right-of-way beyond the existing I-5 right-of-way would be required for some portions of this improvement.

NE 130TH STREET

Direct access HOV ramps from the I-5 median HOV lanes to and from the south would rise to the grade of NE 130th Street where a new intersection would be created. I-5 would require widening for approximately 0.6 mile to the south and 0.5 mile to the north. The NE 130th Street Bridge would require reconstruction to allow the widened I-5 cross-section to pass under the structure and to provide the intersection improvements proposed. The proposed direct access ramp is shown in Figure 4-29.

SHORELINE PARK-AND-RIDE

The B2: Multi-Corridor BRT Alternative assumes that the transit terminus functionality of the Aurora Village Transit Center would be re-located to the Shoreline Park-and-Ride, along with the existing 200-space park-and-ride capacity of the Aurora Village Transit Center. An additional 500 stalls of parking capacity would be provided, for a total of 1,100 park-and-ride stalls. The re-located transit center would consist of nine in-service bays and seven layover bays.

MOUNTLAKE TERRACE TRANSIT CENTER (236TH STREET SW)

The I-5 BRT line would use the existing Mountlake Terrace Freeway Station. No additional improvements are anticipated at this location. This station is an at-grade median transit stop with stairs, elevators, and a pedestrian bridge connecting the station to the existing park-and-ride garage. No additional terminating routes are expected at the Mountlake Terrace Transit Center; thus, no additional layover spaces or bus bays would be required as a result of this alternative.

LYNNWOOD TRANSIT CENTER

This location would use the existing HOV direct access ramps. These ramps connect both north and south along I-5 to the Lynnwood Transit Center. Similar to the light rail alternatives, 500 new structured park-and-ride stalls are assumed at the Lynnwood Transit Center bringing the total to 1,900 spaces. Three additional layover bays would be required at the Lynnwood Transit Center to accommodate the proposed BRT services.

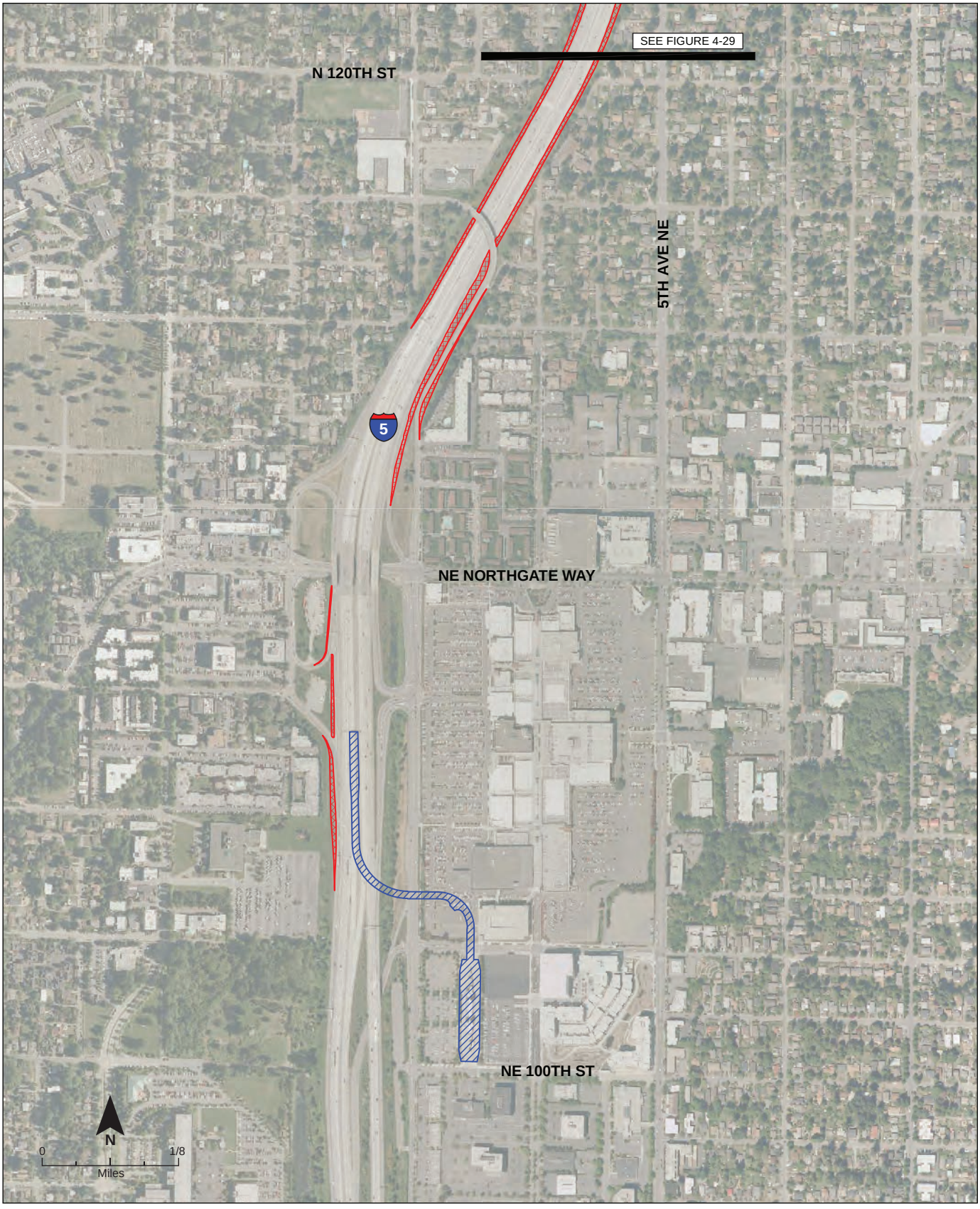


Figure 4-28. Direct Access Improvements and Northgate BRT Station - 1 of 2

Figure 4-29. Direct Access Improvements and Northgate BRT Station - 2 of 2

4.6.2 Service Plan

Service for this alternative consists of three new high-frequency bus routes serving the North Corridor area between the Lynnwood Transit Center and the Northgate Transit Center where service would tie into Link light rail. Specific operating details of these three BRT routes are as follows:

- **SR 99 Route:** Lynnwood Transit Center, 200th Street SW, SR 99/Aurora Avenue North, NE 130th Street, NE 130th Street direct access ramp, I-5, Northgate direct access ramp, Northgate Link Station
- **15th Avenue NE Route:** Mountlake Terrace Transit Center, 236th Street SW, 56th Avenue West/19th Avenue NE, NE 196th Street, 15th Avenue NE, NE 125th Street, Roosevelt Way, NE 130th Street, NE 130th Street direct access ramp, I-5, Northgate direct access ramp, Northgate Link Station
- **I-5 BRT Route:** Lynnwood Transit Center, I-5, Mountlake Terrace Freeway Station, I-5, Northgate Link Station

BRT service on all three routes would be provided from 4:30 am to 1:30 am on Monday to Saturday and from 5:30 am to 1:00 am on Sunday. (The actual schedule would be timed for first southbound and last northbound trains at Northgate.)

Service frequencies were developed and refined to meet the projected ridership demand. On the SR 99 BRT route, frequencies would be every 10 minutes during peak periods and every 15 minutes during off-peak periods. On the I-5 BRT route, frequencies would be every 2 minutes during peak periods and every 10 minutes during off-peak periods. The 15th Avenue NE BRT route frequency would be every 15 minutes during both peak and off-peak periods.

Sound Transit Express and Community Transit commuter and local bus routes would not change, other than a minor re-route of Route 112 to serve the Mountlake Terrace Transit Center. King County Metro Routes 301 and 303 would be replaced by the new SR 99 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. Existing arterial BRT services would not be affected, but would rather be complemented by the new service.

4.7 OPERATION AND MAINTENANCE FACILITIES

All of the build alternatives require vehicle fleet expansions and associated additional operations & maintenance (O&M) base capacity to support them. The ST 2 finance plan includes funds for additional rail and bus O&M facilities to support the expanded system. While the new O&M capacity was determined in the plan and will be developed at the systems level, costs for these additions have been allocated to each corridor expansion on a per vehicle basis. Thus, the costs for O&M facility expansion are included in the estimates for all North Corridor build alternatives. The system-level process of identifying and analyzing alternatives for O&M facility expansion was recently initiated by Sound Transit through a separate effort designed to develop base capacity sufficient to support all corridor needs.

5 ANALYSIS OF ALTERNATIVES

The Level 2 alternatives were evaluated based on criteria and performance measures derived from the project's purpose and need as described by the methodology documented in Chapter 3. Criteria to measure how well the alternatives address the North Corridor Transit Project's purpose and need fall into six broad categories:

- Transportation effectiveness in meeting mobility, access, and capacity needs
- Supportive land use and economic development effects
- Preservation of a healthy environment
- Equitable community impacts and benefits
- Cost and constructability
- Consistency with Sound Transit's Long-Range Plan vision

This chapter discusses the detailed findings of the evaluation of the Level 2 alternatives organized by the evaluation criteria. Key findings are provided at the beginning of each subsection to help distinguish between the alternatives and/or provide added insight into the performance of specific alternatives. Chapter 7 contains a comparative summary analysis of the Level 2 evaluation findings organized by the six broad categories. Chapter 8 presents the next steps and recommendations for the development of alternatives to be carried forward into an EIS.

5.1 TRANSPORTATION EFFECTIVENESS

This section summarizes the evaluation results for the transportation effectiveness measures as applied to each of the alternatives. Sound Transit's Regional Forecasting Model was applied to generate 2030 forecasts of transit ridership for the No Build Alternative, TSM/Baseline Alternative, and each of the build alternatives (Sound Transit 2010f, 2010g).

Model results were used to compare each alternative's effectiveness with regard to ridership potential, ability to accommodate demand, travel time changes, and system-wide vehicle miles traveled. Qualitative assessments of transit reliability and transit service accessibility were also included in this evaluation. Key findings and results for each of the evaluated transportation effectiveness measures are described in this section.

5.1.1 Key Findings

Key findings for each of the transportation effectiveness measure categories are summarized in the following section.

RIDERSHIP POTENTIAL

2030 System-Wide and Project Daily Riders

Both year 2030 total system-wide and daily project ridership forecasts are highest for the L1: I-5 Light Rail Alternative, followed by the L3: SR 99 Elevated Light Rail Alternative. Ridership for the L2: SR 99 Mixed Profile Light Rail Alternative would be lower than for L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative, but would be significantly higher than the TSM/Baseline or B2: Multi-Corridor BRT Alternatives. Similar results are seen for year 2030 annual new riders and user benefits in comparison to the No Build Alternative.

One reason that the L2: SR 99 Mixed Profile Light Rail, B2: Multi-Corridor BRT, and TSM/Baseline Alternatives are projected to have substantially fewer new riders than the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives is that the travel time savings would be less. Another key reason is that competitive transit options exist for these alternatives. Because of longer travel times, less frequent service, and lower capacity for the TSM/Baseline, L2: SR 99 Mixed Profile Light Rail and B2: Multi-Corridor BRT Alternatives, I-5 express bus routes serving the University of Washington and downtown Seattle would be maintained in those alternatives. For the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives, many of these routes are truncated at the Lynnwood, Mountlake Terrace, or 185th Street stations.

Transit Trips to Regional Growth Centers

The L1: I-5 Light Rail Alternative would result in the highest increase over No Build in the number of estimated year 2030 daily transit trips made to all four regional growth centers, at more than 10,000 trips. The L3: SR 99 Elevated Light Rail Alternative would result in approximately 20 percent fewer total trips to the selected growth centers compared to the L1: I-5 Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative would result in more than double the increase in transit trips to the selected regional growth centers of the B2: Multi-Corridor BRT Alternative, and more than three times the increase of the TSM/Baseline Alternative, but less than the L1: I-5 Light Rail Alternative.

ABILITY TO ACCOMMODATE DEMAND

Person-Carrying Capacity Per Hour

The L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail alternatives would provide the highest peak period carrying capacity among the alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative would provide approximately half the capacity of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives due to its 8-minute peak headways (the time between successive train movements in a given direction) as compared to 4 minutes for the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives. The two bus based alternatives provide substantially less carrying capacity than any of the light rail alternatives.

Peak-Hour Ridership Demand/Operating Capacity Per Hour

The L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative would accommodate forecasted ridership demand through 2030 and would provide additional capacity for future growth in demand and future extension of the line to Everett. The L2: SR 99 Mixed Profile Light Rail Alternative would also accommodate forecasted ridership demand through 2030, but would provide very little capacity for future growth in demand or extension to Everett. In addition, if I-5 bus service were truncated at any of the rail stations under the L2: SR 99 Mixed Profile Light Rail Alternative, ridership demand would likely exceed the operating capacity of the alternative. The TSM/Baseline Alternative is expected to be at capacity by the year 2030, while the B2: Multi-Corridor BRT Alternative would be approaching capacity, particularly on the highest demand route connecting Lynnwood and Northgate via I-5.

TRAVEL TIME

2030 Transit Travel Time

For year 2030 peak period travel from Lynnwood and Shoreline to the regional rail system at Northgate, all of the alternatives are estimated to provide substantially shorter travel times compared to the No Build Alternative, with the shortest being the L1: I-5 Light Rail Alternative (14 minutes from Lynnwood, 7 minutes from Shoreline). Peak direction travel times from Lynnwood to Northgate for the L3: SR 99 Elevated Light Rail, the L2: SR 99 Mixed Profile Light Rail, and the B2: Multi-Corridor BRT Alternatives would be approximately 4, 7, and 10 minutes longer than for the L1: I-5 Light Rail Alternative, respectively.

2030 Travel Time Comparison—Transit vs. Automobile

Year 2030 automobile travel times from Lynnwood to Northgate are estimated to be slower than transit travel times for the TSM/Baseline and all the build alternatives (4 minutes slower than the TSM/Baseline Alternative, 10 minutes slower than the B2: Multi-Corridor BRT Alternative, and approximately 13 to 20 minutes slower than the light rail alternatives).

TRANSIT RELIABILITY

Substantial portions of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives would use non exclusive guideway (both more than 20 miles), exposing transit service to traffic congestion, while the light rail alternatives would be on exclusive guideway for their entire length, making them more reliable.

The L1: I-5 Light Rail and the L3: Elevated Light Rail Alternatives would exhibit the best travel time reliability of all the alternatives due to the total length of each being in exclusive right of-way, traversing no signalized intersections, and requiring no transfers to reach multiple regional destinations via the regional transit system. The L2: SR 99 Mixed Profile Light Rail Alternative and the SR 99 North Variation would have slightly lower reliability due to potential delays crossing at-grade signalized intersections. The two bus-based alternatives would be much less reliable due to traveling in non-exclusive right-of-way, traversing a high number of congested intersections, and requiring a transfer to the overall regional rail system to reach other regional destinations.

System-wide Vehicle Miles Traveled

The reduction in overall system daily vehicle miles traveled (VMT) with the L1: I-5 Light Rail Alternative is projected to be more than twice the reduction that would result from the L2: SR 99 Mixed Profile Light Rail Alternative, and roughly 19 percent higher than the L3: SR 99 Elevated Light Rail Alternative. The VMT reduction with both the bus-based alternatives is expected to be substantially less than any of the light rail alternatives.

Transit Service Accessibility

The TSM/Baseline and B2: Multi-Corridor BRT Alternatives are estimated to have the highest level of accessibility to transit service in general because they each have almost twice as many points of access as the rail alternatives. However, despite the higher level of access, the projected ridership and user benefits of the two bus-based alternatives are considerably lower than any of the light rail alternatives, indicating that accessibility needs to be coupled with quality service to be effective in attracting riders.

The level of accessibility is similar between the light rail alternatives. For the L1: I-5 Light Rail Alternative, I-5 provides a barrier that limits accessibility. For the L2: SR 99 Mixed Profile Light Rail Alternative and L3: Elevated Light Rail Alternative, a combination of factors including an incomplete street grid, relatively long distances between blocks, and a prevalence of arterials without sidewalks surrounding SR 99 reduces the relative accessibility of these alternatives.

5.1.2 Ridership Potential

Ridership potential is evaluated based on the following four measures: 2030 project daily riders, 2030 annual new riders, 2030 user benefits – annual hours saved, and transit trips to selected regional growth centers. The measures are designed to distinguish the potential for transit ridership, including new riders generated in the North Corridor and new riders and user benefits

of the entire regional transit system due to the addition of the North Corridor alternative to the system. Detailed ridership forecasting methods and underlying assumptions can be found in the Transit Ridership Forecasting Technical Report (Sound Transit 2010e).

TRANSIT RIDERSHIP AND USER BENEFITS

All of the North Corridor Transit Project alternatives would increase system-wide ridership over the Sound Transit model 2030 No Build projection of 508,000 total daily transit trips. As shown in Figure 5-1, the light rail alternatives show the highest increase in total system transit use. The percentage increase in total system daily transit trips with the L1: I-5 Light Rail Alternative as compared to No Build is nearly four times that forecasted for the B2: Multi Corridor BRT Alternative and over seven times that of the TSM/Baseline Alternative.

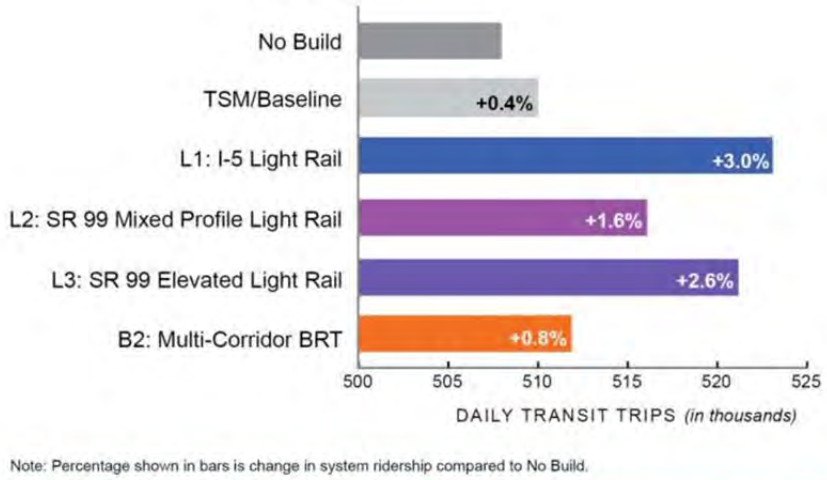


Figure 5-1. 2030 Total System Daily Transit Trips and Percent Change for Alternatives Compared to No Build

A comparison of 2030 user benefits was also made using model output for annual hours of travel time saved system-wide. User benefits are measured based on an economic theorem of consumer surplus that also has been used in the FTA Summit program for estimating user benefits[1]. Similar results, illustrated in Table 5-1, are seen for project daily riders, annual new riders, and user benefits, with the L1: I-5 Light Rail Alternative showing more than double the daily ridership and more than four times the annual new riders and user benefits of the B2: Multi Corridor BRT Alternative. The L3: SR 99 Elevated Light Rail Alternative results in 600,000 fewer annual new riders and 800,000 fewer annual hours saved than the L1: I-5 Light Rail Alternative,

[1] The Summit software program was developed by FTA for preparation of information for evaluation of New Starts applications. The key output from the Summit program is user benefits, which is based on the concept of consumer surplus. People will travel to a destination using their selected mode when the overall cost of travel is less than or equal to the benefit of travel, where the benefit is essentially the maximum cost that they would be willing to incur for that travel. When the cost is less than this "willingness to pay," the difference between the two is referred to as the "consumer surplus." It represents the benefit of travel above and beyond the required cost.

while the L2: SR 99 Mixed Profile Light Rail Alternative shows 2 million fewer annual new riders and 2 million fewer annual hours saved than the L1: I-5 Light Rail Alternative.

Table 5-1. Transit Ridership Forecasting Model Output Summary for 2030

Alternative	Project Daily Riders	Annual New Riders*	User Benefits – Annual Hours Saved*
TSM/Baseline	21,000	0.64 million	0.59 million
L1: I-5 Light Rail	52,000	4.5 million	4.6 million
L2: SR 99 Mixed Profile Light Rail**	41,000	2.5 million	2.4 million
SR 99 North Variation	39,000	2.3 million	2.1 million
L3: SR 99 Elevated Light Rail	48,000	3.9 million	3.8 million
B2: Multi-Corridor BRT	24,000	1.1 million	1 million

*Compared to the No Build Alternative

**The Roosevelt Way Variation was not modeled, but is expected to result in slightly lower values than the L2: SR 99 Mixed Profile Light Rail Alternative for all ridership figures in this table, because it does not include a station at North 130th Street and SR 99.

Year 2030 daily transit ridership by segment is illustrated in Figures 5-2 through 5-7. Similar to other ridership-related measures, the L1: I-5 Light Rail Alternative would have the highest ridership, at more than twice the ridership of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives on the segment north of Northgate. Daily ridership for the L3: SR 99 Elevated Light Rail Alternative would be less than for the L1: I-5 Light Rail Alternative, with approximately 8 percent lower ridership on the highest ridership segment just north of Northgate, and approximately 18 percent higher than the L2: SR 99 Mixed Profile Light Rail Alternative. Daily ridership for the B2: Multi-Corridor BRT Alternative is projected to be higher than the TSM/Baseline Alternative by about 13 percent on the segment north of Northgate. Of the three routes comprising the B2: Multi-Corridor BRT Alternative, the I-5 route would have by far the highest ridership, with the 15th Avenue and SR 99 routes carrying only a small fraction of the overall riders for the alternative.

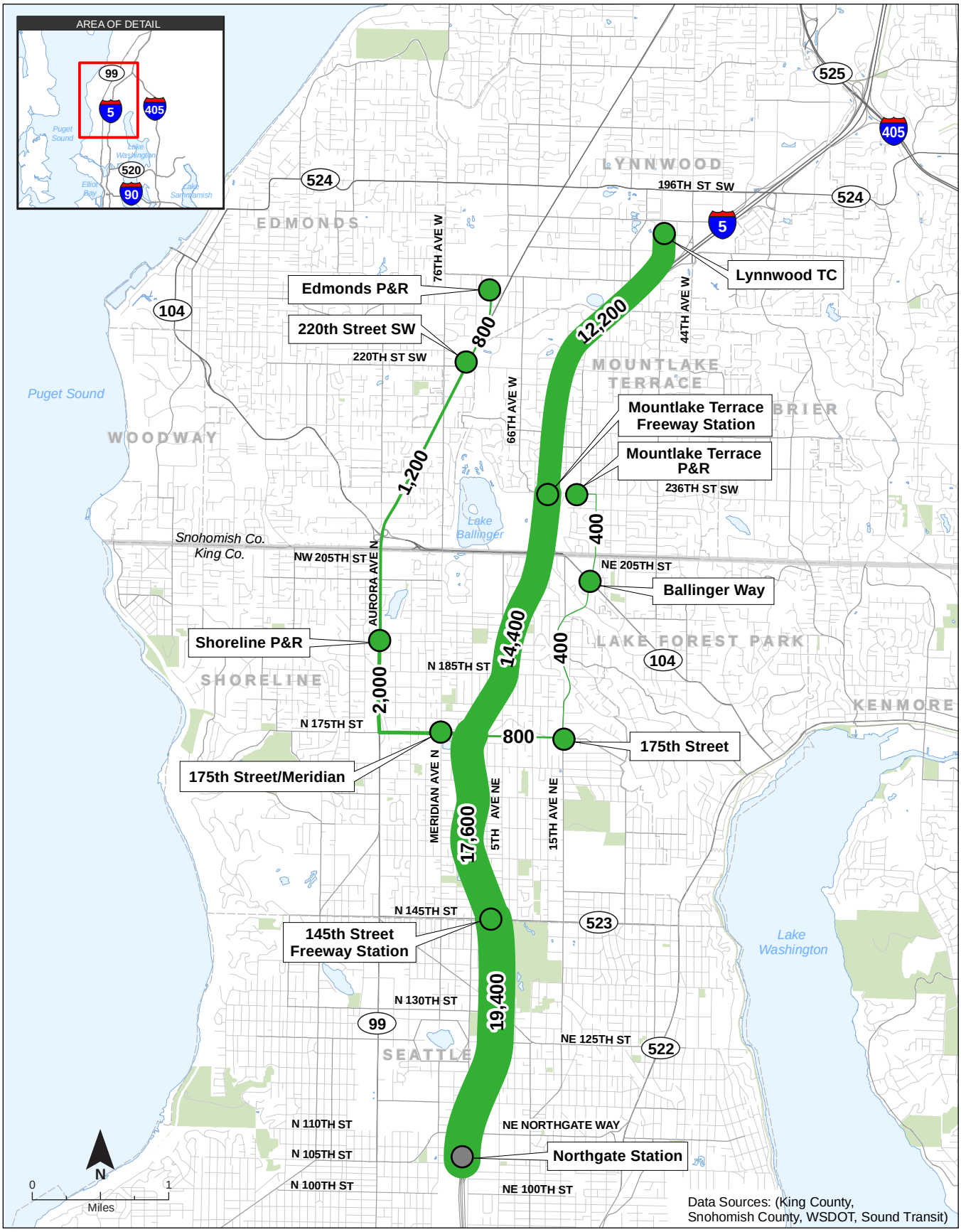
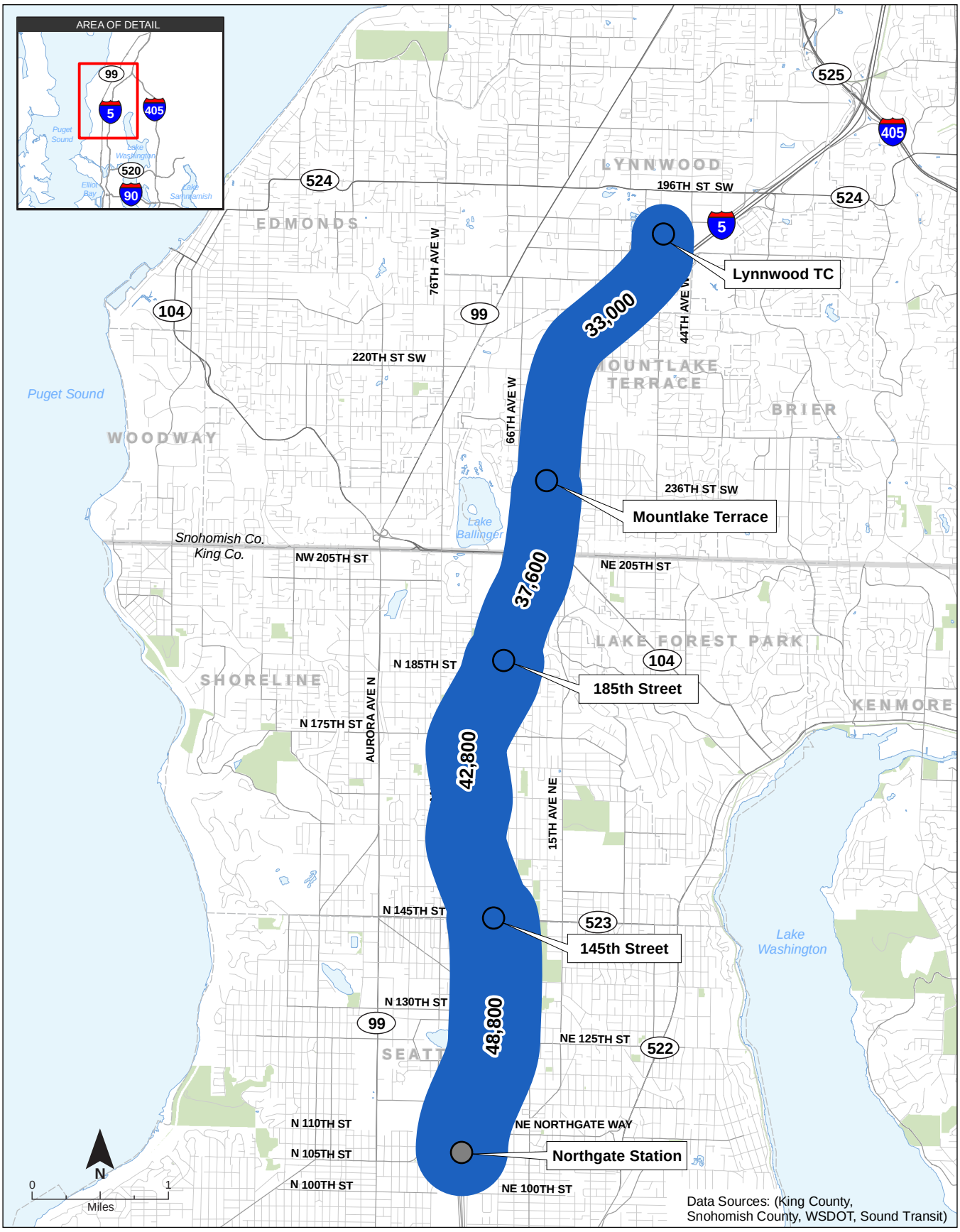


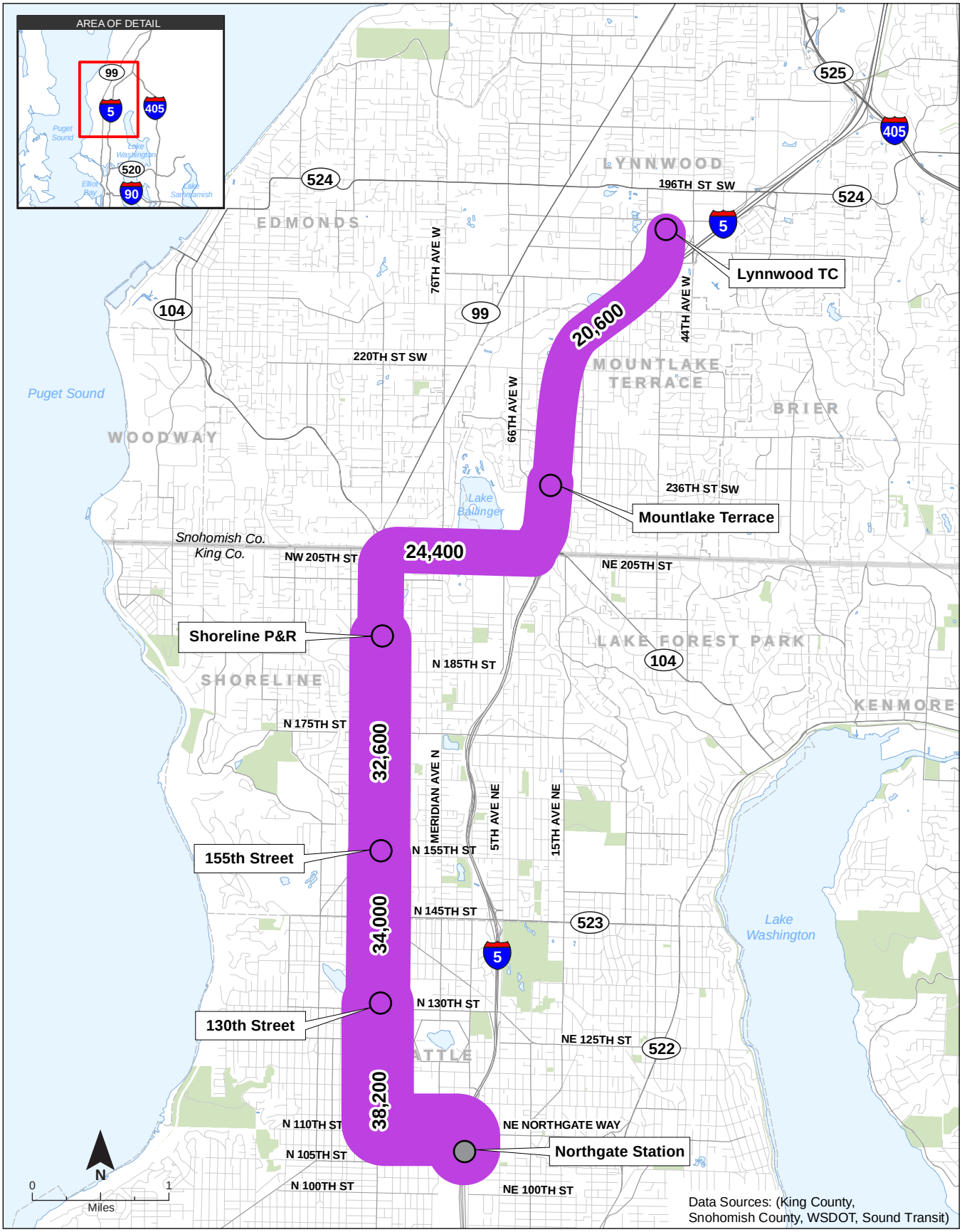
Figure 5-2. 2030 Daily Transit Ridership - TSM/Baseline



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

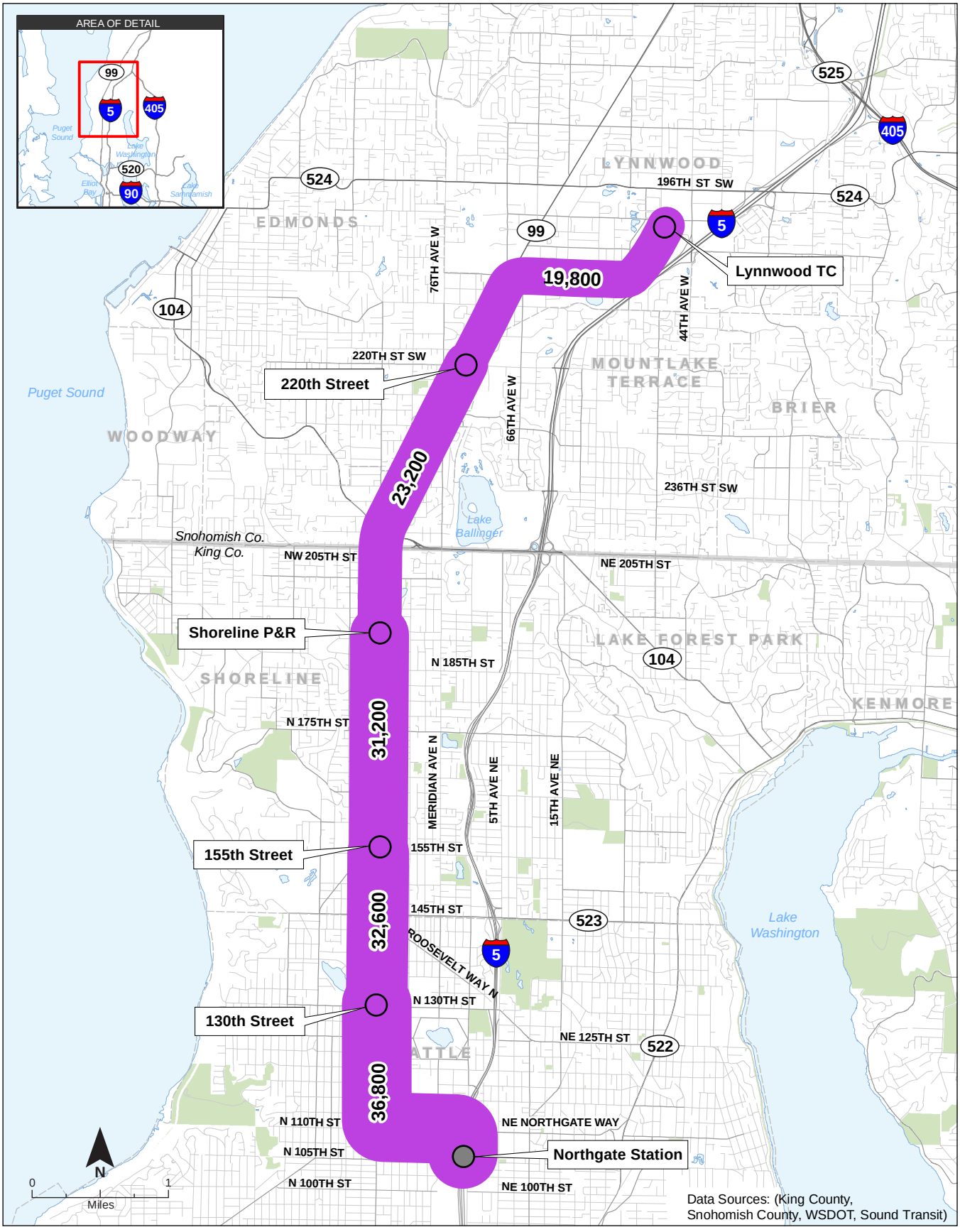
Figure 5-3. 2030 Daily Transit Ridership - L1: I-5 Light Rail



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

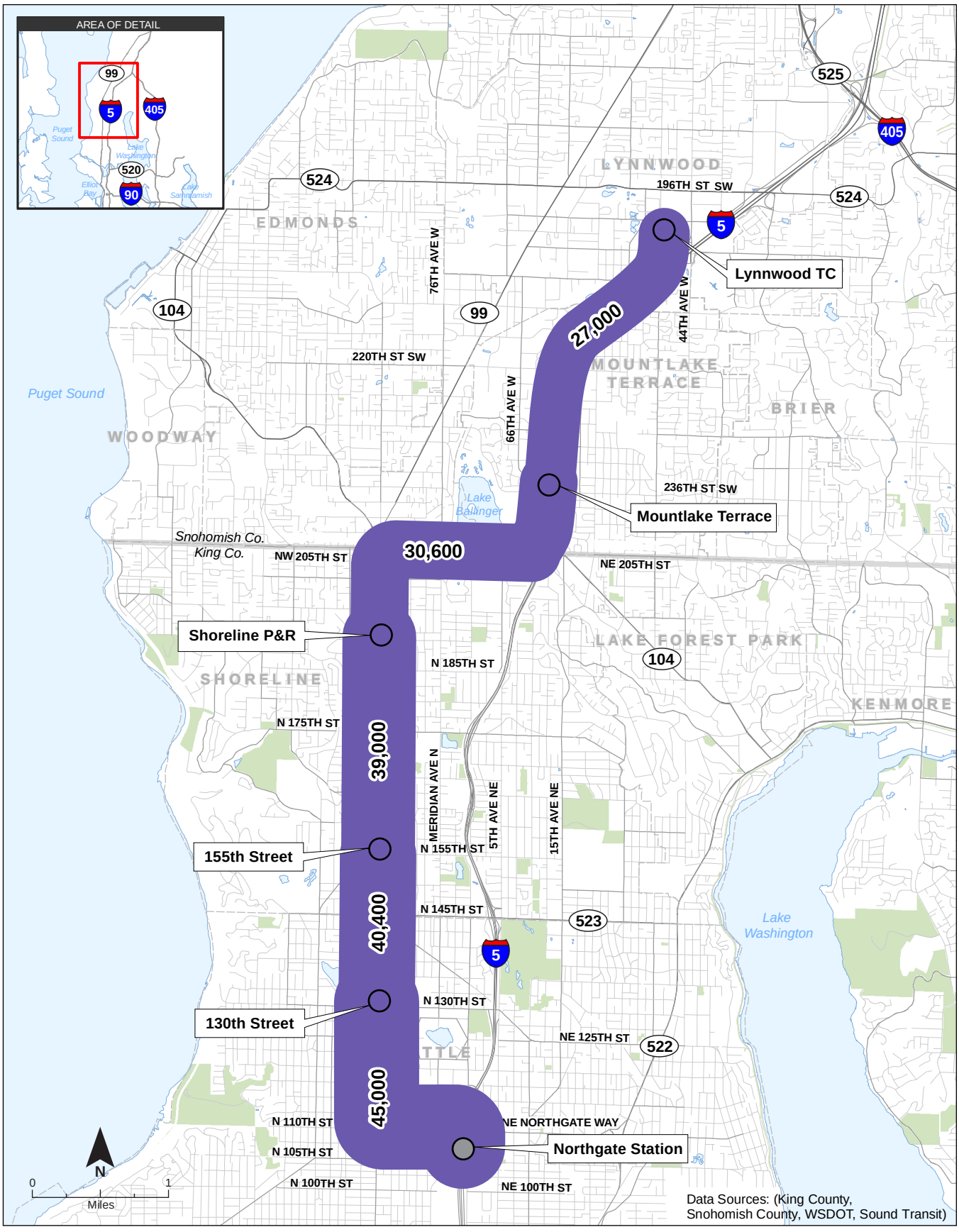
Figure 5-4. 2030 Daily Transit Ridership - L2: SR 99 Mixed Profile Light Rail



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

Figure 5-5. 2030 Daily Transit Ridership - L2: SR 99 North Variation



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

Figure 5-6. 2030 Daily Transit Ridership - L3: SR 99 Elevated Light Rail

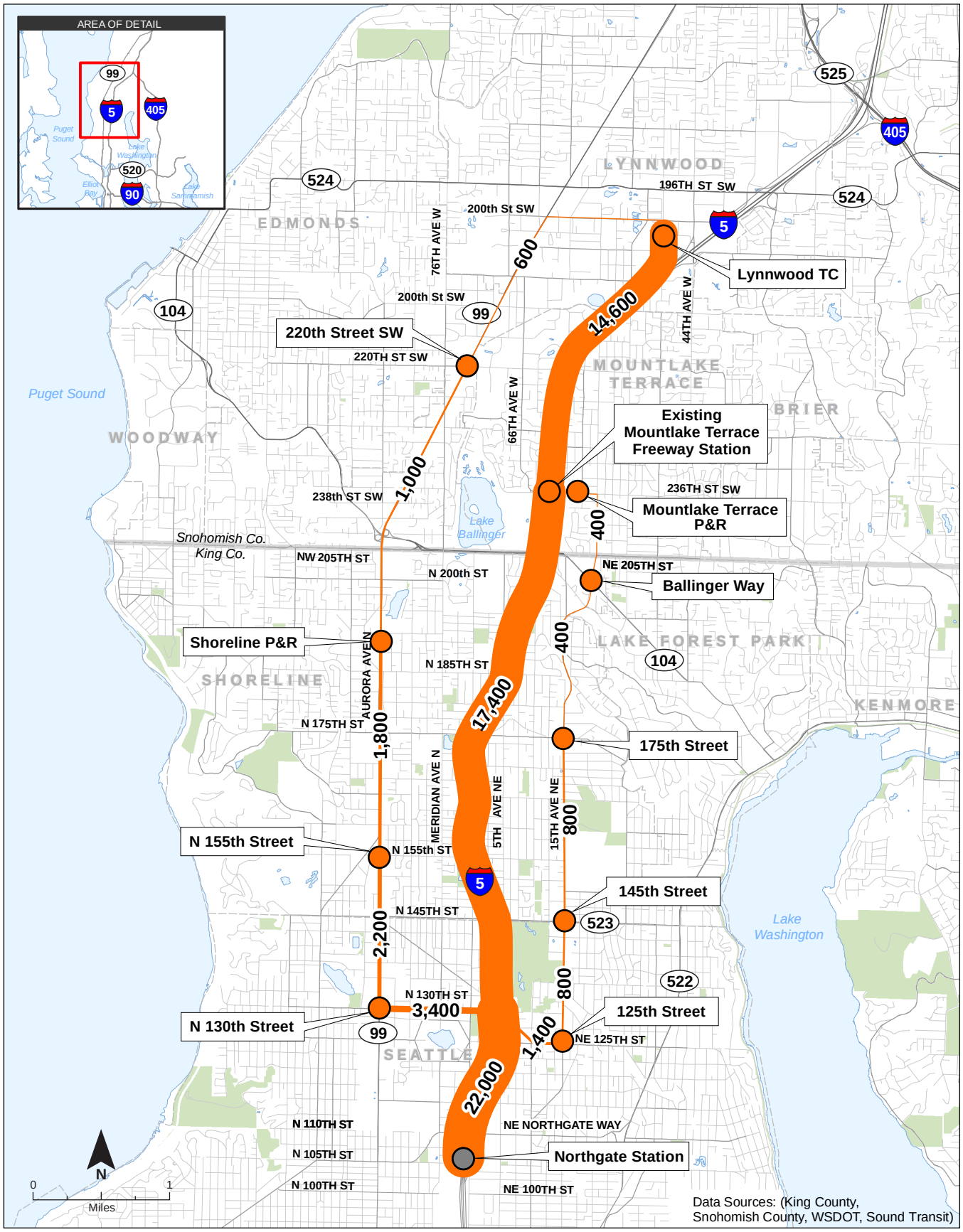


Figure 5-7. 2030 Daily Transit Ridership - B2: Multi-Corridor BRT

TRIPS TO SELECTED REGIONAL GROWTH CENTERS

This measure provides an indicator of how well each alternative connects selected regional destinations via transit by looking at total daily transit trips made to each of the following four PSRC-designated Regional Growth Centers within the North Corridor transit market: Lynnwood, Northgate, University District, and downtown Seattle. (More information on regional growth centers can be found in Section 5.2.)

Table 5-2 provides the changes in daily transit trips to and from the selected regional growth centers.

The L1: I-5 Light Rail Alternative would result in the highest increase in the number of daily transit trips made to all four selected regional growth centers combined, at more than 10,000 trips. The L3: SR 99 Elevated Light Rail Alternative would result in approximately 20 percent fewer total trips to the selected growth centers compared to the L1: I-5 Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative would result in more than 30 percent fewer trips than the L3: SR 99 Elevated Light Rail Alternative, but more than double the increase in transit trips to the selected regional growth centers of the B2: Multi Corridor BRT Alternative, and more than three times the increase of the TSM/Baseline Alternative. The regional growth center with the highest increase in transit trips is downtown Seattle, with approximately 3,700 more transit trips for the L1: I-5 Light Rail Alternative.

Table 5-2. 2030 Change in Daily Transit Trips to/from Selected Regional Growth Centers

Alternative	Lynnwood	Northgate	University District	Seattle CBD	Total
TSM/Baseline	500	500	200	300	1,500
L1: I-5 Light Rail	2,300	1,300	3,100	3,700	10,400
L2: SR 99 Mixed Profile Light Rail*	1,400	200	1,900	1,800	5,300
SR 99 North Variation	1,300	200	1,600	1,600	4,700
L3: SR 99 Elevated Light Rail*	1,900	900	2,600	3,000	8,400
B2: Multi-Corridor BRT	900	700	400	500	2,500

*The Roosevelt Way Variation was not modeled, but is expected to result in slightly fewer transit trips between regional growth centers than the primary alternative because the 130th Street Station is not included.

5.1.3 Ability to Accommodate Demand

The ability of each alternative to provide the capacity to accommodate the forecasted demand in the corridor and give an indication of the potential to accommodate growth in ridership beyond the 2030 forecast horizon year is evaluated based on the following measures.

- **Person-carrying capacity per hour:** An estimate of maximum load person-carrying capacity based on infrastructure capacity and anticipated service levels.

- **Peak-hour ridership demand/operating capacity per hour:** A calculation of forecasted peak direction transit ridership demand for the segment north of Northgate divided by the operational person-carrying capacity of the alternative.

The L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative would provide the highest peak-period capacity of passengers per hour per direction, at 4-minute headways. The L2: SR 99 Mixed Profile Light Rail Alternative would provide half the carrying capacity of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives because it is limited to 8 minute headways[2]. The B2: Multi-Corridor BRT Alternative would provide more than twice the capacity of the TSM/Baseline Alternative, but only about 30 percent of the capacity of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives and about 60 percent of the capacity of the L2: SR 99 Mixed Profile Light Rail Alternative.

A summary of estimated carrying capacity and the ratio of peak-hour ridership demand to capacity is provided in Table 5-3. The carrying capacity amounts shown in Table 5-3 for the alternatives represent operating capacity assumptions of 148 passengers per car for light rail and 80 passengers per bus for BRT. The ratio provided in the table indicates how much of the operating capacity would be used by the forecasted peak-hour ridership demand in the peak direction for the peak segment of the line (which would be the segment north of Northgate Station). The operating capacity provided by the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives would accommodate the forecasted ridership demand in 2030 and would provide additional capacity for future ridership growth. The capacity provided by the L2: SR 99 Mixed Profile Light Rail Alternative would meet forecasted ridership demand; however, it would provide minimal capacity for future ridership growth or extension beyond Lynnwood. In addition, this alternative assumes that parallel commuter bus service would continue to operate in the I-5 corridor. If that bus service were to be truncated or discontinued, ridership demand would be expected to significantly increase for the L2: SR 99 Mixed Profile Light Rail Alternative, likely beyond the carrying capacity of the line at 8-minute headways. The reason that this bus service is assumed to remain with the L2: SR 99 Mixed Profile Light Rail Alternative is because, with the unreliability of at-grade operations, as well as 8-minute peak headways, it is anticipated that parallel express bus service from south Snohomish County would be as attractive as (if not more attractive than) rail service and would continue to serve a large share of riders. Elimination of that bus service is expected to result in an increase in demand for the light rail line. The variations (SR 99 North Variation and Roosevelt Way Variation) to the L2: SR 99 Mixed Profile Light Rail Alternative are expected to perform similarly to the primary alternative.

The TSM/Baseline Alternative is expected to be at capacity by the year 2030, while the B2: Multi-Corridor BRT Alternative would be approaching capacity, particularly on the highest demand

[2] When operating in an at-grade alignment on SR 99 as compared to the fully grade-separated L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives, which would operate at the 4-minute headways required by the system. As explained in Chapter 4, headways for the L2: SR 99 Mixed Profile Light Rail Alternative would be limited to 8 minutes because of the unreliability of at-grade train operations with 4-minute headways in the heavily congested SR 99 corridor.

route connecting Lynnwood and Northgate via I-5. The primary factor limiting the capacity of these alternatives is the volume of buses that can be accommodated at the expanded Northgate Transit Center. For the TSM/Baseline Alternative, the Lynnwood-to-Northgate route is anticipated to be over capacity, while the other routes would be able to accommodate the forecasted demand. In order to accommodate forecasted demand for the TSM/Baseline Alternative, peak period service frequencies would need to be increased to less than 2-minute headways. This would also be the case for accommodating demand for the B2: Multi-Corridor BRT Alternative beyond 2030, or if service were to be extended north to Everett. These frequencies would be extremely difficult to maintain and would require additional capacity at the Northgate Transit Center. Adding capacity to the Northgate Transit Center beyond the additional deck that is proposed for the B2: Multi-Corridor BRT Alternative may be difficult to accomplish and/or not cost-effective due to the expense of adding additional levels to the transit center or expanding its footprint.

Table 5-3. 2030 Maximum Person-Carrying Capacity

Alternative	Passengers per Hour per Direction*	Ratio of Peak-Hour Peak Direction Ridership to Capacity
TSM/Baseline	1,680	At capacity
L1: I-5 Light Rail	8,880	0.72
L2: SR 99 Mixed Profile Light Rail	4,440	0.95
L3: SR 99 Elevated Light Rail	8,880	0.62
B2: Multi-Corridor BRT	3,600	0.86

*Rail capacity based on an operating capacity of 148 passengers per vehicle. Bus capacity based on an operating capacity of 80 passengers per vehicle.

5.1.4 Travel Time

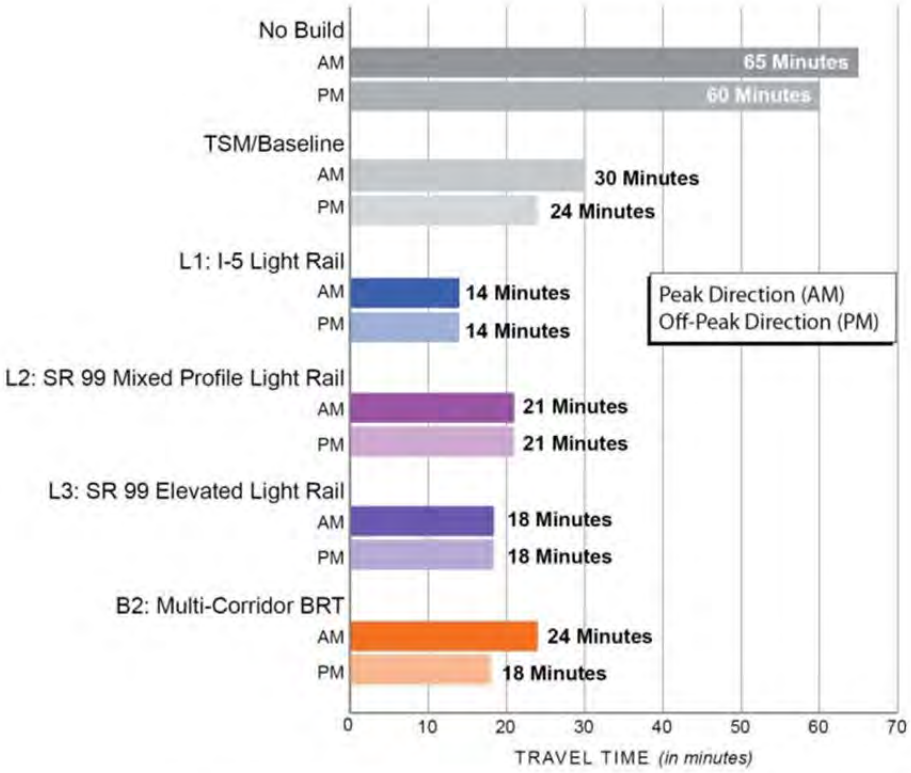
The measures in this category provide a comparison of estimated transit travel times among alternatives as well as a comparison to estimated automobile travel times. Travel times were compared for trips from Lynnwood and Shoreline to the selected regional growth centers of Northgate, University District, downtown Seattle, SeaTac, downtown Bellevue, and Overlake.

TRANSIT TRAVEL TIME

Year 2030 peak period transit travel times were estimated for the peak direction (AM southbound) and off-peak direction (PM southbound) based on estimated travel speeds and distance. Total travel times from Lynnwood and Shoreline to Northgate as well as six other representative regional centers were calculated. Transit travel time calculations assume travel south of Northgate is on the 2030 light rail system unless a faster bus alternative exists. Transit travel time routes from Shoreline begin at the Shoreline Park-and-Ride Station for all alternatives except for the L1: I-5 Light Rail Alternative, which begins at the I-5/185th Street

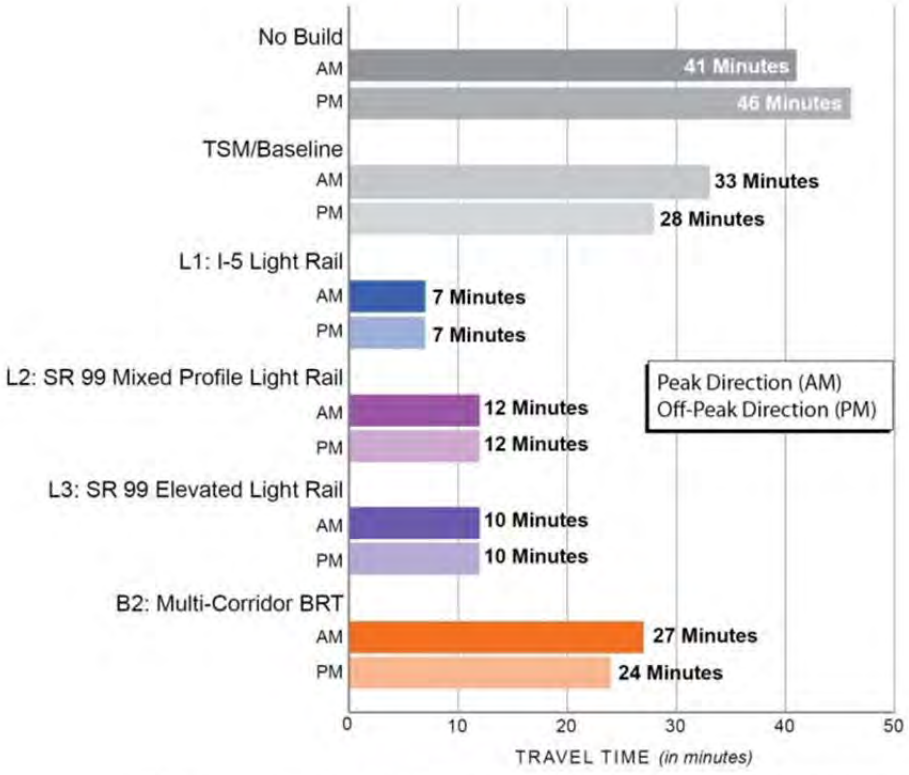
Station. Travel time routes from Lynnwood begin at the Lynnwood Transit Center for all alternatives.

Transit travel times from Lynnwood and Shoreline to Link light rail at Northgate are shown in Figures 5-8 and 5-9. Estimated travel times include dwell times at stations, in-vehicle travel time and, for bus alternatives, transfer time from bus to rail at Northgate. They do not include station access time. All of the alternatives would provide shorter travel times compared to the No Build Alternative, with the shortest being the L1: I-5 Light Rail Alternative.



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. The SR 99 North Variation would increase travel time by approximately 2 minutes, while the Roosevelt Way Variation would increase travel time by approximately 2 minutes.

Figure 5-8. Estimated 2030 Travel Times from Lynnwood to Northgate



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. The SR 99 North Variation would not affect travel time from Shoreline, while the Roosevelt Way Variation would decrease travel time by approximately 2 minutes.

Figure 5-9. Estimated 2030 Travel Times from Shoreline to Northgate

Peak direction travel times from Lynnwood to Northgate for the L2: SR 99 Mixed Profile Light Rail, L3: SR 99 Elevated Light Rail, and the B2: Multi-Corridor BRT Alternatives would be approximately 4 to 10 minutes longer than for the L1: I-5 Light Rail Alternative. In the off peak direction, the L1: I-5 Light Rail Alternative would be shorter by 4 to 7 minutes. Peak direction and off-peak direction travel times would differ for the bus alternatives because roadway congestion in the North Corridor varies by direction during peak periods, particularly during the PM peak period (Sound Transit 2010b). The SR 99 North Variation is estimated to be 2 minutes slower than the primary L2: SR 99 Mixed Profile Light Rail Alternative from Lynnwood to Northgate. The Roosevelt Way Variation is estimated to be 2 minutes faster than the primary alternative due to a reduction in the amount of at-grade alignment and elimination of one station (SR 99 at North 130th Street).

For trips from Shoreline to Northgate, the L1: I-5 Light Rail Alternative would provide the shortest travel time. The travel time advantage for the light rail alternatives over the TSM/Baseline and B2: Multi-Corridor BRT Alternatives would be greater for the trips from Shoreline due to bus travel on arterials for a portion of the trip to serve the Shoreline area, as well as a lack of direct access to the I-5 HOV lanes in the TSM/Baseline Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative and SR 99 North Variation alignments and travel times would

be identical between Shoreline and Northgate, while the Roosevelt Way Variation would reduce the travel time by 2 minutes.

Transit travel times from Lynnwood and Shoreline to selected PSRC-designated Regional Growth Centers are shown in Tables 5-4 through 5-7, and illustrated for selected centers in Figures 5-10 and 5-11. Estimated travel times shown in these tables and figures include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. In cases where the travel time for a build alternative is longer than existing transit service, some users may choose the faster existing service. However, some may choose the slower build alternative due to increased reliability and frequency of service.

Table 5-4. Estimated 2030 Transit Peak Period, Peak Direction, Travel Times (minutes) from Lynnwood to Selected Regional Growth Centers

Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	25	52	43	88	49	68
TSM/Baseline	35	41	45	77	68	79
L1: I-5 Light Rail	19	25	29	61	52	63
L2: SR 99 Mixed Profile Light Rail	26	32	36	68	59	70
L3: SR 99 Elevated Light Rail	23	29	33	65	56	67
B2: Multi-Corridor BRT	29	35	39	71	62	73

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.

Table 5-5. Estimated 2030 Transit Peak Period, Off-Peak Direction, Travel Times (minutes) from Lynnwood to Selected Regional Growth Centers

Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	43	77	44	89	55	81
TSM/Baseline	29	35	39	71	62	73
L1: I-5 Light Rail	19	25	29	61	52	63
L2: SR 99 Mixed Profile Light Rail	26	32	36	68	59	70
L3: SR 99 Elevated Light Rail	23	29	33	65	56	67
B2: Multi-Corridor BRT	23	29	33	65	56	67

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.

Table 5-6. Estimated 2030 Transit Peak Period, Peak Direction, Travel Times (minutes) from Shoreline to Selected Regional Growth Centers

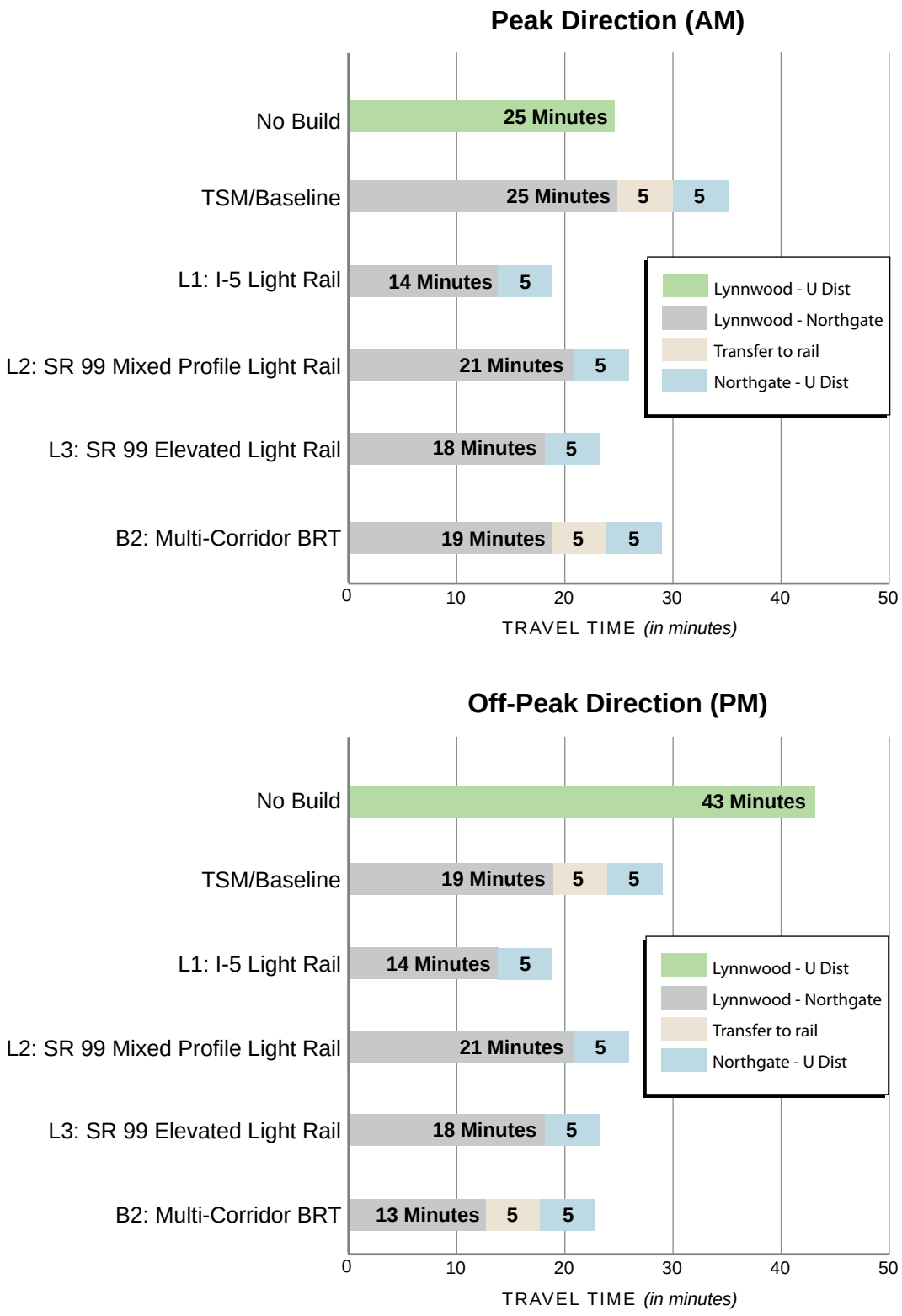
Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	49	45	33	74	76	89
TSM/Baseline	38	44	48	80	71	82
L1: I-5 Light Rail	12	18	22	54	45	56
L2: SR 99 Mixed Profile Light Rail	17	23	27	59	50	61
L3: SR 99 Elevated Light Rail	15	21	25	57	48	59
B2: Multi-Corridor BRT	32	38	42	74	65	76

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.

Table 5-7. Estimated 2030 Transit Peak Period, Off-Peak Direction, Travel Times (minutes) from Shoreline to Selected Regional Growth Centers

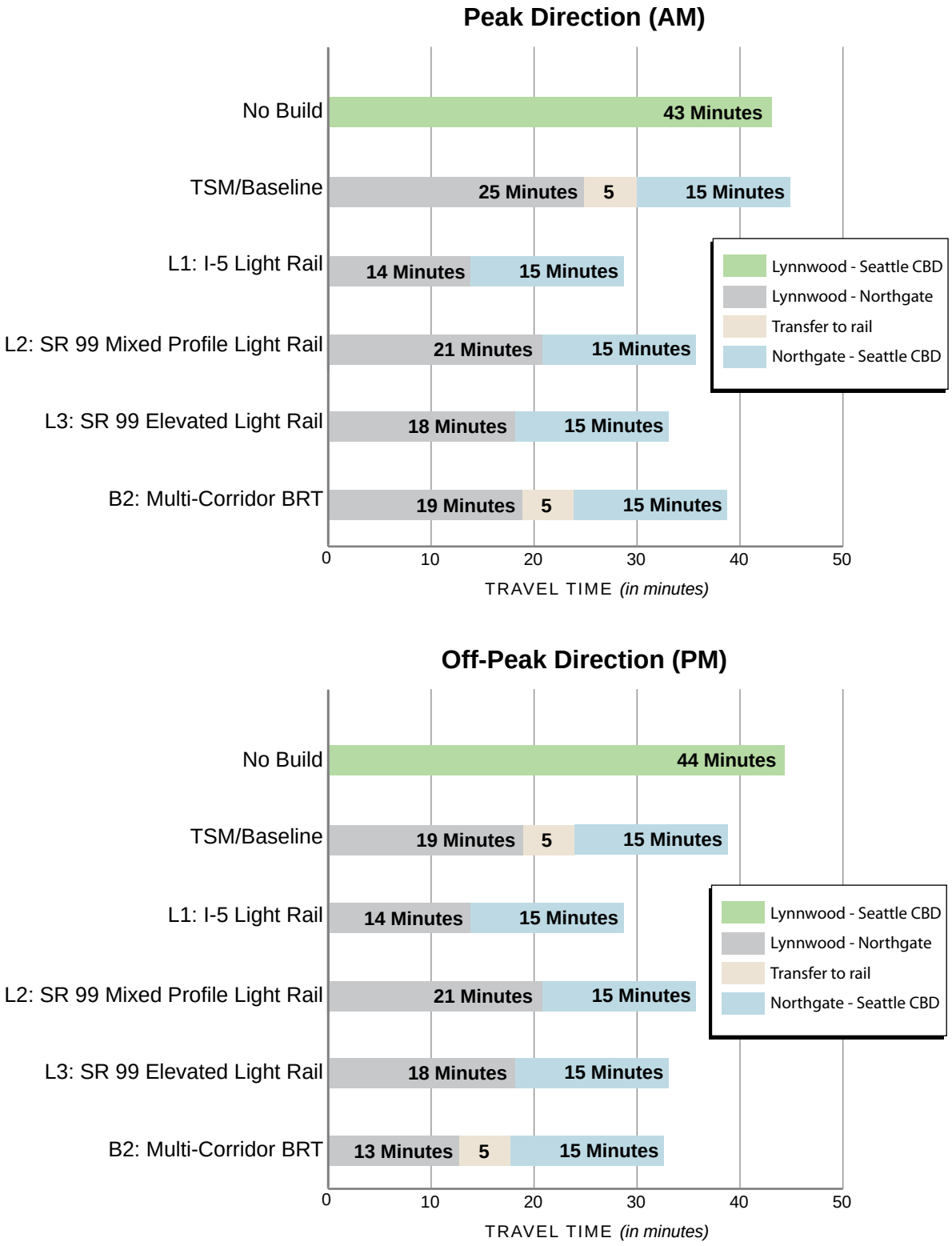
Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	63	79	42	87	92	81
TSM/Baseline	33	39	43	75	66	77
L1: I-5 Light Rail	12	18	22	54	45	56
L2: SR 99 Mixed Profile Light Rail	17	23	27	59	50	61
L3: SR 99 Elevated Light Rail	15	21	25	57	48	59
B2: Multi-Corridor BRT	29	35	39	71	62	73

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-10. 2030 Transit Peak Period Travel Times from Lynnwood to University District



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-11. 2030 Transit Peak Period Travel Times from Lynnwood to Downtown Seattle

TRAVEL TIME COMPARISON—TRANSIT VS. AUTOMOBILE

A comparison of peak period travel times for key travel time pairs was also made using the same general methodology as for the transit travel time measure. Estimated 2030 transit and automobile travel times from Lynnwood to selected PSRC-designated Regional Growth Centers are illustrated in Figures 5-12 and 5-13. Estimated automobile travel times are based on observed travel times (WSDOT loop detectors, 2008) and speed degradation through 2030 derived from the regional travel demand model.

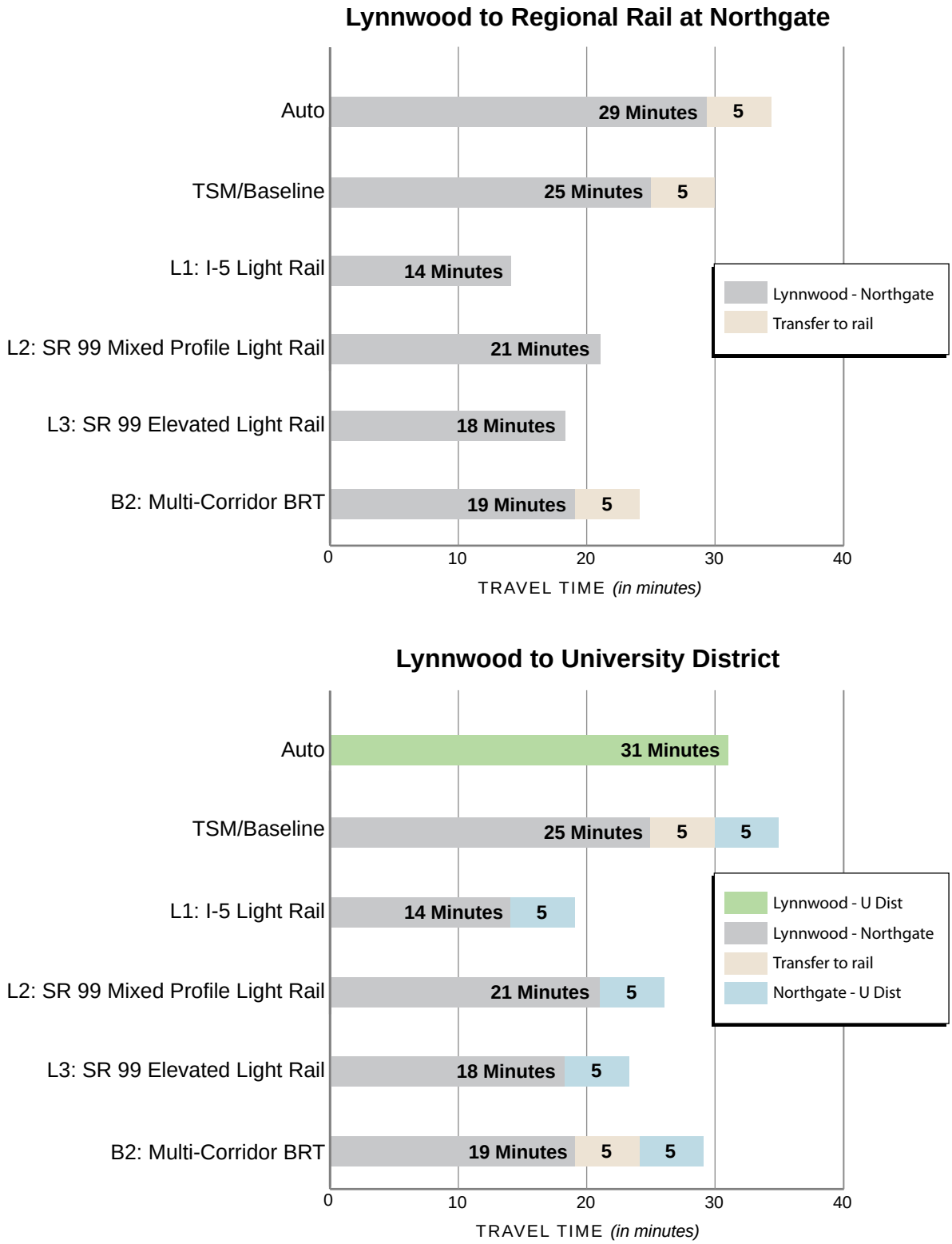
As shown in Figure 5-12, the automobile travel time from Lynnwood to regional light rail at Northgate is expected to be approximately 4 minutes longer than the TSM/Baseline Alternative, at approximately 34 minutes. This is approximately 10 minutes longer than the B2: Multi-Corridor BRT Alternative, and approximately 10 to 16 minutes longer than the light rail alternatives. The automobile travel time to the University District is expected to be 4 minutes shorter than the TSM/Baseline Alternative and 2 to 12 minutes longer than the B2: Multi-Corridor BRT Alternative and light rail alternatives. The automobile travel time to downtown Seattle is expected to be shorter than the TSM/Baseline Alternative, similar to the B2: Multi-Corridor BRT Alternative, and longer than the light rail alternatives. For trips to Sea Tac Airport, automobile travel times are expected to be 8 to 24 minutes shorter than the bus and light rail alternatives.

5.1.5 Transit Reliability

The following measures provide an assessment of the alternatives based on the operational conditions that affect transit travel time reliability: miles of alignment in non-exclusive right of-way, number of at-grade signalized intersections traversed, and number of transfers required to reach major destinations.

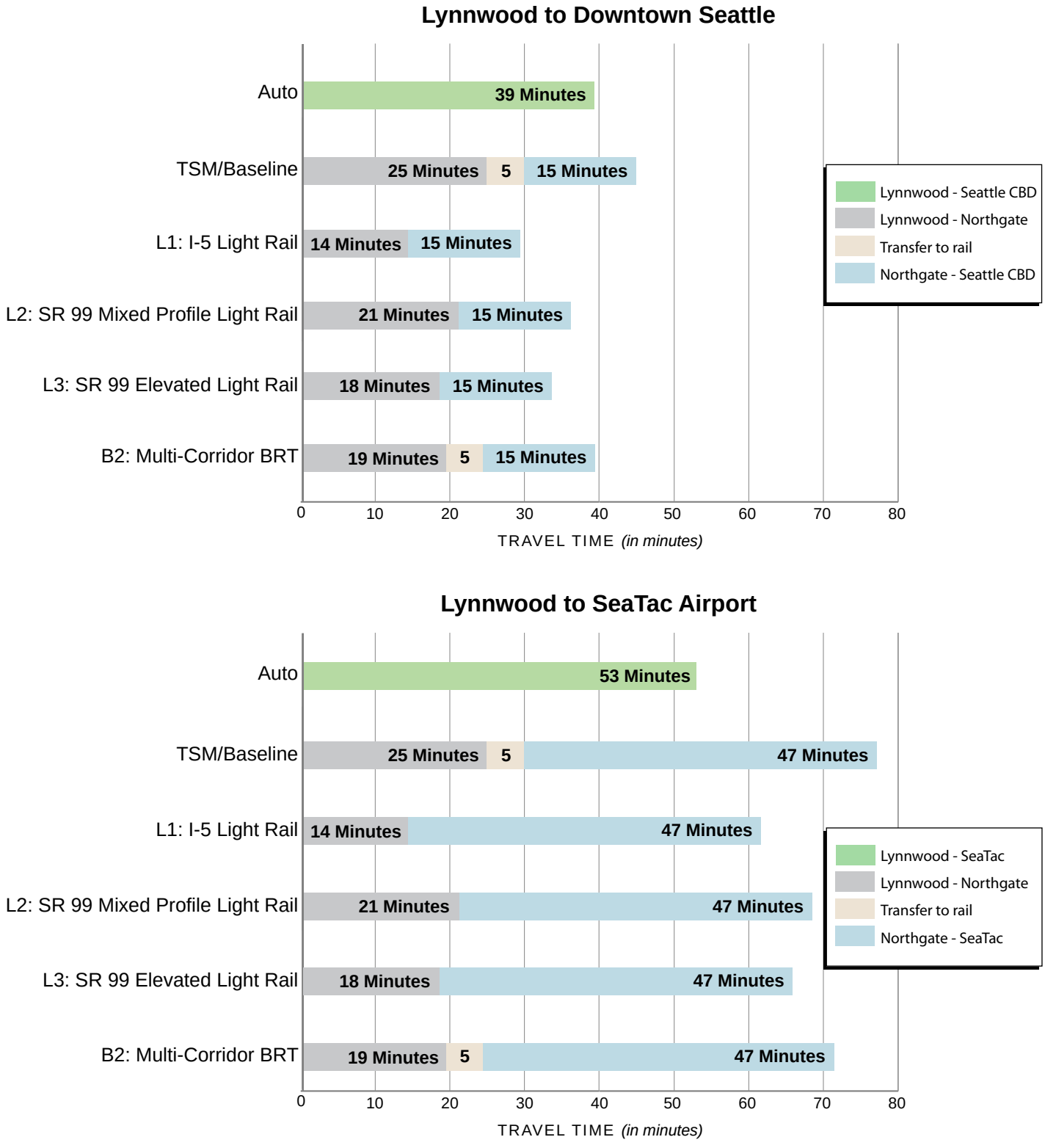
MILES OF NON-EXCLUSIVE GUIDEWAY

Transit travel in non exclusive right-of-way means that the travel time would vary by time of day depending on roadway congestion levels and be subject to the same frequently occurring but unpredictable delays resulting from traffic incidents such as vehicle breakdowns and accidents. The approximate miles of operation on non-exclusive guideway associated with each alternative is presented in Table 5-8 by alternative. For the TSM/Baseline Alternative, buses on the I-5 Lynnwood-to-Northgate route would be required to use the existing general purpose on- and off-ramps at Northgate and navigate on local arterials with general purpose traffic to reach the transit center. (Transit-only lanes would provide some travel time savings for buses using the I-5 southbound off-ramp and northbound on-ramp at Northgate.) The HOV lanes (non-exclusive guideway) on I-5 do not currently meet the WSDOT performance standard of 45-mph travel speed in HOV lanes during peak periods.



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-12. 2030 Peak Period, Peak Direction, Travel Times from Lynnwood to Northgate and University District - Transit vs. Automobile



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-13. 2030 Peak Period, Peak Direction, Travel Times from Lynnwood to Downtown Seattle and SeaTac Airport - Transit vs. Automobile

Table 5-8. Miles of Operation on Non-Exclusive Guideway

Alternative	Miles of Operation on Non-Exclusive Guideway
TSM/Baseline	23.8
L1: I-5 Light Rail	0
L2: SR 99 Mixed Profile Light Rail	0
L3: SR 99 Elevated Light Rail	0
B2: Multi-Corridor BRT	25.8

Transportation 2040 (PSRC 2010a), the region's Long-Range Plan 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 develop one or more managed lanes in each direction of I-5 between Northgate and Lynnwood. If implemented and successfully managed, these improvements should reduce peak period travel times by as much as 5 minutes and provide better reliability for buses operating in this section of I-5. However, at this time, the design, construction costs, right-of-way, transportation system, environmental effects, and funding of these improvements are not known.

The light rail alternatives all would operate on completely exclusive guideway, regardless of whether they are elevated or at-grade. The B2: Multi-Corridor BRT Alternative would operate 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 considered non-exclusive guideway, the lanes would offer a level of priority that provides some reliability benefit over general purpose lanes.

NUMBER OF AT-GRADE SIGNALIZED INTERSECTIONS AND CONGESTION

The number of at-grade signalized intersections traversed and the number of highly congested intersections for each alternative is provided in Table 5-9. The TSM/Baseline Alternative, with three express bus routes, would traverse 30 signalized intersections, with 11 of them highly congested.

Table 5-9. Number of At-Grade Signalized Intersections Traversed and Congestion

Alternative	Number of At-Grade Signalized Intersections Traversed	Highly Congested* Signalized Intersections
TSM/Baseline	30	11
L1: I-5 Light Rail	0	0
L2: SR 99 Mixed Profile Light Rail	5	2
Roosevelt Way Variation	2	0
SR 99 North Variation	11	4
L3: SR 99 Elevated Light Rail	0	0
B2: Multi-Corridor BRT	50	13

*Highly congested signalized intersections are defined as intersections operating at or over capacity (LOS E or F) with heavy to severe delay.

The L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Alternative would not traverse any at-grade signalized intersections, while the L2: SR 99 Mixed Profile Light Rail Alternative would traverse five at-grade signalized intersections, with two of those being highly congested. The Roosevelt Way Variation would not have the at-grade section between North 125th Street and North 143rd Street; this variation would traverse only two signalized intersections with none of them highly congested. The SR 99 North Variation would follow SR 99 north of SR 104/Ballinger Way rather than travel on Ballinger Way and then turn east of 208th Street SW. The segment north of SR 104 would traverse 6 additional at-grade signalized intersections, with 2 of them highly congested, for a total of 11 intersections, 4 of which are highly congested.

The B2: Multi-Corridor BRT Alternative, with three express bus/BRT routes and direct access into and out of the Northgate Transit Center, as well as direct access to and from the south at North 130th Street, would traverse 50 signalized intersections, with 13 of those highly congested.

NUMBER OF TRANSFERS REQUIRED TO REACH MAJOR DESTINATIONS

Each transfer made to reach a destination introduces another source of travel time unreliability and day-to-day variation. Both the TSM/Baseline and the B2: Multi-Corridor Alternatives would require a transfer to light rail at Northgate in order to reach destinations south of Northgate via the regional light rail system, adding time to those trips. The light rail alternatives would not require a transfer at Northgate to reach the same destinations.

5.1.6 System-Wide Vehicle Miles Traveled

This system-wide measure provides information on travel characteristics relative to each alternative and is used as input for calculation of several environmental measures. Total system VMT can serve as an indicator of mode shift. For example, a reduction in VMT is often due to a shift from automobile to transit. System-wide statistics for reduction in daily VMT are provided in Table 5-10.

The reduction in overall system daily VMT with the L1: I-5 Light Rail Alternative would be more than twice the reduction that would result from the L2: SR 99 Mixed Profile Light Rail Alternative. The VMT reduction with the L3: SR 99 Elevated Light Rail Alternative would be less than that of the L1: I-5 Light Rail Alternative, but still almost double that of the L2: SR 99 Mixed Profile Light Rail Alternative. The VMT reduction with the B2: Multi-Corridor BRT Alternative would be less than half that of the L2: SR 99 Mixed Profile Light Rail Alternative, while the reduction with the TSM/Baseline Alternative would be half that of the B2: Multi-Corridor BRT Alternative. This indicates that the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives would have a greater effect on reducing automobile travel than the other alternatives.

Table 5-10. Year 2030 Highway Performance Measures

Alternative	Reduction in Daily VMT
TSM/Baseline	16,900
L1: I-5 Light Rail	191,500
L2: SR 99 Mixed Profile Light Rail*	85,200
SR 99 North Variation	75,200
L3: SR 99 Elevated Light Rail	160,700
B2: Multi-Corridor BRT	33,100

*The Roosevelt Way Variation was not modeled, but is expected to result in slightly less VMT reduction than the primary alternative

5.1.7 Transit Service Accessibility

Transit service accessibility is measured by the quality of pedestrian, bicycle, feeder bus, and automobile access to the transit stations. Other modes such as automobile access by individuals with disabilities and drop-off passengers will be addressed in the station design and will be defined during the design phase, consistent with Sound Transit policies.

Pedestrian and bicycle accessibility is evaluated for each alternative based on the amount of geographic area accessible within a 15 minute walk and a 15-minute bicycle ride. The following qualitative factors were used to determine how each alternative is rated for pedestrian and bicycle accessibility:

- **Connectivity of local streets**—Greater connectivity means that a greater area is accessible by walking or biking. A closely spaced grid of local streets provides the highest level of connectivity and accessibility.
- **Barriers**—Barriers limit the area accessible by walking and biking. I-5, for example, is a barrier that requires pedestrians and bicycles to cross the freeway at a limited number of locations, potentially resulting in a much smaller area across I-5 that is accessible within a 15-minute walk shed. Streams, open space, and large contiguous land uses (e.g., golf courses and cemeteries) also have a barrier effect, limiting the size of residential or commercial areas that are within a 15 minute walk shed to the transit station.
- **Presence of sidewalks on arterial streets**—Arterial streets provide the primary access to the stations. Many arterials within the North Corridor project area lack sidewalks. Stations located in the vicinity of arterials with sidewalks result in a higher rating for accessibility.

The resulting pedestrian and bicycle accessibility scores were summed for all stations under each alternative and then the alternatives were rated as high, moderate, and low based on these scores.

The accessibility of transit stations by bus is measured by the number of existing bus routes passing within 0.25 mile of a transit station. The number of bus routes that could provide connectivity to the transit alternative was summed for the stations under each alternative, and then the alternatives were rated as high, moderate, and low based on the results.

Because land use patterns in the North Corridor are generally suburban, park-and-ride facilities are needed to bring substantial volumes of passengers to the stations. As the areas surrounding the stations continue to urbanize, the role of park and-ride access to stations would likely diminish. In order to assess the ability for automobiles to access transit stations, the number of park-and-ride stalls by alternative was summed for the stations under each alternative and then the alternative was ranked as high, moderate, and low based on the results.

A detailed evaluation was compiled and the accessibility by mode for each alternative was assigned a relative result with 3 being the highest and 1 the lowest. The priority for providing convenient and direct access to stations was established by the Link Light Rail North Link Design Criteria Manual (Sound Transit 2009).

Modal priority identified in this manual is listed as follows in descending order of importance:

- Pedestrian
- Individual with disability—non-driver (Paratransit)
- Bus or commuter rail
- Individual with disability—self driver (at park-and-ride facilities)
- Bicycle
- Drop-off passengers (including non-driver individual with disability)
- Taxi
- Park-and-ride
- Motorcycle

Accordingly, in the evaluation of various access characteristics at stations, of the four access modes assessed, pedestrian access was given the highest weighting at 2.0 and park-and-ride the lowest at 0.5. A summary of accessibility results by mode is presented in Table 5-11 for each alternative.

Table 5-11. Service Accessibility

Mode	Weight	TSM/Baseline	L1: I-5 Light Rail	L2: SR 99 Mixed Profile Light Rail*	L3: SR 99 Elevated Light Rail	B2: Multi-Corridor BRT
Pedestrian	2.0	3	2	2	2	3
Bus Connectivity	1.5	3	2	2	2	3
Bicycle	1.0	3	2	2	2	3
Park-and-Ride Availability	0.5	3	2	2	2	2
Overall Rating		High	Moderate	Moderate	Moderate	High

Scale: 3 = high, 2 = moderate, and 1 = low.

* The overall rating for the Roosevelt Way Variation and the SR 99 North Variation would be the same as for the primary alternative, "Moderate"

The 15-minute pedestrian and bicycle travel sheds for each station area are presented in Figures 5-14 to 5-17. For pedestrians, the 15-minute walk is based on a 3-mph walking speed, or a distance of 3,960 feet from a station location. For bicycles, the 15 minute travel shed is based on a bicycling speed of 7 mph, or a distance of 1.75 miles. For the purposes of this exercise, neither the pedestrian nor bicycle speeds were adjusted for topography. The travel distance was measured with geographic information system (GIS) mapping along public roadways and walking/cycling paths. The distance was measured from station locations up to a parcel edge. For large parcels, the distance was measured to the known entrance to the property (e.g., the entrance to the Jackson Park Golf Course is on the southeast portion of the parcel). The pedestrian and bicycle travel sheds, when evaluated by station and alternative, do not dramatically distinguish between alternatives.

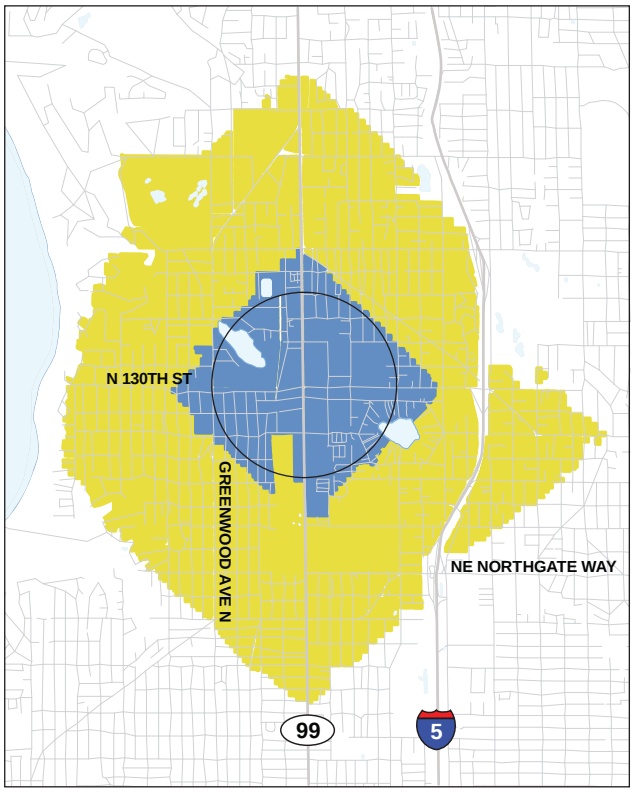
The travel shed diagrams illustrate where the lack of local street connectivity could limit accessibility in the area within a 15 minute walk or bike travel distance of each station. The travel sheds also show physical barriers between the transit station and nearby areas within the 15-minute walk shed, such as open/green space, golf courses, and cemeteries.

Overall, accessibility for all modes would be improved with implementation of any alternative. Facility development would include improvements to the pedestrian and bicycling environment in the immediate vicinity of stations, provision for passengers being dropped off, and taxi facilities, as well as access for individuals with disabilities. These improvements will be further defined during the design phase, consistent with Sound Transit policies.

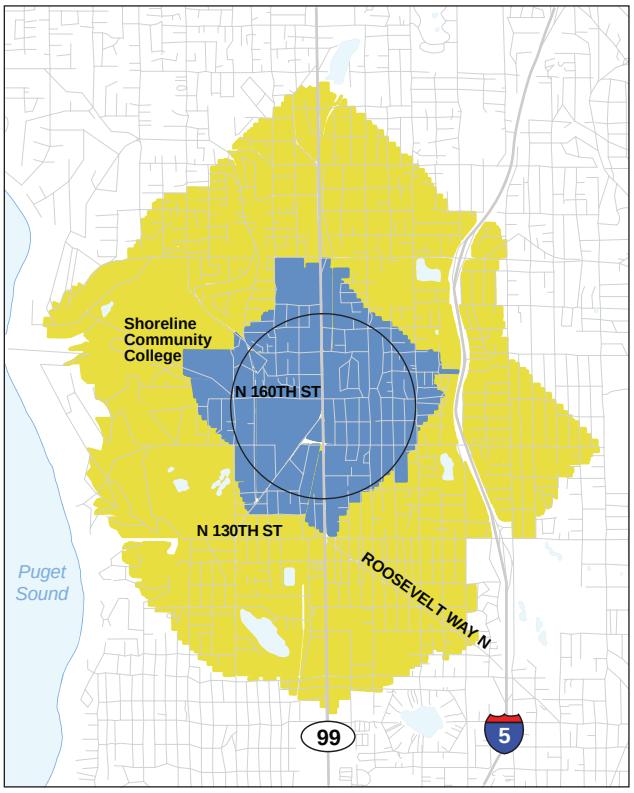
For the TSM/Baseline Alternative, accessibility to bus stops would be equal to the B2: BRT Multi-Corridor Alternative and higher than the light rail alternatives. The Edmonds Park and Ride, 19th Avenue NE/Ballinger Way, and 15th Avenue NE/North 175th Street areas would provide the highest level of pedestrian and bicycle accessibility because of the well developed sidewalk network. Lower levels of accessibility would exist at the other bus stop and station areas due to barriers, limited local street connectivity, and limited sidewalks on arterials.

There are 69 existing bus routes at or near the nine station areas that could provide connectivity to the three TSM/Baseline Alternative bus routes, resulting in a high rating for bus connectivity. The TSM/Baseline Alternative also includes the highest number of planned park-and-ride spaces, at 4,640.

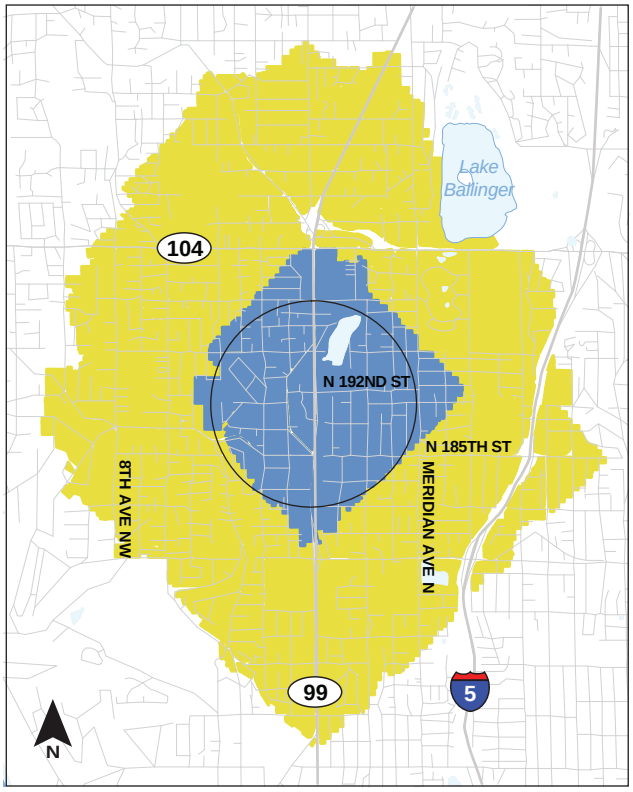
For the L1: I-5 Light Rail Alternative, a high level of accessibility would be provided at the North 185th Street station area, though the current large school district parcel immediately adjacent to the station may present an obstacle for pedestrians and cyclists. The remaining three station areas would provide lower levels of accessibility due to the presence of I-5 and lack of sidewalks on surrounding arterial streets. There are 40 existing bus routes at or near the four station areas that could provide connectivity to the L1: I-5 Light Rail Alternative, resulting in an average rating for bus connectivity. The L1: I-5 Light Rail Alternative includes 3,790 planned park-and-ride spaces, resulting in a moderate rating for this type of accessibility.



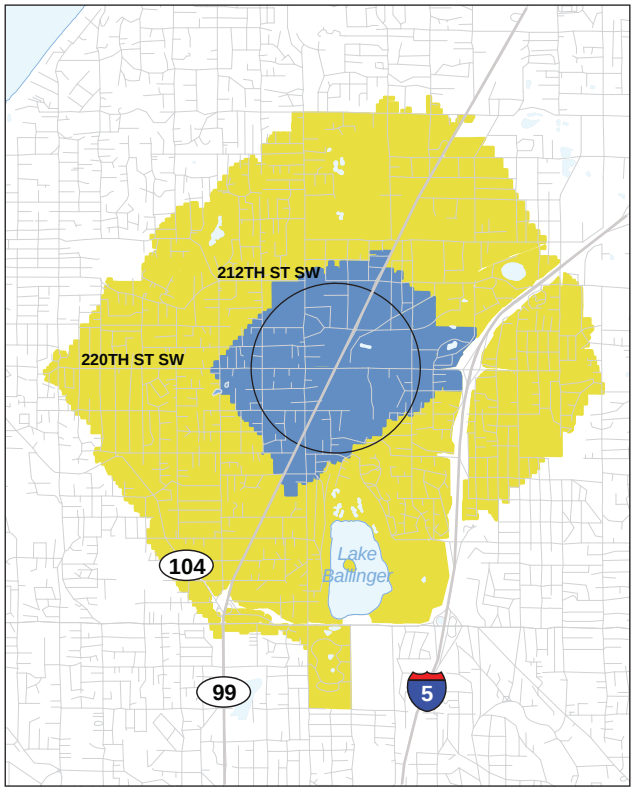
SR 99/130TH STREET



SR 99/160TH STREET



SHORELINE PARK-AND-RIDE



SR 99/220TH STREET

15-minute Walk Shed — Walk speed = 3 Miles per hour

15-minute Bike Shed — Bike speed = 7 Miles per hour

0.5 Mile Radius Station Area

Figure 5-14. 15-Minute Pedestrian and Bicycle Travel Sheds at the SR 99/130th Street, SR 99/160th Street, Shoreline Park-and-Ride and SR 99/220th Street Stations

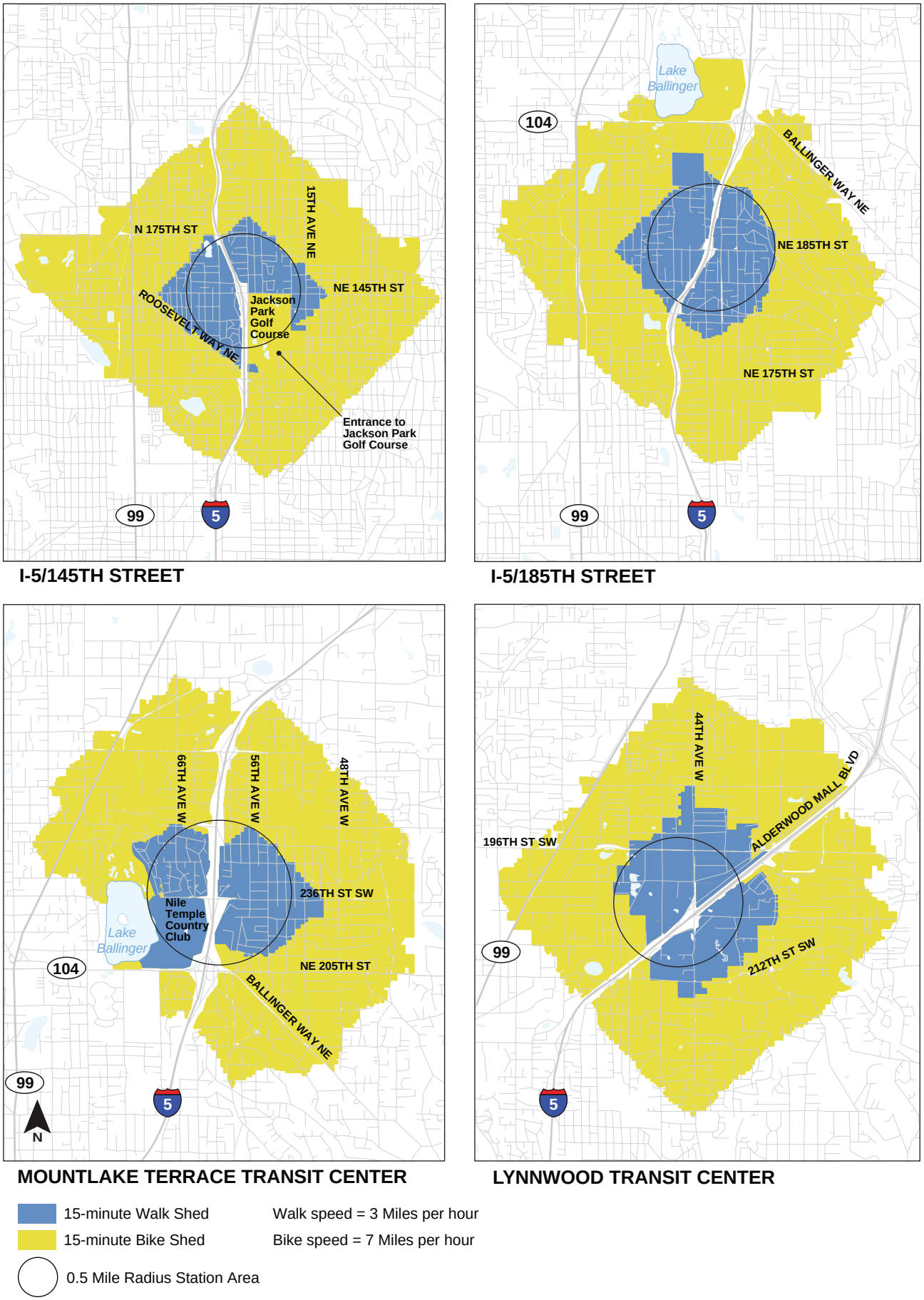


Figure 5-15. 15-Minute Pedestrian and Bicycle Travel Sheds at the I-5/145th Street, I-5/185th Street, Mountlake Terrace and Lynnwood Transit Center Stations