



SOUND TRANSIT

HCT Planning

Sound Transit Long-Range Plan Update

Issue Paper S.5: Rail between Burien and Renton

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Sound Transit

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FINAL

March 2005

Foreword

This issue paper is part of a series of reports designed to inform the Sound Transit Board in its decision-making on the Regional Transit Long-Range Plan update for the Sound Transit service area. Each issue paper provides information about a specific element or area of the Long-Range Plan and potential options. These reports focus on issues such as costs, ridership, engineering feasibility and operations.

The environmental impacts of the updated Long-Range Plan and Options, as well as potential mitigation measures, are examined in the Draft Supplemental EIS for the Regional Transit Long-Range Plan (December 2004). The Draft SEIS supplements the 1993 EIS prepared on the Regional Transit System Plan, and it generally updates that information and analysis through the year 2030. Public and agency comments on the 2004 Draft Supplemental EIS have been received and will be responded to in a final SEIS to be issued in June 2005.

The Sound Transit Board anticipates identifying a draft updated Long-Range Plan in the spring of 2005. There will be an opportunity for public review and comment on the draft Plan. The Board will adopt a final updated Long-Range Plan after public comments are received on the draft plan and the final SEIS is issued.

References in these reports to Sound Transit's existing Long-Range Plan are to the 1996 Regional Transit Long-Range Vision, which functions as the agency's Long-Range Plan. Discussion of the updated Long-Range Plan refers to the Plan being developed by Sound Transit over the coming months.

The following issue papers are being prepared:

East Corridor

E.1 – I-90/East King County High-Capacity Transit (HCT) Analysis

North Corridor

N.1 – Bus Rapid Transit (BRT) in SR 99 Corridor

N.2 – I-5 Corridor Northgate to Everett HCT Assessment

N.3 – Seattle Streetcar Options

N.4 – SR 522 Corridor HCT Assessment

N.5 – Convertibility of BRT to Light Rail

South Corridor

S.1 – Tacoma Link Integration with Central Link

S.2 – Potential Rail Extensions to Frederickson and Orting

S.3 – HCT System Development Issues in the South Corridor

S.4 – Potential Tacoma Link Extension - West

S.5 – Rail between Burien and Renton

S.6 – Potential Tacoma Link Extension – East

Table of Contents

1.	Study Purpose	1
2.	Key Findings.....	1
3.	Major Study Elements.....	1
3.1	Potential Rail Alignments	2
3.1.1	Potential Shared Track versus Separate Track Configurations.....	2
3.1.2	Downtown Burien-Tukwila Segment	5
3.1.3	Tukwila/North Renton Segment	7
3.2	Estimated Ridership for the Extension	9
3.3	System Operations	10
3.3.1	Station Spacing and Locations.....	10
3.3.2	Service Frequencies and Vehicles	11
3.4	Maintenance and Operations Facilities.....	11
3.5	Cost Estimates.....	12

List of Figures

Figure 1. Potential Rail Corridor/Burien-Renton.....	3
Figure 2. Burien-Renton Rail Corridor Alignment Options	6
Figure 3. Potential Rail Corridor/Tukwila-Renton	8

1. Study Purpose

The purpose of this analysis is to evaluate the potential for a light rail transit (LRT) corridor between downtown Burien and Renton as part of an update to Sound Transit's Long-Range Plan (LRP). The purpose of this analysis is not to select a specific route but to provide information on the corridor by evaluating potential alignments, station locations, estimated ridership levels, and costs to help inform a Long-Range Plan decision.

Options have been developed for conceptual-level evaluation of the proposed LRT system. These concepts help define the magnitude of potential costs associated with this corridor. To determine conceptual-level costs, conceptual alignments were analyzed to address the interplay between ridership demand and the operational characteristics to meet this demand. These options center on the issue of how an east-west Burien-Renton light rail corridor might interface with Central Link, Airport Link, and Sounder.

2. Key Findings

- A potential LRT line between Burien and Renton is projected to have daily ridership of approximately 24,000 by 2030.
- A variety of factors will influence projected ridership including transfers with both Airport Link and Central Link at the future S 154th Street Station in Tukwila.
- Capital costs for the LRT line would range between \$1.0 billion and \$1.4 billion.
- For the portion of the corridor between Tukwila (at the S. 154th Street Central Link Station) and Burien, there are opportunities for surface alignment options.
- For the portion of the line between Tukwila and Renton, the extent of development, the topography, and limited opportunities for using right-of-way adjacent to roadways would require that the alignment be predominantly within exclusive right-of-way and grade-separated, with major portions likely elevated.

3. Major Study Elements

The major study elements addressed in this issue paper will help assess the potential for a light rail corridor between downtown Burien and Renton. The major study elements include:

- Potential rail alignments
- Projected ridership (2030)
- System operations
- Cost estimates

3.1 Potential Rail Alignments

This section describes potential alignments for a light rail line between Burien and Tukwila. To introduce this section, there is a discussion of potential configurations for the rail line in relationship to the currently planned north-south Link rail system. One configuration would have a segment of an east-west rail line shared with the future Central Link /Airport Link line connecting Seattle with SeaTac, while another would have a line that operates separately from the Central Link/Airport Link line.

The potential Burien-Renton corridor was evaluated in two major segments. These segments are:

- Downtown Burien to Tukwila (S 154th Street Station) and
- Tukwila (S 154th Street Station) to North Renton

Figure 1 shows the potential Burien-Renton rail corridor. The following further describes the components of the corridor, including locations for shared versus separate track alignments.

3.1.1 Potential Shared Track versus Separate Track Configurations

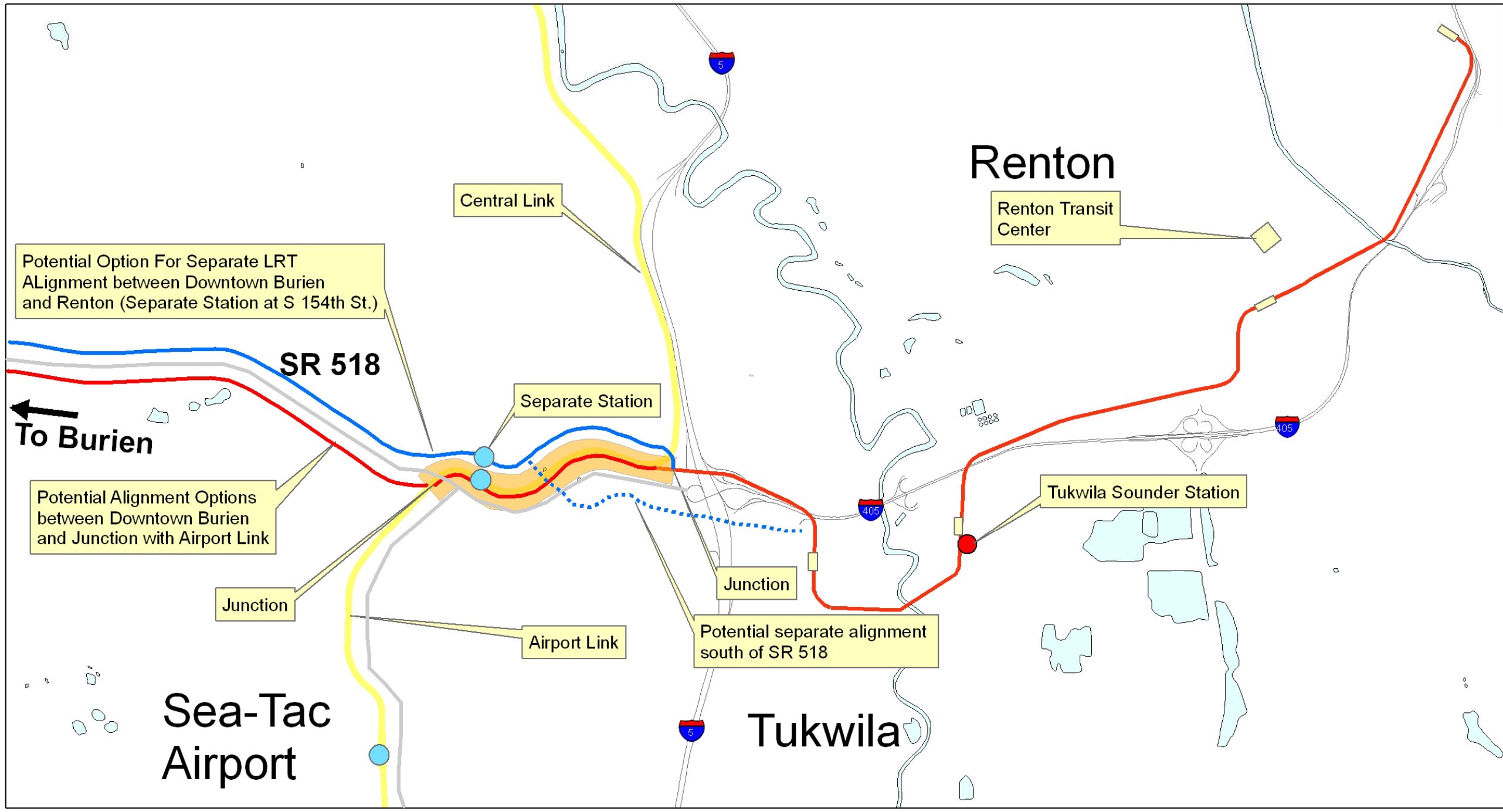
A potential east-west rail line between downtown Burien and Renton should integrate in some manner with the future north-south LRT service between Seattle and SeaTac. This north-south LRT line will be comprised of the initial Central Link LRT system between downtown Seattle and the interim terminal station at S. 154th Street/International Boulevard in Tukwila. This line will eventually be extended south through Sea-Tac Airport with the Airport Link system. It is assumed that a Burien-Renton LRT line would provide connections with the north-south service at the S 154th Street Station. To do this, the Burien-Renton east-west rail line could:

- 1) Be aligned in a manner that would result in a shared track with north-south service; or
- 2) Operate as a separate alignment from the north-south service.

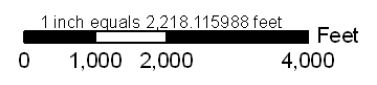
Figure 1 illustrates the shared track and separate alignment configurations for a potential Burien-Renton line. The following summarizes potential key elements for each configuration:

Shared Track Configuration

Under a potential shared track configuration, a portion of the future LRT line between Seattle and SeaTac would be in common with a portion of a potential Burien-Renton line. Figure 1 highlights that portion of the LRT line that would be in common with the north-south and east-west rail lines. To allow the shared track configuration, two junctions would be constructed. One junction, located west of the future S 154th Street Station, would allow LRT service to operate west to a potential downtown Burien station. A second junction would be constructed east of the S. 154th Street Station and allow east-west LRT trains to travel east and serve stations in Tukwila and Renton.



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- Potential Future LRT Stations
- Segment of Track Shared between N-S and E-W Rail Lines

rr/Burien-Renton

The following identifies potential advantages and disadvantages of the shared track configuration:

- One potential advantage of a shared track configuration involves capital costs savings as compared to a stand-alone track. These savings would occur since the shared portion would use the future track for north-south rail and avoid new track construction along that portion. The S. 154th Street Station would also be shared. However, since this station will have side platforms, some transferring riders will have to leave the platform area, go down to street level, and then proceed to the opposite side platform. Therefore, some modifications to the currently planned configuration may be necessary to make transfers between the east-west and north-south lines occur more efficiently and comfortably for riders.
- A potential disadvantage of the shared track is that it would use capacity of the future north-south line between Seattle and SeaTac. However, a review of peak-demand operating capacity of the north-south line indicates that Burien-Renton trains operating at headways of six minutes could be accommodated. More detailed analysis is needed to confirm this.
- Another potential disadvantage of a shared track configuration is the possible suspension of Seattle-SeaTac rail service to allow construction of the junctions with a potential Burien-Renton line. The suspension of service appears likely; however a final determination would need to await more detailed study.

Separate Track Configuration

Under a separate track configuration, a potential Burien-Renton rail line would operate on a distinct and completely detached line from the north-south line.

The following identifies potential advantages and disadvantages of the separate track configuration:

- Because the track would be stand-alone and separate from Central/Airport Link, it would offer two advantages:
 - There would no need for junctions with Central and Airport LRT thereby saving some capital costs;
 - Since junctions would not be necessary, there may be no need for any potential suspension of north-south rail service.

Potential disadvantages of a separate track configuration are:

- While a transfer could still occur at the 154th Street Station, a separate station would have to be built along the potential Burien-Renton rail line. This would incur additional capital costs as compared to a shared track arrangement.
- Under this configuration, the Burien-Renton line would be separate from Central/Airport Link. Therefore, it could not use the maintenance-operations center south of downtown Seattle or any planned new maintenance and operations facilities that could be built to serve

expansions of the Central/Airport Link system -- separate maintenance and operations facility would have to be constructed.

- Since this line would be entirely separate from the north-south LRT line, there would be additional costs for approximately one mile of additional track route length. This additional track would not be necessary under a shared configuration since it will already be constructed as part of the future Seattle-SeaTac LRT line.
- For the corridor between S 154th Street Station and I-5, there is limited right-of-way (ROW) available for a separate track. The ROW challenges will be difficult. The future Central Link line to be located along this corridor will use the limited available space between SR 518 and S. 154th Street, while the south side of SR 518 is a steep slope adjacent to and within WSDOT right-of-way, some of which would be occupied by planned expansion of the freeway.

3.1.2 Downtown Burien-Tukwila Segment

Three potential general alignment options were identified for evaluation. Land uses vary along the alignment options and the mix of commercial and residential uses would help support and generate peak and non-peak ridership for the LRT service. Along this segment, the alignment options would include elevated sections, sections on retained fill, and an at-grade profile. The alignment options are shown in Figure 2.

Option 1 – Alignment North of the SR 518 Westbound Lanes

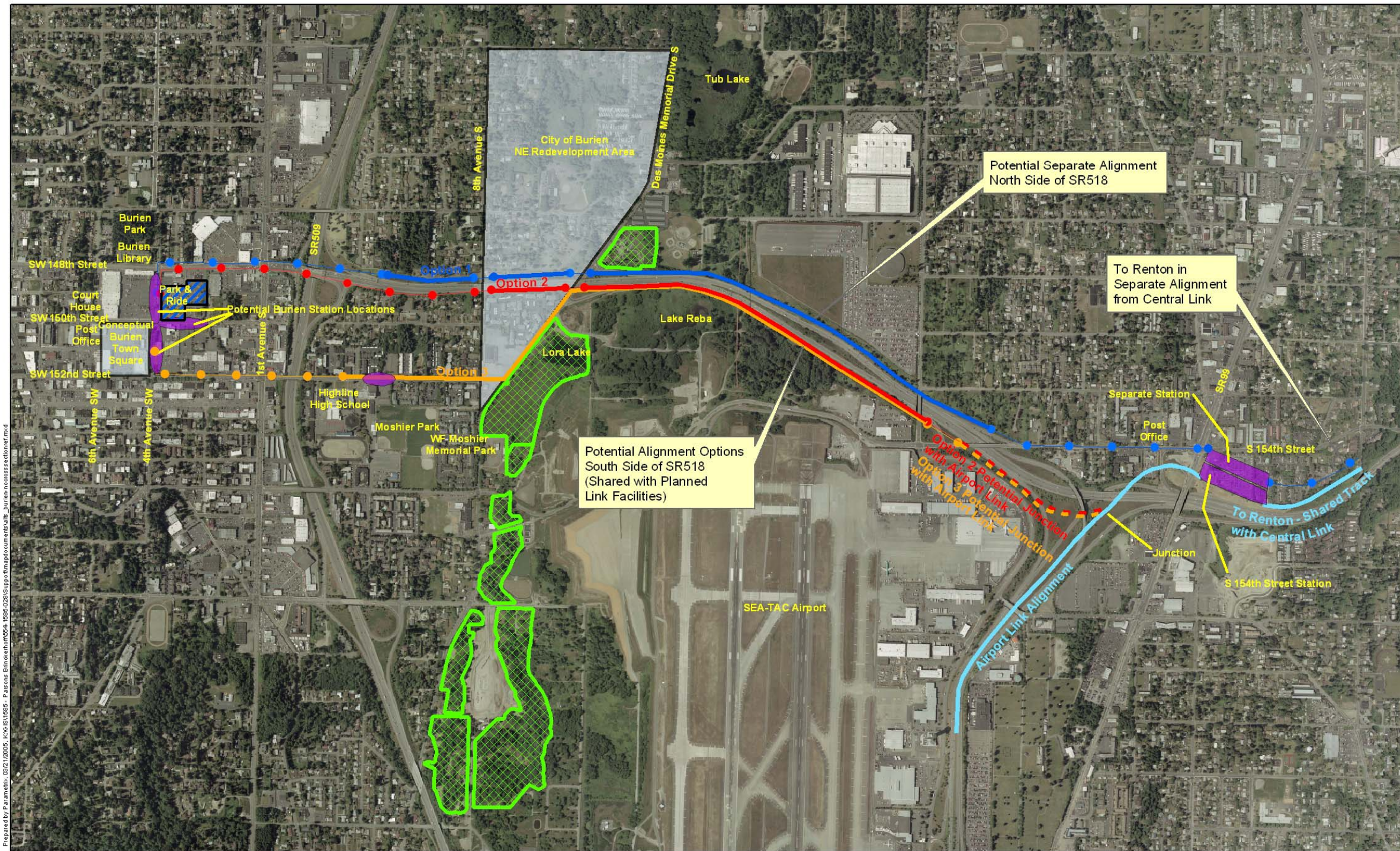
As shown on Figure 2, Option 1 follows a 2.5-mile alignment extending from the S 154th Street Station west along S 154th Street, turning north to follow the north side of SR 518 westbound lanes, crossing SR 509 and following SW 148th Street, and finally turning south into the Burien Station in the vicinity of 4th Avenue SW. Under this option the alignment would be located on a separate track from Airport Link. A separate station would have to be constructed adjacent to the future 154th Street Station.

Option 2 – Alignment South of the SR 518 Eastbound Lanes

As shown on Figure 2, Option 2 follows a 2.5-mile alignment extending from the Airport Link LRT line near the S. 154th Street Station, then west following the south side of SR 518 eastbound lanes, crossing SR 509 and following SW 148th Street, and turning south into the Burien Station in the vicinity of 4th Avenue SW. Under the option, the track for the Burien-Tukwila line would share a short portion of the Airport Link line. To allow this track sharing, a rail junction would be constructed southwest of the 154th Street Station within the SR 518/North Airport Expressway interchange area.

Option 3 – Alignment South of the SR 518 Eastbound Lanes and Passing by Highline High School

As shown on Figure 2, Option 3 follows a 2.6-mile alignment that along its eastern half is similar to the same segment in Option 2 until it approaches Des Moines Memorial Drive S, where it veers south to follow SW 152nd Street, then crosses SR 509 and continues along SW 152nd Street until it reaches the vicinity of 4th Avenue SW, where it turns north and terminates.



Parametrix

1 inch equals 1,100 feet
 0 550 1,100 Feet



- Potential Light Rail Station Area
- Restrictive Covenant
- Burien Planning Areas
- Park and Ride

At Grade/Retained Fill Sections of Light Rail Options

- Airport Link and Central Link Alignment
- Light Rail Option 1
- Light Rail Option 2
- Light Rail Option 3

Aerial Sections of Light Rail Options

- Light Rail Option 1
- Light Rail Option 2
- Light Rail Option 3
- Option 2 Potential Junction
- Option 3 Potential Junction

Figure 2 - Burien-Renton Rail Corridor Alignment Options

As is the case with Option 2, the track for the Burien-Tukwila line would share a portion of the Airport Link LRT line. To allow this track sharing, a rail junction would be constructed southwest of the 154th Street Station within the SR 518/North Airport Expressway interchange area.

3.1.3 Tukwila/North Renton Segment

Figure 3 shows a possible alignment for the Tukwila-Renton portion of a potential Burien-Renton LRT line. Given the need to clear major barriers such as I-5 as well as the limited right-of-way for surface operations, the alignment between Tukwila and Renton will likely require many grade-separated, elevated segments. East of the Tukwila Sounder Station, there may be opportunities for surface alignment segments through Renton. Further analysis of the corridor, including variations on potential specific alignments would provide more information about where surface versus aerial alignments are possible.

For the purposes of this issue paper, the rail link between Tukwila and Renton is assumed to include a portion that would be shared with the future north-south Central Link LRT line. An option to this shared track would involve a separate LRT line between Burien and Renton. However, a separate line and station at S 154th Street could raise potential issues that were noted in Section 3.1.1 – *Separate Track Configuration*.

The following further describes key components of the Tukwila-Renton alignment.

Rail Junction with Central Link

As noted above, this issue paper assumes a 0.7 mile portion of shared track shared with Central Link. Issues associated with a separate, stand-alone track are discussed above under Section 3.1.1. Key issues such as limited ROW for a separate track between the S 154th Street Station and I-405 indicate that the shared track configuration may be more viable if construction issues related to potential lengthy periods of non-operation for Central/Airport Link can be resolved.

The alignment shown in Figure 3 includes a track junction that would be constructed east of the S 154th Street Station. To allow for a potential future junction on Central Link with a potential east-west LRT line, design features were incorporated into the plans for the Central Link line. These features (i.e., adequate vertical and horizontal tangents of the spans) allow for a junction to be built on Central Link at a location approximately 0.3 miles west of I-5 and outside of the curved track segment. This location is shown on Figure 3.

Should a Burien-Renton LRT line become a project candidate, further analysis will be needed of potential impacts on Central/Airport Link operations, including the possibility of needing to temporarily suspend service. While this suspension appears likely, more detailed analysis could reveal a solution that avoids it entirely, or at least mitigates it significantly.



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Potential Future LRT Stations

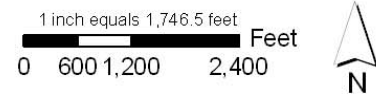


Figure 3 - Potential Rail Corridor/Tukwila-Renton

Tukwila Alignment

East of the junction with Central Link, the elevated track approaches I-5 at a level that would clear the freeway. After spanning the freeway to reach the eastside of I-5, the elevated track continues eastward along an alignment between Southcenter Boulevard and I-405. The track then heads south, crosses I-405, and travels along the east side of Southcenter Mall, (possibly within the Andover Park West right-of-way.) A potential station is located in the area east of the mall and north of Strander Boulevard. The track then heads south to Strander Boulevard where it turns east to follow the north side of Strander Boulevard.

From the north side of Strander Boulevard, the rail line continues eastward toward West Valley Highway. When it reaches West Valley Highway, the track turns northward and parallels the Burlington Northern Santa Fe Railroad track to reach the Tukwila Sounder station. An LRT station would be located at the Sounder Station area

Tukwila-Renton Alignment

From the Tukwila Sounder Station, the line continues north and crosses over I-405 to Grady Boulevard where it turns and follows Grady Boulevard eastward to a point roughly 500 feet from the intersection with Rainier Avenue. The alignment then turns north to Hauser Way, where it then turns east and parallels Hauser Way and the BNSF tracks. A station is located in the Hauser Way/BNSF railroad corridor at Burnett Avenue and about one to two blocks south of the downtown Renton Transit Center. Leaving the station, the line then follows Hauser Way, Sunset Boulevard, and Hauser again (a segment which also parallels the BNSF line) to a North Renton station.

The assumed downtown Renton station would be located one to two blocks south of the existing downtown Renton Transit Center which is located at 3rd Street and Burnett Avenue. It may be possible to provide a more centralized location for a downtown LRT station, one that is integrated with the Renton Transit Center, by having the LRT line be elevated or at surface in-street as it approaches the present location of the transit center. These alignments would require more detailed study to address such items as traffic operations and compatibility with the surrounding development.

3.2 Estimated Ridership for the Extension

Ridership estimates for the potential extension were prepared for a future year of 2030 using ST's ridership forecasting model. A potential Burien-Renton LRT line was estimated to have approximately 24,000 daily riders. These ridership estimates have been identified in the Draft Supplemental Environmental Impact Statement for the Regional Transit Long-Range Plan.

Several factors are expected to affect this projected demand. These factors include:

- Transfers to/from Central Link and Airport Link LRT Service
- Transfers to/from Sounder service at the Tukwila commuter rail Station

- Assumed six-minute frequencies in the peak periods
- Access to the regional retail center in Tukwila at and adjacent to the mall
- Connections with local transit service at various rail stations
- Park-and-ride access at three locations on the rail corridor (downtown Burien, Tukwila Sounder, and North Renton).
- Drop-off facilities at all locations

3.3 System Operations

System operations for a potential LRT line would be similar for the three alignment options identified for the Tukwila-Burien segment. Also, the ridership demand is assumed to be consistent among the options for this issue paper. Station spacing and location differ only slightly among the options, and headways and number of vehicles required for the system are assumed to be the same.

3.3.1 Station Spacing and Locations

The following sections further identify potential station locations for a possible Burien-Renton LRT line. This identification is provided for the Tukwila-Burien and Tukwila-Renton segments of the potential rail line.

Tukwila-Burien Segment

Along the Burien-Tukwila segment, two possible stations were identified: the future S 154 Street Station in Tukwila and a potential west terminal station in downtown Burien near or at the existing Burien Transit Center. The existing residential population from which to draw riders around the potential Burien Station is approximately 400 people within a quarter-mile radius and approximately 3,200 within a half-mile radius. However, the proximity of the Burien Transit Center and park-and-ride lot to the west terminal station would provide connections for riders that could significantly increase the area from which to draw riders.

Only alignment Option 3 has a potential third station, which would be located near Highline High School on SW 152nd Street. This station would provide an additional transportation option to the high school and Moshier Park.

Tukwila-Renton Segment

For the Tukwila-Renton portion of the potential rail line, four stations were identified: Southcenter, Tukwila Sounder, Downtown Renton, and North Renton. The Southcenter Station would serve primarily retail/office/light industrial activity. No park-and-ride lot facility is assumed at this station since it would primarily serve as a destination.

The Tukwila Sounder Station would provide connections to commuter rail serving the Everett-Seattle-Tacoma-Lakewood Corridor. This station would also be within walking distance of

employment at the Boeing Longacres facility and potentially in Tukwila should the city follow through with plans that target the area between the Sounder Station and the mall for higher density commercial development. Since the station could also serve as an origin for trips, additional park-and-ride capacity may be needed.

The downtown Renton station would serve a mix of uses, including residential, employment, and retail. The North Renton LRT station would be located near major employment (e.g., the Boeing and Paccar plants.) For the purpose of this issue paper, additional park-and-ride capacity has been identified for this station. Also, the location of the North Renton LRT station and rail alignment should be coordinated with potential HCT development along the I-405 corridor to downtown Bellevue. As part of the I-405 program, potential locations for bus rapid transit (BRT) stations have been identified for the Renton area. Within Renton, the potential BRT stations would be located near the existing Boeing facility at N. 8th Street adjacent to I-405. Another BRT station would be located in downtown Renton. A potential rail station in North Renton could provide an opportunity for transfers with the Boeing BRT station.

3.3.2 Service Frequencies and Vehicles

The assumed peak period frequency is consistent among alignment options. Specifically, a peak period frequency of six minutes was used to estimate Year 2030 ridership and to determine vehicle needs for the LRT corridor.

Based on alignment lengths, an assumed 30 mph average travel speed (including acceleration and deceleration at stations), and other factors, the estimated LRT travel time between downtown Burien and North Renton would be approximately 25 minutes in each direction.

Given the 6-minute frequency and the estimated capacity of 148 persons (74 seating plus 74 standing, the same as that for a Central Link light rail vehicle (LRV)), the estimated peak hour ridership demand could be met with single-car trains. An alternative would be to provide 12-minute frequencies with 2-car trains. However, this frequency of service would be less than what was assumed for the 2030 ridership projections for the Burien-Renton rail corridor. To allow for potential multi-car trains, the station cost estimates assumed platform lengths for up to 3-car length trains.

The peak directional capacity for an LRV would be approximately 1,400 riders per hour. This capacity would be sufficient to meet projected demand in during peak periods.

3.4 Maintenance and Operations Facilities

The additional vehicles that would be need to support a potential Burien-Renton rail corridor would also require additional maintenance and operations support. The maintenance and operations center located along the Central Link line in Seattle would have sufficient capacity to serve a vehicle fleet for a Northgate-SeaTac (S 200th Street) LRT line, as described in *Sound Move*. Therefore, the additional vehicles for the potential Burien-Renton corridor would require capacity at a new facility.

In the option where the Burien-Renton LRT line is directly connected to the north-south LRT line, the additional maintenance and operations needs may be able to be accommodated at a future maintenance facility built to serve future extensions of the Central/Airport/North Link line (i.e., beyond Northgate and/or S. 200th Street stations.) However, if the Burien-Renton rail corridor is built using a separate line, a stand-alone maintenance and operations facility would have to be constructed.

3.5 Cost Estimates

A potential Burien-Renton rail corridor would have a mix of at-grade, retained cut and fill, and elevated configurations. Between downtown Burien and the S 154th Street Station, the extent of this mix would vary by alignment option. The extent of elevated track could range from 1.1 to 1.5 miles while at-grade alignments could also vary between 1.1 miles and 1.5 miles. Between the 154th Street Station and North Renton, the rail alignment of 6.3 miles is assumed to be entirely elevated for purposes of this analysis.

The cost estimates reflecting these potential types of alignments range from \$1.0 billion to \$1.4 billion. For the purposes of this issue paper the cost estimate assumes a shared track along the Central/Airport Link LRT line between the junctions to the Burien-Renton line. The estimate also includes costs for integrating the junctions into this segment.

It is important to note that these cost estimates are at a *conceptual level* only and do not involve any level of engineering or detailed analysis. To recognize potential variations around this conceptual-level estimate, this range reflects a potential deviation in estimated costs of between 95 percent and 130 percent.

The cost estimates used available information, including the Draft Supplemental EIS and results of the Trans-Lake Washington Study, which examined potential high-capacity transit developments between Seattle and the Eastside. The estimates also recognize recent cost information for Link projects currently underway.

The following further describes other information relating to the cost estimates:

- For each construction item, estimates for design and construction contingencies have been identified.
- An environmental mitigation factor of 15 percent has been added to construction costs.
- An overall agency factor of 35 percent has been added to total construction costs.
- An agency factor of 10 percent has been added to LRV acquisition costs.
- Structured parking facilities are assumed for the park-and-ride operations that have been identified for the Burien, Tukwila (Sounder commuter rail station), and North Renton LRT stations and are included in the cost estimates.
- Kiss-and-ride facilities are assumed at the five potential new LRT stations.

- The cost estimates do not include a maintenance and operations base; but they do include a factor of approximately \$1.5 million per vehicle to reflect maintenance and operations requirements for the potential level of rail service provided.
- The number of LRV vehicles is based on a preliminary operations plan which projected that 11 vehicles would be needed for the corridor.