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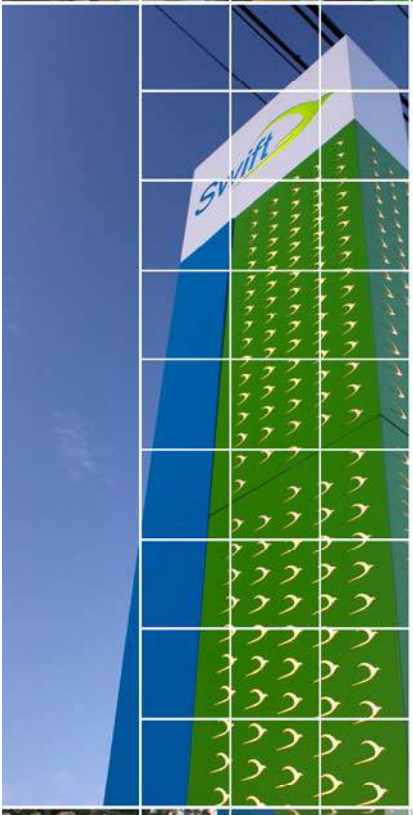

Community Transit BRT Corridor Planning and Route Definition Study: Boeing to Canyon Park

FINAL REPORT

August 2014

communitytransit

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Acronyms and Abbreviations

BAT	business access and transit
BRT	bus rapid transit
EB	eastbound
FTA	Federal Transit Administration
HOV	high-occupancy vehicle
I-	Interstate
NB	northbound
NEPA	National Environmental Policy Act
PSRC	Puget Sound Regional Council
PUD	Public Utility District
SB	southbound
SR	State Route
SSGA	Small Starts Grant Agreement
TSP	transit signal priority
WB	westbound
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

S.1 Introduction

Launched in November 2009, the initial *Swift* BRT line, a 17-mile route along SR 99 between the cities of Everett and Shoreline, has grown to become the centerpiece of Community Transit's system. *Swift* BRT provides fast, frequent, and convenient service. It includes unique branding, stations, and vehicles; off-board fare collection; near-level boarding; BAT lanes and infrastructure improvements; and transit signal priority. *Swift* stations are located approximately 1 mile apart and incorporate features designed to support rapid service and establish a sense of place—such as permanent structures with raised platforms, ticket vending machines, shelter and seating, and local artwork.

Currently, one in six Community Transit passenger boardings are on *Swift*. The initial line is the system's most productive non-commuter route and routinely carries more than 100,000 riders per month. Local jurisdictions have embraced *Swift*, changing land use codes to incentivize transit-oriented development around stations and investing in transit priority infrastructure and technology to improve service reliability.

S.2 Study Purpose and Need

With funding support from the Washington State Legislature Community Transit is taking the next step in planning for expansion of *Swift* BRT service in Snohomish County. This report documents results of a planning study for a potential second *Swift* line between Boeing and Bothell-Canyon Park, both of which are Regional Growth Centers designated by the Puget Sound Regional Council (PSRC).

The Boeing to Bothell-Canyon Park corridor has relatively dense development, including multiple activity centers comprised of both employment and residential uses. The existing and planned activity centers within the corridor include:

- Paine Field/Boeing Manufacturing/Industrial Center
- Bothell-Canyon Park: Regional Growth Center
- Snohomish County designated urban centers at
  - I-5 and 128th Street SW
  - SR 527 and 196th Street SE
- Snohomish County urban village at SR 527 and 185th Street SE
- Mill Creek Town Center with higher density residential and retail uses
- Retail/commercial centers at
  - Thrasher's Corner—208th Street SW and SR 527
  - 180th Street SE and SR 527

Local and regional jurisdictions are looking to manage land use within this corridor and Snohomish County overall in order to focus densities in appropriate locations and maintain open space and the natural environment elsewhere.

The Boeing to Bothell-Canyon Park corridor represents a key east-west transportation corridor as well as an important north-south corridor connecting two designated regional growth centers. The corridor also intersects several key regional roadways (i.e., SR 99, I-5, SR 527, and I-405) and connects the Boeing/

Paine Field major employment site and the Bothell-Canyon Park regional center with activity centers and population east of I-5. The corridor also connects with vital transit services, including the existing SR 99 *Swift* line and multiple regional express and commuter routes along I-5 and I-405, connecting to downtown Seattle, Bellevue, and other parts of the region. East-west travel within Snohomish County is difficult at present due to a lack of through roads and high levels of congestion on the roads that do exist. Consequently, there is an unmet need for effective and efficient east-west mobility in this portion of the county.

A high-capacity transit service that connects these key regional activity centers and interfaces with the existing local and regional transit services would provide a major new component in the transportation system for fulfilling this unmet need for east-west mobility.

S.3 Methodology

The overall objective of this study is to determine the most promising alignment and potential operating scenario for this new BRT service. To this end, a universe of potential routing options was initially identified and then packaged into four initial alternative alignments. These initial alternatives were evaluated across a range of screening criteria. For comparison, data for selected criteria were also developed for the existing SR 99 *Swift* corridor. The initial screening resulted in the recommendation of two alternative alignments to explore in a more refined analysis. Further analysis was then conducted to evaluate alignment extension alternatives beyond the initial primary corridor endpoints of Boeing and Mill Creek.

A set of 11 evaluation criteria was developed for high-level screening and subsequent evaluation of routing and alignment alternatives. The measures are a combination of quantitative and qualitative criteria:

- Forecasted transit trips to/from and within corridor
- Existing population and employment within 0.5 mile of alignment
- Rapid and direct service
- Estimated operational cost
- Estimated capital cost
- Connections to other local and regional transit services
- How well line connects ridership generators
- Economic development opportunities
- Availability of transit priority infrastructure
- Traffic constraints/infrastructure chokepoints
- Future land use as described in adopted plans

S.4 Recommendations and Conclusions

This study has determined that a *Swift* BRT route connecting the regional centers of Bothell-Canyon Park and Boeing/Paine Field is a viable project.

The project as evaluated includes the following elements:

- The proposed route (Figure S-1).
- Construction of 30 stations with BRT station elements consistent with the SR 99 *Swift* line. Preliminary station locations are discussed in Section 10.2.3.

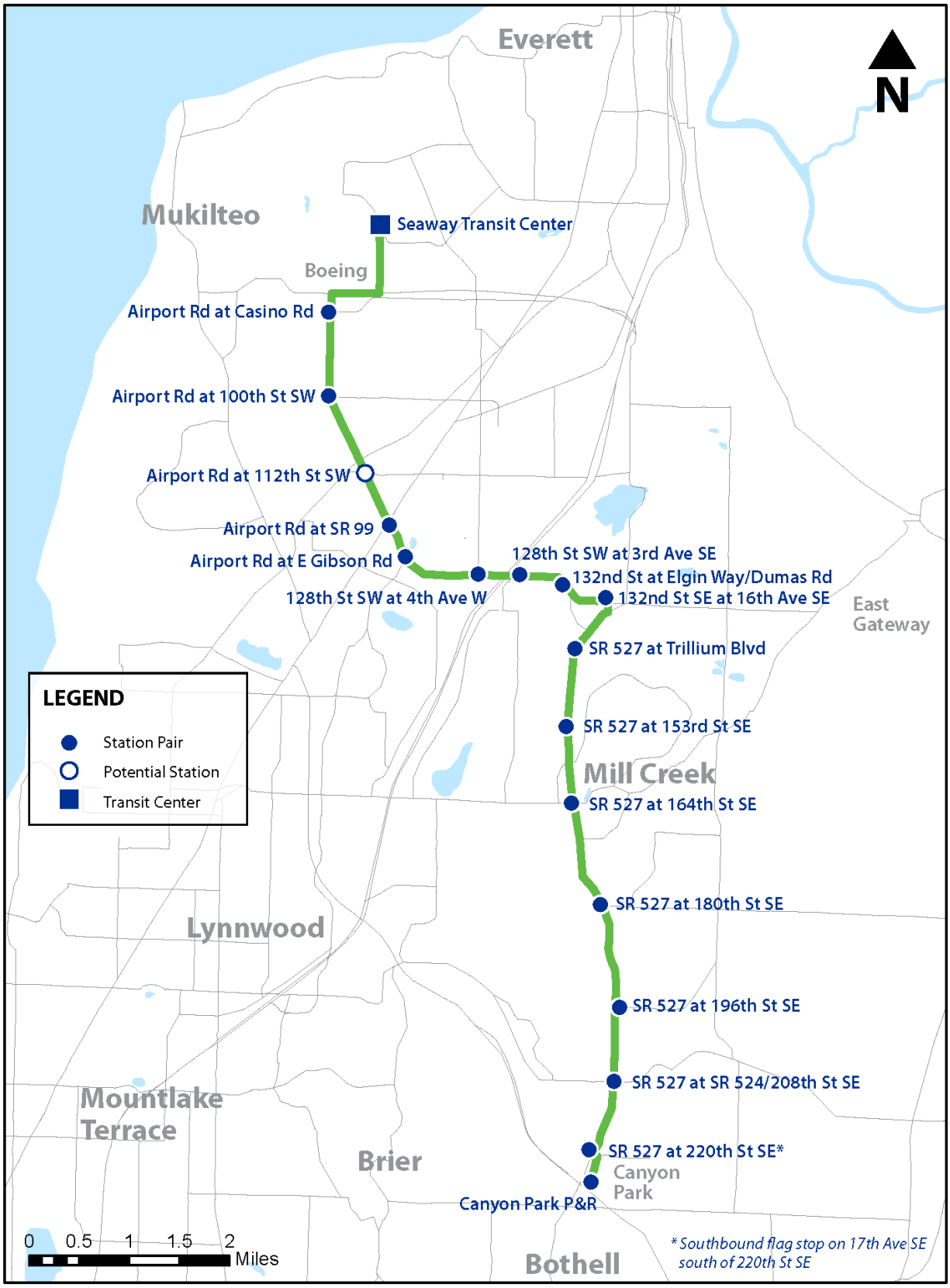


Figure S-1. Proposed BRT Route Alignment

- Construction of a northern transit center terminal at Seaway Boulevard and 75th Street SW on property adjacent to the Boeing Manufacturing Industrial Center.
- Approach widening improvements along 128th Street approaching I-5 from both the eastbound and westbound directions to facilitate transit movement through the heavily congested interchange as shown in Figure S-2.
- Conversion of the existing peak period/peak direction high-occupancy vehicle (HOV) 2+ lanes on Airport Road to either 24-hour HOV lanes or, preferably, 24-hour business access and transit (BAT) lanes
- Transit signal priority along the entire length of the route. Snohomish County and WSDOT partnering with other agencies have obtained a grant to provide adaptive signal control, including the ability to provide TSP and signal queue jumps throughout the corridor.
- Relocation of a retaining wall and potential remediation costs associated with the southbound station on 132nd Street at Dumas Road
- Intersection modifications to provide BRT use of the right-turn lanes as queue bypass lanes at stations on SR 527 at 164th Street (northbound only) and 208th Street (both northbound and southbound)
- Island modification at SR 99 and Airport Road
- Operating headways of 10 minutes in the peak periods and midday and 20 minutes in the evening.

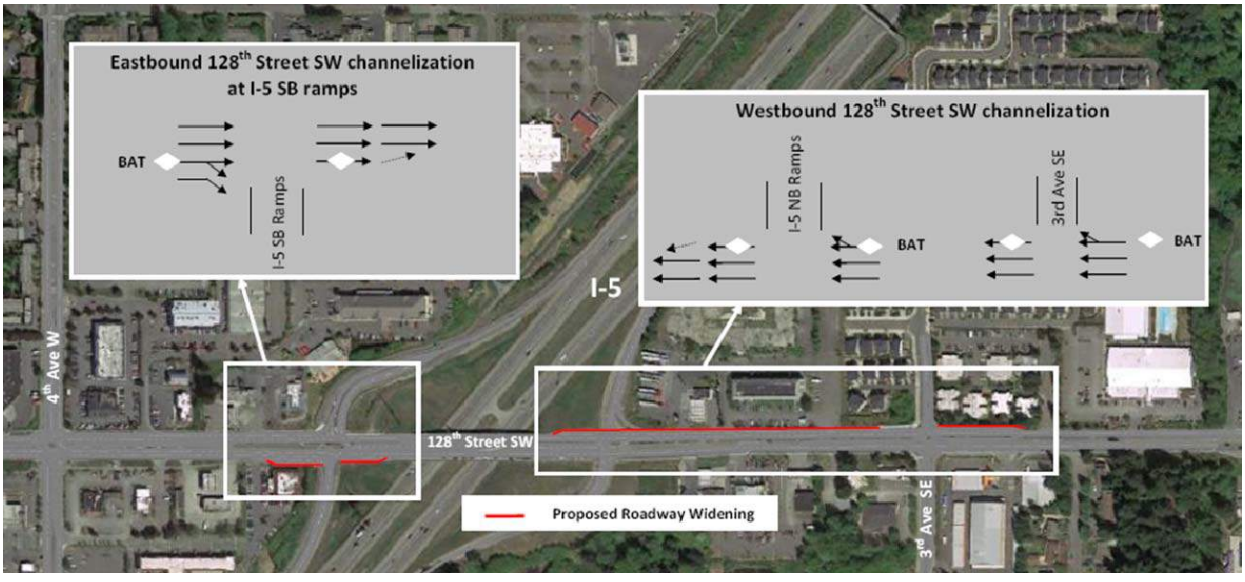


Figure S-2. Proposed Improvements at the 128th Street/I-5 Interchange

S.4.1 Capital and Operating Costs

Total capital cost of the project is estimated at approximately $42 to $48 million, with annual operating costs estimated to range from $7 to $8 million.

S.4.2 Ridership Projections

Preliminary ridership estimates project 3,300 riders per day if the line were operating today. By the year 2035, ridership is expected to increase to nearly 4,000 daily riders. Additionally, implementation of this route, which would intersect with the existing SR 99 *Swift* route, is expected to increase riders on the existing route by 600 riders per day—or by 12.5 percent.

S.4.3 Projected Travel Times

Implementation of the proposed *Swift* route between Boeing and Canyon Park would provide a significant improvement in transit travel times connecting key locations within the corridor. Depending on the direction, transit connections between Canyon Park and Boeing would be from 15 to 38 minutes faster during the peak commute periods and from 51 to 56 minutes faster during the midday. This represents a transit travel time improvement ranging from 30 percent to over 50 percent in the peak periods and up to 64 percent during the midday period.

S.4.4 Next Steps

The recommended route is included in PSRC's Regional Transportation Plan. Community Transit has obtained a competitive federal grant and local matching funds to initiate Project Development work as defined by the Federal Transit Administration (FTA) process to pursue Small Starts grant funds.

1. INTRODUCTION

1.1 Background

Community Transit is a special purpose municipal corporation—a public transportation benefit area—providing public transportation services. It was created by Snohomish County voters in 1976 and began operation on October 4, 1976. In the 38 years since beginning service, Community Transit has expanded to serve almost every community in Snohomish County. Today, the agency provides bus, paratransit, vanpool, rideshare matching, and commute trip reduction services to individuals and businesses throughout the county, as well as commuter bus service to downtown Seattle and the University District of Seattle. In addition, Community Transit constructed and operates Washington State's first BRT service, *Swift*, operating along the SR 99 corridor between Everett and Shoreline. Community Transit services carry more than 9 million passengers a year.

Launched in November 2009, the initial *Swift* line, a 17-mile route along SR 99 between the cities of Everett and Shoreline, has grown to become the centerpiece of Community Transit's system. *Swift* BRT provides fast, frequent, and convenient service. It includes unique branding, stations, and vehicles; off-board fare collection; near-level boarding; BAT lanes and infrastructure improvements; and transit signal priority. *Swift* stations are located approximately 1 mile apart and incorporate features designed to support rapid service and establish a sense of place—such as permanent structures with raised platforms, ticket vending machines, shelter and seating, and local artwork.

Currently, one in six Community Transit passenger boardings are on *Swift*. The initial line is the system's most productive non-commuter route and routinely carries more than 100,000 riders per month. Local jurisdictions have embraced *Swift*, changing land use codes to incentivize transit-oriented development around stations and investing in transit priority infrastructure and technology to improve service reliability.

1.2 Study Purpose

Community Transit is taking the next step in planning for expansion of *Swift* BRT service in Snohomish County. This report documents results of a planning study for a potential second *Swift* line.

In 2011, Community Transit adopted the *Long Range Transit Plan: Thinking Transit First* that identified a network of future *Swift* BRT lines running on Transit Emphasis Corridors connecting centers in urbanized areas of Snohomish County. The schedule for implementing these new lines depends on market readiness, operational funding, and partnerships with local, state, and federal agencies for land use, infrastructure, capital investment, and other project requirements.

The proposed *Swift* corridor (Figure 1-1) documented and evaluated in this study represents a minimum operating segment combining portions of two Transit Emphasis Corridors identified in the Long Range Transit Plan: Airport Road/128th Street and SR 527—between Boeing/Paine Field in Everett and Bothell-Canyon Park—both of which are Regional Growth Centers designated by the PSRC. The area shaded in green in the figure is the primary study area reflecting a corridor with the primary end points being Boeing on the north and Mill Creek on the south. The areas shaded in orange are areas containing possible extensions to the primary corridor area, including Mukilteo to the west, East Gateway to the east, and Canyon Park to the south.

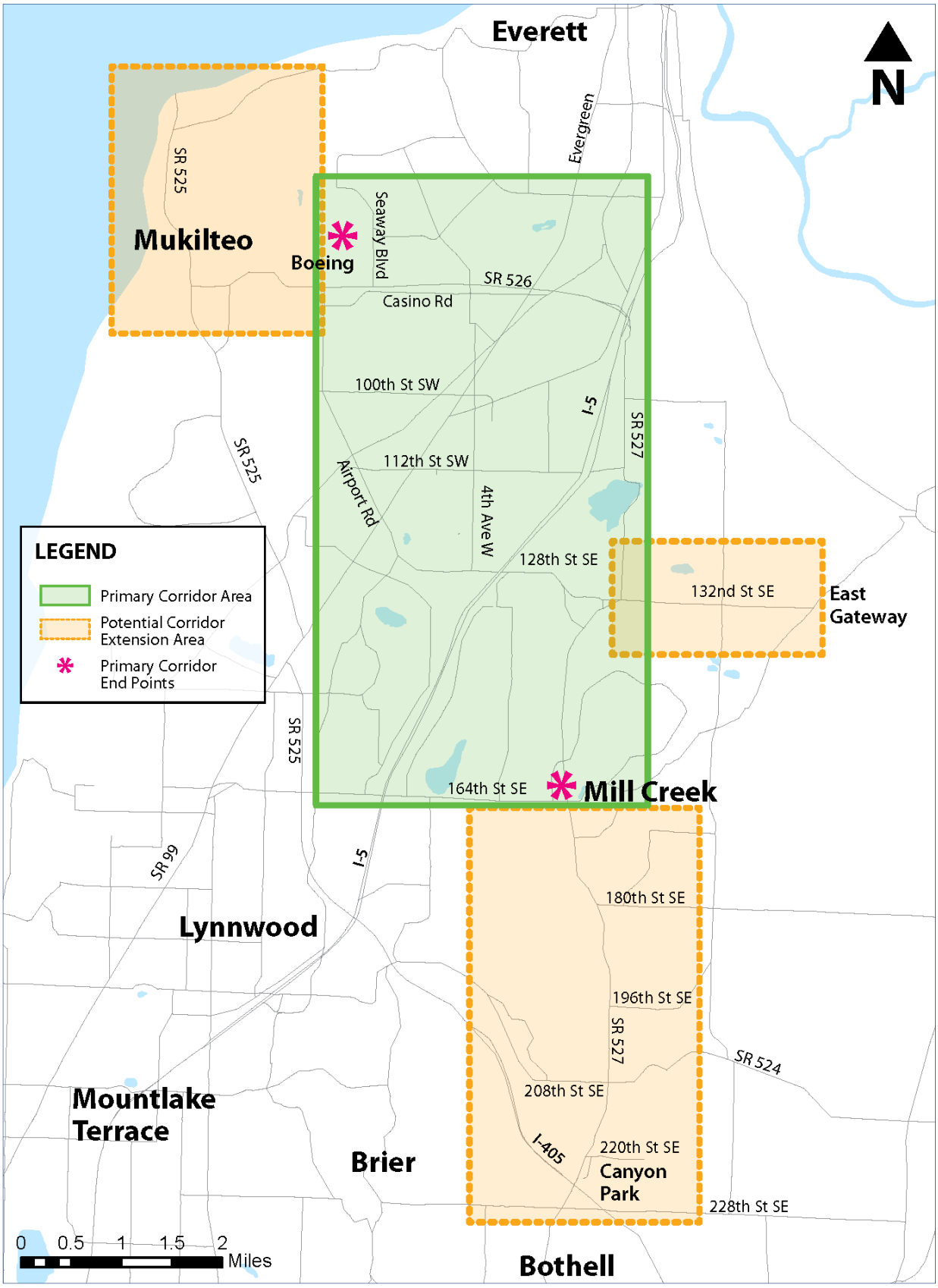


Figure 1-1. *Swift II* Study Corridor

1.3 Organization of Report

In addition to this Chapter 1, the report is comprised of the following chapters that document the study and results:

- Chapter 2 outlines the purpose and need for the proposed BRT route.
- Chapter 3 summarizes the analysis methods used to develop and assess the alternatives in this report.
- Chapter 4 describes the development of the initial four alignment alternatives evaluated.
- Chapter 5 summarizes the results of initial evaluation of the four alternatives across a broad range of measures, with two alternatives selected for further evaluation.
- Chapter 6 includes discussion of key corridor improvements needed to make the alternatives viable and summarizes refined evaluation results for the final two alternatives.
- Chapter 7 presents evaluation results of the effect of alternative extensions to a core alignment alternative.
- Chapter 8 summarizes the evaluation findings and recommendations.
- Chapter 9 outlines more detailed development and assessment of the final two alternatives, including a conceptual layout and cost estimate for a transit center terminus at the Boeing end, potential station siting challenges, extension to Canyon Park park-and-ride, and ridership forecast comparisons, culminating in a final recommended alternative.
- Chapter 10 describes the characteristics of the recommended BRT alternative, including high level capital and operating cost estimates, needed policy and partner stakeholder actions, linkage with the existing transit network and plans, Federal Transit Administration (FTA) funding potential, and next steps to advance the project toward implementation.

2. PURPOSE AND NEED

Community Transit has a long-held goal of "Think Transit First." This means that Community Transit will give people such convenience at such an affordable price that they will use transit alternatives as a matter of course. To reach this goal, Community Transit adopted a Long Range Transit Plan which identifies the following key objectives:

1. Preserve and Increase access to and usability of the public transportation system
2. Provide a range of services tailored to the neighborhoods being served
3. Provide efficient and sustainable services
4. Partner with other transportation agencies
5. Integrate land use and transportation
6. Support corridor-based development practices
7. Maximize use of existing services
8. Support reductions in greenhouse gas emissions

The Boeing to Bothell-Canyon Park BRT line combines portions of two Transit Emphasis Corridors: Airport Road/128th Street and SR 527—between Boeing/Paine Field in Everett and the Bothell-Canyon Park Regional Center identified in the Long Range Transit Plan.

The Boeing to Bothell-Canyon Park corridor has relatively dense development, including multiple activity centers comprised of both employment and residential uses. The existing and planned activity centers within the corridor include:

- Paine Field/Boeing Manufacturing/Industrial Center
- Bothell-Canyon Park: Regional Growth Center
- Snohomish County designated urban centers at
  - I-5 and 128th Street SW
  - SR 527 and 196th Street SE
- Snohomish County urban village at SR 527 and 185th Street SE
- Mill Creek Town Center with higher density residential and retail uses
- Retail/commercial centers at
  - Thrasher's Corner—208th Street SW and SR 527
  - 180th Street SE and SR 527

Local and regional jurisdictions are looking to manage land use within this corridor and Snohomish County overall in order to focus densities in appropriate locations and maintain open space and the natural environment elsewhere. This trend in land use is consistent with the overall goals of the region and local jurisdictions. A high capacity transit service connecting these land uses is supportive of these goals as well.

Community Transit uses the measure of a corridor's "total density" (i.e., combined residents and employees per acre) as one indication of its readiness to support varying degrees of transit service. The Boeing to Bothell-Canyon Park corridor has a current total density of approximately 12 residents/

employees per acre and an estimated 2035 density ranging from 13 to 14. This compares favorably with that of the original *Swift* BRT line SR 99 corridor which has a current density of just over 13 and an expected 2035 density of 15.

The Boeing to Bothell-Canyon Park corridor represents a key east-west transportation corridor as well as an important north-south corridor connecting two designated regional growth centers. The corridor also intersects several key regional roadways (i.e., SR 99, I-5, SR 527, and I-405) and connects the Boeing/ Paine Field major employment site and the Bothell-Canyon Park regional center with activity centers and population east of I-5. The corridor also connects with vital transit services, including the existing SR 99 *Swift* line and multiple regional express and commuter routes along I-5 and I-405 connecting to downtown Seattle, Bellevue, and other parts of the region. East-west travel within Snohomish County is difficult at present due to a lack of through roads and high levels of congestion on the roads that do exist. Consequently, there is an unmet need for effective and efficient east-west mobility in this portion of the county.

Mobility is particularly compromised in the vicinity of I-5 interchanges, and crossing I-5 is a significant barrier to providing connections throughout the corridor. Added to this is the high volume of traffic destined to and from Boeing each day that uses this corridor and also contributes to high congestion levels. Taken together, these conditions not only affect mobility within the corridor, but they constrain the economic vitality of Boeing and other critical Southwest Everett businesses and impede development opportunities within the corridor as well. A high-capacity transit service that connects these key regional activity centers and interfaces with the existing local and regional transit services would provide a major new component in the transportation system for fulfilling this unmet need for east-west mobility.

2.1 Purpose

The purpose of the Community Transit Boeing to Bothell-Canyon Park BRT Project is to establish a critical east-west mobility link within South Snohomish County by implementing the first high-capacity east-west transit service within the corridor and connecting two designated regional growth centers. This service would also further the goals of Community Transit's adopted *Long Range Transit Plan* by implementing the second *Swift* line and, by intersecting the existing SR 99 *Swift* service, would create significant synergy with that service. Taken together, this would support the overarching Community Transit goal of "Think Transit First" by accomplishing the following goals:

- Provide fast, frequent, reliable, and convenient all-day transit service within the corridor
- Establish a critical east-west transportation option that connects two regional growth centers with existing and future activity centers within the corridor, thus supporting high-density development in centers and along corridors
- Support economic vitality of businesses within the corridor, including Boeing and the Paine Field manufacturing and industrial center and the Bothell-Canyon Park Regional Growth Center
- Encourage the use of sustainable transportation
- Provide linkages to other local and regional public transportation services, including SR 99 *Swift*; local routes 101, 105, 106, 115, 120, 201 and 202; Sound Transit Regional Express service;

Community Transit Express Commuter services; as well as to future Sound Transit light rail service currently being planned

- Support local, regional, and state plans and goals for enhanced land use and transportation integration
- Support corridor economic development and redevelopment opportunities while being sensitive to and protecting the natural and built environmental resources

2.2 Need

Implementing the Boeing to Canyon Park BRT Project would address the following needs that currently exist in the corridor:

- Need for high capacity transit service to areas within the corridor with relatively high employment and residential density
- Lack of mobility options, particularly east-west, between the major activity centers of Bothell-Canyon Park and Boeing and to other activity centers in between (e.g., Mill Creek Town Center, 128th/I-5 Urban Center, 112th/4th W Urban Village, Silver Lake community, and multiple nodes of higher-density housing)
- Transit service delays created by a traffic bottleneck crossing I-5 at 128th Street
- Traffic congestion within the corridor which threatens the economic vitality of existing and future businesses
- Lack of transit connections from part of the corridor to other key public transportation services, such as the SR 99 *Swift* route and regional and express bus service
- Local and regional land use and development plans, goals, and objectives that identify portions of the corridor for new development or redevelopment, including transit-oriented development
- The region's growing reliance on and *desire for* public transportation to meet travel needs

3. METHODOLOGY

3.1 Evaluation Process

The overall objective of this study is to determine the most promising alignment and potential operating scenario for this new BRT service. To this end, a universe of potential routing options was initially identified and then packaged into four initial alternative alignments. These initial alternatives were evaluated across a range of screening criteria. For comparison, data for selected criteria were also developed for the existing SR 99 *Swift* corridor. The initial screening resulted in the recommendation of two alternative alignments to explore in a more refined analysis. Subsequent to this, further analysis was conducted to evaluate alignment extension alternatives beyond the initial primary corridor end points of Boeing and Mill Creek.

3.1.1 Evaluation Criteria and Measures

A set of 11 evaluation criteria was developed for high-level screening and subsequent evaluation of routing and alignment alternatives. Table 3-1 presents the criteria and associated measures. The measures listed in the table are a combination of quantitative and qualitative measures.

Table 3-1. Corridor Evaluation Criteria and Measures

Criteria	Measure
1. Transit markets served	Forecasted transit trips to/from and within corridor (based on PSRC traffic analysis zones surrounding the alternative alignment, assessing transit trips between zones within the alignment, and between the alignment and major regional destinations, i.e., U-District and Seattle central business district)
2. Ridership potential	Existing population and employment within 0.5 mile of alignment
3. *Swift* design principles	Rapid and direct service (minimal number of turns, number and severity of potential "choke points")
4. Operational cost/efficiency	Estimated operational cost (based on assumed distance/run time for initial screening)
5. Capital construction cost	Estimated capital cost (qualitative and relative for initial screening based on identified major cost factors)
6. Connections to other services	Connections to other local and regional transit services
7. Connections between land uses	How well line connects ridership generators, such as dense residential, medical, government, educational, and commercial uses (i.e., number and size of activity centers/ridership generators connected)
8. Economic development opportunities	Availability of developable land, zoning, and transit-oriented development policies
9. Availability of transit priority infrastructure	Existing priority infrastructure and opportunities to introduce new infrastructure
10. Traffic constraints/infra-structure chokepoints	Congested corridors and intersections and opportunities to address those constraints
11. Future land use	Transit-compatible land uses as described in adopted plans

Criteria 9 and 10 combined affect BRT speed and reliability, which are key considerations for an effective BRT service, and results for these are particularly significant in terms of reflecting the potential for effective BRT service.

3.2 Study Assumptions

The initial focus of the proposed route assessed in this study was on the primary end points of Boeing and the Mill Creek Town Center. However, after initial analyses, it was determined that extending the transit connection from Boeing to Bothell-Canyon Park offered additional benefits. A variety of other factors and assumptions related to the study approach, including development and analysis of alternatives, are discussed below.

3.2.1 Background Information and Assumptions

- Analyses considered existing year and future year 2035 conditions.
- Ridership forecasts were based on PSRC land use forecasts adopted in August 2013.
- Sound Transit's ST2 program, including the Lynnwood Link Extension, was assumed to be operational in the future study year.
- The proposed BRT route would interface with the future north-south regional transit spine yet to be specifically defined.
- Traffic conditions were based on observed data, including travel time runs, observed queue lengths, traffic counts, and knowledge of the corridors.
- Near term traffic volumes were reflected by using a 5-percent growth factor on existing traffic counts, and longer-term volumes were estimated by applying a 15-percent growth factor.

3.2.2 Infrastructure Assumptions

- The alternative BRT alignments analyzed were assumed to utilize existing infrastructure and minor intersection modifications as much as possible, avoiding major infrastructure improvements and right-of-way takes. Some targeted infrastructure improvements, such as short traffic queue bypass lanes and signal queue jumps, were assumed to provide reliability through critical chokepoints.
- The existing peak period, peak direction 2+ occupancy HOV lanes on 128th Street/Airport Road were assumed to be converted to all-day BAT lanes.
- Transit signal priority (TSP) was assumed along the entire corridor (to be implemented by others).

3.2.3 Station Location Assumptions

- BRT stations would need to be located strategically to be compatible with the future planned BRT network.
- Far side BRT stations were assumed wherever feasible.
- BRT vehicle stops were assumed to be in-lane, with BRT stations built in right-of-way currently occupied by existing bus pullouts (where appropriate and feasible).
- The northern terminus transit center near Boeing was located off Boeing property but near a major employment hub within the property. Additionally, circulator bus service (provided by

others) was assumed to interface with the proposed *Swift* BRT route at the transit center to better serve the Boeing site.

- The northern transit center was sized to accommodate *Swift*, local transit, and Boeing circulator bus service.
- BRT passenger alightings at the Canyon Park southern terminus were assumed to occur at the proposed BRT layover location in the existing bus zone.
- Traffic Analysis Assumptions (128th Street SW/I-5 interchange area)
  - Year 2012 Synchro model traffic operations files received from Washington State Department of Transportation (WSDOT) were used for volumes and signal timings for existing conditions for the intersections along 128th Street SW near its interchange with I-5.
  - The eastbound through volumes were increased along 128th Street SW in the analysis to create congestion consistent with field observations and 24-hour counts. The 24-hour counts show that the volume throughput drops significantly during the peak hour and then goes back up after the peak hour indicating there is latent demand (i.e., not all the traffic that wants to get through the area can get through due to high congestion levels, hence the traffic counts do not reflect the true level of vehicle demand). Hence, traffic operations baseline conditions were based on a 5-percent volume increase over existing traffic counts to reflect true existing or near-term traffic conditions.

4. INITIAL ALIGNMENT ALTERNATIVES

4.1 Universe of Routing Options Identified

The initial routing/alignments that were screened in Phase 1 of the study are shown on Figure 4-1 as a set of segment options. These alternatives were developed by starting with an initial set of alternatives provided by Community Transit. The consultant team then explored other potential alignments that would connect the initial primary corridor end points of Boeing and Mill Creek, as well as potential extensions beyond these points. Some of the other potential alignments were included in the list of alternatives to be assessed further, and a number of alignments were dropped from further consideration. The selected alternatives were broken up into segments for ease of analysis and to facilitate combining into logical end-to-end alternatives. Table 4-1 lists the individual segments by number, roadway, and end points, and Figure 4-1 graphically shows them.

Table 4-1. Individual Routing/Alignment Alternative Segments

Segment Number	Roadway	From	To
1	SR 525	Mukilteo	Boeing
2	Seaway Blvd	Boeing	Boeing @ Seaway
3	Airport Rd	Boeing	Airport Rd/112th St
4	Airport Rd/128th St	Airport Rd/112th St	128th Urban Center
5	128th St/132nd St	128th Urban Center	SR 527/132nd St
6	132nd St	SR 527/132nd St	East Gateway
7	112th St	Airport Rd/112th St	4th Ave/112th St
8	112th St	4th Ave/112th St	SR 527/112th St
9	4th Ave	4th Ave/112th St	128th Urban Center
10	Casino Rd/SR 526/SR 527	Boeing	SR 527/112th St
11	SR 527	SR 527/112th St	SR 527/132nd St
12	SR 527	SR 527/132nd St	Mill Creek
13	SR 527	Mill Creek	Canyon Park

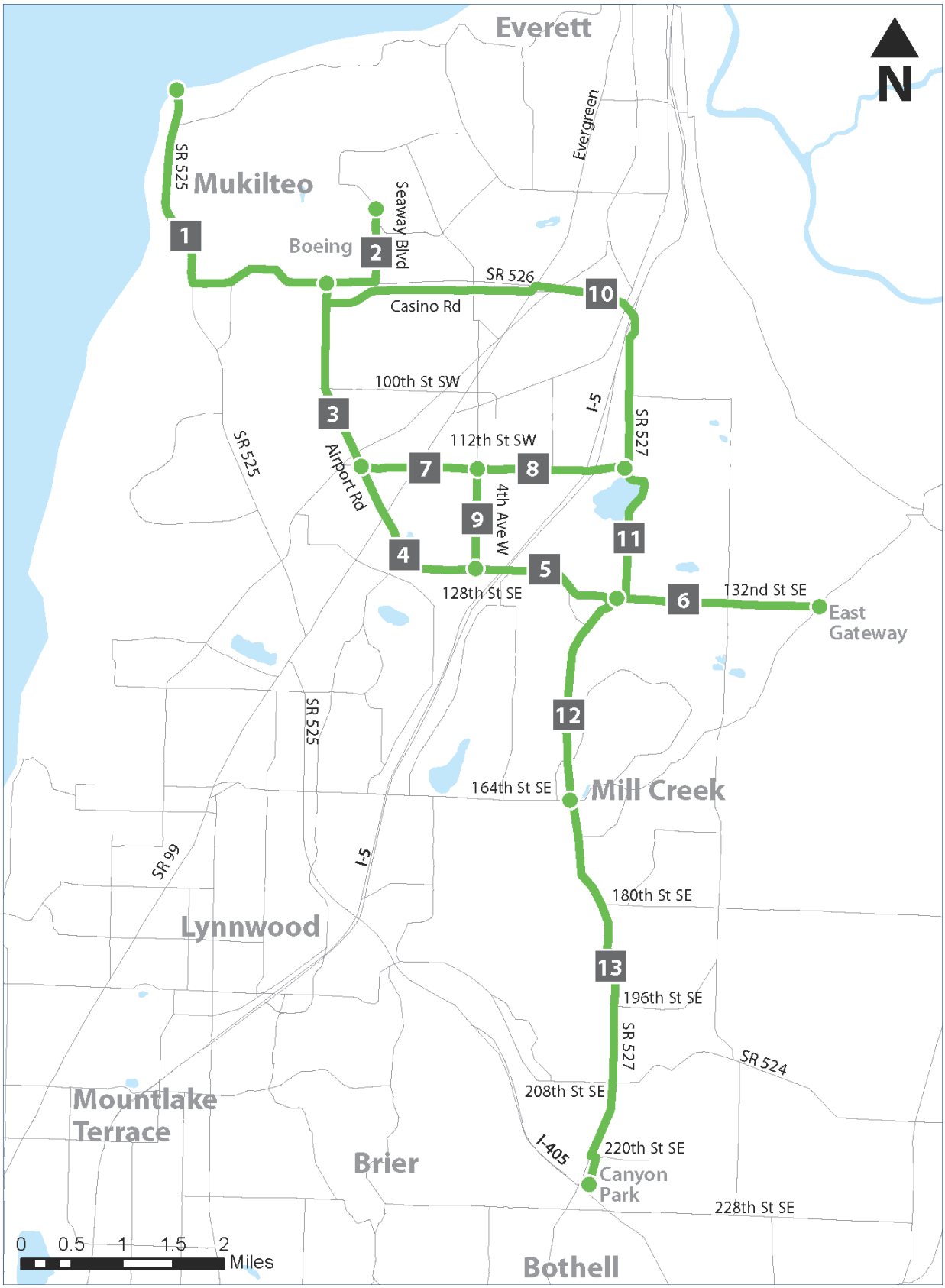


Figure 4-1. Routing/Alignment Alternative Segments

4.2 Development of Initial Alternatives

The routing/alignment alternative segments initially identified were combined into four initial alignment alternatives for evaluation representing the most logical options for connecting Boeing with Mill Creek. These initial alternatives are summarized in Table 4-2 and shown on Figure 4-2. Because these initial alternatives were developed to only connect the initial primary end points between Boeing and Mill Creek, the segments representing the extensions—i.e., segment 1 to Mukilteo, Segment 6 to East Gateway, and Segment 13 to Canyon Park—were not included in them. Operating assumptions for these alternatives include 10-minute peak and midday period headways and 20-minute evening headways. Stations would be located approximately 1 mile apart.

Table 4-2. Initial Evaluation Alternatives

Alignment	Segments	Description
A	2+3+4+5+12	Boeing @ Seaway to Mill Creek via 128th
B	2+3+7+8+11+12	Boeing @ Seaway to Mill Creek via 112th
C	2+10+11+12	Boeing @ Seaway to Mill Creek via Casino Road and SR 526
D	2+3+7+9+5+12	Boeing @ Seaway to Mill Creek via 112th, 4th, 128th

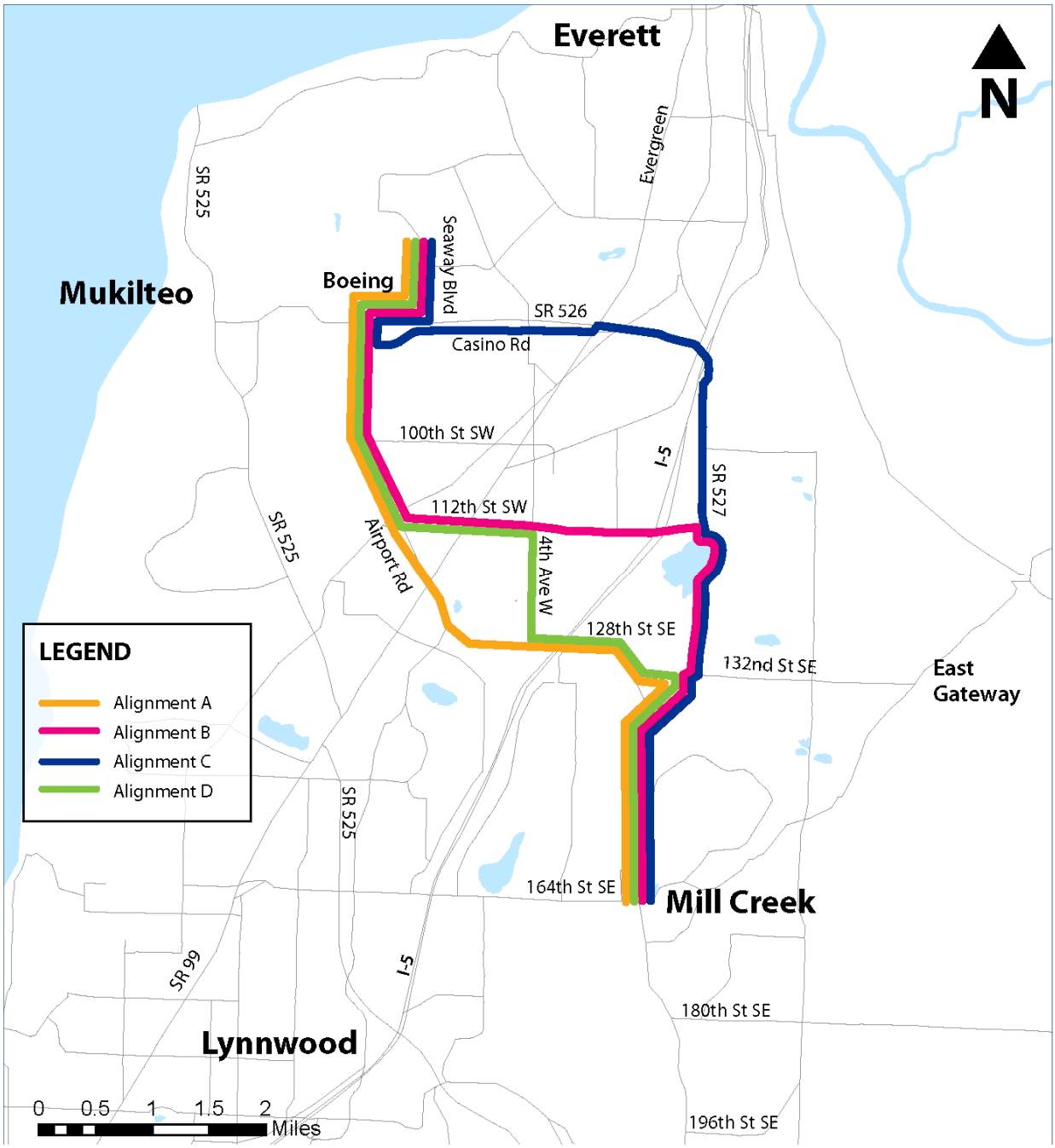
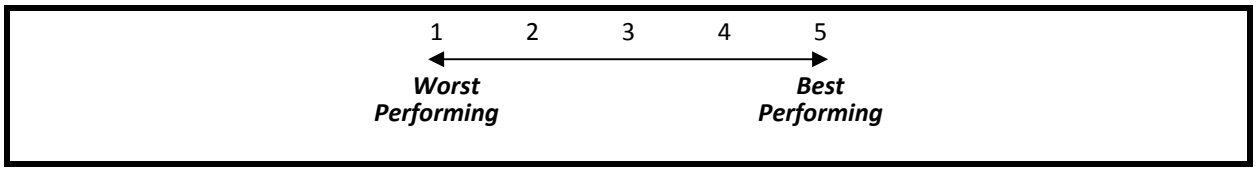


Figure 4-2. Initial Route Alignment Alternatives

5. INITIAL EVALUATION OF ALTERNATIVES

The results of the evaluation of the four initial alternatives are discussed below. Results are provided for each screening criteria. is a summary matrix presenting evaluation results across each measure for each of the initial alternatives. A five point rating scale is used to summarize results for each measure, with the general ratings as follows:



In addition to results for the four initial alignment alternatives, ratings are also provided for selected criteria for the existing SR 99 *Swift* line for comparison. Detailed technical results for the initial evaluation are contained in Appendix A.

Throughout this chapter, the alignment alternatives (Figure 5-1) are identified as follows:

- Alignment A–128th
- Alignment B–112th
- Alignment C–SR 526
- Alignment D–112th/4th/128th

5.1 Transit Markets Served

Transit markets served was evaluated by calculating the number of forecasted daily transit trips and total person trips that originate and end in traffic analysis zones along each alignment alternative. Forecasted transit trips were derived from the Sound Transit ridership forecasting model, while total person trips were derived from the PSRC regional highway model. Daily trips were calculated for the years 2011 and 2035. Alignment B–112th scored the highest (even higher than the SR 99 corridor alignment), followed by Alignment A–128th and Alignment C–SR 526. Alignment D–112th/4th/128th scored the lowest. Note that for transit trips within the corridor, SR 99 has by far the highest number compared with the four study alignment alternatives, but for person trips within the corridors, when "normalized" for the extra length of SR 99, they are relatively equivalent, with Alignment B scoring somewhat higher than Alignments A, C, and D as well as SR 99. One of the reasons that SR 99 has more transit trips in the model is that it has by far the best transit service of all the corridors.

Alignment	Transit markets served	Ridership potential	Swift design principals	Operational cost/efficiency	Capital construction cost	Connections to other transportation services	Connections between land uses	Economic development opportunities	Availability of effective transit priority infrastructure	Traffic constraints/ infrastructure chokepoints	Future land use
A	4	4	4	3	2	4	4	5	3	1	3
B	5	4	4	3	2	4	4	3	4	4	4
C	4	4	3	2	2	3	3	3	4	2	3
D	3	4	1	3	2	4	4	5	2	2	4
SR 99	4	5	4	N/A	N/A	5	5	N/A	5	3	5
Rating Thresholds	Average of ratings for 2011 and 2035 Transit Trips and Person Trips to/from Zones Along Alignment 5 = > 14 4 = 10 - 14 3 = 6 - 10 2 = 2 - 6 1 = < 2	Weighted Averaged Pop & Emp Density	Average Rating: Turns	Approximate Running Time 5 = < 30 min 4 = 30 - 35 min 3 = 35 - 40 min 2 = 40 - 45 min 1 = > 45 min	5 = < $10 million 4 = $10 - $15 million 3 = $15 - $20 million 2 = $20 - $25 million 1 = > $25 million	5 = connects with existing Swift, commuter rail, regional transit or commuter express, and local transit 4 = connects with existing Swift, regional transit or commuter express, and local transit 3 = Swift and local transit 2 = local transit only 1 = no other transportation service	Activity Centers Served (weights assigned) 5 = > 21 4 = 16 - 20 3 = 11 - 15 2 = 6 - 10 1 = < 6	5 = above 66% 4 = 3 = 33% - 65% 2 = 1 = below 33%	5 = Available at 50% or more of chokepoints 4 = Readily attainable at 50% or more of chokepoints 3 = exists for a least one chokepoint, and is attainable at another 2 = Is attainable at at least 1 chokepoint 1 = Does not exist and is not readily attainable	5 = no chokepoints 4 = 1-2 chokepoints 3 = 3-4 chokepoints 2 = 5-6 chokepoints 1 = 7 or more chokepoints	5 (High) = strong jurisdiction support 4 3 (Mod) = moderate jurisdiction support 2 1 (Limited) = limited jurisdiction support

Note: The majority of the ratings for this initial screening task are based on relative comparisons between alignments as opposed to absolute magnitude of the given measure. This was done so as to better distinguish between alignments. Once a preferred alignment is identified, rating thresholds for measures may be adjusted to reflect whether the project is feasible in its own right rather than to how it compares to an alternative alignment.

Alignment Definitions

Alignment	Segments	Description
A	2+3+4+5+12	Boeing @ Seaway to Mill Creek via 128th
B	2+3+7+8+11+12	Boeing @ Seaway to Mill Creek via 112th
C	2+10+11+12	Boeing @ Seaway to Mill Creek via Casino Rd & SR 526
D	2+3+7+9+5+12	Boeing @ Seaway to Mill Creek via 112th, 4th, 128th
SR 99		Existing SR 99 Swift Corridor

Figure 5-1. Initial Alignment Evaluation Matrix

5.2 Ridership Potential

Ridership potential was measured by the combined density of forecasted population and employment (population + employment per acre) for the years 2010 and 2035. The population and employment density for year 2010 was weighted higher than for year 2035, since the goal of this study is to assess the feasibility of a potential new *Swift* line for implementation in the near future. The four alignment alternatives rated similarly for this criterion with existing densities ranging from 11.9 to 12.5 and year 2035 from 15.9 to 16.7. These are all slightly lower than that calculated for the SR 99 corridor, which were 13.2 and 18.5 for existing and 2035, respectively.

5.3 *Swift* Design Principles

Consistency with *Swift* design principles was assessed based on the number of turns required by a given alignment alternative. Alignment A–128th and Alignment B–112th rated the highest, followed by Alignment C–SR 526. Alignment D–112th/4th/128th rated the lowest due to the high number of turns required combined with the impact of the traffic chokepoints that it would encounter through the 128th Street SW/I-5 interchange area. The SR 99 rating was similar to Alignments A and B.

5.4 Operational Cost and Efficiency

Estimated running time was calculated as a proxy for operational cost/efficiency. Total estimated run time consisted of running time along the alignment, dwell time at stations, and added delay associated with traffic chokepoints. Alignment A–128th, Alignment B–112th, and Alignment D–112th/4th/128th rated similarly, followed by Alignment C–SR 526. This criterion was not calculated for the SR 99 corridor.

5.5 Capital Construction Cost

Capital construction cost was estimated based on number of stations, vehicles (based on estimated running time), and some moderate potential traffic chokepoint improvements assumed. All four alignments scored similarly, with an estimated total capital and construction cost of approximately $20 to $21 million. The capital construction cost for the SR 99 corridor was approximately $31 million; however, due to significant difference in length and other factors, this was not compared with the study alternatives.

5.6 Connections to Other Transportation Services

Connections to other transportation services was based on how well the alignment alternatives would provide opportunities to connect with the existing SR 99 *Swift* line, as well as regional transit or commuter express, commuter rail, and local transit services. Alignments A–128th, B–112th, D–112th/4th/128th ranked below SR 99, as they provide connections with all of the services except commuter rail. Alignment C–SR 526 rated the lowest as it does not interface with commuter rail, regional transit or commuter express service.

5.7 Connections between Land Uses

The rating for connections between land uses was based on the number of activity centers served by the alignment alternatives. Activity centers were identified from adopted plans and were weighted based on the estimated relative level of activity. See Appendix A for details on activity centers for all alternatives.

The SR 99 corridor, normalized for length, rated the highest due to the sheer number of activity centers along its alignment, as well connections to the Everett Station and the south edge of downtown Everett. This was followed closely by Alignment A–128th, Alignment B–112th, and Alignment D–112th/4th/128th, which rated similarly to each other because not only do they connect the major activity centers of Boeing/Paine Field and the Mill Creek Town Center but multiple smaller activity centers in between. Alignment C–SR 526 rated the lowest.

5.8 Economic Development Opportunities

The level of economic development opportunities for each alignment alternative was calculated using GIS-based analysis by assessing the percentage of "developable" parcels within 0.25 mile of the alignment. Developable parcels were assumed to be all those that were NOT zoned as parks, open space, or transportation right-of-way. Alignment A–128th and Alignment D–112th/4th/128th rated the highest, followed by Alignment B–112th and Alignment C–SR 526. This criterion was not calculated for the SR 99 corridor.

5.9 Availability of or Potential for Effective Transit Priority Infrastructure

Availability of effective transit priority infrastructure relates to not only the existence of priority infrastructure, such as transit or HOV lanes, but also whether or not that infrastructure is located where it is needed (i.e., where it can effectively provide transit with a travel time or reliability advantage over general purpose traffic at traffic chokepoints). It also pertains to whether a transit priority treatment is readily and feasibly attainable at an identified chokepoint. The SR 99 corridor, with BAT lanes for roughly half of its length, rated highest, Alignment B–112th and Alignment C–SR 526 rated the next highest, followed by Alignment A–128th. Alignment D–112th/4th/128th rated the lowest. The primary reason that Alignment A rated relatively low even though peak period HOV lanes currently exist along Airport Road is because those facilities do not provide transit priority through the majority of the traffic chokepoints along the route, primarily at the 128th Street/I-5 interchange.

5.10 Traffic Constraints and Infrastructure Chokepoints

Traffic constraints and infrastructure chokepoints were identified, assessed for severity, and summed for each alignment alternative. Alignment B–112th rated the highest due to its lack of severe chokepoints, followed by Alignment C–SR 526 and Alignment D–112th/4th/128th. Alignment A–128th rated the lowest due to having the most severe chokepoints. The SR 99 corridor scored a medium rating for this criterion.

5.11 Future Land Use

Future land use was assessed based on the relative strength of adopted comprehensive plan policies for transit-supportive land uses along the alignment. The SR 99 corridor rated the highest for this measure, with Alignment B–112th and Alignment D–112th/4th/128th the next highest, followed relatively closely by Alignment A–128th and Alignment C–SR 526. See Appendix A for more detail on adopted comprehensive plans for the different alternatives.

5.12 Initial Alternatives—Overall Rating and Conclusions

An overall average rating for each of the initial alternatives was developed by averaging the ratings across all criteria. Based on this, the existing SR 99 *Swift* corridor rated the highest, with Alignment B–112th being the next highest, followed by Alignment A–128th, Alignment C–SR 526, and Alignment D–112th/4th/128th with similar ratings. The results were also compared by calculating the raw overall ratings for each of the candidate alignment alternatives (i.e., the average score before it is rounded to a whole number) as a percentage of the overall SR 99 corridor rating. Calculating this value resulted in the overall ratings shown in Table 5-1.

Table 5-1. Overall Ratings for Alignment Alternatives

Alignment	Rating as a % of SR 99 Corridor Rating
A—Airport Rd/128th/SR 527	75%
B—Airport Rd/112th/SR 527	85%
C—Casino Rd/SR 526/SR 527	67%
D—Airport Rd/112th/4th/128th/SR 527	69%

These results indicate that without major improvements to the corridors as they currently exist, Alignment B had the highest potential as an effective BRT corridor with an 85-percent rating, followed by Alignment A at 75 percent and then Alignments C and D at 67 percent and 69 percent, respectively. Note that these results assume equal weighting for each of the criteria assessed. If the ability to facilitate transit speed and reliability were given a higher weight than the other criteria (i.e., criteria 9 and 10), then the difference in the overall ratings between Alignments B and A would be even larger, as Alignment B scores noticeably higher than Alignment A in these criteria. However, if infrastructure and operational improvements were made to Alignment A so as to provide effective transit priority through the 128th/I-5 interchange, then the difference in overall ratings between Alignments B and A would decrease significantly.

Based on these results, it was recommended that Alignments A and B be further explored for *Swift* extension and that Alignments C and D be dropped from further consideration. While the overall average rating for Alignments C and D was similar to Alignment A, a more detailed look at the results showed that either Alignment C or D, or both, rated lower than Alignment A in key areas, including consistency with *Swift* design principles, operational cost/efficiency, and connections between land uses. Additionally, when looking at the raw overall rating calculated as a percent of the SR 99 rating, these alignments were noticeably lower than either Alignments B or A. Portions of these alignments may be considered as part of future extensions of *Swift* service, particularly Casino Road and SR 527 north of 112th Street.

6. REFINED EVALUATION RESULTS—ALIGNMENT A

Alignment A is the most direct connection between Boeing and Mill Creek, would provide for excellent service to two highly used transit hubs (Mariner and McCollum park-and-rides) connecting to local and regional routes, and has an existing HOV/transit facility along 3.3 miles of the 7-mile route. A significant challenge to implementing *Swift* service along Alignment A, however, is the degree of congestion experienced along 128th Street SW/SE approaching the I-5 interchange, where general-purpose traffic can experience delays averaging 7 to 8 minutes but at times can approach 10 to 20 minutes over a 0.5-mile-long stretch of 128th Street. This same congestion could threaten the reliability of *Swift* operating in the corridor. A task for the BRT Corridor Planning Study was to identify potential treatments for transit priority in the corridor that could help to mitigate the impact to transit from the high level of congestion on 128th Street between 4th Avenue W and 3rd Avenue SE, thereby improving the reliability of a *Swift* line if it were to use this alignment. Detailed technical results for the refined alternatives evaluation are contained in Appendix B.

6.1 Transit Mobility Improvement Options at 128th and I-5

The refined evaluation involved analyzing various improvement scenarios created to address the severe chokepoint located along 128th Street and the I-5 interchange. The refined alignment alternatives are summarized in Table 6-1 and discussed in the following sections.

Table 6-1. Refined Evaluation Alternatives

Alignment	Segments (Refer to Figure 4-1)	Description
A1	2+3+4+5+12	Boeing @ Seaway to Mill Creek via 128th (no improvements)
A2a	2+3+4+5+12	A1 + EB approach widening @ SB I-5 ramp, WB BAT lane e/o 3rd Ave (15% growth)
A2b	2+3+4+5+12	A1 + EB approach widening @ SB I-5 ramp, WB BAT lane e/o 3rd Ave (5% growth)
A3	2+3+4+5+12	A1 + I-5 bridge widening, WB & EB BAT lanes (15% growth)
A4	2+3+4+5+12	A1 + I-5 loop ramps, WB & EB BAT lanes (15% growth)

6.1.1 Approach Widening Analysis (Alignments A2a and A2b)

The following improvements were included in the approach widening analysis and are shown on Figure 6-1:

- Add an eastbound queue jump at 128th/I-5 southbound ramps. This includes adding an additional eastbound right-turn pocket for approximately 120 feet. Dual right-turns are maintained so the transit queue jump is shared with right turns. Add an additional westbound lane from east of 3rd Avenue SE to west of the northbound ramps. General purpose traffic can use this lane to make right-turns but otherwise it is a transit-only lane.

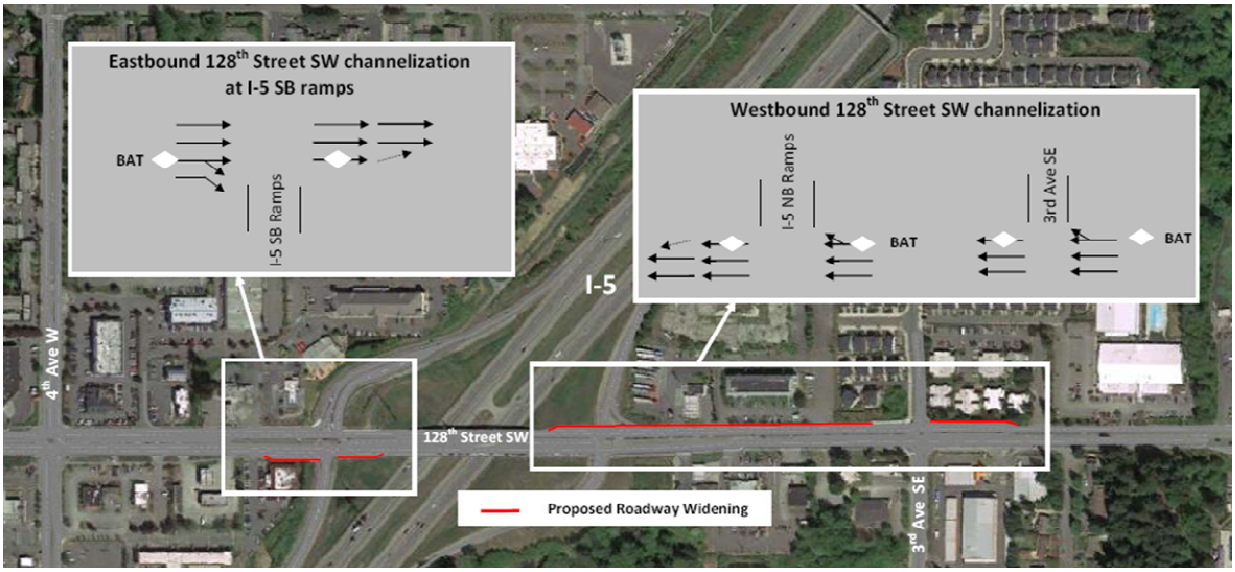


Figure 6-1. Approach Widening Scenario

- Add a westbound queue jump at both the 128th Street/I-5 northbound ramps and the 128th Street/3rd Avenue intersections. A queue jump at 3rd Avenue may not be necessary since transit does not need to get out of that lane.
- Add bus refuge areas after the 128th Street and I-5 ramp intersections in both directions.
- Optimize signal timing offsets and phase order.

This improvement scenario was assessed with both a 5-percent (A2b) and 15-percent (A2a) traffic volume increase through the area to test the improvement's effectiveness with added traffic growth in both the short term and long term.

6.1.2 Bridge Widening Analysis (Alignment A3)

The following improvements are included in the bridge widening scenario analysis and are shown on Figure 6-2:

- Adds a third lane across bridge in both the eastbound and westbound directions for transit. The eastbound added lane extends east of 3rd Avenue SE.
- Does not include the eastbound and westbound queue jumps at the ramp intersections since there is no longer a need for transit to merge back in with general purpose traffic.

The bridge widening scenario was tested at a 15-percent volume increase to examine its effectiveness under potential future conditions.

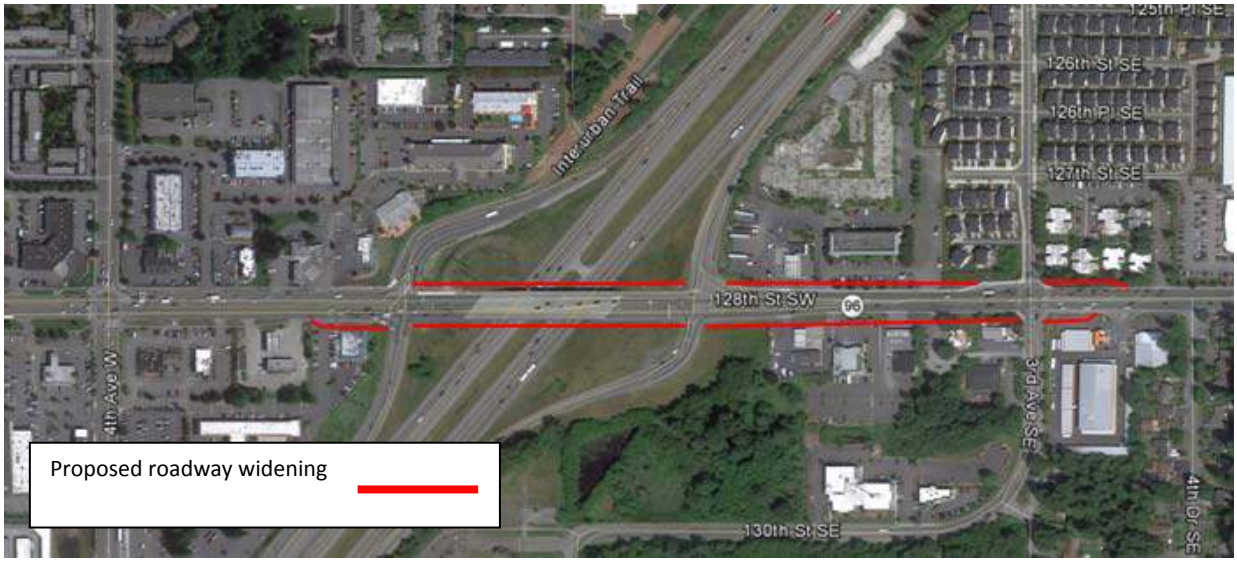


Figure 6-2. Bridge Widening Scenario

6.1.3 Loop Ramp Analysis (Alignment A4)

The following improvements are included in the Loop Ramp Scenario analysis and are indicated on Figure 6-3:

- Add loop ramps to both northbound and southbound I-5 and remove the eastbound and westbound left-turns to I-5.
- Utilize the pavement on the bridge from the removed dual left-turn lanes to create new outside right-turn/BAT lanes to the loop ramps in both directions.
- Add eastbound and westbound BAT lanes from west of 3rd Avenue SE to the southbound ramp intersection.
- Adjust signal phasing to remove the two left-turn phases (resulting in simplified two-phase signal operation).
- Optimize signal offsets.
- Add a short eastbound right-turn pocket to the southbound I-5 ramp.
- Add BAT lanes from east of 3rd Avenue SE to the I-5 northbound ramp intersection in both directions.

Note that this option does not require widening of the bridge and assumes the conversion of the left-turn lanes.

The loop ramp and BAT lanes scenario was assessed at a 15-percent volume increase to examine its effectiveness under potential future conditions.

Figure 6-3. Loop Ramp and BAT Lanes Scenario

6.1.4 Traffic Analysis of 128th Street Improvement Options

A traffic analysis of potential transit priority treatments for 128th Street SW/SE was conducted using the VISSIM traffic simulation model software to confirm what treatments are viable and to estimate what amount of transit travel time savings could be expected with the various treatments. The refined existing conditions analysis was used as the baseline condition with which to compare results of potential transit priority treatments along 128th Street SW/SE. This includes a proposed *Swift* BRT route with 10-minute headways to test the network and *Swift* line performance with each of the improvement options.

Table 6-2 summarizes the model estimated peak-hour transit travel times along eastbound and westbound 128th Street SW from east of 3rd Avenue SE to west of 4th Avenue SW for the baseline condition and the three priority treatment options.

Table 6-2. Transit Travel Times (minutes) along 128th Street SW

Route	Baseline		Approach Widening		Bridge Widening		Loop Ramp and BAT Lane	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Eastbound 128th St SW from 4th Ave SW to 3rd Ave SE	3.6	5.5	3.4	4.1	3.4	3.6	3.3	3.4
Westbound 128th St SW from 3rd Ave SE to 4th Ave SW	7.3	7.2	4.1	3.9	4.0	3.6	3.8	3.5

The Approach Widening Scenario provides a reasonable amount of transit travel time savings and reliability over baseline conditions for the least estimated cost. The Bridge Widening Scenario provides somewhat higher transit travel time savings for PM peak hour conditions and similar savings for AM conditions, but at a much higher cost. The Loop Ramps Scenario has even higher costs as well as

additional institutional implications due to the need to submit an Interchange Access Modification Request to the Federal Highway Administration through WSDOT. While this scenario appears to provide the highest benefits to both general-purpose traffic and transit passing through the interchange, the added benefits to transit are not significant in comparison to the other scenarios assessed. More detailed 128th Street SW/I-5 Interchange area traffic analysis results and cost estimates are contained in Appendices C and D, respectively.

6.2 Evaluation Results

The refined evaluation results for these alignment alternatives are summarized in Figure 6-4. In addition to the five alignment alternatives, ratings are also provided for selected criteria for the existing SR 99 *Swift* line for comparison. Because the only differences between the Alignment A alternatives are the different design treatments of 128th Street at I-5, only four evaluation criteria show any differences between the alternatives at this level of analysis. These are operational cost and efficiency, capital construction cost, availability of effective transit priority infrastructure, and traffic constraints and infrastructure chokepoints. Results for these four criteria are discussed below.

6.2.1 Operational Cost and Efficiency

Alignments A3 and A4 ranked the highest for operational cost/efficiency followed by medium scored ranking for the rest of the alignments. This criterion was not calculated for the SR 99 corridor.

6.2.2 Capital Construction Cost

Alignments A1, A2a, and A2b scored similarly, with an estimated total capital construction cost of approximately $20 to $22 million. Following was Alignment A3 with a capital construction cost of approximately $33.6 million. Alignment A4 had the lowest rated score with an estimated capital construction cost of over $35 million. The cost of improvement options varies notably, resulting in a noticeable difference between alternative alignment options. The capital construction cost for the SR 99 corridor was approximately $31 million; however, due to significant difference in length and other factors, this was not compared with the study alternatives.

6.2.3 Availability of Effective Transit Priority Infrastructure

Alignment A4 and the SR 99 corridor rated the highest for the availability of effective transit priority infrastructure based on existing and proposed priority infrastructure and its effectiveness in accommodating future needs.

6.2.4 Traffic Constraints and Infrastructure Chokepoints

Due to the travel time improvements achieved through the scenario assumed in Alignment A4, that alternative rated the highest. Alignments A3 and A2b followed, and Alignment A1 rated the lowest. The SR 99 corridor scored a medium rating for this criterion.

Alignment/ Scenario	Transit markets served	Ridership potential	Swift design principals	Operational cost/efficiency	Capital construction cost	Connections to other transportation services	Connections between land uses	Economic development opportunities	Availability of effective transit priority infrastructure	Traffic constraints/ infrastructure chokepoints	Future land use
A1	4	4	4	3	4	4	4	5	3	2	3
A2a	4	4	4	3	4	4	4	5	3	2	3
A2b	4	4	4	3	4	4	4	5	4	3	3
A3	4	4	4	4	3	4	4	5	4	3	3
A4	4	4	4	4	2	4	4	5	5	4	3
SR 99	4	5	4	N/A	N/A	5	5	N/A	5	3	5
Rating Thresholds	Average of ratings for 2011 and 2035 Transit Trips and Person Trips to/from Zones Along Alignment	Weighted Averaged Pop & Emp Density 5 = > 14 4 = 10 - 14 3 = 6 - 10 2 = 2 - 6 1 = < 2	Average Rating: Turns	Approximte Running Time 5 = < 30 min 4 = 30 - 35 min 3 = 35 - 40 min 2 = 40 - 45 min 1 = > 45 min	5 = < $15 million 4 = $15 - $25 million 3 = $25 - $35 million 2 = $35 - $45 million 1 = > $45 million	5 = connects with existing Swift, commuter rail, regional transit or commuter express, and local transit 4 = connects with existing Swift, regional transit or commuter express, and local transit 3 = Swift and local transit 2 = local transit only 1 = no other transportation service	Activity Centers Served (weights assigned) 5 = > 21 4 = 16 - 20 3 = 11 - 15 2 = 6 - 10 1 = < 6	5 = above 66% 4 = 3 = 33% - 65% 2 = 1 = below 33%	5 = Available at 50% or more of chokepoints 4 = Readily attainable at 50% or more of chokepoints 3 = exists for a least one chokepoint, and is attainable at another 2 = Is attainable at at least 1 chokepoint 1 = Does not exist and is not readily attainable	5 = no chokepoints 4 = 1-2 chokepoints 3 = 3-4 chokepoints 2 = 5-6 chokepoints 1 = 7 or more chokepoints	5 (High) = strong jurisdiction support 4 3 (Mod) = moderate jurisdiction support 2 1 (Limited) = limited jurisdiction support

Note: The majority of the ratings for this initial screening task are based on relative comparisons between alignments as opposed to absolute magnitude of the given measure. This was done so as to better distinguish between alignments. Once a preferred alignment is identified, rating thresholds for measures may be adjusted to reflect whether the project is feasible in its own right rather than to how it compares to an alternative alignment.

Alignment/Scenario Definitions

Alignment	Segments	Description
A1	2+3+4+5+12	Boeing @ Seaway to Mill Creek via 128th (no improvements)
A2a	"	A1 + EB queue jump @ SB I-5 ramp, WB BAT lane e/o 3rd Ave (15% growth)
A2b	"	A1 + EB queue jump @ SB I-5 ramp, WB BAT lane e/o 3rd Ave (5% growth)
A3	"	A1 + I-5 bridge widening, WB & EB BAT lanes (15% growth)
A4	"	A1 + I-5 loop ramps, WB & EB BAT lanes (15% growth)
SR 99		Existing SR 99 Swift Corridor

Figure 6-4. Refined Alignment Evaluation Matrix

6.3 Refined Alternatives—Overall Rating and Conclusions

As indicated on the summary matrix showing evaluation results for the refined alternatives, all alignment alternatives other than the existing SR 99 *Swift* corridor received the same overall average rating. However, as with the initial evaluation, a comparison of the raw overall ratings for each of the candidate alignment alternatives as a percentage of the overall SR 99 corridor rating was calculated and is shown in Table 6-3. Using this more refined comparison, Alignment A4 (Loop Ramps) scored the highest at 87 percent, followed closely by alignments A2b (Approach Widening—Near-Term) and A3 (Bridge Widening), both with 85 percent. Alignments A1 (No Improvements) and A2a (Approach Widening—Long-Term) scored the lowest with matching overall ratings of 81 percent. Note that these results assume equal weighting for each of the criteria assessed. If capital construction costs were given a higher weight than the other criteria, Alignments A3 and A4 would not have rated as high overall due to significantly greater scenario-specific capital costs.

Table 6-3. Overall Ratings for Refined Alignment Alternatives

Alignment		Rating as a % of SR 99 Corridor Rating
A1	Boeing @ Seaway to Mill Creek via 128th (no improvements)	81%
A2a	A1 + EB approach widening @ SB I-5 ramp, WB BAT lane e/o 3rd Ave (15% growth)	81%
A2b	A1 + EB approach widening @ SB I-5 ramp, WB BAT lane e/o 3rd Ave (5% growth)	85%
A3	A1 + I-5 bridge widening, WB & EB BAT lanes (15% growth)	85%
A4	A1 + I-5 loop ramps, WB & EB BAT lanes (15% growth)	87%

In general, these results indicate that the Approach Widening Scenario (Alignments A2a and A2b) provides a reasonable amount of transit travel time savings and reliability in the relatively near-term future for the least estimated cost, though some of the benefits during the PM-peak hour are lost with added traffic growth over the long term. The Bridge Widening Scenario (Alignment A3) provides somewhat higher transit travel time savings for PM conditions and similar savings for AM conditions but at a much higher cost. The Loop Ramps Scenario (Alignment A4) has even higher costs as well as additional institutional implications due to the need to submit an Interchange Access Modification Request to the Federal Highway Administration through WSDOT. However, this option tends to maintain or increase its effectiveness in the longer term. While the Loop Ramps Scenario appears to provide the highest benefits to both general purpose traffic and transit passing through the interchange, the added benefits to transit are not significant in comparison to the other scenarios assessed, particularly in the near-term. Additionally, this scenario would likely require use of the I-5 median and may impact the ability to implement future light rail in the median through this interchange.

In summary, a range of transit operations improvements through the 128th Street/I-5 interchange area were considered, including approach widening, adding loop ramps, and 128th Street Bridge widening. These improvements vary widely by cost, constructability, ability to implement, and support of stakeholder agencies. Community Transit can most *cost-effectively* achieve much of the potential improvement to speed and reliability through this segment with implementation of the approach widening improvement, Alignment A2.

7. FURTHER EVALUATION OF ALIGNMENT B

7.1 Potential Station Locations

An assessment of potential station locations for Alignment B was performed with an assumed extension to Canyon Park. These station locations, shown on Figure 7-1, were identified in coordination with Community Transit staff using a number of factors, including:

- Proximity to significant activity centers or areas of higher residential density
- Proximity and ability to transfer between other transit services, such as the existing SR 99 *Swift* route or transit nodes such as Mariner and McCollum park-and-ride facilities
- Provision for a reasonable spacing between stations, such as typically not closer than 0.5-mile spacing and not longer than 1.5-mile spacing,
- Use of bus turn-outs for stations, with BRT vehicles stopping in-lane

7.1.1 Station Siting Challenges

Based on field visits and observations, each potential station location identified on Figure 7-1 for Alignment B was assessed to identify if any challenges or obstacles to implementing them existed. The following two issues were identified:

- The eastbound station on 112th Street at I-5 would require widening of the 112th Street Bridge structure or, if located immediately east of the bridge, would require acquisition of a residence.
- Additionally, siting an eastbound station farther east on SR 527 south of 112th Street would be difficult due to multiple driveways as well as a jersey barrier wall adjacent to the roadway leading up to and around Silver Lake. Hence, it would be difficult to site an eastbound station anywhere in the vicinity of the South Everett park-and-ride or the Silver Lake commercial district.

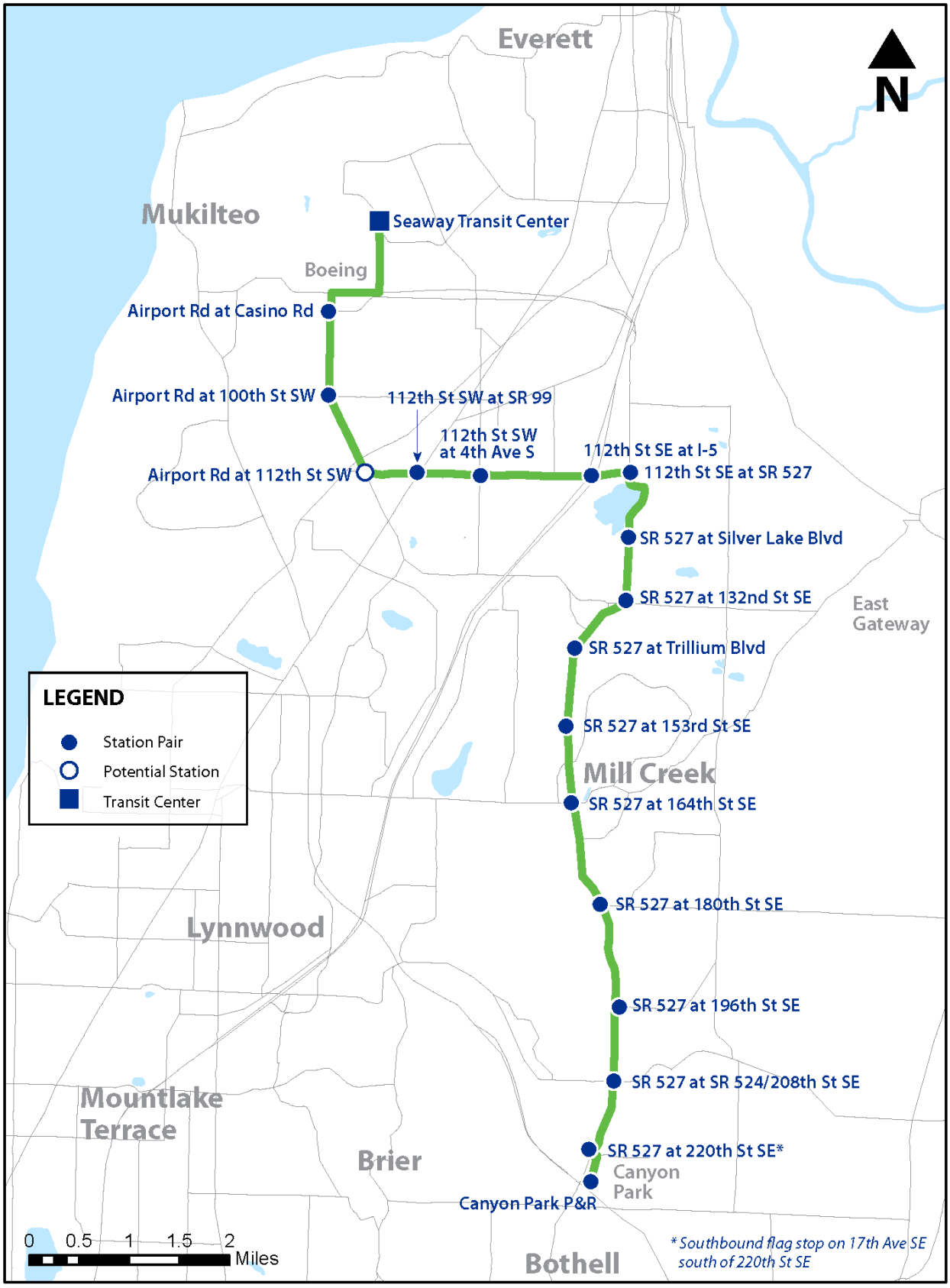


Figure 7-1. Potential Station Locations for Alignment B

7.2 Conclusions

Based on the results of the evaluation, it was recommended that Alignment B–112th be dropped from further consideration. Alignment B–112th, even though it compared relatively well across many of the evaluation measures, was not chosen primarily for the following reasons:

- A sizeable share of its ridership was projected to come from passengers transferring from express bus and regional bus services using the South Everett park-and-ride facility in the median of I-5 just north of 112th Street where it bridges over I-5. This assumes a relatively short walk distance and easy transfer between the *Swift* BRT line on 112th Street and the I-5 services at the park-and-ride. However, field visits indicated that placing a BRT station on the 112th Street Bridge at this location would be difficult and costly. Placing it off the bridge would lengthen to the connecting walk transfer distance considerably and, in the eastbound direction, would likely require acquiring a house to do so. Given this reality, the attractiveness of transferring from regional express bus to *Swift* BRT at this location decreases considerably.
- The 128th Street/I-5 area has been designated as an urban center by Snohomish County and is a focus of development in this corridor. Alignment B would not serve this location.

8. ALIGNMENT EXTENSION EVALUATION RESULTS

Following the refined alternatives evaluation of the routes connecting the primary end points of Boeing and Mill Creek, the merits of possible extensions to either end of that corridor were investigated. For this step, Alignment A1 (the 128th Street alignment with no improvements crossing I-5) was chosen as the representative alignment, and it was evaluated along with three different extension options as listed in Table 8-1 and shown on Figure 8-1.

Table 8-1. Alignment Extension Evaluation Alternatives

Alignment	Segments (Refer to Figure 4-1)	Description
A1	2+3+4+5+12	Boeing @ Seaway to Mill Creek via 128th
AE1	1+3+4+5+12	Mukilteo to Mill Creek via 128th
AE2	2+3+4+5+6	Boeing @ Seaway to East Gateway via 128th
AE3	2+3+4+5+12+13	Boeing @ Seaway to Canyon Park via 128th

Alignment AE1, also identified as AE1–Mukilteo in subsequent text, would have a different northern terminus than A1 and would travel to the western end of SR 526, then follow 84th Street SW and SR 525 to the Mukilteo ferry terminal. This extension option provides a strong connection to regional transit with both the ferry and Sounder commuter rail at Mukilteo.

Alignment AE2, also identified as AE2–Gateway, would continue east on 132nd Street SE instead of turning south on SR 527 and would terminate at the planned East Gateway development just east of 44th Avenue SE. The development is expected to be a mixed-use urban village and is planned to include a combination of residential, retail, and office.

Alignment AE3, also identified as AE3–Canyon Park, would continue beyond Mill Creek on SR 527 to Bothell-Canyon Park at I-405. This alignment would intersect with Sound Transit's regional express buses connecting Canyon Park to Bellevue, Lynnwood, and Everett.

The extension evaluation results for each screening criterion are discussed below. Figure 8-2 summarizes the overall evaluation results. In addition to the four alignment alternatives, ratings are also provided for selected criteria for the existing SR 99 *Swift* line for comparison. Detailed technical results for the alignment extension alternatives evaluation are contained in Appendix E.

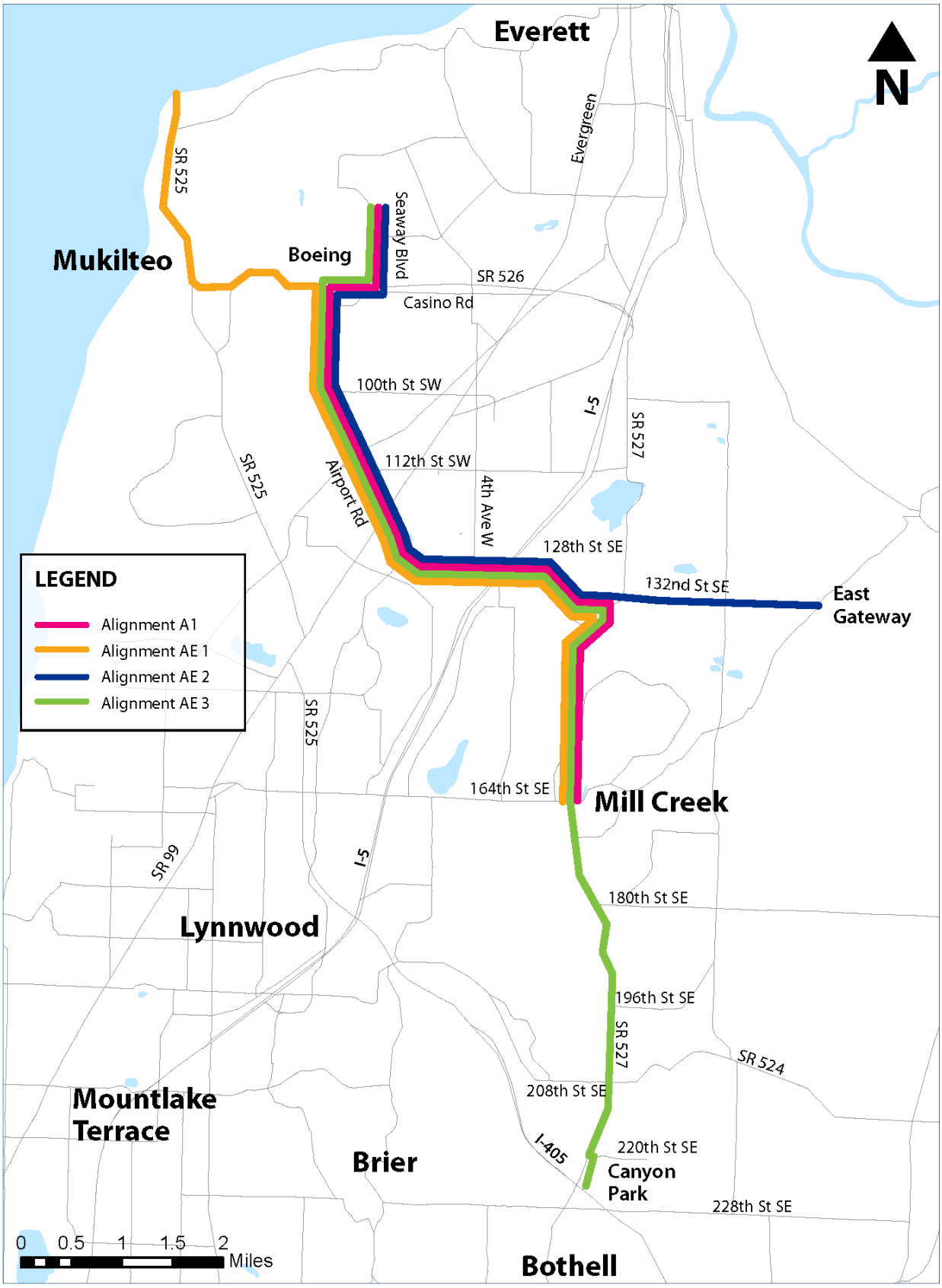


Figure 8-1. Potential Route Extensions

Alignment/ Scenario	Transit markets served	Ridership potential	Swift design principals	Operational cost/efficiency	Capital construction cost	Connections to other transportation services	Connections between land uses	Economic development opportunities	Availability of effective transit priority infrastructure	Traffic constraints/ infrastructure chokepoints	Future land use
A1	4	4	4	3	3	4	3	5	3	2	3
AE1	4	3	2	2	2	4	4	4	3	2	3
AE2	2	5	5	3	3	4	3	4	3	2	3
AE3	5	4	4	1	1	4	5	5	3	2	3
SR 99	4	5	4	N/A	N/A	5	5	N/A	5	3	5
Rating Thresholds	Average of ratings for 2011 and 2035 Transit Trips and Person Trips to/from Zones Along Alignment	Weighted Averaged Pop & Emp Density 5 = > 14 4 = 10 - 14 3 = 6 - 10 2 = 2 - 6 1 = < 2	Average Rating: Turns	Approximte Running Time 5 = < 30 min 4 = 30 - 35 min 3 = 35 - 40 min 2 = 40 - 45 min 1 = > 45 min	5 = < $10 million 4 = $10 - $15 million 3 = $15 - $20 million 2 = $20 - $25 million 1 = > $25 million	5 = connects with existing Swift, commuter rail, regional transit or commuter express, and local transit 4 = connects with existing Swift, regional transit or commuter express, and local transit 3 = Swift and local transit 2 = local transit only 1 = no other transportation service	Activity Centers Served (weights assigned) 5 = > 25 4 = 21 - 24 3 = 16 - 20 2 = 10 - 15 1 = < 10	5 = above 66% 4 = 50% - 66% 3 = 33% - 50% 2 = 20% - 33% 1 = below 20%	5 = Available at 50% or more of chokepoints 4 = Readily attainable at 50% or more of chokepoints 3 = exists for a least one chokepoint, and is attainable at another 2 = Is attainable at at least 1 chokepoint 1 = Does not exist and is not readily attainable	5 = no chokepoints 4 = 1-2 chokepoints 3 = 3-4 chokepoints 2 = 5-6 chokepoints 1 = 7 or more chokepoints	5 (High) = strong jurisdiction support 4 3 (Mod) = moderate jurisdiction support 2 1 (Limited) = limited jurisdiction support

Note: The majority of the ratings for this initial screening task are based on relative comparisons between alignments as opposed to absolute magnitude of the given measure. This was done so as to better distinguish between alignments. Once a preferred alignment is identified, rating thresholds for measures may be adjusted to reflect whether the project is feasible in its own right rather than to how it compares to an alternative alignment.

Alignment/Scenario Definitions

Alignment	Segments	Description
A1	2+3+4+5+12	Boeing @ Seaway to Mill Creek via 128th
AE1	1+3+4+5+12	Mukilteo to Mill Creek via 128th
AE2	2+3+4+5+6	Boeing @ Seaway to East Gateway via 128th
AE3	2+3+4+5+12+13	Boeing @ Seaway to Canyon Park via 128th
SR 99		Existing SR 99 Swift Corridor

Figure 8-2. Alignment Extension Evaluation Matrix

8.1 Transit Markets Served

Alignment AE3–Canyon Park scored the highest (even higher than the SR 99 corridor), followed by a tie between Alignments A1–128th and AE1–Mukilteo. Alignment AE2–Gateway scored the lowest. Note that for transit trips within the corridor, the SR 99 *Swift* corridor has a considerably higher number compared with the four study alignment alternatives, but for person trips within the corridors, when "normalized" for the extra length of SR 99, they are relatively equivalent, with Alignment AE3 scoring the highest (once again higher than the SR 99 corridor). A primary reason the SR 99 corridor has more transit trips in the model is that it has by far the best transit service of all the corridors.

8.2 Ridership Potential

Ridership potential was gauged by comparing combined population plus employment densities along each alternative alignment. Alignment AE2–Gateway ranked the highest for ridership potential with an existing population plus employment density of 12.6 per acre for existing and 17.2 per acre for 2035, ranking similarly to the SR 99 *Swift* corridor. Following Alignment AE2 was Alignment A1–128th (12.1 and 16.6 for existing and year 2035 densities, respectively) and Alignment AE3–Canyon Park (11.1 and 15.6). Alignment AE1–Mukilteo scored the lowest (8.8 and 12.5). However, even though Alignment AE3 rated relatively low for this measure, its actual potential for ridership was expected to be higher than indicated because it connects dense portions of the corridor with two regional centers.

8.3 *Swift* Design Principles

Alignment AE2–Gateway ranked the highest for having the least number of turns. Following was a tie between Alignments A1 and AE3–Canyon Park (also the same rating given to the SR 99 corridor). Alignment AE1–Mukilteo rated the lowest, due to the high number of turns and relatively steep grades required to extend the potential alignment to Mukilteo.

8.4 Operational Cost and Efficiency

Based on the estimated running time along the alignment, dwell time at stations, and added delay associated with traffic chokepoints, Alignments A1 and AE2–Gateway ranked the highest, followed by Alignment AE1–Mukilteo. Alignment AE3–Canyon Park ranked the lowest primarily due to its extended length in comparison to the others. This criterion was not calculated for the SR 99 corridor.

8.5 Capital Construction Cost

Alignments A1 and AE2–Gateway rated the highest, with the same total capital construction cost of approximately $20 million. Alignment AE1–Mukilteo followed, with an estimated total capital cost slightly over $23 million. The lowest rated was Alignment AE3–Canyon Park at approximately $26 million. The capital construction cost for the SR 99 corridor was approximately $31 million; however, due to significant difference in length and other factors, this was not compared with the current study alternatives.

8.6 Connections to Other Transportation Services

SR 99 rated high for providing connections to all possible transportation services, including the existing SR 99 *Swift* line, commuter rail, regional transit, commuter express, and local transit services. This was

followed by identical ratings for all the alignment extension scenarios, which had all but the connection to commuter rail.

8.7 Connections between Land Uses

Alignment AE3–Canyon Park rated the highest for serving the most activity centers, along with the SR 99 corridor (normalized for length), because it connects two major designated regional growth centers in Boeing/Paine Field and Bothell-Canyon Park. Alignment AE1–Mukilteo followed closely behind. Alignments A1 and AE2–Gateway rated the lowest.

8.8 Economic Development Opportunities

Alignments A1 and AE3–Canyon Park rated the highest for the percentage of developable parcels within 0.25 mile of the alignment, followed by Alignments AE1–Mukilteo and AE2–Gateway. This criterion was not calculated for the SR 99 corridor.

8.9 Availability of Effective Transit Priority Infrastructure

The SR 99 corridor, with BAT lanes for roughly half of its length, rated highest for availability of effective transit priority infrastructure. All four other alignments received a medium rated score for this criterion.

8.10 Traffic Constraints and Infrastructure Chokepoints

The SR 99 corridor rated the highest with a medium score rating for number and severity of chokepoints along the alignment. All four extension alignments received a low rating due to having a severe number of chokepoints as they all pass through the 128th Street/I-5 interchange area. Note that this analysis assumes that Alignments A1, AE1–Mukilteo, and AE2–Gateway do not cross through the chokepoint at the intersection of 164th and SR 527 in Mill Creek.

8.11 Future Land Use

Based on the relative strength of adopted comprehensive plan policies for transit-supportive land uses along the alignment, the existing SR 99 *Swift* corridor rated the highest. All four extension alignments scored a medium rating for this criterion.

8.12 Alignment Extension Alternatives—Overall Rating and Conclusions

As shown previously on Figure 8-2, all alignment alternatives other than the existing SR 99 *Swift* corridor received the same overall average rating. However, a more refined comparison is made by comparing the raw overall ratings for each of the candidate alignment alternatives (i.e., the average score before it is rounded to a whole number) as a percentage of the overall SR 99 corridor rating are shown in Table 8-2. These results indicate that Alignments A1 and AE3–Canyon Park are the most favorable options for an effective BRT corridor with the same rating of 77 percent, followed by Alignment AE2–Gateway at 75 percent. As noted for the previous evaluations in Sections 5.11 and 6.3, these results assume equal weighting for each of the criteria assessed. If operational cost/efficiency and capital construction criteria were given a higher weight than others, overall ratings would differ. In particular, Alignment AE3–Canyon Park may be less appealing because its route length is considerably longer than the other alignments, thus increasing construction and operating costs. Alignment AE1–Mukilteo ranked

the lowest overall, largely as a result of its poor rating for *Swift* design principles (multiple turns and steep grade) and not as effectively serving Boeing's large employment base.

Table 8-2. Overall Ratings for Alignment Extension Alternatives

Alignment		Rating as a % of SR 99 Corridor Rating
A1	Boeing @ Seaway to Mill Creek via 128th	77 %
AE1	Mukilteo to Mill Creek via 128th	69 %
AE2	Boeing @ Seaway to East Gateway via 128th	75 %
AE3	Boeing @ Seaway to Canyon Park via 128th	77 %

Based on these results, it is recommended that Alignment AE1 - Mukilteo be dropped. While this option has the advantage of serving a portion of the corridor that already has a measurable level of daily transit trips, as well as providing a connection to Sounder commuter rail and the Mukilteo-Clinton ferry, it has some notable disadvantages as well. It would not serve Boeing as effectively as the other options, would rate poorly in terms of *Swift* design principles (adding multiple turns and a steep grade), and would require navigating through ferry-related traffic congestion on a regular basis.

The overall ratings for the other two extension options (Alignments AE2 and AE3) were similar to the original alignment. However, because the East Gateway extension is less attractive in the near-term (i.e., it is primarily attractive as a future option once the East Gateway development has matured), and the Canyon Park extension would serve existing development (including the Mill Creek Town Center, which would not be served with the East Gateway alignment), it is recommended that Alignment AE3–Canyon Park be the only extension considered for the initial operating segment of this route.

9. ADDITIONAL ASSESSMENT

This section discusses additional considerations related to the Seaway transit center terminus, the siting of stations along Alignment AE3, and transit ridership projections.

9.1 Seaway Transit Center Terminus

The Boeing employment site represents a major concentration of jobs as it is one of Washington's largest employers and is a major anchor for the proposed BRT route. However, jobs within the site are dispersed over a footprint of approximately 500 acres on the site north of SR 526, and a single point BRT station could not effectively serve all portions of the site. Complicating this further are security restrictions that do not conveniently allow for public transit service throughout the campus. Due to these factors, it is acknowledged that a circulator system would need to be implemented within the Boeing site to distribute/collect riders to/from the proposed BRT route. To facilitate this, the proposed Seaway terminus location for the route at the southeast corner of Seaway Boulevard and 75th Street SW was selected because it was (a) within convenient walking distance from buildings housing some larger concentrations of Boeing employees, and (b) it provided enough available space for a transit center where the BRT route could effectively interface with a Boeing circulator as well as other local bus routes serving the area.

9.1.1 Conceptual Layout

A conceptual layout of the Seaway terminus transit center is shown on Figure 9-1. Access to/from Seaway Boulevard northbound would be right-in/right-out only at a point south of 75th Street. Full access/egress would be provided with 75th Street SW on the east side of the site. This intersection with 75th Street would be immediately adjacent to an existing signalized intersection of 75th Street with a driveway serving a Snohomish County Public Utility District (PUD) facility. These two intersections would operate in tandem with a coordinated signal phasing and timing plan. This access point would serve buses traveling to/from the east on 75th Street, as well as Boeing circulator buses to/from Boeing and BRT vehicles needing to travel southbound on Seaway Boulevard.

Development of the access point to/from 75th Street would also require widening of 75th Street to provide a westbound left-turn lane into the site. The widening is anticipated to require acquisition of a strip of right-of-way along the south side of 75th Street east of the PUD driveway.

9.1.2 Conceptual Cost Estimate

A conceptual cost estimate for the transit center facility was developed and is estimated at $6.2 million, including property acquisition. Cost estimate calculations are contained in Appendix F.

9.2 Potential Station Locations

For the purposes of further developing the alignment alternatives, as well as assessing the trade-offs between them in more detail, potential station locations were identified for both Alignments A and B with an assumed extension to Canyon Park. These locations, shown on Figure 9-2, were identified in coordination with Community Transit staff using a number of factors, including:

Figure 9-1. Potential Seaway Terminus Transit Center Layout

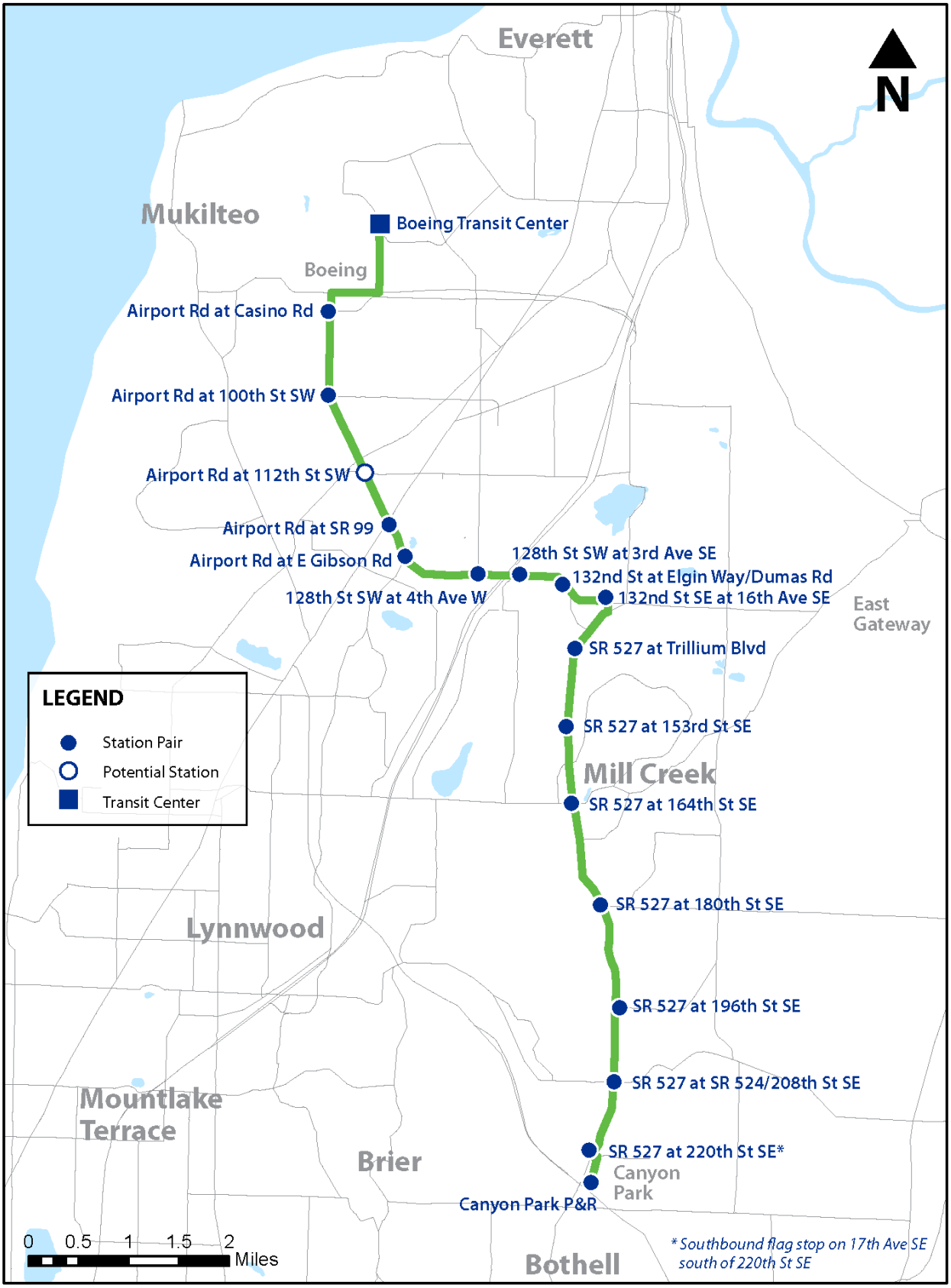


Figure 9-2. Potential Station Locations for Alignment AE3

- Proximity to significant activity centers or areas of higher residential density
- Proximity and ability to transfer between other transit services, such as the existing SR 99 *Swift* route or transit nodes such as Mariner and McCollum park-and-ride facilities
- Provision for a reasonable spacing between stations, such as typically not closer than 0.5-mile spacing and not longer than 1.5-mile spacing,
- Use of bus turn-outs for stations, with BRT vehicles stopping in-lane

9.2.1 Station Siting Challenges

Based on field visits and observations, each potential station location identified on Figure 9-2 for Alignment AE3 was assessed to identify if any challenges or obstacles to implementing them existed. The following issue was identified:

- The eastbound station on 132nd Street SE on the far side of its intersection with Dumas Road may require widening into an old landfill area which is currently sealed in order to contain the landfill remnants. This widening may require relocating the existing retaining wall to the west slightly and then resealing the landfill as needed. Some remediation would be required, but is not expected to be significant.

No other significant issues were identified in relation to the potential station sitings.

9.3 Ridership Forecasts

Alignment A–128th, including extensions to Canyon Park as shown on Figure 9-2, was evaluated to assess potential ridership levels.

9.3.1 Ridership Forecast Methodology

The Sound Transit Ridership Forecasting Model was used for this analysis. This incremental transit model, originally developed in 1992, is grounded in actual observed ridership and was updated in 2011 based on current ridership counts from all regional transit agencies, including Community Transit. The model's development has been closely monitored by FTA, and the use of the model for transit ridership forecasting has been approved and accepted by FTA. The model was used successfully on Sound Transit's Central Link and University Link New Starts grant applications and is currently being used by Sound Transit for the Lynnwood Link Extension light rail project, which is currently in the project development stage of the New Starts process. More information on the model's development, calibration, and use is documented in the *Transit Ridership Forecasting Methodology Report* (Sound Transit, June 2014), prepared for the Lynnwood Link Extension project.

To assess how well the Sound Transit Model addresses bus transit ridership levels in south Snohomish County, base year ridership (2011) from the model were compared to observed counts for key routes in the study corridor. The results, shown in Table 9-1, indicate that the model is reasonably accurate within ±10 percent of observed ridership counts with the exception of route 105 that has a relatively low ridership.

Table 9-1. 2011 Observed vs. Model Estimated Daily Transit Ridership

Transit Line	Daily Line Boardings		
	Observed	Model Estimated	Est. over Obs.
SR 99 *Swift*	4,800	4,800	1.00
116	2,000	2,100	1.05
105	850	750	0.88
201/202	3,000	2,800	0.93
511	4,500	4,100	0.91

9.3.2 Ridership Forecast Comparison

The model estimate of potential ridership with the project in place was compared between Alignment AE3–128th existing conditions (i.e., if they were implemented under today's conditions) and for the future year 2035. Results are shown in Table 9-2. Also estimated was the ridership for the current SR 99 *Swift* route with the alternative BRT routes in place. The results indicate that ridership for Alignment A is expected to be 3,300 daily riders if implemented under current conditions and 3,900 for the year 2035. The results also indicate that ridership on the existing SR 99 *Swift* route would increase by approximately 600 riders if Alignment A were implemented under existing conditions due to the synergy between the two routes. More detailed transit ridership forecasting results can be found in Appendix G.

Table 9-2. 2011 and 2035 Model Estimated Daily Transit Ridership with Project

	Build on Existing Conditions	Build on 2035
	Alignment A–128th	Alignment A–128th
Current SR 99 *Swift*	5,400	—
SR 99 *Swift* to 185th	—	10,400[1]
Proposed BRT	3,300	3,900

[1] About 4,600 of the estimated SR 99 *Swift* daily ridership are transfers to/from Link Light Rail at 185th Street Station.

9.4 Conclusions

Based on the analysis and evaluation of multiple corridor alternatives, Alignment AE3–128th with the approach widening improvements at the I-5 interchange and an extension to Canyon Park is recommended as the next *Swift* BRT route. This alternative was selected because of the following:

- It would provide a relatively direct connection between Boeing and Canyon Park while connecting important existing and future activity centers along the way, including the 128th/I-5 Urban Center and the Mill Creek Town Center, as well as three significant transit facilities with connections to local and regional routes (McCollum, Mariner, and Canyon Park park-and-rides).
- With the improvements at the 128th Street/I-5 interchange, it would provide a fast and reliable trip between its two end points.

- It would leverage existing transit priority infrastructure through use of the Airport Road arterial HOV lanes.
- The proposed stations along the alignment appear to be reasonably constructible.
- It crosses the Interurban Trail, providing a key connection between bicycle travel and *Swift* service. This would encourage continuing the trend of high bicycle access to *Swift* service (currently 8 percent of *Swift* riders board with a bicycle, while only 1.5 percent access Community Transit service system wide).
- It would be consistent with the transit emphasis corridors identified in Community Transit's adopted Long Range Plan.

10. SUMMARY AND RECOMMENDATIONS

10.1 Evaluation Findings and Recommendations

Based on the results of the initial evaluation, it was recommended that Alignment C–SR 526 and Alignment D–112th/4th/128th be dropped from further consideration as discussed in Section 5.11. However, portions of these alignments may be considered as part of future extensions of *Swift* service, particularly Casino Road and SR 527 north of 112th Street.

Alignment A–128th and Alignment B–112th were recommended to be carried forward into more detailed analysis of refined alignment alternatives. The refined alternatives focused on solving the primary traffic and transit chokepoint in the corridor—128th Street SW through the I-5 interchange area. Refinements analyzed included assessing improvements ranging from transit queue jumps and BAT lanes to interchange modifications with new loop ramps to address the heavy congestion at this location and provide transit a means to more efficiently and reliably navigate through it, both in the near-term and long-term future.

In general, results from the refined evaluation indicate that the Approach Widening Scenario (Alignment A2) would provide a reasonable amount of transit travel time savings and reliability in the relatively near-term for the least estimated cost.

As discussed in Section 7.2, further evaluation of Alignment B-112th was performed and due primarily to the difficulty in siting stations at a couple of key locations it was recommended that Alignment B–112th also be dropped from further consideration.

Subsequent to this, further analysis was conducted to evaluate alignment extension alternatives to Alignment A beyond the primary corridor end points of Boeing and Mill Creek. Based on the results, it was recommended that:

- Alignment AE1 (extension to Mukilteo) be dropped
- Alignment AE2 be deferred to a point when the East Gateway development has become more established
- Alignment AE3–Canyon Park be considered as part of the initial operating segment for the proposed BRT route even though it would increase running time and would require additional capital costs related to stations and vehicles

10.2 Elements of Recommended Alignment

The recommended alignment and potential station locations for *Swift* BRT are shown on Figure 10-1. The northern terminus is a proposed transit center at the southeast corner of the intersection of Seaway Boulevard with 75th Street SW. This transit center is where the BRT route would interface with a Boeing circulator system that would distribute and collect riders from throughout Boeing's dispersed employment site. It is anticipated that other local bus service in the area, both Community Transit and Everett Transit routes, would also interface with *Swift* at this location.

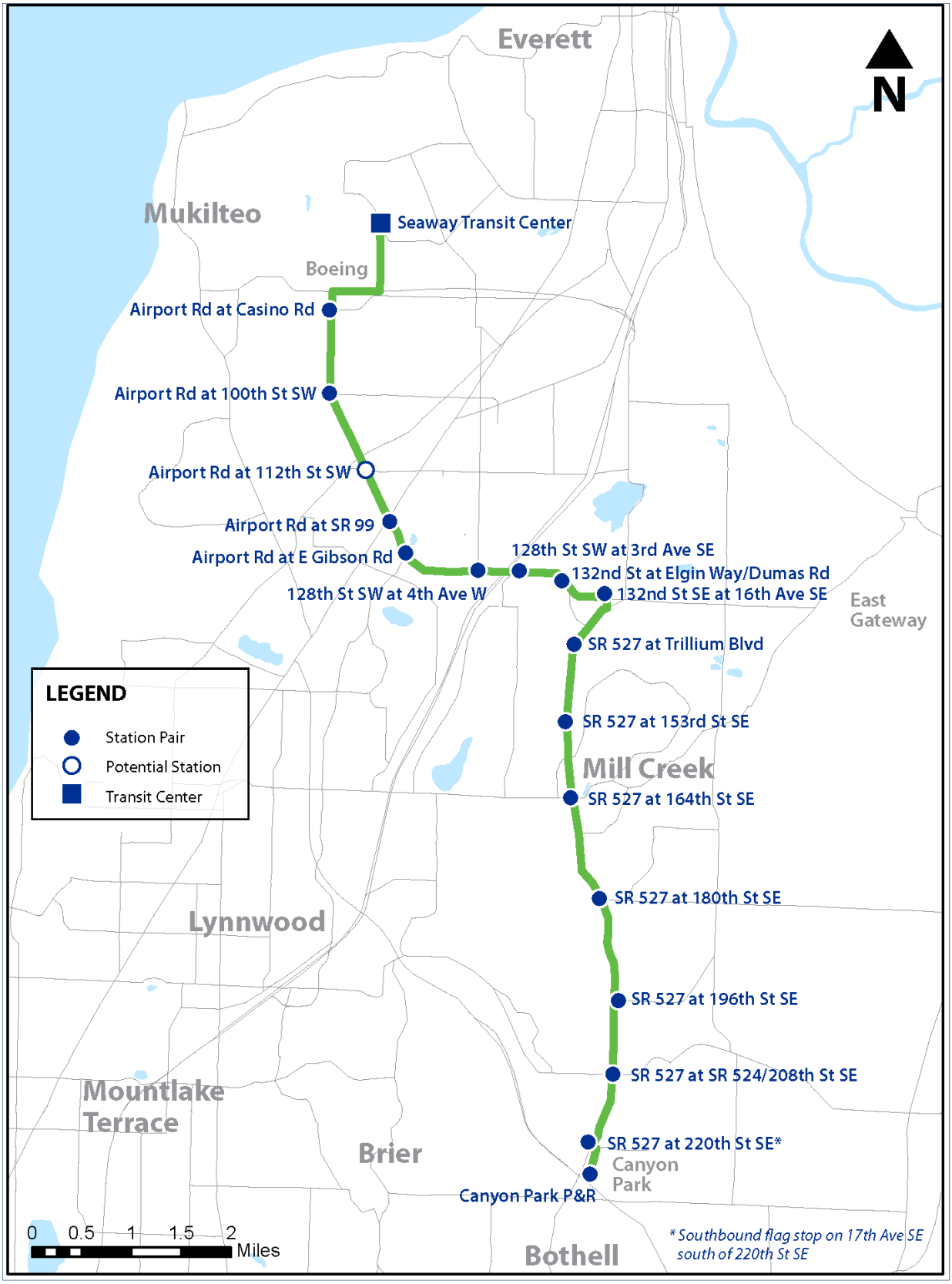


Figure 10-1. Proposed BRT Route Alignment and Station Pair Locations

The study recommends that:

- The existing peak-period peak-direction HOV lane on Airport Road be transitioned into a 24-hour BAT lane in both directions
- The improvements described and analyzed in Chapter 6, the 128th Street approach widening at I-5, be implemented as shown on Figure 10-2.

The southern terminus would be at the Canyon Park park-and-ride facility in the northwest corner of the SR 527 interchange with I-405. At this location, *Swift* could interface with both local and express Community Transit service, as well as Sound Transit Regional Express Bus service connecting into Everett, Lynnwood, and Bellevue.

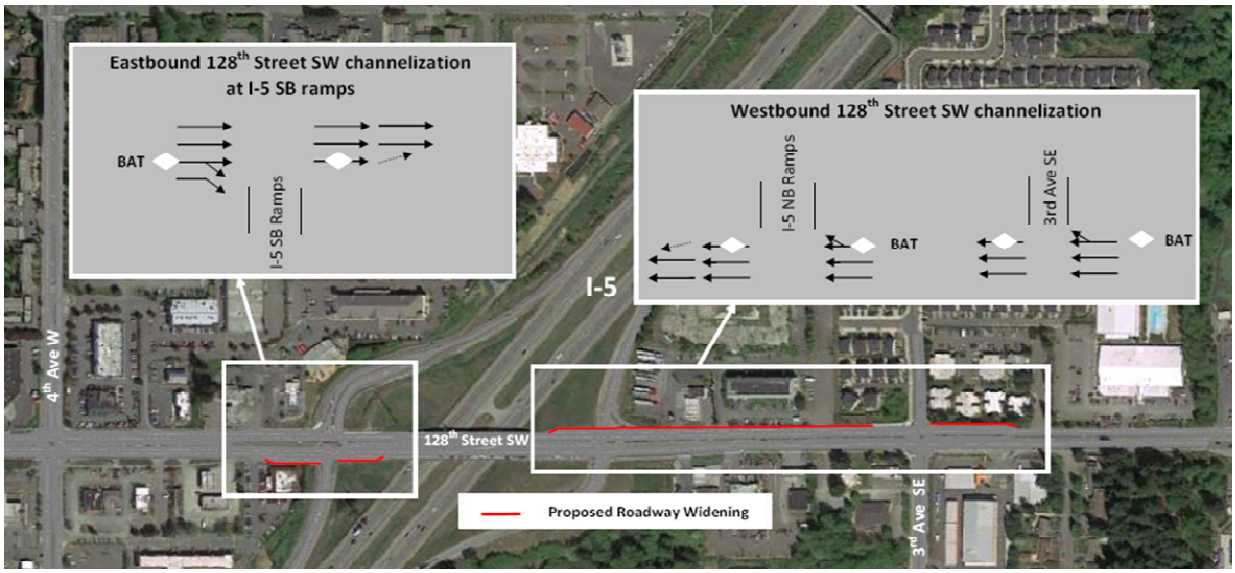


Figure 10-2. Proposed Improvements at the 128th Street/I-5 Interchange

10.2.1 Route Description—Southbound

From the Seaway Terminus transit center, the route would travel southbound along Seaway Boulevard to SR 526. It would then use the auxiliary lanes of SR 526 between Seaway Boulevard and Airport Road. From SR 526, the route would travel south along Airport Road utilizing a right-side BAT lane beginning just south of W Casino Road and extending to 4th Avenue W after Airport Road transitions into 128th Street SW. This intersection experiences significant congestion and traffic back-ups, and the BAT lane would provide BRT vehicles a significant advantage by bypassing significant queues at this location. Approaching the southbound ramps to I-5, another significant source of congestion and delay, general purpose traffic would have dual right-turn lanes to the southbound on-ramp. BRT would be able to use the left-most right-turn lane as both a queue bypass and queue jump to continue through the intersection and onto the bridge, thereby bypassing much of the congestion at this location. The route would continue eastbound along 128th/132nd Street, turning southbound on 16th Avenue SE to connect with SR 527 where it would continue south past the Mill Creek Town Center and Thrasher's Corner and on to Canyon Park. To access the Canyon Park park-and-ride facility, the route would turn left at 220th Street SE and then immediately right onto southbound 17th Avenue SE, which terminates at the park-and-ride lot.

10.2.2 Route Description—Northbound

From the Canyon Park park-and-ride facility, the route would use the transit slip ramp to access the northbound off-ramp from I-405 to northbound SR 527. The route would then travel north on SR 527 past Thrasher's Corner and the Mill Creek Town Center, turn northbound on 16th Avenue SE to connect with 132nd Street SE, and then travel westbound on 132nd/128th Street past the McCollum park-and-ride lot to the I-5 interchange area. Approaching the interchange area, BRT vehicles would use a short BAT lane beginning approximately 300 feet east of 3rd Avenue SE and continuing across 3rd Avenue to and through the intersection with the northbound on-ramp to I-5. West of the northbound on-ramp, the BAT lane would taper into the right side general-purpose lane just before the bridge abutment. This westbound BAT lane would serve as a queue bypass and queue jump facility providing BRT a significant travel time savings through two intersections that experience recurring congestion. Past I-5, the route would follow 128th Street SW and use a BAT lane beginning just past the intersection with 4th Avenue W and continuing onto Airport Road past Paine Field and terminating at Kasch Park Road. North of this point, the route would use the on-ramp from Airport Road to SR 526, use the auxiliary lane on SR 526 to the off-ramp to Seaway Boulevard, and then travel Seaway Boulevard north to the Seaway Transit Center on the south side of 75th Street SW.

10.2.3 Stations

The typical *Swift* station design facilitates in-lane stops on concrete pads and includes a 60-foot platform length as shown in the Figure 10-3 layout and the photograph in Figure 10-4. Swift stations are located approximately 1 mile apart and incorporate features designed to support rapid service and establish a sense of place—such as permanent structures with raised platforms, the iconic Swift marker, overhead canopy, ticket vending machines, shelter and seating, and local artwork. Station pair locations, shown on Figure 10-1, are described in more detail in Table 10-1. Outside of the termini stations, most stations are expected to be located on the far side of signalized intersections and require relatively standard construction. Those stations and station areas that may require extra intersection modifications include the following:

- 132nd Street SE at Dumas Road—southbound/eastbound direction: Far side station location would likely require relocation of a retaining wall with fill. It would likely extend into a reclaimed landfill area and would need to address hazardous materials/liner disturbance. A conceptual cost estimate for this work is calculated at approximately $305,000. Cost estimate details are in Appendix H.
- SR 527 at 164th Street—northbound direction: Far side station locations. *Swift* BRT vehicles would use the right-turn lane northbound as a transit-only through lane allowing them to bypass queues at this intersection. This would require modifying the raised traffic islands and relocating traffic signal poles to provide the necessary through clearance. A conceptual cost estimate for this work is calculated at approximately $920,000. Cost estimate details are in Appendix H.

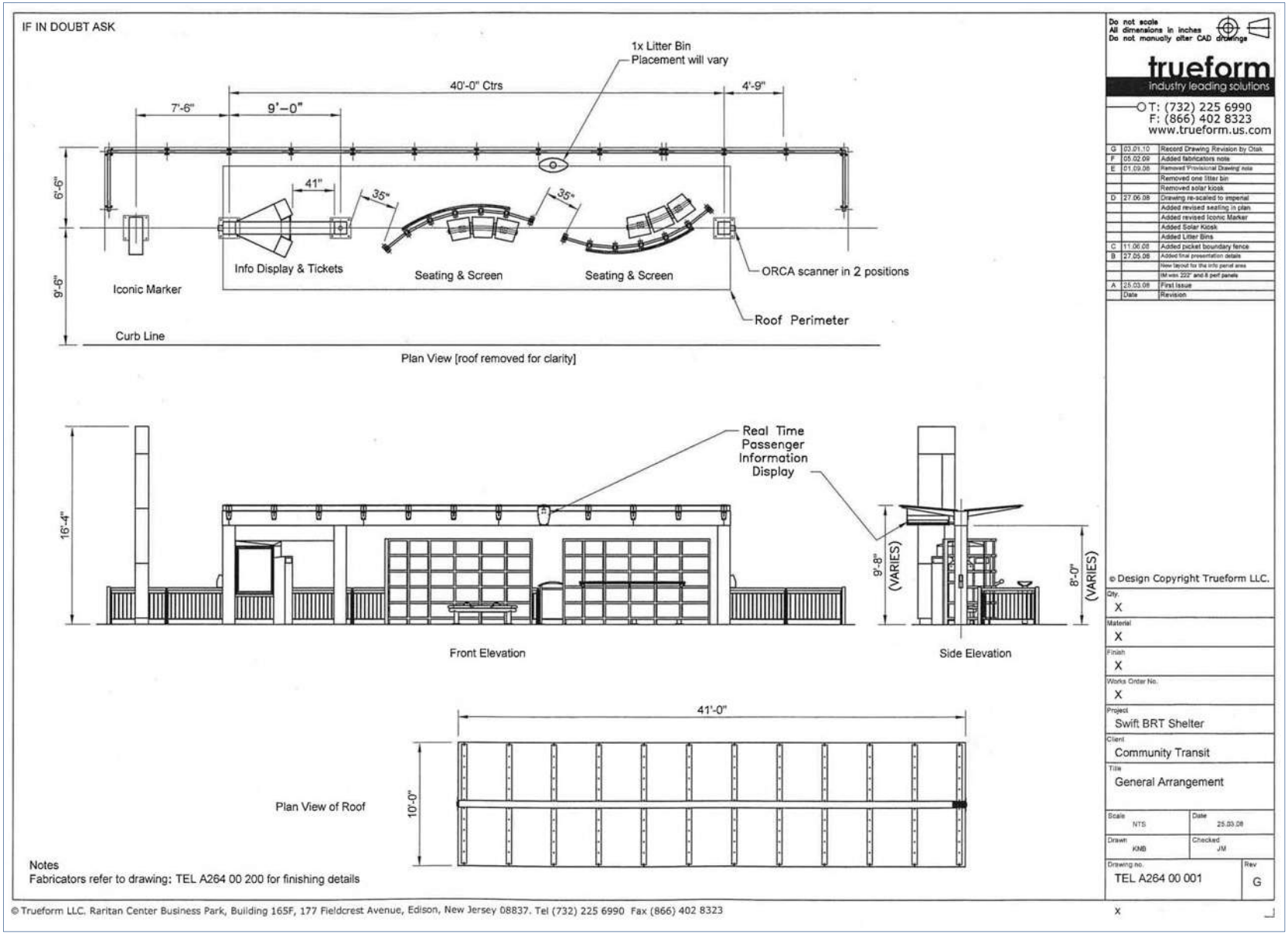


Figure 10-3. Typical Swift Station Design Layout

(Source: Community Transit)

Figure 10-4. Typical Swift Station
(Source: Community Transit)

- SR 527 at 208th Street—southbound and northbound directions: Far side station locations. Similar to the stations at 164th Street, *Swift* BRT vehicles would use the right-turn lanes as transit-only through lanes allowing them to bypass queues at this intersection. This would require modifying the raised traffic islands and relocating traffic signal poles to provide the necessary through clearance. A conceptual cost estimate for this work is calculated at approximately $790,000. Cost estimate details are in Appendix H.

The termini for the route would be at the Seaway Transit Center on the north end, and at the Canyon Park Park-and-Ride facility on the south end. The Seaway Transit Center would be a permanent facility providing an interface with a potential Boeing circulator system as well as other local transit routes. The Canyon Park terminus would be temporary, assuming that eventually the BRT route would extend south to Bothell as indicated in the Long-Range Transit Plan.

Table 10-1. Proposed BRT Station Locations

Station Location	Direction	Configuration for Station
Seaway Transit Center/Terminus		Transit Center layout with layover and two *Swift* Station Stop locations
Airport Road at Casino Road	NB	Near side stop, in lane, lined up correctly for on-ramp to EB SR 526
	SB	Far side stop
Airport Road at 100th SW/Paine Field Access	NB	Far side stop
	SB	Far side stop
Airport Road at SR 99/ Evergreen Way	NB	Far side stop—modify existing island
	SB	Far side stop
Airport Road at E Gibson Road	NB/WB	Far side stop
	SB/EB	Far side stop
128th St SW at 4th W	NB/WB	Far side stop
	SB/EB	Far side stop
128th St SE at 3rd SE	NB/WB	Far side stop
	SB/EB	Far side stop
132nd St at Dumas Road	NB/WB	Far side stop
	SB/EB	Far side stop may require retaining wall relocation and landfill remediation
132nd St SE at 16th Ave SE, SR 527	NB/WB	Far side stop—
	SB	On SR 527 at current bus stop located 200 feet south of 16th Ave
SR 527 at Trillium Boulevard	NB	Far side stop
	SB	Far side stop
SR 527 at 153rd St SE	NB	Far side stop
	SB	Far side stop
SR 527 at 164th	NB	Far side stop—Q-jump requiring signal pole relocation
	SB	Far side stop
SR 527 at 180th St SE	NB	Far side stop
	SB	Near side stop
SR527 at 196th St SE	NB	Far side stop
	SB	Far side stop
SR 527 at SR 524/ 208th/Thrasher's Corner	NB	Far side stop—Q-jump requiring signal pole relocation
	SB	Far side stop—Q-jump requiring signal pole relocation
SR 527 at 220th St SE	NB	Far side stop
Canyon Park Transit Center	Station at Platform, near elevator and bridge	

10.2.4 Ridership Projections

With conversion of the existing peak period HOV lanes on Airport Road to BAT lanes, completion of the approach widening transit improvements on 128th Street at the I-5 interchange, the Boeing to Canyon Park BRT line is projected to carry 3,300 riders per day if it were opened and operating today. By the year 2035, ridership is expected to increase to nearly 4,000 daily riders. Additionally, implementation of this route, which would intersect with the existing SR 99 *Swift* route, is expected to increase riders on the existing route by 600 riders per day—or by 12.5 percent. More details of the ridership forecasting results are included in Appendix G.

10.2.5 Projected Travel Times

Implementation of the proposed *Swift* route between Boeing and Canyon Park would provide a significant improvement in transit travel times connecting key locations within the corridor. Table 10-2 lists estimated transit travel times between selected activity centers within the corridor using both existing transit service and the proposed BRT service. Table 10-3 summarizes the travel time improvements that would be expected with implementation of the proposed *Swift* service. Depending on the direction, transit connections between Canyon Park and Boeing would be from 15 to 38 minutes faster during the peak commute periods and from 51 to 56 minutes faster during the midday. This represents a transit travel time improvement ranging from 30 percent to over 50 percent in the peak periods and up to 64 percent during the midday period.

10.2.6 Infrastructure Improvements

As discussed and described previously, in addition to construction of the *Swift* stations, including concrete pads in the roadway lane adjacent to each station, multiple infrastructure improvements are assumed as part of the recommended BRT route. These include the following:

- Construction of a transit center at the Seaway terminus station
- Approach widening improvements along 128th Street approaching I-5 from both the eastbound and westbound directions
- Relocation of a retaining wall and potential remediation costs associated with the southbound station on 132nd Street at Dumas Road
- Intersection modifications to provide BRT use of the right-turn lanes as queue bypass lanes at stations on SR 527 at 164th Street (northbound only) and 208th Street (both northbound and southbound)
- Island modification at SR 99 and Airport Road

Table 10-2. Estimated Transit Travel Times (Minutes) for Selected Trips—Existing Transit Service and Proposed *Swift* BRT

Time Period		Transit Travel Time Trip Pairs							
		Canyon Park to Boeing	Boeing to Canyon Park	Mill Creek to Boeing	Boeing to Mill Creek	Mariner P&R to Boeing	Boeing to Mariner P&R	Canyon Park to Mariner P&R	Mariner P&R to Canyon Park
Existing	Existing AM[1]	56	71	54	68	47	73	25	24
	Existing Midday[1]	83	87	81	78	75	55	26	24
	Existing PM[1]	62	49	76	41	59	25	31	26
Proposed	SWIFT II—AM	34	33	25	25	13	13	21	20
	SWIFT II—Midday	32	31	23	23	13	13	21	20
	SWIFT II—PM	36	34	25	25	13	13	23	21

[1]*Source: Community Transit Trip Planner*

Table 10-3. Estimated Transit Travel Time Savings (in minutes and percent) for Selected Trips—Proposed *Swift* BRT vs. Existing Transit Service

Time Period	Canyon Park to Boeing	Boeing to Canyon Park	Mill Creek to Boeing	Boeing to Mill Creek	Mariner P&R to Boeing	Boeing to Mariner P&R	Canyon Park to Mariner P&R	Mariner P&R to Canyon Park
AM	22/39%	38/54%	29/54%	43/63%	34/72%	60/82%	4/16%	4/17%
Midday	51/61%	56/64%	58/72%	55/71%	62/83%	42/76%	5/19%	4/17%
PM	26/42%	15/31%	51/67%	16/39%	46/78%	12/48%	8/26%	5/19%

10.2.7 Capital and Operating Costs

An initial estimate of capital cost required to implement the proposed Boeing to Canyon Park *Swift* BRT route is summarized in Table 10-4. The total overall cost is estimated to range from between $42 and $48 million. This is a preliminary cost that provides an order of magnitude level cost for this project.

Table 10-4. Estimated Capital Costs

Element	Unit Cost ($K)	No.	Cost ($K)
BRT stations	$550	30	$16,500
128th St approach widening at I-5	$4,200	1	$4,200
Seaway Terminus Transit Center	$6,200	1	$6,200
Intersection and station area improvements	$2,000	1	$2,000
BRT vehicles	$1,200	11	$13,200
		Low range	**$42,000**
		High range	**$48,000**

Operating costs, assuming an average platform hour cost of $130 including all administrative and maintenance (vehicle and facility) operating expenses, are estimated to range from $7 to $8 million per year. This assumes that operations on this route would be similar to the initial SR 99 *Swift* route when it opened. It would operate every 10 minutes weekdays from 5 a.m. to 7 p.m., every 20 minutes week-nights from 7 p.m. to 1 a.m., and every 20 minutes on both weekend days from 6 a.m. to 1 a.m.

10.3 Policy Implications and Project Partner Actions

For the proposed BRT route to be most effective, several actions by partner entities are needed or recommended. These are described below.

10.3.1 Airport Road HOV Lanes

The HOV lanes that currently exist on Airport Road/128th Street between 4th Avenue W and Kasch Park Road operate today as peak-period, peak-direction (northbound toward Boeing in the AM-peak and southbound in the PM-peak periods) lanes for vehicles with 2 or more occupancy. At all other times, they are open to all general-purpose traffic. For this project to be successful, it requires a policy change designating these lanes as all-day HOV or BAT lanes, i.e., lanes reserved for transit on a 24-hour basis, but can be used for right-turning general traffic vehicles accessing/egressing properties off the lane or cross streets. This action will need to be undertaken by Snohomish County, which currently has jurisdiction over this stretch of roadway.

10.3.2 Transit Signal Priority

Currently, transit signal priority (TSP) is not active within the proposed BRT route corridor, but it is highly recommended that it be implemented throughout the corridor to facilitate speed and reliability of the proposed *Swift* route. Snohomish County and WSDOT partnering with other agencies has obtained a grant to provide adaptive signal control, including the ability to provide TSP and signal queue jumps

throughout the corridor. It is recommended that these discussions continue with a goal of implementing TSP in conjunction with opening the new *Swift* BRT service.

10.3.3 SR 527 BAT Lanes

The proposed project was evaluated assuming that it would operate in mixed traffic flow along SR 527 between 132nd Street SE and Canyon Park, with utilization of right-turn lanes as queue bypass/queue jump lanes at two of the most highly congested intersections along this portion of the corridor (SR 527 at 164th Street and 208th Street). However, as this area continues to develop and grow, it is anticipated that additional traffic chokepoints affecting transit speed and reliability will develop throughout this segment. To address this, it is recommended that the agencies with jurisdiction over this roadway—WSDOT, Snohomish County, and the local jurisdictions of Mill Creek and Bothell—consider taking steps to develop a BAT lane through all or key portions of SR 527 from 132nd Street to I-405.

10.3.4 Boeing Circulator

As discussed in Section 9.1, for the proposed BRT service to effectively serve the Boeing employment site, a circulator system would need to be implemented within the Boeing site to distribute/collect riders to/from the proposed BRT terminus at Seaway Boulevard and 75th Street SW. This circulator would likely be a private system under the purview of the Boeing Company and would be most effective if its implementation coincided with the implementation of the *Swift* BRT service.

10.3.5 Taxing Authority

The Washington State Legislature will need to act to allow increased local taxing authority for Community Transit. Community Transit is currently at the maximum allowable taxing authority of 9/10ths of a cent. Increased authority by the Legislature allows Community Transit to take the issue to a vote of the people for more funding. The increased funds will be necessary for a sustainable source of ongoing operating funding.

10.4 Linkage with Existing Community Transit Network and Current Plans

10.4.1 Existing Transit Network

The proposed BRT route would interface with existing transit service at several points along the route and would connect with both regional transit service and local transit services. The route would interface with the existing SR 99 *Swift* route at SR 99 and Airport Road and with additional local, commuter express, or regional transit service at the Seaway Transit center, Canyon Park park-and-ride, Mariner park-and-ride, and McCollum park-and-ride.

10.4.2 Long Range Transit Plan

The proposed project represents the initial implementation of Community Transit's Long Range Transit Plan adopted in 2011. That plan identified a network of future *Swift* BRT lines running on Transit Emphasis Corridors connecting centers in urbanized areas of Snohomish County. The proposed *Swift* corridor represents a minimum operating segment combining portions of two Transit Emphasis Corridors—Airport Road/128th Street and SR 527.

10.4.3 Other Transit Planning Efforts

The proposed route is included in PSRC's *Transportation 2040* fiscally constrained preferred alternative and *VISION 2040*. PSRC designates regional centers that are expected to receive more growth—population and employment—than other areas. This project would serve two centers—Paine Field/Boeing manufacturing/industrial center and Bothell-Canyon Park regional growth center. Both of these employment centers are expected to grow in coming decades.

The proposed project also integrates well with Sound Transit's Long Range Plan, which calls for a regional high-capacity transit spine connecting downtown Seattle with Everett. Although a specific route has not been identified, the general corridors under consideration are along either I-5 or SR 99, and the importance of connecting with a proposed *Swift* BRT route has been expressed. If an I-5 route is selected for light rail transit, the 128th Street/Mariner park-and-ride vicinity just west of I-5 would offer an excellent intercept point. If an SR 99 alignment is chosen, the intersecting location would be at SR 99 and Airport Road. Either way, this interface would provide a critical link between the major regional employment center at Boeing/Paine Field and the regional transit spine along I-5.

Snohomish County has designated urban centers and urban villages with mixed-use zoning appropriate for transit-oriented development. The proposed project would directly serve three of these (two centers and one urban village) at I-5 and 128th Street SW (mentioned above), SR 527 and 196th Street SE, and SR 527 and 185th Street SE. The County is currently updating its Comprehensive Plan and potential zoning changes are aimed at allowing higher density near services and transit. The Plan is expected to be complete in June 2015.

The proposed project would serve a number of other smaller centers identified by local jurisdictions in planning studies, including the Mill Creek Town Center and nodes along SR 99 (Evergreen Way) identified in the Evergreen Revitalization Plan and zoned for more intense development.

10.5 FTA Funding Potential

The FTA New Starts/Small Starts program provides funds to be allocated to qualifying high-capacity transit projects through a competitive grant process. The Small Starts element of the New Starts program is used for projects that do not exceed $250 million in total cost and are limited to $75 million in FTA funding, which fits for the Boeing to Canyon Park project. To qualify for these funds, FTA has established rules and processes for how projects are developed, how money is requested, and how that money is distributed. Figure 10-5 presents the general flow of the overall Small Starts process.

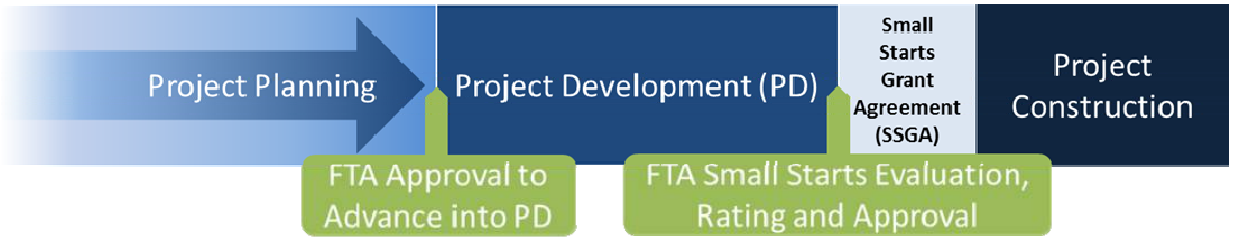


Figure 10-5. FTA's Small Starts Process

The first step in the process is to complete project planning to a sufficient degree that the project can obtain entry into Project Development. This report documents the project planning phase. Project sponsors wishing to enter the Project Development phase must submit a letter to FTA that includes the following information:

- The name of the study sponsor, any partners involved in the study, and the roles and responsibilities of each
- Identification of a project manager and other key staff that will perform the Project Development work
- A brief description of the corridor being studied
- The transportation problem in the corridor or a statement of purpose and need
- Identification of a proposed project if one is known and alternatives to that project if any are being considered
- Identification of a cost estimate for the project, if available
- Identification of whether the project would be a New Starts, Small Starts, or Core Capacity project
- Current levels of transit service in the corridor
- Copies of prior studies done in the corridor, if any
- Identification of the funding available and committed to conduct the Project Development work
- Documentation demonstrating commitment of funds for the Project Development work

The materials listed above required for entry into Project Development are readily available or in process.

The recommended route is already included in PSRC's Regional Transportation Plan, and a competitive grant and local matching funds have been obtained by Community Transit for Project Development work. As such, Community Transit is positioned to submit the Request to Enter Project Development to FTA.

The Project Development phase includes all the steps necessary to prepare the project for construction. This includes the following:

- Completion of environmental analysis and satisfying the requirements of the National Environmental Policy Act (NEPA)
- Completion of third-party agreements
- Updating of the Project Management Plan and subplans to include a management approach at a sufficient level of development to construct and implement the project
- Analysis of the project against Small Starts criteria
- FTA Evaluation and Rating of the project
- Commitment of the local (non-federal) funds to match the federal funding

- Preliminary and final design and engineering to prepare project plans and specifications
- Acquisition of needed right-of-way, if required
- Relocation of utilities, if necessary
- Identification and commitment of operating funds

As the project advances through Project Development, a submittal to FTA is compiled for rating the project against the Small Starts criteria. This generally occurs at about the 60-percent design level. The project will be rated based on the criteria shown on Figure 10-6, each of which must be analyzed using FTA-approved methods.

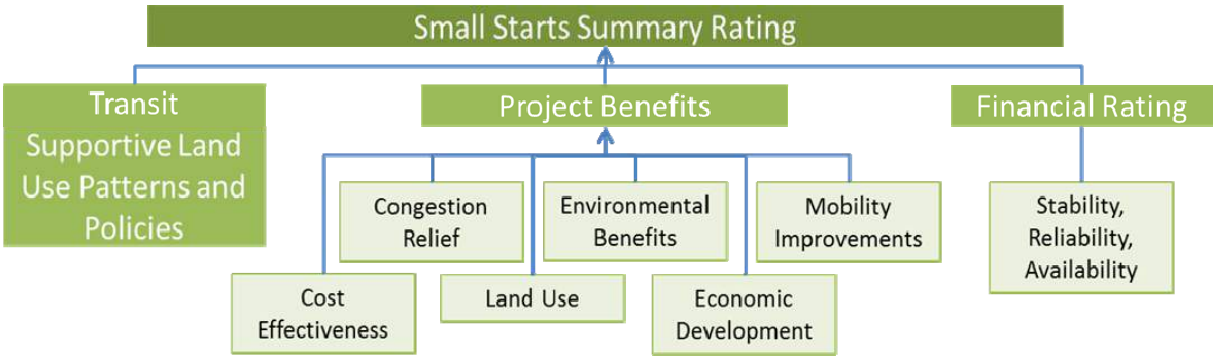


Figure 10-6. FTA Small Starts Rating Criteria

If a project has achieved an overall rating by FTA of medium or better and has been recommended for funding in the New Starts Report, it can seek a Small Starts Grant Agreement (SSGA) which contractually determines the amount and timing of the local and FTA funding. Once an SSGA has been executed, the project can proceed into construction.

At this point, the proposed route appears to be a viable candidate for FTA Small Starts funds. With an estimated ridership of 3,300 riders per day and because it is relatively inexpensive to implement, the route is projected to have an FTA cost-effectiveness rating close to the "medium-high" range. Additionally, it is consistent with local and regional plans and policies and connects to a major regional employment center at Boeing.

10.6 Next Steps

Recommended next steps for Community Transit to undertake to advance this project include the following:

- Continue coordination with FTA Region 10 staff to provide an overview of the project and seek their advice on the Project Development request. In the past, FTA required a "Project Initiation Package" prior to the start of Alternatives Analysis. While this is no longer required, it may be helpful to develop a similar document to provide the background and current status of the project for FTA to review as part of this coordination.
- Pursue additional taxing authority from the Washington State Legislature.

- Coordinate with partner agencies on key elements of the proposed project, including the following:
  - Snohomish County PUD, which owns the property on which the proposed Seaway terminus transit center would be located, regarding acquiring the property for the terminus
  - City of Everett regarding proposed access at the Seaway terminus, including the proposed signalized access point to 75th Street SW adjacent to the signalized Snohomish County PUD entrance
  - Property owners along the south side of 75th Street immediately east of the Snohomish County PUD driveway, from which a strip of property would be required to develop a westbound left-turn lane on 75th Street to both the PUD entrance and the transit center
  - Boeing regarding provision of a circulator system connecting the various Boeing worksites with the BRT terminus transit center
  - Snohomish County regarding re-purposing the existing peak period, peak direction HOV 2+ lanes on Airport Road to either 24-hour BAT lanes or HOV lanes
  - Snohomish County and WSDOT regarding implementing TSP along the corridor
  - WSDOT regarding improvements along 128th Street at the I-5 interchange and transit signal priority along SR 527.
- Conduct an early initial assessment of the FTA Small Starts criteria, identifying what further steps, if any, may need to be taken to enhance the project's competitiveness for FTA funds.
- Complete the following once the project has entered the Project Development Phase:
  - Develop a Project Management Plan and related subplans as required by FTA to assist in effectively and efficiently managing and controlling the proposed project, including guidelines for the orderly interaction of the multiple agencies, organizations, and staff involved in its implementation.
  - Complete NEPA, assuming this is a Documented Categorical Exclusion or an Environmental Assessment. NEPA approval can start before 30-percent design is attained and can be completed concurrent with further design work. It will need to be completed before execution of the SSGA. FTA Region 10 can provide guidance on the NEPA classification.
  - Advance the design as needed to move the project through the Small Starts process, as well as readying the project for implementation.
  - Secure Non-Small Starts Funding Commitments.
  - Identify and commit operating funds to project.
  - Develop Small Starts criteria in order to obtain project rating. An initial estimate can occur so that the project can be rated earlier as part of an annual submission to FTA.

APPENDIX A—DETAILED RESULTS FOR THE INITIAL ALTERNATIVES EVALUATION

APPENDIX B—DETAILED RESULTS FOR THE REFINED ALTERNATIVES EVALUATION

APPENDIX C—TRAFFIC ANALYSIS FOR POTENTIAL TRANSIT PRIORITY TREATMENTS AT THE 128TH STREET SW/I-5 INTERCHANGE AREA

APPENDIX D—COST ESTIMATE CALCULATIONS FOR THE 128TH STREET SW/I-5 AREA IMPROVEMENTS

APPENDIX E—DETAILED RESULTS FOR THE ALIGNMENT EXTENSION ALTERNATIVES EVALUATION

APPENDIX F—COST ESTIMATE CALCULATIONS FOR THE SEAWAY TERMINUS AND TRANSIT CENTER STATION

APPENDIX G—DETAILED RIDERSHIP FORECASTING RESULTS

APPENDIX H—COST ESTIMATE CALCULATIONS FOR STATION AREA IMPROVEMENTS