

# Sound Transit

## High Capacity Transit Connections Feasibility Study



May 2005

Prepared for



Prepared by



with

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May 2005

To the reader:

With Sounder commuter rail in operation and providing connections at the Tukwila Station, and the coming of Link light rail service to Sea-Tac International Airport, a strong interest emerged from civic and business leaders to explore ways in which these two regional transit hubs might be better connected by transit. The Sound Transit Board responded to this interest by commissioning a study of potential high-capacity transit (HCT) service between SeaTac and Tukwila.

This study, called the *High Capacity Transit Connections Feasibility Study*, reviewed and evaluated possible routes and transit technologies -- including Bus Rapid Transit (BRT), streetcar, light rail, monorail and Personal Rapid Transit -- that could be used to connect to the other HCT services serving this area. To accomplish this, the study considered many quantitative and qualitative factors for comparison among alternatives. These factors included conceptual estimates of capital and operating costs, potential ridership, environmental constraints and community acceptance.

Through a Technical Advisory Committee, staff from the cities of SeaTac and Tukwila, and the Port of Seattle, assisted Sound Transit's Office of Policy and Planning and its consultant team with developing and selecting HCT connection alternatives, establishing evaluation criteria, reviewing analyses, and preparing findings and recommendations. Their insight and input were an integral part of the study. Sound Transit appreciates the time and expertise that these partner jurisdictions committed toward creating the final report.

The purpose, process, and major conclusions and recommendations of the study are summarized in the Executive Summary. Of the eight alternatives examined, the study concludes that two -- BRT, and a branch line from Central Link light rail -- have the most feasibility and deserve further consideration. Most members of the Technical Advisory Committee found that another light rail alternative -- a stand-alone rail line that connects Sea-Tac to Tukwila via a southern approach to their Link and Sounder stations -- also deserved further consideration. However, Sound Transit and some TAC members deemed this alternative too disruptive to the community and too indirect to accomplish the HCT connection goal, and therefore did not recommend carrying this alternative forward.

Sound Transit will use the results of the study to inform its planning for the next phase of HCT improvements (Sound Transit 2) which begins this summer after the adoption of an updated Regional Transit Long-Range Plan by the Sound Transit board.

This study also has a secondary goal. There may exist other areas within the region that experience a similar situation, i.e, two HCT services coming close to each other, but not so close that riders are able to make a convenient direct connection. Lessons learned from this study can serve as guidance for how to conduct future studies that address this issue.

Thank you for your interest in regional transit in south King County.

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|              |   |
|--------------|---|
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# **Sound Transit**

## **High Capacity Transit Connections Feasibility Study**

### **Executive Summary**

The High Capacity Transit (HCT) Connections Feasibility Study was initiated by Sound Transit to evaluate potential transit services connecting the Sounder Commuter Rail at Tukwila Station to the Central Link Light Rail Station at Sea-Tac International Airport. The study area was bounded on the east by the BNSF rail line (Sounder Commuter Rail at Tukwila Station), on the west by Highway 99 / International Boulevard (Link Light Rail Station at Sea-Tac International Airport), on the north by I-405 / SR 518, and on the south by 200<sup>th</sup> Street SE to allow connection to large development areas.

The study was managed by Sound Transit staff with a Technical Advisory Committee with representatives from the Port of Seattle, the City of SeaTac and the City of Tukwila.

To evaluate the feasibility of the hundreds of transit connector technologies, the Technology Advisory Committee to the study directed the consultants to aggregate candidate technologies into five groups as follows:

- Bus / Bus Rapid Transit (BRT)
- Streetcar / Light Rail Transit (LRT)
- Monorail and Skytrain Systems
- Personal Rapid Transit (PRT) and Automated Guideway Transit (AGT)
- Suspended and Cable Systems

Through a series of workshops, Sound Transit staff, the Technology Advisory Committee, consultants and other local participants reviewed potential alignments for each of the five technology groups. The alignment alternatives were based on the local knowledge of topography, existing and future land use development, environmental constraints, and potential community impacts.

The initial results of these workshops were developed into about twelve alternatives by the consultants and Sound Transit staff. Preliminary alignments, profiles, and rights-of-way were developed. Potential station locations were proposed and reviewed. The alternatives were eventually narrowed down to eight specific routes and technologies for screening evaluation. The eight alternatives are shown on the following table along with the summary conclusions and the recommendations for next steps.

## Conclusions and Recommendations for Alternatives Considered

| <u>Alternative</u>  | <u>Conclusions</u>  | <u>Recommendations</u>  |
|---|---|---|
| <b>Alternative 1:</b><br>BRT – SR 518 Route   | <b><u>Feasible</u></b> <ul style="list-style-type: none"> <li>• Low Cost</li> <li>• Good early implementation project</li> </ul>  | Explore ST Express Route 560 serving Tukwila, including supporting capital improvements.  |
| <b>Alternative 2:</b><br>At-grade Trolley – S. 188 <sup>th</sup> St. Route                        | <b><u>Not Preferable</u></b> <ul style="list-style-type: none"> <li>• Undesirable community impacts</li> <li>• Low ridership</li> </ul>   | Do not consider further.  |
| <b>Alternative 3:</b><br>LRT – Southcenter Boulevard Route  | <b><u>Feasible</u></b> <ul style="list-style-type: none"> <li>• Good ridership potential</li> <li>• Consistent with long-range plans / technology</li> </ul>  | Study rail extension from Central Link serving Tukwila and adjacent communities with ST planning work.  |
| <b>Alternative 4/4A:</b><br>LRT – S. 200 <sup>th</sup> Street Route                               | <b><u>May be Feasible</u></b> <ul style="list-style-type: none"> <li>• Good ridership potential</li> <li>• Undesirable community impacts</li> <li>• Higher costs (4A)</li> </ul>                            | Do not consider further.  |
| <b>Alternative 5:</b><br>Elevated (Monorail) – SR 518 Route                                       | <b><u>Not Preferable</u></b> <ul style="list-style-type: none"> <li>• Higher costs compared to similar alternative</li> <li>• Inconsistent with current plans / technology</li> </ul>                       | Do not consider further.  |
| <b>Alternative 6:</b><br><b>Elevated (Aerobus) – S. 188<sup>th</sup> Street Route</b>             | <b><u>Not Preferable</u></b> <ul style="list-style-type: none"> <li>• Higher costs</li> <li>• Inconsistent with current plans / technology</li> <li>• Undesirable community impacts</li> </ul>              | Do not consider further.  |
| <b>Alternative 7:</b><br><b>PRT – SR 518 / S. 200<sup>th</sup> Street Loop</b>                    | <b><u>Not Feasible at this time</u></b> <ul style="list-style-type: none"> <li>• High ridership potential</li> <li>• Unproven technology</li> <li>• Uncertainties about actual costs / ridership</li> </ul> | Ridership potential and operations warrant further analysis (beyond the scope of this study).<br><br>Monitor new information and studies developed by others regarding this technology. |
| <b>Alternative 8/8A:</b><br><b>PRT – S. 188<sup>th</sup> St. / 200<sup>th</sup> St. Extension</b> | <b><u>Not Feasible at this time</u></b> <ul style="list-style-type: none"> <li>• High ridership potential</li> <li>• Unproven technology</li> <li>• Uncertainties about actual costs / ridership</li> </ul> |   |



## *Summary and Recommendations*

### **Sound Transit Phase 2 Planning Study Alternatives**

It is recommended that the following alternatives be considered for further evaluations in the planning for Sound Transit's next phase of projects (Sound Transit 2):



BRT – SR 518 Route



LRT - Southcenter Boulevard Route

# **Sound Transit**

## **High Capacity Transit Connections Feasibility Study**

### **Final Report**

#### **1. INTRODUCTION**

The High Capacity Transit (HCT) Connections Feasibility Study was initiated by Sound Transit to evaluate potential transit services connecting the Sounder Commuter Rail at Tukwila Station to a future Link Light Rail Station at Sea-Tac International Airport. The primary objective of the project is to develop a process or framework to evaluate collection/distribution/feeder services to existing and proposed HCT corridors.

The study has been managed by Sound Transit staff. A Technical Advisory Committee (TAC) was formed with representatives from the Port of Seattle, the City of SeaTac and the City of Tukwila, meeting about every 60 days. Other representatives of commissions and developers provided advice at the TAC meetings. A series of workshops were also undertaken to receive input from other community members.

Key components of the HCT Connections alternatives are

- the connector technology,
- the route alignments,
- the station locations, and
- the adjacent land uses.

Depending on the route selected for the connecting services, there may be significant opportunities for other intermediate stations where higher density land uses exist or are planned which will significantly contribute to ridership.

The study area was considered to be generally bounded on the east by the Sounder Commuter Rail at Tukwila Station on the BNSF rail line, on the west by the future Link Light Rail Station at Sea-Tac International Airport near International Boulevard, on the north by I-405 / SR 518, and on the south by 200<sup>th</sup> Street SE.

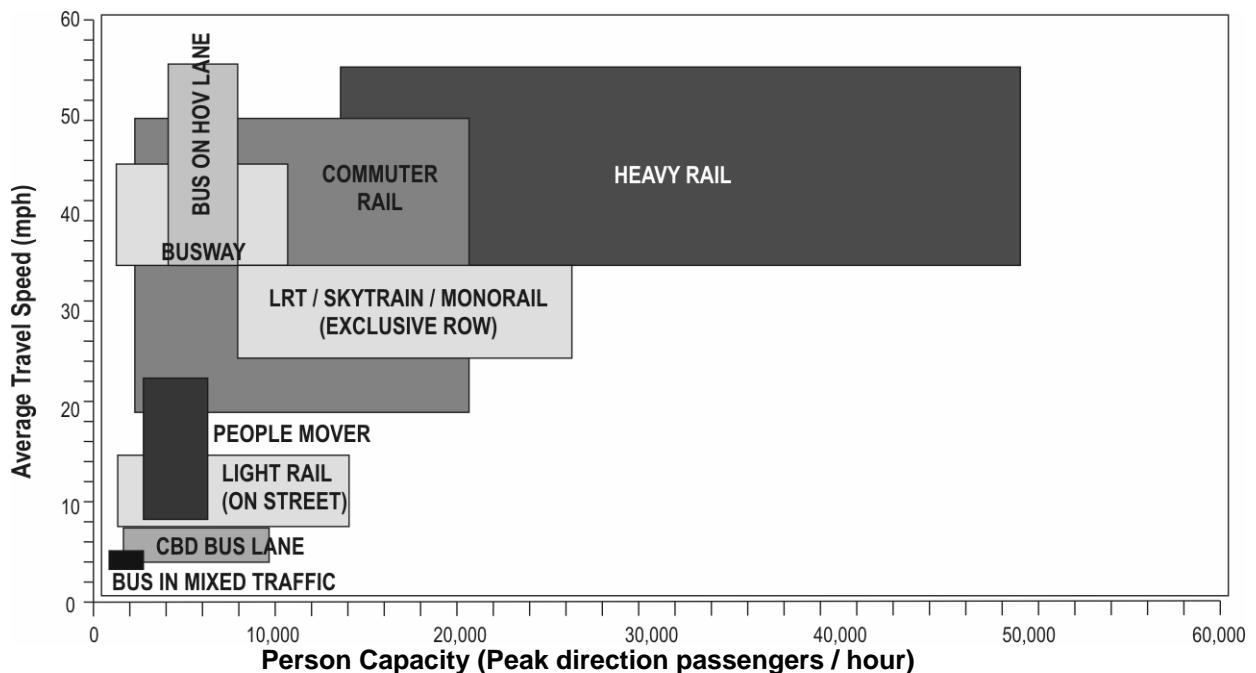
This report represents the work done under the study program wherein conceptual alignments and technology alternatives have been identified and evaluated. Recommendations are made for alternatives that are found to be currently feasible to be studied in more detail.

## 2. HCT CONNECTION ALTERNATIVES

### 2.1 Technology Alternatives

The feasibility of any high capacity transit connection will be a function of the transit technology used. There are several hundred transit technologies available including systems that are proven and operated in many locations and systems that are in planning or test-model stages.

The passenger capacity of the various systems can range from 200 passengers per hour per direction (PPHPD) for conventional buses operating on high headways (a bus every 20 to 30 minutes) to nearly 50,000 PPHPD for heavy rail subway systems operating at low headway (trains every 30 to 60 seconds). The range of capacities to move passengers of these technologies is illustrated in the following chart.



Source: TCRP Report 100 2<sup>nd</sup> Edition Transit Capacity and Quality of Service Manual TRB 2003

Each technology also has different characteristics of speed, station spacing, ability to climb grades and capital and operating costs. To evaluate the feasibility of the hundreds of technologies, the Technology Advisory Committee to the study directed the consultants to aggregate candidate technologies into five groups as follows:



### a) Bus / Bus Rapid Transit (BRT) Systems

A conventional diesel bus is about 40 feet long and can carry up to 60 passengers. It usually operates on city streets in mixed traffic with a headway (time between buses) of 3 to 30 minutes and therefore has a capacity of about 200 to 1200 passengers per hour per direction (PPHPD). BRT uses higher capacity diesel or diesel/electric buses on separate lanes or guideways. The Irisbus CIVIS is one example of the new technology. An articulated CIVIS bus can carry 90 passengers while a double articulated CIVIS bus is rated at 150 passengers. At headways as low as 3 minutes, the CIVIS BRT can achieve capacities of 1,000 to 3,000 PPHPD. Buses and BRT are operated by drivers at speeds usually ranging between 15 to 50 mph and can climb grades of 15%.



Irisbus CIVIS

### b) Streetcar / Light Rail Transit (LRT) Systems

Streetcars and LRT operate on steel rails, typically at-grade. Streetcars typically operate on streets in lanes open to other types of traffic and signalize to regulate traffic signal controls. The Skoda Astro, operated in Portland and Tacoma, is one example of current streetcar technology. The vehicle can carry 150 passengers at headways typically of about 6 minutes for a capacity of about 1,500 PPHPD. Streetcars are operated by drivers at speeds of 15 to 30 mph and can climb grades of about 10%. LRT vehicles frequently operate along surface streets but usually on separate rights-of-way with transit signal priority. LRT can also operate on grade-separated alignments such as tunnels and aerial structures. The Siemens S70 vehicle operated by Portland Max and the San Diego Trolley is one example of current LRT technology. The vehicles carry up to 180 passengers and typically operate in trains of 3 vehicles at headways as low as 3 minutes for a capacity of over 10,000 PPHPD. Stations are typically spaced about one mile apart. The trains are operated by drivers at speeds of 40 to 60 mph and can climb grades of about 10%.



Tacoma Link (Skoda Astro)

### c) Monorail and Skytrain System

Monorail and Skytrain operate on separate guideway rails or beams above grade, below grade, or on exclusive rights-of-way and are not impeded by vehicular or pedestrian cross traffic. They are typically controlled by computers, not human drivers, and can achieve very low headways. Stations are grade separated and are preferably spaced about one mile apart.

The Hitachi Monorail, operated in several cities in Japan and one of the finalists for the Seattle Monorail, is an example of current monorail technology. With about 100 passengers per vehicle, 4 vehicles per train and headways as low as 2 minutes, it can achieve a capacity of over 12,000 PPHPD.



Vancouver Skytrain (Bombardier Mark II)

The Bombardier Mark II operated in Vancouver, British Columbia, is an example of Skytrain technology. With about 130 passengers per vehicle, 4 vehicles per train and headways of 90 seconds, it can achieve a capacity of over 20,000 PPHPD. Monorail and Skytrain systems can climb grades of up to 6 percent.

### d) Personal Rapid Transit (PRT) / Automated Guideway Transit (AGT)

PRT and AGT systems are similar to monorails as they typically operate on separate guideway rails or beams above grade, below grade or on exclusive rights-of-way, and are not impeded by vehicular or pedestrian traffic. They are also computer controlled and can achieve very low headways.

The PRT vehicles are small personalized units where passengers can select their final destination on a keypad and the vehicle will be automatically guided to that destination. Vehicles are automatically switched to an “off-line” station which allows stations to be closely spaced without interfering with mainline capacity.



Skyweb Express System by Taxi 2000

The Skyweb Express System by Taxi 2000 is an example of the current technology. Although there is no operating example of Skyweb Express, it is estimated that up to

6,000 vehicles per hour can be accommodated on a mainline with up to 3 passengers per vehicle for a maximum capacity of 18,000.

The AGT vehicles tend to be larger vehicles. The Urbanaut is an example of the current technology with a capacity of up to 54 passengers per vehicle. It can be configured in a variety of vehicles, mainline networks (including “off line” stations), system speeds and propulsion systems. With this variety, the estimated capacity of the Urbanaut is 3,000 to 20,000 PPHPD. PRT/AGT Systems can climb grades of up to 10 percent.



Urbanaut

#### **e) Suspended / Cable Systems**

Suspended and cable systems are similar to monorail and AGT systems in that they are elevated and therefore not impeded by other vehicle or pedestrian traffic. Cable systems, such as “gondolas” are frequently found in ski resorts and other recreational areas but have some examples in urban areas. Other suspended systems such Aerobus, which has been operated in Mannheim, Germany and Ste. Anne, Quebec, is an example of a system suspended from elevated aluminum tracks attached to cables with greater urban applications. The cables can be suspended from slender steel pylons spaced up to 2,000 feet apart. Similar to the PRT systems, the Aerobus vehicles can be switched “offline” to dock in a station. While existing cable systems at ski resorts operate at about 1,600 PPHPD, it is estimated that suspended systems such as Aerobus can have a capacity as high as 20,000 PPHPD. Unlike the cable systems found in ski resorts which can climb grades of up to 25% but are limited to cable lengths of under 3 miles, the Aerobus system is limited to grades of 8 %, and have been considered for systems as long as 17 miles. Unlike the monorail and AGT, the standard spans of the pylons can be up to 750 feet instead of every 90 to 100 feet. Spans of up 2000 to 3000 feet are believed possible in special cases, however, there would be an impact on frequency. The Aerobus system has considerably less of a footprint and therefore less of an impact on the ground than other elevated systems, PRT and light rail in street dedicated right-of-way included.



Aerobus

## **2.2 Route Alternatives and Station Locations**

In a series of workshops, staff, consultants and local participants reviewed potential alignments for each of the five technology groups. The alignment alternatives were based on the local knowledge of topography, existing and future land use development, environmental constraints, and potential community impacts.

The initial results of these workshops were developed into about twelve alternatives by the consultants and Sound Transit staff. Preliminary alignments, profiles, and rights-of-way were developed. Potential station locations were proposed and reviewed.

Through several subsequent meetings of the TAC, these alternatives were narrowed down to eight specific routes and technologies for the first level of screening. The eight alternatives are as follows:

### **Alternative 1: Bus Rapid Transit (BRT) Connector – SR 518 Route**

In this alternative (*Figure 1*), express buses depart from the Sounder Commuter Rail at Tukwila Station and follow Strander Boulevard to Southcenter Parkway, access SR 518 via Klickitat Drive, exit SR 518 at International Boulevard and head south to the future Link Light Rail Station at Sea-Tac International Airport. Because there is no reasonable alternative for turn-around, the BRT route would continue south to a turn-around terminal at S. 188<sup>th</sup> Street. The entire route is approximately 6.3 miles.

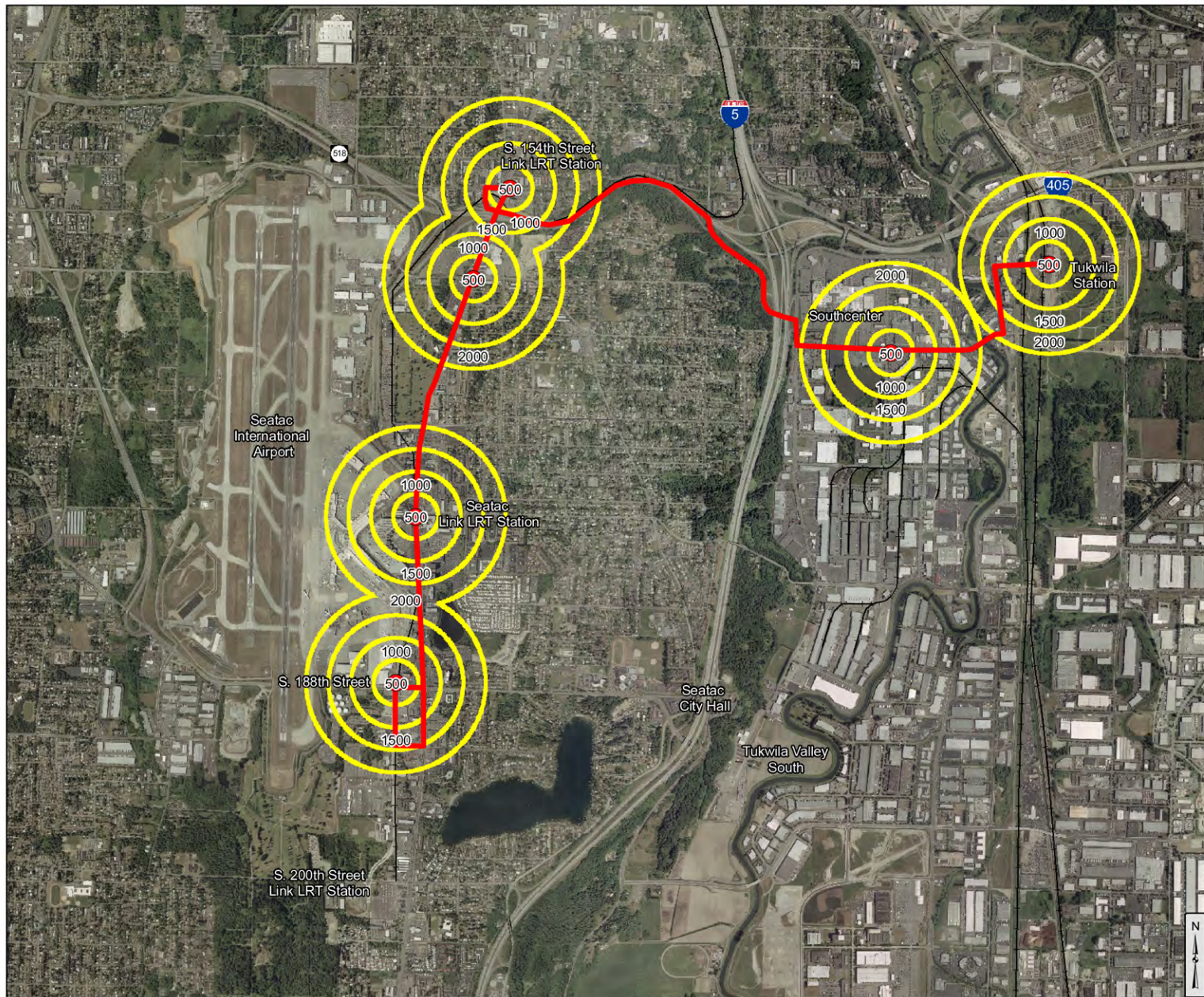
The express buses would only make four stops in addition to the defined ends at Tukwila Station and Sea-Tac International Airport; those being at Southcenter Mall, the proposed Link Light Rail station at S. 154<sup>th</sup> Street, a rental car station at S. 160<sup>th</sup> Street and at the S. 188<sup>th</sup> Street turn-around.

### **Alternative 2: At-Grade Trolley Connector - S. 188<sup>th</sup> Street Route**

In this alternative (*Figure 2*), trolley cars on rail depart from the Sounder Commuter Rail at Tukwila Station and follow Strander Boulevard to West Andover Parkway, head south through the Southcenter industrial area to S. 180<sup>th</sup> and through the Segale lands to S. 200<sup>th</sup> Street, follow the alignment of Orillia Road across I-5 to S. 188<sup>th</sup> Street and then north on International Boulevard to the future Link Light Rail Station at Sea-Tac International Airport. The entire route is approximately 6.4 miles.

The trolleys would make ten stops in addition to the defined ends at Tukwila Station and Sea-Tac International Airport; most notably being at Southcenter Mall, the Segale development area, SeaTac City Hall, and S. 188<sup>th</sup> Street.





Legend

- Proposed Routes
- Transit Stations



Walking Distance to Transit Station

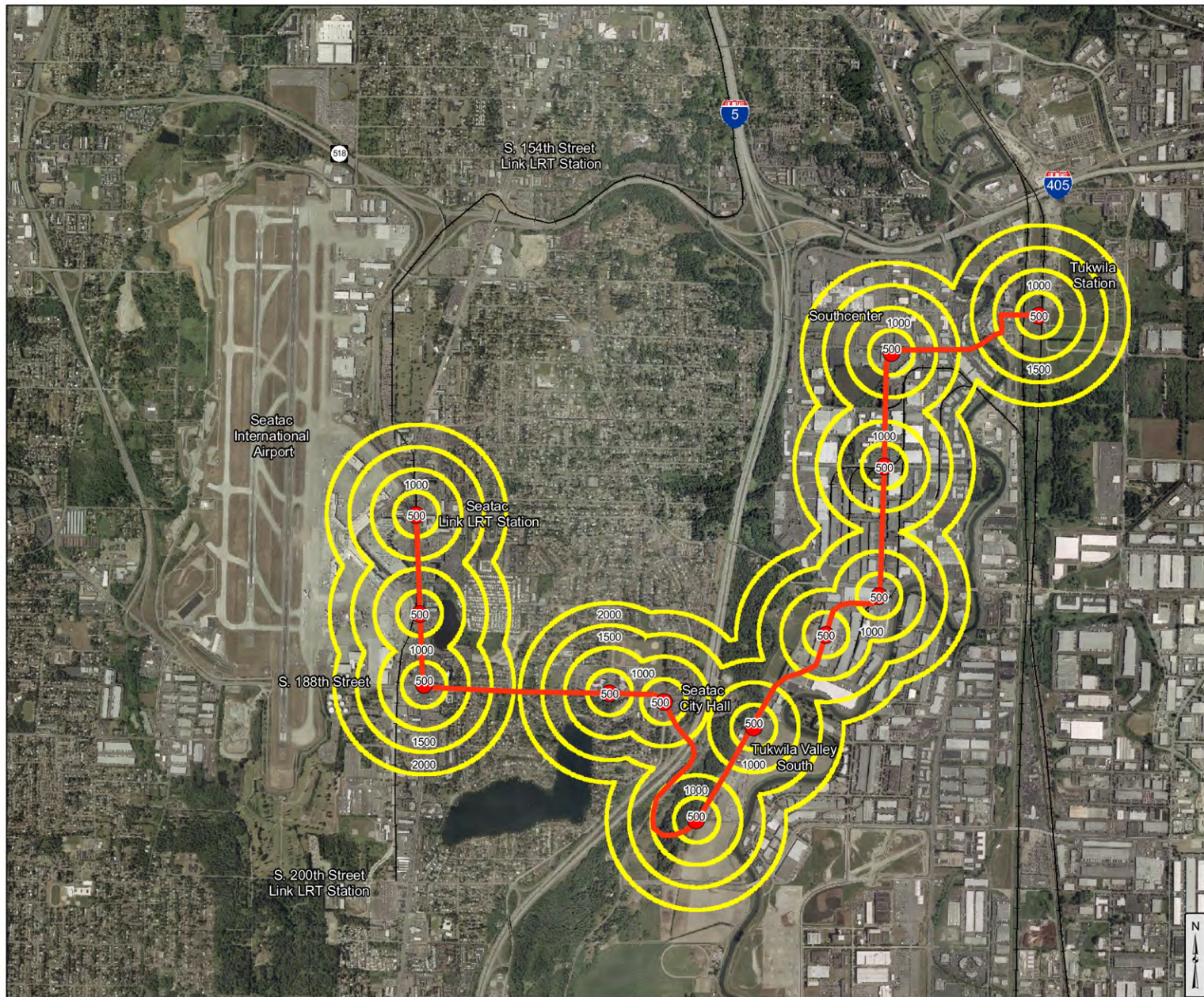


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HCT Connections Feasibility Study  
Alternative 1 - Bus Rapid Transit  
(BRT) SR 518 Route

Figure 1





Legend

- Proposed Routes
- Transit Stations



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HCT Connections Feasibility Study

Alternative 2 - At-grade Trolley

S. 188th Street Route

Figure 2



### **Alternative 3: Light Rail Transit (LRT) – Southcenter Blvd. Route**

In this alternative (*Figure 3*), light rail vehicles depart from the Sounder Commuter Rail at Tukwila Station and cross the Green River on a new bridge to Baker Street, head north through Southcenter Mall to I-405 and cross I-5 to connect with the proposed Central Link Light Rail line from Seattle to Sea-Tac International Airport. It is assumed that the connector LRT would operate on the same Link LRT tracks to the airport. Therefore, while the newly built route would only be about 1.5 miles in length, the LRT vehicles would actually operate over about 4 miles all the way to Sea-Tac International Airport.

The route would make two additional stops to the defined ends at Tukwila Station and Sea-Tac International Airport; those being a new station at Southcenter Mall, and the currently proposed Central Link LRT station at S. 154<sup>th</sup> Street.

### **Alternative 4/4A: Light Rail Transit (LRT) – S. 200<sup>th</sup> Street Route**

In this alternative (*Figure 4*), light rail vehicles depart from the Sounder Commuter Rail at Tukwila Station and cross the Green River to Baker Street, head south through the Southcenter industrial area via existing rail rights of way to the Segale lands and S. 200<sup>th</sup> Street, follow a new alignment across I-5 to S. 200<sup>th</sup> Street in SeaTac and west to International Boulevard where it would link into the long-term potential Link Light Rail at the S. 200<sup>th</sup> Street Station. The newly built route is about 4.6 miles in length. Therefore, while the newly built route would only be about 4.6 miles in length, the LRT vehicles would actually operate over about 6.3 miles all the way to Sea-Tac International Airport.

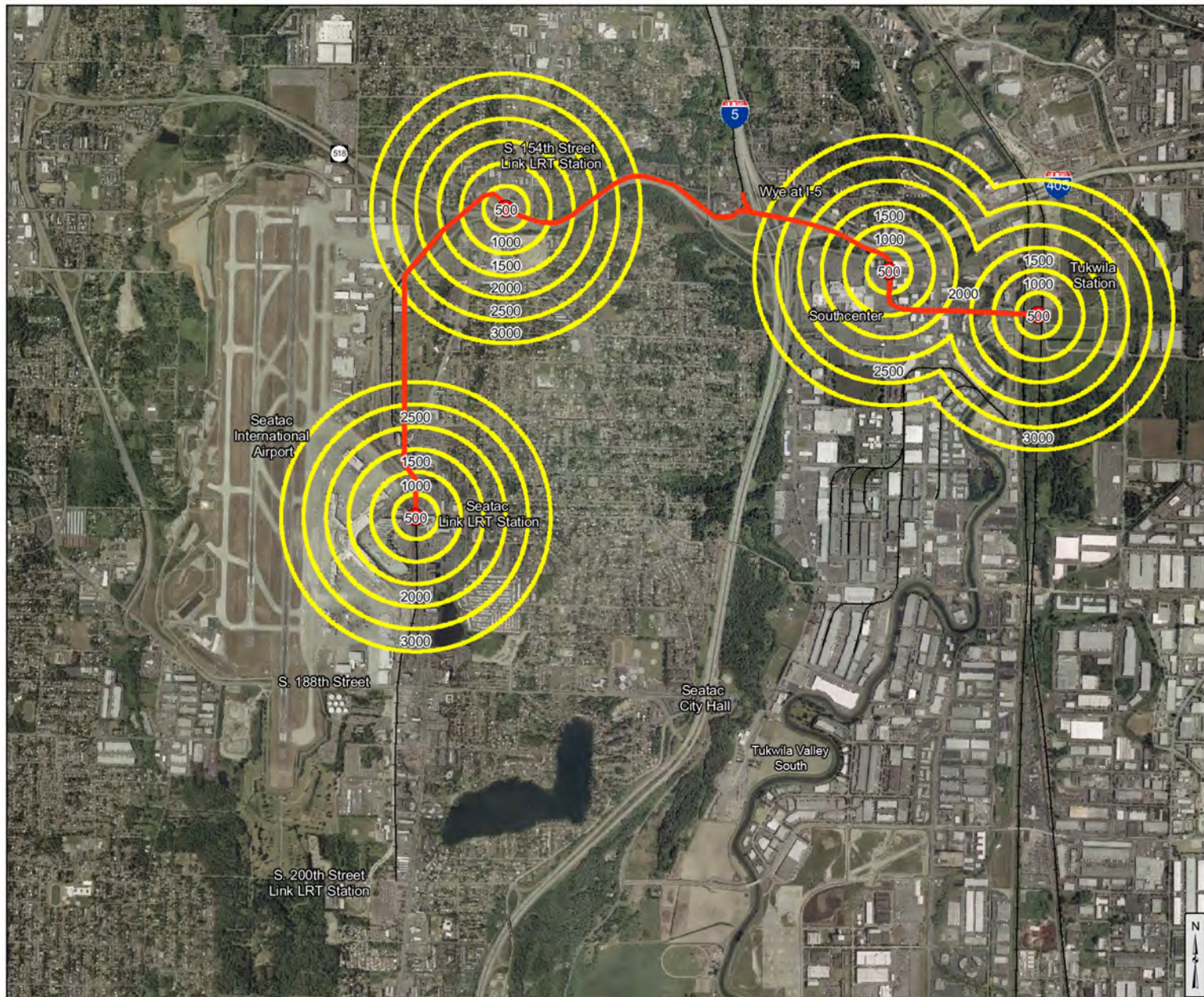
As a sub-alternative (Alternative 4A) the section north to Sea-Tac International Airport is considered to be part of the project, and the capital and other costs would reflect the full 6.3 miles in length.

The route would make five additional stops to the defined ends at Tukwila Station and Sea-Tac International Airport including locations near Southcenter Mall, in south Tukwila, and at S. 200<sup>th</sup> Street.

### **Alternative 5: Elevated (Monorail) – SR 518 Route.**

In this alternative (*Figure 5*), an elevated monorail would depart from the Sounder Commuter Rail at Tukwila Station and follow Strander Boulevard to I-5, parallel Klickitat Drive and SR 518, to International Boulevard and then head south to the future Link Light Rail Station at Sea-Tac International Airport. The entire route is approximately 4.2 miles and is very similar to the BRT route.

The monorail would only make two stops in addition to the defined ends at Tukwila Station and Sea-Tac International Airport; those being at Southcenter Mall, and at the proposed S. 154<sup>th</sup> Street Link Light Rail Station.



Legend

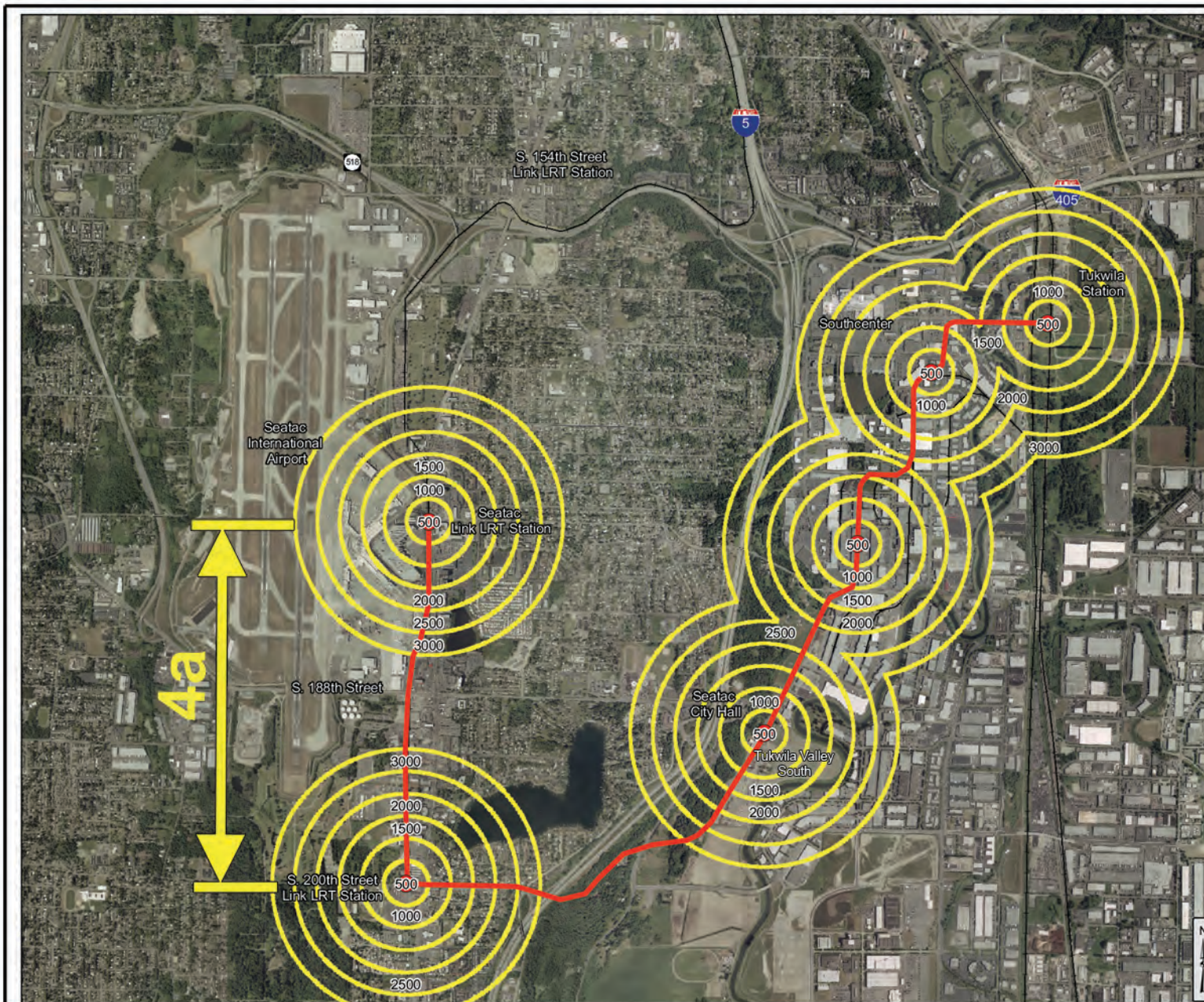
- Proposed Routes
- Transit Stations



HCT Connections Feasibility Study  
Alternative 3 - Light Rail Transit  
(LRT) Southcenter Boulevard Route

Figure 3





### Legend

- Proposed Routes
- Transit Stations



Walking Distance  
to Transit Station



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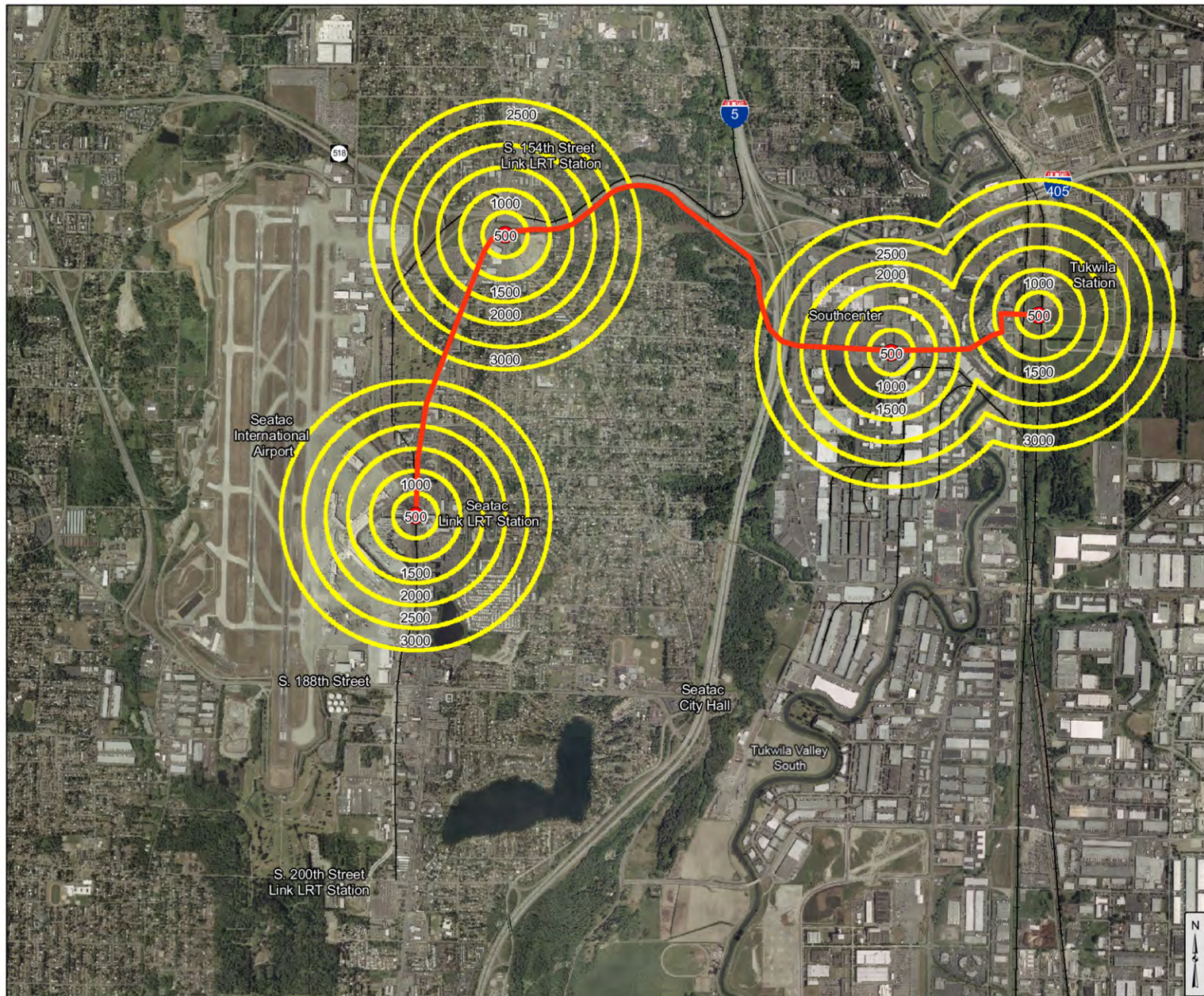
HCT Connections Feasibility Study

Alternative 4 - Light Rail Transit

(LRT) S. 200th Street Route

Figure 4





Legend

- Proposed Routes
- Transit Stations



HCT Connections Feasibility Study  
Alternative 5 - Elevated (Monorail)  
SR 518 Route

Figure 5



### **Alternative 6: Elevated (Aerobus) – S. 188<sup>th</sup> Street Route.**

In this alternative (*Figure 6*), an elevated cable system would depart from the Sounder Commuter Rail at Tukwila Station and follow Strander Boulevard to West Andover Parkway, head south through the south Tukwila industrial area to S. 180<sup>th</sup> and through the Segale lands to about S. 200<sup>th</sup> Street, follow the alignment of Orillia Road across I-5 to S. 188<sup>th</sup> Street and then north on International Boulevard to the future Link Light Rail Station at Sea-Tac International Airport. The entire route is approximately 6.4 miles and is very similar to the Trolley route.

However, the elevated Aerobus cars would make only six additional stops to the defined ends at Tukwila Station and Sea-Tac International Airport, most notably being at Southcenter Mall, the Segale development area, SeaTac City Hall, and S. 188<sup>th</sup> Street.

### **Alternative 7: Personal Rapid Transit (PRT) – SR 518 / S. 200<sup>th</sup> Loop**

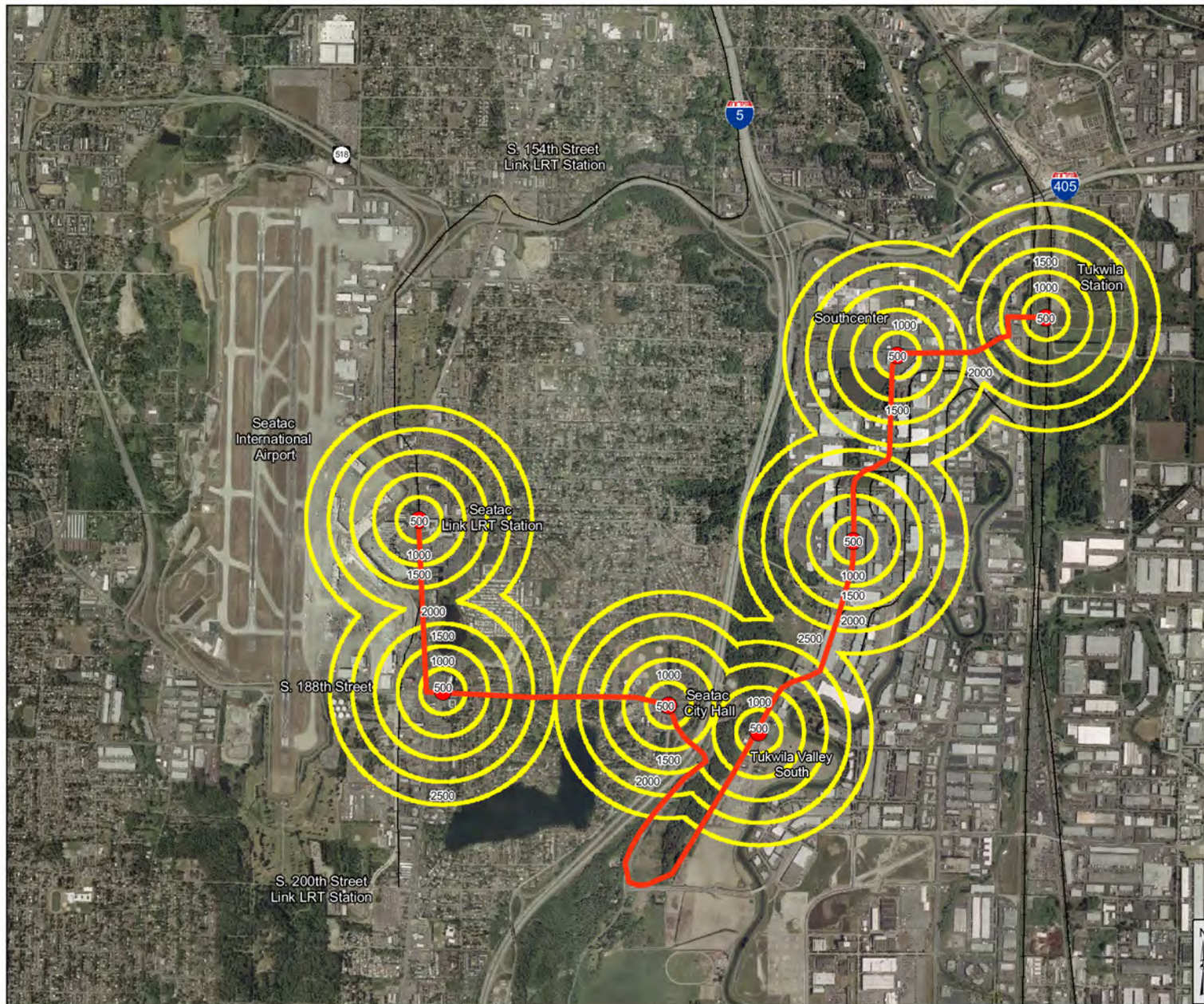
In this alternative (*Figure 7*), PRT vehicles on elevated structures would depart from the Sounder Commuter Rail at Tukwila Station and cross the Green River to Baker Street, head south through the south Tukwila industrial/warehouse area, turn west following a new alignment across I-5 to S. 200<sup>th</sup> Street in SeaTac and west to International Boulevard, turn north on International Boulevard past the Sea-Tac International Airport to SR 518, east along SR 518 and Klickitat to Strander Boulevard where it links into the initial part of the loop. The route is about 9.8 miles in length.

Because of the nature of the PRT system, it would make twenty-three additional stops to the defined ends at Tukwila Station and Sea-Tac International Airport; most notably being several near Southcenter Mall, the south Tukwila area, the future Link Light Rail Station at S. 200<sup>th</sup> Street and across SR 518 from the Link Light Rail Station at S. 154<sup>th</sup> Street.

### **Alternative 8/8A: PRT – S. 188<sup>th</sup> Street Route & S. 200<sup>th</sup> Route**

In this alternative (*Figure 8*), PRT vehicles on elevated structures would depart from the Sounder Commuter Rail at Tukwila Station and follow Strander Boulevard to West Andover Parkway, head south through the Tukwila industrial/warehouse area to S. 180<sup>th</sup>, then follow the alignment of Orillia Road across I-5 to S. 188<sup>th</sup> Street and then north on International Boulevard to the future Link Light Rail Station at Sea-Tac International Airport. The entire route is approximately 5.9 miles and is very similar to the Trolley and Aerobus routes.

A further extension (Alternative 8A) could be built south from S. 188<sup>th</sup> Street to the future Link Light Rail Station at S. 200<sup>th</sup> Street. This PRT system would make twenty additional stops to the defined ends at Tukwila Station and Sea-Tac International Airport; most notably being at Southcenter Mall, the south Tukwila area, SeaTac City Hall, S. 188<sup>th</sup> Street and S. 200<sup>th</sup> Street.



Legend

- Proposed Routes
- Transit Stations



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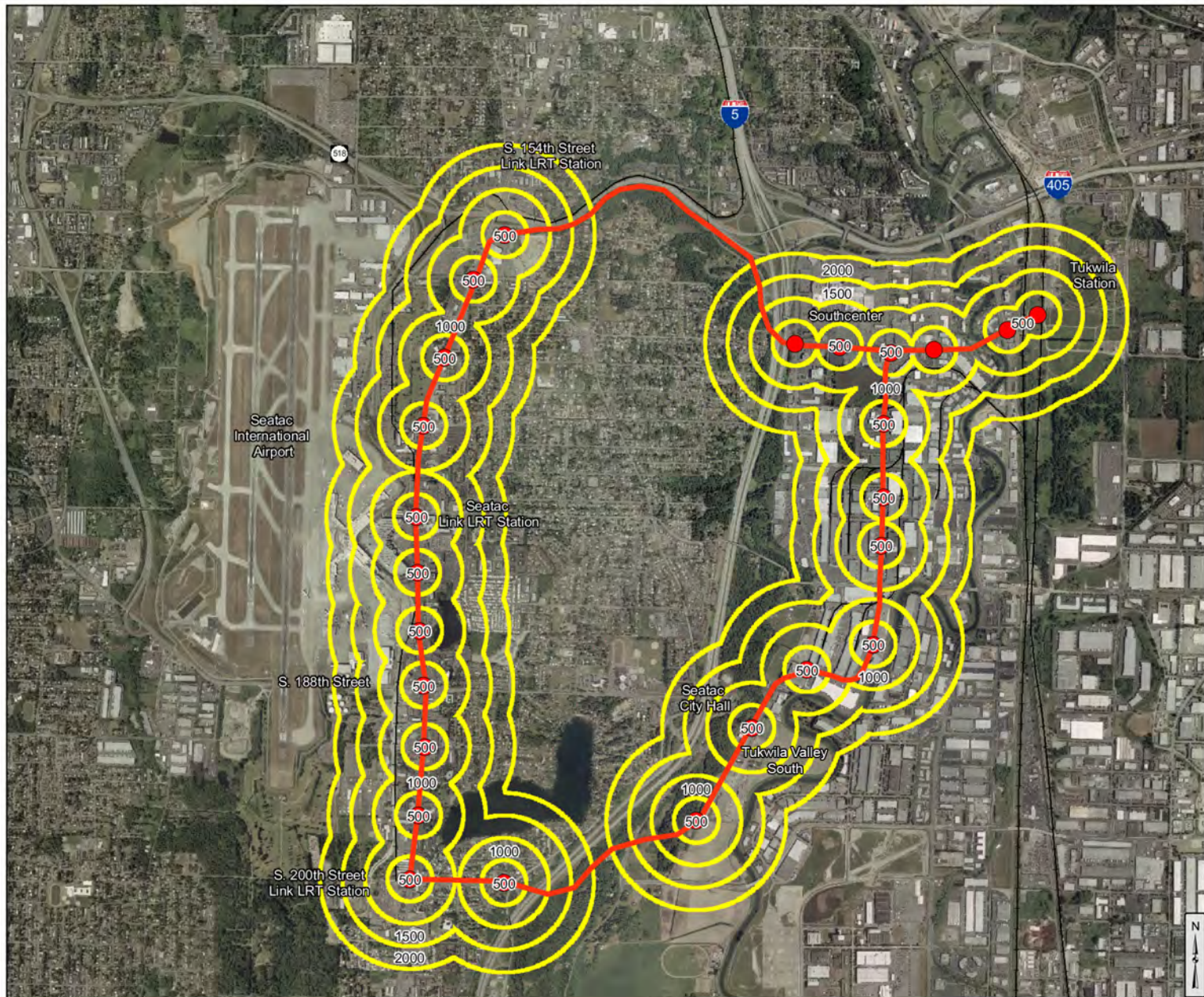
HCT Connections Feasibility Study

Alternative 6 - Elevated (Aerobus)

S. 188th Street Route

Figure 6





Legend

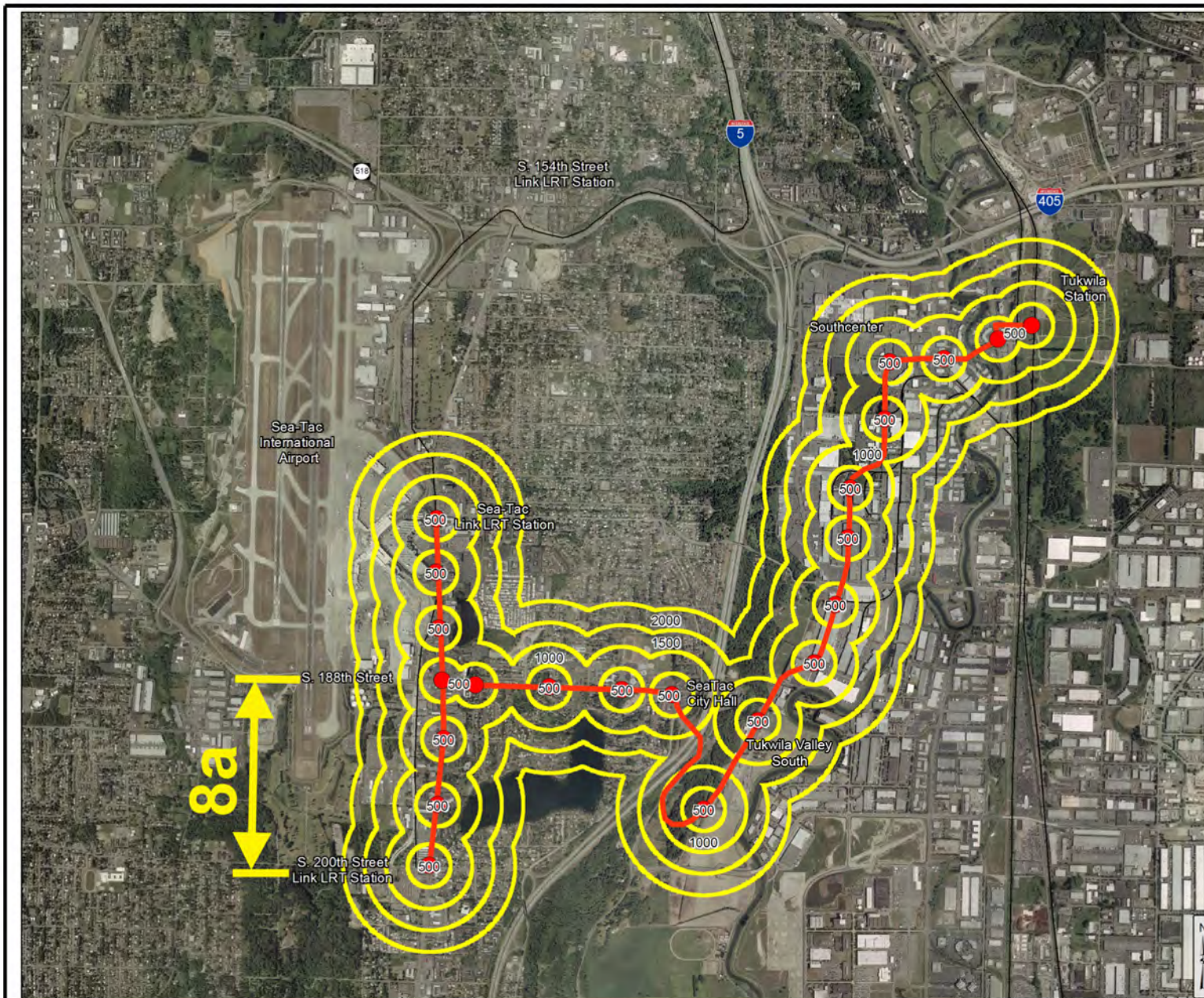
- Proposed Routes
- Transit Stations



HCT Connections Feasibility Study  
Alternative 7 - Personal Rapid Transit  
(PRT) SR 518 / S. 200th Street Loop

Figure 7





Legend

- Proposed Routes
- Transit Stations



HCT Connections Feasibility Study  
 Alternative 8-Personal Rapid Transit  
 (PRT) S.188th Street Route

Figure 8

### 3. SCREENING CRITERIA

Criteria for evaluating each alignment were developed by the consultants and Sound Transit staff and approved by the TAC. Following concurrence on the evaluation criteria, each one of the alignments was evaluated using the screening criteria shown in **Table 1**.

**Table 1 - Screening Criteria**

|   |   |
|---|---|
| <b>1. Capital Costs</b>                       | <ul style="list-style-type: none"> <li>• Right-of-way</li> <li>• Guideway construction</li> <li>• Stations</li> <li>• Vehicles</li> </ul>   |
| <b>2. Construction Feasibility</b>            | <ul style="list-style-type: none"> <li>• Grades</li> <li>• Slope stability</li> <li>• Soils</li> </ul>  |
| <b>3. Operating Costs</b>                     | <ul style="list-style-type: none"> <li>• Drivers</li> <li>• Vehicle O &amp; M</li> <li>• Track/Station O &amp; M</li> <li>• Other operating costs</li> </ul>  |
| <b>4. Ridership Potential</b>                 | <ul style="list-style-type: none"> <li>• Tukwila Station to Sea-Tac Airport connections</li> <li>• Existing local land-use commuter ridership</li> <li>• Future local land-use commuter ridership</li> <li>• Other existing / future ridership / air travelers</li> </ul>   |
| <b>5. Environmental / Community Impact</b>    | <ul style="list-style-type: none"> <li>• Compatibility with Land Use Plans</li> <li>• Residential impacts (noise / visual)</li> <li>• Commercial impacts (business)</li> <li>• Traffic / access impacts</li> <li>• Parks / wetlands</li> <li>• Safety and Security</li> </ul>   |
| <b>6. Financial Feasibility</b>               | <ul style="list-style-type: none"> <li>• Federal Funding (eg. FTA New Starts) opportunity</li> <li>• Public-Private partnerships / Local Improvement Districts (LID) / Tax Increment Financing (TIF)</li> <li>• Other user fees / taxes (eg. hotel, sales, parking taxes)</li> <li>• Comparative Costs per Passenger</li> </ul> |
| <b>7. Community Endorsement or Acceptance</b> | <ul style="list-style-type: none"> <li>• City Councils / Port Commissioners</li> <li>• Neighborhood associations</li> <li>• Chambers / EDC / Business Associations</li> </ul>   |
| <b>8. Expandability</b>                       | <ul style="list-style-type: none"> <li>• Compatibility with Adopted Regional Networks (eg. Sound Transit)</li> <li>• Compatibility with Draft Regional Networks (eg. Sound Transit Phase 2)</li> <li>• Compatibility with other regional concepts (eg. Freeway Monorail)</li> <li>• Expanding local delivery systems</li> </ul> |

The following chapters describe each criteria, the criteria measurement or evaluation methodology, and how each alternative fared when evaluated by the criteria.











#### 4. CRITERIA 1 - CAPITAL COSTS






Preliminary cost estimates were prepared for the eight different alternatives connecting the SeaTac Link LRT Station with Tukwila Station. For each alternative, route profiles were developed to determine vertical grades and structural requirements.

*It should be noted that the costs shown here are for comparative purposes only and are for screening evaluations; they should not be considered full-level cost-estimates for construction purposes.*

The costs are summarized on **Table 2** followed by a brief explanation of the cost highlights of each alignment.

**Table 2: Capital Cost Estimates**

| Alignment  | Length    | Cost  |
|--|-----------|---|
| <b>Alternative 1:<br/>BRT – SR 518 Route</b>                                 | 6.3 miles |    |
| <b>Alternative 2:<br/>At-grade Trolley – S. 188<sup>th</sup> Route</b>       | 6.4 miles |    |
| <b>Alternative 3:<br/>LRT – Southcenter Boulevard Route</b>                  | 1.5 miles |    |
| <b>Alternative 4:<br/>LRT – S. 200<sup>th</sup> Street</b>                   | 4.6 miles |  |
| <b>Alternative 4A:<br/>LRT – S. 200<sup>th</sup> To SeaTac</b>               | 6.3 miles |   |
| <b>Alternative 5:<br/>Elevated (Monorail) – SR 518 Route</b>                 | 4.2 miles |  |
| <b>Alternative 6:<br/>Elevated (Aerobus) – S. 188<sup>th</sup> St. Route</b> | 6.4 miles |  |
| <b>Alternative 7:<br/>PRT – SR 518 / S. 200<sup>th</sup> Street Loop</b>     | 9.8 miles |  |
| <b>Alternative 8:<br/>PRT – S. 188<sup>th</sup> Street Route</b>             | 5.9 miles |  |
| <b>Alternative 8A:<br/>PRT – S. 188<sup>th</sup> to S. 200<sup>th</sup></b>  | 6.8 miles |   |

|               | Higher-range  |   | Mid-range   |   | Lower-range   |
|---------------|---|---|---|---|---|
| <b>Legend</b> |  |  |  |  |  |
|               | > \$200M  | \$150-200M  | \$100-150M  | \$50-100M   | < \$50M   |

##### **Alternative 1: BRT – SR 518 Route**

The entire alignment would operate on existing roads in existing rights of way and therefore minimal new infrastructure is required, other than new station construction. A

capital cost allowance has been made for Transportation Systems Management (TSM) improvements to ensure rapid movement of the buses through the corridor.

**Alternative 2: At-Grade Trolley – S. 188<sup>th</sup> Route**

The majority of this alignment operates in-street and rail track installation accounts for the greatest proportion of costs. Approximately half of the route would require additional right-of-way.

**Alternative 3: LRT – Southcenter Boulevard Route**

The costs for this route are only for the segment between Tukwila Station and the planned Link Light Rail line west of I-5. More than half of the new route is elevated and above I-405 and I-5 right-of-way. Between the Southcenter Station and Tukwila Station, the route operates at grade in either shared or new right-of-way. Two new stations are required.

**Alternative 4/4A: LRT – S. 200<sup>th</sup> Street Route**

Cost estimates for two alignment options were developed. The LRT – S. 200<sup>th</sup> Street Route (Alternative 4) includes only the costs for new track between Tukwila Station and the proposed Link LRT Station at S. 200<sup>th</sup> Street. Alternative 4A includes the costs of extending the route from S. 200<sup>th</sup> Street to the Link LRT Station at Sea-Tac International Airport. Over one third of this route is elevated and most of the route requires new right-of-way.

**Alternative 5: Elevated (Monorail) – SR 518 Route**

The majority of capital costs are due to guideway infrastructure. Approximately 18,000 linear feet of right-of-way are also required.

**Alternative 6: Elevated (Aerobus) – S. 188<sup>th</sup> Street Route**

Guideway costs account for almost three quarters of the total estimated costs. Approximately 34,000 linear feet of new right-of-way are required.

**Alternative 7: PRT – SR 518 / S. 200<sup>th</sup> Street Loop**

This large loop is the longest of all the alternatives studied. Guideway costs account for almost three quarters of the total estimated costs. Approximately 52,000 linear feet of new right-of-way are required.

**Alternative 8/8A: PRT – S. 188<sup>th</sup> Street / S. 200<sup>th</sup> Route**

The S. 188<sup>th</sup> Street Route (Alternative 8) includes costs for an alignment between Sea-Tac International Airport and Tukwila Station. Alternative 8A includes the cost of the extension from S. 188<sup>th</sup> Street to S. 200<sup>th</sup> Street. Guideway costs are the largest cost element. Approximately 35,000 linear feet of new right-of-way are required for Alternative 8A.

## 5. CONSTRUCTION FEASIBILITY

The construction feasibility of each alignment was evaluated using a selected set of five criteria, which are summarized on **Table 3**. Each of the alternatives were ranked according to whether the risks, difficulties or complexities encountered during design and construction would be relatively minimal, moderate or high. A brief description of each impact is below the summary matrix.

**Table 3: Construction Feasibility Evaluation**

| Alignment   | Grades | Slope Stability | Soils | Construction Under Traffic | Permitting Feasibility | Overall Rating |
|---|--------|-----------------|-------|----------------------------|------------------------|----------------|
| Alternative 1:<br>BRT – SR 518 Route  | ●      | ●               | ●     | ◐                          | ◐                      | ●              |
| Alternative 2: At-grade Trolley – S. 188 <sup>th</sup> Route                      | ●      | ○               | ○     | ◐                          | ◐                      | ◐              |
| Alternative 3:<br>LRT – Southcenter Boulevard Rte                                 | ●      | ◐               | ◐     | ◐                          | ◐                      | ◐              |
| Alternative 4:<br>LRT – S. 200 <sup>th</sup> Street Rte – To S. 200 <sup>th</sup> | ●      | ◐               | ◐     | ◐                          | ◐                      | ◐              |
| Alternative 5:<br>Elevated (Monorail) – SR 518 Rte                                | ●      | ◐               | ◐     | ◐                          | ◐                      | ◐              |
| Alternative 6:<br>Elevated (Aerobus) – S. 188 <sup>th</sup> Street Rte            | ●      | ◐               | ◐     | ◐                          | ◐                      | ◐              |
| Alternative 7:<br>PRT – SR 518 / S. 200 <sup>th</sup> St. Loop                    | ●      | ◐               | ◐     | ◐                          | ◐                      | ◐              |
| Alternative 8:<br>PRT – S. 188 <sup>th</sup> Street Rte                           | ●      | ◐               | ◐     | ◐                          | ◐                      | ◐              |

| Legend | High Risk |   | Medium Risk |   | Low Risk |
|--------|-----------|---|-------------|---|----------|
|        | ○         | ◐ | ◐           | ◐ | ●        |

### Grades

All alignments have been designed to be able to meet the respective technologies grade requirements. Therefore all alignments have been scored the same.

### Slope Stability

The escarpments in the Puget Sound region have had unstable sections. Without extensive geotechnical work, knowing where these instable areas are is not possible.

The potential for hitting an unstable slope area is higher for the S. 200<sup>th</sup> routes (Alternatives 4 and 7) as well as the S. 188<sup>th</sup> routes (Alternative 2, 6, and 8), and therefore these alternatives were scored lower.



Alternative 2 scores the lowest, as the at-grade double-back along the slope increases risk.

No slope stability issues are foreseen for Alternative 1, the BRT, as there would be no construction on slopes.

### **Soils**

Soil conditions and slope stability go hand in hand. Poor soil conditions, particularly finding clays on slopes, can introduce significant construction costs increases. The rankings for soils correspond to that of slope stability.

In addition, each of the alternatives travel through the Tukwila Valley, whose soil types are prone to liquefaction during earthquakes. The risks in the Tukwila Valley, however, are virtually identical for all alternatives, and therefore do not impact the rankings.

### **Construction under Traffic**

The ability to maintain existing operating capacities on roadways while still maintaining access to any construction is a significant impact to construction feasibility.

Alternative 1 has the least amount of construction impacts, as station construction would be the only impact.

For Alternatives 5 and 7, which travel along SR 518, construction along on SR 518 would be difficult, as access would be needed from SR 518.

For Alternatives 2, 4, 6 and 7, both S. 200<sup>th</sup> and S. 188<sup>th</sup> would be severely impacted by construction of either an at-grade system (Alternative 2) or elevated systems (Alternatives 4, 6, 7, and 8). The impacts are deemed less on S. 200<sup>th</sup> because traffic levels are lower than on S. 188<sup>th</sup>.

### **Permitting Feasibility**

Permitting feasibility is a measure of how easy it will be to obtain permits for construction. An overall assumption made for this was that both SeaTac and Tukwila are in support of any final alignment.

Alternative 1, the BRT, is projected to be easiest to permit, as very little construction would be necessary.

Alternative 3 (LRT – Southcenter Boulevard Route) is projected to be the most difficult to permit, as its elevated alignment would need to traverse the I-405/I-5 interchange and thus require approval from both FHWA and WSDOT in addition to the local jurisdictions.

## 6. OPERATING COSTS

The operating and maintenance cost estimates were prepared on the basis of local or industry standards. In some cases there are no known examples of real operating costs.

The comparative values for the operating costs are summarized on **Table 4**, followed by a brief explanation of the operating cost highlights of each alignment.

**Table 4: Operating Cost Estimates**

| Alignment   | Annual O&M |
|---|------------|
| Alternative 1:<br>BRT – SR 518 Route  |            |
| Alternative 2:<br>At-grade Trolley – S. 188 <sup>th</sup> Route   |            |
| Alternative 3:<br>LRT – Southcenter Boulevard Route   |            |
| Alternative 4:<br>LRT – S. 200 <sup>th</sup> Street Route – To S. 200 <sup>th</sup><br>Alternative 4A:<br>LRT – S. 200 <sup>th</sup> Street Route – To SeaTac |            |
| Alternative 5:<br>Elevated (Monorail) – SR 518 Route  |            |
| Alternative 6:<br>Elevated (Aerobus) – S. 188 <sup>th</sup> Street Route  |            |
| Alternative 7:<br>PRT – SR 518 / S. 200 <sup>th</sup> Street Loop   |            |
| Alternative 8:<br>PRT – S. 188 <sup>th</sup> Street Route<br>Alternative 8A:<br>PRT – S. 188 <sup>th</sup> Street Route & S. 200 <sup>th</sup>                |            |

| Legend | Much Higher than Average |           | Average  |          | Much Lower than Average |
|--------|--------------------------|-----------|----------|----------|-------------------------|
|        |                          |           |          |          |                         |
|        | > \$10M                  | \$7.5-10M | \$5-7.5M | \$2.5-5M | < \$2.5M                |

### Alternative 1: BRT – SR 518 Route O&M Cost Summary

The O&M costs for this alternative were based on the need for 37,000 hours of bus service and local per hour operating costs. On-going maintenance needs for capital infrastructure is assumed to be included in existing road costs and the additional TSM maintenance cost is minimal.

### Alternative 2: At-Grade Trolley – S. 188<sup>th</sup> Route O&M Cost Summary

The O&M costs for this alternative were based on needing 46,400 hours of trolley service and local per hour operating costs.

**Alternative 3: LRT – Southcenter Boulevard Route O&M Cost Summary**

The annual O&M costs for this alternative were based on Sound Transit's estimates of per mile operating costs. Because only 1.5 miles of this alignment are considered "new", the O&M costs assumed 1.5 miles of fully allocated LRT O&M costs, and equivalent O&M costs to account for increased operations on the additional 2.5 miles from the Tukwila Turnout to the Sea-Tac Airport stop.

**Alternative 4/4A: LRT – S. 200<sup>th</sup> Street Route O&M Cost Summary**

The annual O&M costs for this alternative were based on Sound Transit's estimates of per mile operating costs. O&M costs for Alternative 4 include 4.6 miles of fully allocated LRT O&M costs and an equivalent 0.9 miles of O&M costs to account for increased operations between S. 200<sup>th</sup> and the Sea-Tac Airport stop.

**Alternative 5: Elevated (Monorail) – SR 518 Route Cost Summary**

The annual O&M costs for this alternative were based on the Seattle Monorail's estimates of operating costs.

**Alternative 6: Elevated (Aerobus) – S. 188<sup>th</sup> Street Route Cost Summary**

The annual O&M costs for this alternative are based on data from Aerobus that states that O&M costs are comparable to light rail costs. Therefore, the O&M estimates were based on Sound Transit's estimates of per mile operating costs.

**Alternative 7: PRT – SR 518 / S. 200<sup>th</sup> Street Loop Cost Summary**

The annual O&M costs for this alternative are based on data from Skyweb Express by Taxi 2000.

**Alternative 8/8A: PRT – S. 188<sup>th</sup> Street Route & S. 200<sup>th</sup> Route Cost Summary**

The annual O&M costs for this alternative are based on data from Skyweb Express by Taxi 2000.

## 7. RIDERSHIP POTENTIAL

This Chapter summarizes the results of a comparative screening level of ridership estimates for the eight different alternatives connecting the SeaTac Link LRT Station with Tukwila Station.

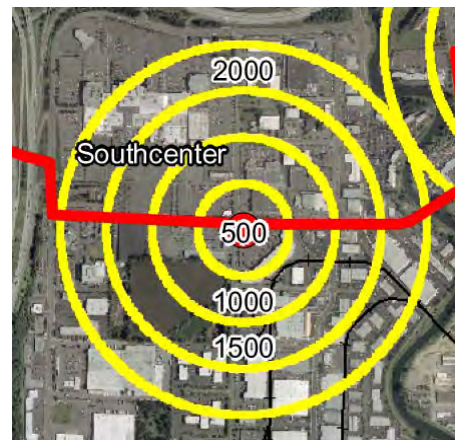
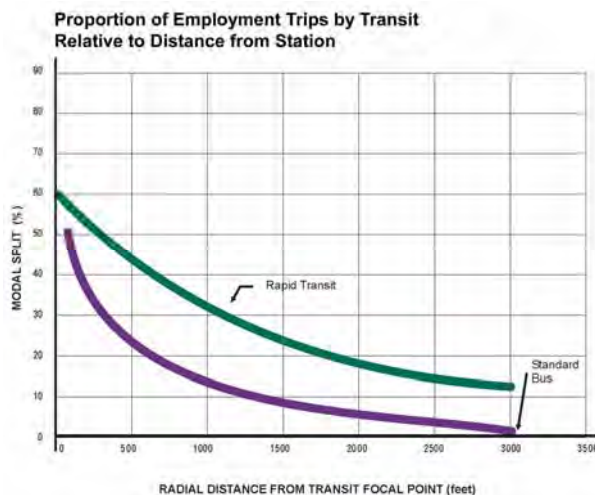
*The reader is cautioned that the ridership estimates shown here are for comparative screening purposes only; they should not be considered as operations level ridership estimates for financial planning purposes.*

### Estimating Methods

Two methods of estimating potential ridership were used: the EMME/2 method is a regional model using zonal structure, while the “Transit TIA” method is an empirical method applied to a fine-grained land use base.

The first method used the PSRC 2030 EMME/2 Travel Demand model modified by adding the alternative Connector Route alignments and technology characteristics to the existing zonal structure of the model. In each case, the alignment was added to the link-node network and the average travel time parameters of link speeds and access times were input. Link speeds and travel times were tested. The 2030 travel demand models were rerun and the potential 2030 trips on each alternative Connector Alignment were determined.

The second method used the transportation impact analysis approach. A “Transit TIA” approach uses transit rider trip rates determined from empirical data in the same way that a typical “Traffic TIA” uses vehicle trip rates published in the ITE Trip Generation Manual, which were also derived from empirical data. The Transit TIA trip rates are based on the type of land use and the distance of the development from a high capacity transit station as illustrated on the following graph. To apply the trip rates, distance bands are drawn around each potential station and the trip rates are applied to the land uses within those distance bands.



### **Land Use Assumptions**

Two sets of land use assumptions were also used. The land uses contained in the PSRC 2030 EMME/2 Travel Demand model are generally developed through a process involving economic forecasts on a state-wide and regional basis with allocations of relative population and employment made through discussions with Counties, Cities and other agencies. These land uses were the basis of the EMME/2 model runs and ridership estimates previously described.

More recent development proposals change the PSRC Land Use assumptions significantly. As proposed annexations and development concepts are adopted by local jurisdictions, the PSRC Land Uses will eventually be updated. The “Local Land Uses” assumed were generally proposed in the City of SeaTac along International Boulevard and on properties in south Tukwila between 188<sup>th</sup> and 200<sup>th</sup> Streets in Tukwila’s urban growth area. The “Local Land Uses” were the basis of the “Transit TIA” ridership predictions.

The proposed development on the south Tukwila properties alone are estimated to increase the PSRC 2030 employment estimates by more than 30,000 employees in the study area. The “Local Land Use” increase in population and employment within the basic study area will increase total trip making by all modes by about 225%. The proportion of these trips captured by the HCT Connector alternatives is a function of the route alignment and the relative travel times compared against other modes.

To test the sensitivity of the alternative land uses only, the EMME/2 land uses were modified to include the “local land uses” for two of the alternatives – ***Alternative 2 - Trolley via 188<sup>th</sup> Street*** and ***Alternative 7 – PRT Loop***. The EMME/ 2 model was rerun and the results were compared to the original EMME/2 ridership forecasts. In both cases the ridership estimates increased significantly. Based on the two alternatives tested, the average ridership for the Local Land Use data was 197% of the average ridership for the PSRC 2030 Land Use data.

The land use assumptions therefore have a significant influence on the ridership estimates and the results must be considered for comparative planning purpose only.

### **Ridership Estimate Summary**

The Transit TIA model consistently generated higher ridership on the HCT Connector alternatives than the EMME/2 model generated. On average, the Transit TIA model generated more than three times the daily ridership that was generated by the EMME/2 model. Part of the differences are in the ridership estimating methods and part of the differences are in the land use assumptions.

As illustrated above, land use sensitivity tests used for the PSRC EMME/2 model indicated that the ridership estimates for Local Land Uses could be at least twice as high as for the PSRC 2030 Land Uses. Since the Transit TIA model was based solely on the Local Land Uses, this would explain most of the discrepancies.

However, the Local Land Uses sensitivity tests used for the PSRC EMME/2 model were also compared with the Transit TIA model outputs, to provide a direct comparison between the two ridership estimating methods. In one case, the Transit TIA method predicted higher ridership, and the other case, the EMME/2 model predicted higher ridership. Overall, the EMME/2 model generated about 10% more daily ridership than the Transit TIA model in these two cases.

The two models are considered to be fairly compatible on this basis. The fundamental issue to be considered in the HCT Connections ridership estimates is whether or not the proposed local land uses (alternatively, the "enhanced" land uses) would actually occur and, if so, when. Because the HCT Connections Feasibility Study is a comparative feasibility analysis, it was considered sufficiently accurate to average the estimated ridership from both methods.

The ridership estimates are summarized below, and include a brief explanation with the highlights of each alignment.

**Table 5 - Ridership Estimates**

| <b>Alignment</b>   | <b>Number of Stations</b> | <b>Daily Riders</b> |
|--|---------------------------|---------------------|
| Alternative 1: BRT – SR 518 Route  | 6                         | 2,000               |
| Alternative 2: At-grade Trolley – S. 188 <sup>th</sup> Route                 | 12                        | 6,000               |
| Alternative 3: LRT – Southcenter Boulevard Route                             | 4                         | 6,000               |
| Alternative 4: LRT – S. 200 <sup>th</sup> St Route – To S. 200 <sup>th</sup> | 5                         | 10,000              |
| Alternative 4A: LRT – S. 200 <sup>th</sup> St Route – To SeaTac              | 7                         | 12,000              |
| Alternative 5: Elevated (Monorail) – SR 518 Route                            | 4                         | 6,000               |
| Alternative 6: Elevated (Aerobus) – S. 188 <sup>th</sup> Street Route        | 8                         | 12,000              |
| Alternative 7: PRT – SR 518 / S. 200 <sup>th</sup> Street Loop               | 25                        | *                   |
| Alternative 8: PRT – S. 188 <sup>th</sup> Street Route                       | 19                        | *                   |
| Alternative 8A: PRT – S. 188 <sup>th</sup> St. Route & S. 200 <sup>th</sup>  | 22                        | *                   |

*\* The PRT ridership estimates are not shown. The travel time variables may be unrealistic, and system capacity limits may introduce factors that affect ridership estimates but are unaccounted for within the methodologies utilized here. Development of reasonable estimates requires analysis at a level beyond the scope of this study.*

#### **Alternative 1: BRT – SR 518 Route Ridership Summary**

The potential riders on the BRT system include transfers from Tukwila Station to SeaTac airport plus connections from South Center and rental car facilities along International Boulevard. The route does not access the enhanced land uses in SeaTac or south Tukwila. There would be an average of about 330 daily boardings per station.

#### **Alternative 2: At-Grade Trolley – S. 188<sup>th</sup> Route Ridership Summary**



The majority of this alignment operates with in-street tracks and stations, offering a lower average speed than grade-separated alternatives. However, the route would access most of the enhanced land uses. An average of 500 daily boardings per station is estimated.

### **Alternative 3: LRT – Southcenter Boulevard Route Ridership Summary**

This route operates at high speed on separate right-of-way between Sea-Tac airport and the Southcenter Station and slightly slower at-grade to the Tukwila Station. The route does not access the enhanced land uses in SeaTac or south Tukwila. However, because the speed is faster, more direct and easy connections can be made to Link LRT heading to Seattle, about 1,500 daily boardings per station are estimated.

### **Alternative 4/4A: LRT – S. 200<sup>th</sup> Street Route Ridership Summary**

This route operates at high speed on separate right-of-way between Sea-Tac airport and 200<sup>th</sup> Street near I-5 and then at medium speed on both shared and separate right-of-way to Southcenter Station and Tukwila Station via south Tukwila properties. Because the route would access all of the enhanced land uses, about 1,700 to 2,000 daily boardings per station are estimated.

### **Alternative 5: Elevated (Monorail) – SR 518 Route Ridership Summary**

This route also operates at high speed on separate right-of-way between Sea-Tac airport and the Tukwila Station, but it does not access the enhanced land uses in SeaTac or south Tukwila. It is very similar to the LRT in Alternative 3, with about 1,500 daily boardings per station estimated.

### **Alternative 6: Elevated (Aerobus) – S. 188<sup>th</sup> Street Route Ridership Summary**

This route also operates at high speed on separate right-of-way between Sea-Tac airport and 188<sup>th</sup> Street and then to Southcenter Station and Tukwila Station via south Tukwila properties. Because the route would access most of the enhanced land uses, about 1,500 daily boardings per station are estimated.

### **Alternative 7: PRT – SR 518 / S. 200<sup>th</sup> Street Loop Ridership Summary**

This route operates at high speed on separate right-of-way between Sea-Tac airport and 188<sup>th</sup> Street and then to Southcenter Station and Tukwila Station via south Tukwila properties. Because the PRT system has more frequent stations, walking distances and waiting times are significantly reduced, increasing ridership. The route would also access all of the enhanced land uses, and about 1,200 daily boardings per station were estimated. *The PRT ridership estimates are much higher than any other mode and require further analysis to verify the accuracy of the predictions. The travel time variables are suspect.*

### **Alternative 8/8A: PRT – S. 188<sup>th</sup> Street Route & S. 200<sup>th</sup> Route Ridership Summary**

These routes also operate at high speed on separate right-of-way via the south Tukwila properties. The routes would access most of the enhanced land uses, and about 1,000 daily boardings per station were estimated.

*The PRT ridership estimates are much higher than any other mode and require further analysis to verify the accuracy of the predictions. The travel time variables are suspect.*

## 8. ENVIRONMENTAL / COMMUNITY IMPACT

This Chapter summarizes the results of the first level screening of Environmental / Community Impacts for the eight different alternatives connecting the Sea-Tac Link LRT Station with Tukwila Station. It should be noted that the impacts shown here are comparative for screening purposes; they should not be considered as a detailed environmental assessment or check-list. The impacts are summarized below (*Table 6*) and include a brief explanation of the criteria and of the highlights of each alignment.

The impacts on the SeaTac and Tukwila communities were evaluated using a selected set of six criteria. A brief description of each alignment impact follows.

**Table 6: Environmental / Community Impacts Evaluation**

| Alignment   | Compatibility with Land Use Plans | Residential Visual and Noise Impacts | Commercial Impacts | Traffic / Access Impacts | Parks and Wetland Impacts | Safety / Security Impacts | Overall Rating |
|---|-----------------------------------|--------------------------------------|--------------------|--------------------------|---------------------------|---------------------------|----------------|
| Alternative 1:<br>BRT – SR 518 Route  |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 2:<br>At-grade Trolley – S. 188 <sup>th</sup> Route                   |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 3:<br>LRT – Southcenter Boulevard Rte                                 |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 4:<br>LRT – S. 200 <sup>th</sup> Street Rte – To S. 200 <sup>th</sup> |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 5:<br>Elevated (Monorail) – SR 518 Rte                                |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 6:<br>Elevated (Aerobus) – S. 188 <sup>th</sup> Street Rte            |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 7:<br>PRT – SR 518 / S. 200 <sup>th</sup> St. Loop                    |                                   |                                      |                    |                          |                           |                           |                |
| Alternative 8:<br>PRT – S. 188 <sup>th</sup> Street Rte                           |                                   |                                      |                    |                          |                           |                           |                |

| Legend | Higher Impact /<br>Worse<br>Compatibility | Moderate Impact,<br>Comptibility | Lower Impact /<br>Better<br>Compatibility |
|--------|---|----------------------------------|---|
|        |   |                                  |   |
|        |   |                                  |   |
|        |   |                                  |   |
|        |   |                                  |   |
|        |   |                                  |   |

### **Compatibility with Land Use Plans**

The alternatives were reviewed vis a vis the established land use plans. The Tukwila Comprehensive Plan, particularly the sections on the Tukwila Urban Center (TUC) and Tukwila Valley South (TVS) were referenced when evaluating the alternatives. In SeaTac, the Comprehensive Plan, the City Center Plan and the Light Rail Station Area Planning were reviewed in light of the proposed HCT Connections alternatives. In general, the provision of additional accessibility in the commercial areas was considered as a compatible relationship. The City of Tukwila designates an area south of TUC and north of TVS as light industrial. In some cases, the HCT alternatives provided additional access in that area, which would accelerate the conversion of light industrial to commercial. The situation was considered as less compatible, although the City may reconsider the designation of this area, particularly in light of development concepts for TVS. Also, in the City of Tukwila, policies addressing the conversion of existing rail right of way to pedestrian trails was considered where HCT alternatives used rail right-of-way for potential alignment. The use of existing rail right-or-way for new transit alignments was considered in conflict with this policy.

### **Noise and Visual Impacts**

Alternatives 1, 3, 5, and 7 avoided the residential areas (McMicken Heights and other neighborhoods on the SeaTac plateau, which also includes Tukwila neighborhoods) by using the SR518 corridor. Alternatives 2 and 6 impacted the residential areas along S. 188<sup>th</sup>, while Alternatives 4 and 7 impacted S. 200<sup>th</sup>. More homes in the 188<sup>th</sup> corridor will be impacted because the interface between transit and the residential areas along S 188<sup>th</sup> is longer than the interface between transit and residential areas along S 200<sup>th</sup>.

The assessment of visual impacts was a combination of the position of the vehicle (either on-grade or elevated), the scale of the overhead structures (power lines for trolley, support structure for PRT/Monorail/Aerobus) and the access patterns of the community.

In assessing noise sensitivity of the two residential communities (i.e., S.188<sup>th</sup> and S 200<sup>th</sup> neighborhoods) three criteria were used: S. 188<sup>th</sup> is a more heavily trafficked route than S 200<sup>th</sup>; and therefore is assumed it has a higher existing ambient noise level than S. 200<sup>th</sup>, For the most part, the residences along S 188<sup>th</sup> have access from other streets and the backyards are between the street and the homes, while S 200<sup>th</sup> has more access from that street.

### **Commercial Impacts**

Providing more accessibility for customers or clients while not contributing to congestion was considered a positive contribution when assessing commercial impacts. In general, independent of the technology, alternatives with more stations were considered as providing more accessibility. This assessment was conditioned when new accessibility was not duplicating service provided in the proposed Sound Transit light rail station areas. The ability of transit to serve as a stimulus of new development or redevelopment (such as TVS and opportunities such as the Lewis and Clark Theatre site) was considered as a positive effect. Therefore, alignments that provided new access to unused or

underused land rated higher than alternatives that served existing commercial areas with existing transit service.

### **Traffic/Access Impacts**

Technologies that were elevated ranked high because other than the support structures, no conflict with surface traffic is anticipated. Of the alternatives than used surface routes, the trolley ranked lowest because of the greatest length of fixed route, when compared to the light rail alternatives which use a combination of surface/elevated routes. While BRT is similar to the trolley in being exclusively at grade, the maneuverability of the vehicle and a shorter length of route on local streets ranked this alternative higher than the trolley

### **Parks and Wetland Impacts**

The parks and wetland impacts included the evaluation of the impacts on the hillsides along SR518 and I-5 and the crossing of the Green River new Strander Boulevard. Other than Tukwila Pond, it is assumed that no wetlands exist in the urbanized area of Tukwila and SeaTac. Alternatives that required new or additional bridge structures (trolley, light rail) to cross the Green River were ranked lower than those that used the existing Strander Bridge (BRT) or that used a narrow section guideway (monorail/PRT)

When alignments were along the hillside on SR518 or I-5, the alternatives that used elevated structures (monorail/PRT) were ranked higher than the alternatives that required track beds to be cut into the hillside (trolley/light rail).

Tukwila Pond was assessed for impacts by the Alternatives 2, 6, 7, and 8 (Aerobus, PRT and trolley technologies). The aerobus and PRT structures would cast a shadow onto the easternmost portion of the pond, although this was considered a very minor impact.

### **Safety and Security**









































The evaluation of the safety and security characteristics of the HCT alternatives considered the potential of accidents between at grade vehicles and pedestrian or other vehicles; the ability of emergency personnel to access the vehicles and remove passengers in an emergency; and the personal safety of passengers. Overall, the elevated technologies (PRT, monorail, aerobus, portions of the light rail alternatives) were ranked higher because of potentially lower accident rates, but this advantage was countered by lower ranking when the emergency response criteria was applied. When evaluating the elevated alignments, the routes were considered when assessing the emergency personnel's ability to access the overhead vehicles. Alignments through the I-5/SR518 interchange, within the steep hillsides of the I-5/SR518 right-of-way were ranked lower for emergency response because of the difficult in accessing these areas.



Personal safety was considered, although this issue may not be particularly pertinent. Alternatives 7 and 8, the PRT alignments, ranked high, because passengers do not share their ride with anyone else. Alternatives 1, 2, and 6, which are one car and require a driver (BRT, trolley, light rail, and aerobus), were ranked higher than Alternatives 3 and 4 (LRT) and Alternative 5 (Monorail) because there was not a human operator in each car. The rider's perception of personal security may be more important than the reality.

## 9. FINANCIAL FEASIBILITY

This Chapter summarizes the results of a preliminary screening of funding or financial criteria for the eight different alternatives connecting the SeaTac Link LRT Station with Tukwila Station. The Financial Feasibility Ratings are summarized below (*Table 7*) and a brief explanation of the criteria with the highlights of each alignment follows.

**Table 7: Financial Feasibility Evaluation**

| Alternative   | Federal Funding   | Public / Private LID/TIF  | User Fees   | Overall Rating  |
|---|---|---|---|---|
| <b>Alternative 1:<br/>BRT – SR 518 Route</b>                                      |    |    |    |    |
| <b>Alternative 2:<br/>Trolley – 188<sup>th</sup> Street Route</b>                 |    |    |    |    |
| <b>Alternative 3:<br/>LRT – Southcenter Blvd Route</b>                            |    |    |    |    |
| <b>Alternative 4:<br/>LRT – 200<sup>th</sup> Street Route</b>                     |    |    |    |    |
| <b>Alternative 4A:<br/>LRT – 200<sup>th</sup> - To SeaTac</b>                     |    |    |    |    |
| <b>Alternative 5:<br/>Monorail – SR 518 Route</b>                                 |   |   |   |   |
| <b>Alternative 6:<br/>Aerobus – 188<sup>th</sup> Street Route</b>                 |  |  |  |  |
| <b>Alternative 7:<br/>PRT Loop – SR 518 / 200<sup>th</sup> Street</b>             |  |  |  |  |
| <b>Alternative 8:<br/>PRT Line – 188<sup>th</sup> Street Route</b>                |  |  |  |  |
| <b>Alternative 8A:<br/>PRT – 188<sup>th</sup> with 200<sup>th</sup> Extension</b> |  |  |  |  |

| Legend | Higher Compatibility / Acceptance   | Moderate Compatibility / Acceptance   | Lower Compatibility / Acceptance   |
|--------|---|---|--|
|        |  |  |  |

### Funding Source Criteria

**Federal funding** opportunities are usually related to compatibility with existing transit system operations in the area, comparative financial benefits of the project (compared with other project funding opportunities throughout the country), and confidence in the technologies proposed. Sources of federal funding sources for transit include:

- Federal Transit Administration discretionary grants (Section 5309) including New Starts grants for major fixed-guideway capital investments, Rail Modernization



- grants for improvements to fixed guideway systems, and grants for bus system rolling stock and facilities;
- FTA Section 5307 formula-based funding for planning, capital projects, maintenance and operations of urban area transit systems;
- Congestion Management/Air Quality (CMAQ) grants -- from Federal Highway Administration TEA 21 funding programs -- for projects that reduce transportation system congestion and improve air quality; and
- direct congressional funding ("earmarks"), usually for planning and design work.

Other federal funding sources may be available depending on specific aspects of a project, such as when Intelligent Vehicle Highway System (IVHS) features are included (e.g., automated vehicle location systems and advanced passenger information systems.)

Within this analysis, the ratings of federal funding opportunities are done in the context of the alternative's ability to compete for such funds relative to other projects and improvements anticipated by Sound Transit and other transit agencies within the Puget Sound region.

**Public / private funding** through Local Improvement Districts (LID) or Tax Incremental Financing (TIF) are usually related to the immediate value realized by properties adjacent to the route – in this case within a reasonable walking distance of a station where some relief to traffic and parking impacts and costs could be realized.






















**User fee** opportunities extend beyond the standard transit fares collected to include non-direct user fees. For example, if the transit service was of value to a hotel, rental car facility or park-and-fly facility, then a user fee could be incorporated into those services much as they are today with shuttle buses.

### **Comparative Cost-per-Passenger**

To evaluate the comparative financial benefits, an estimate of the comparative cost-per-passenger was developed where available. The capital costs of each project were divided by the average annual ridership and then spread over a twenty-year period. The annual operating and maintenance costs were divided by the average annual ridership. Note that the actual number resulting from these calculations are not provided; instead a relative rating is shown. The reason for this is that the cost estimates and the ridership estimates are preliminary and conceptual and only to be used for comparative purposes within this study. Further, the cost estimates do not include specific features such as administration, insurance, debt financing, inflation, etc., and as such are likely significantly lower than cost estimates developed more fully-defined project level analysis. Hence, it would be misleading to use the cost and ridership estimates developed here to derive an actual cost-per-passenger figure.

The resulting comparative cost-per-passenger for each alternative is shown in Table 8.

**Table 8. Combined Capital and Operating Costs-per-Passenger**

|  | Daily Rides | Annual Rides | Capital Cost / Ride   | O&M Cost / Ride   | Total Cost / Ride   |
|--|-------------|--------------|---|---|---|
| Alt. 1: BRT – SR 518 Route                           | 2,000       | 508,000      |  |  |  |
| Alt. 2: Trolley – 188 <sup>th</sup> St.              | 6,000       | 1,524,000    |  |  |  |
| Alt. 3: LRT – Southcenter Blvd                       | 6,000       | 1,524,000    |  |  |  |
| Alt. 4: LRT – 200 <sup>th</sup> Street               | 10,000      | 2,540,000    |  |  |  |
| Alt. 4A: LRT – 200 <sup>th</sup> to SeaTac           | 12,000      | 3,048,000    |  |  |  |
| Alt. 5: Monorail – SR 518                            | 6,000       | 1,524,000    |  |  |  |
| Alt. 6: Aerobus – 188 <sup>th</sup> Street           | 12,000      | 3,048,000    |  |  |  |
| Alt. 7: PRT Loop – SR 518 / 200 <sup>th</sup>        | *           | *            | *   | *   | *   |
| Alt. 8: PRT – 188 <sup>th</sup> Street               | *           | *            | *   | *   | *   |
| Alt. 8A: PRT – 188 <sup>th</sup> / 200 <sup>th</sup> | *           | *            | *   | *   | *   |



**Notes:**

(1) *Capital and operating cost estimates are preliminary and conceptual, and do not include features that would be necessary for development of a full cost estimate at the project design level.*

\* *PRT ridership estimates are not available. Travel time variables may be unrealistic, and system capacity limits may introduce factors that affect ridership.*

**Comparative Costs for PRT**

The comparative cost-per-ride for the PRT alternatives are not shown because of the largely unproven nature of the PRT system. A study completed for the City of SeaTac in 1997 for a 21 station PRT system parallel to International Boulevard servicing hotels, rental cars and park-and-fly lots estimated that up to 24,000 trips per day could be generated with a costs-per-passenger of about \$4.44 including capital and operating costs. However, the 1997 Study cautioned that the technology was wholly unproven and that there were significant risks associated with ridership and cost estimates. Ridership estimates for the PRT alternatives conducted in this study were also found to be highly dependent on potentially unrealistic travel times based on the unproven technologies. It was therefore considered prudent not to present these estimates.

**Evaluation of Individual Alignments**

**Alternative 1: BRT – SR 518 Route.**

The Bus Rapid Transit route is considered compatible with federal funding since it is a known technology, similar transit services are in operating within the region, and the capital cost-per-passenger is very attractive compared to other projects. It would likely receive funding consideration, even though the operating cost-per-passenger is fairly high.

The limited stop route is not considered to have sufficient ridership value to attract public / private investments in terms of Local Investment Districts (LID) or Tax Incremental Financing (TIF).

Similarly, while some ridership might be gained from servicing off-airport rental car sites, the potential for any associated user fees is considered to be quite limited.

The overall financial feasibility rating is considered to be less than average.

### **Alternative 2: At-Grade Trolley – 188<sup>th</sup> Route**

Trolley/streetcar-type systems exist in the regions (i.e., King County Metro's Waterfront Streetcar in Seattle, and Sound Transit's downtown Tacoma Link); hence, a trolley/streetcar could be considered compatible with the operating divisions of these transit agencies. However, the capital cost-per-passenger is high which would probably rate the project less than average attraction for federal funding.

Because the route would operate along a potentially higher density corridor, the potential for public / private partnerships and user fees might be higher than the BRT route, but the slower speed of the trolley would still likely rate the project less than average attraction for these funding sources.

The overall financial feasibility rating is considered to be less than average.

### **Alternative 3: LRT – Southcenter Boulevard Route**

The LRT – Southcenter Boulevard route is considered to be very compatible with Sound Transit's operating division as it would be essentially considered as an extension of the Link LRT currently under construction. The capital and operating costs-per-passenger appear to be reasonable making it possible that a project of this kind average could have an average level attraction for federal funding.

The limited stop route has enough ridership value to potentially attract limited public / private investments. However, good user fee potential is considered highly unlikely on this route.

The overall financial feasibility rating is considered to be average.

### **Alternative 4/4A: LRT – 200<sup>th</sup> Street Route**

The LRT – 200<sup>th</sup> Street route is considered to be compatible with Sound Transit's Link operating division but only as a long-term project. The combined capital and operating cost-per-passenger is high which would probably rate the project less than average attraction for federal funding in the immediate future.

Because the route would operate along a potentially higher density corridor, the potential for public / private partnerships are good but the potential for user fees are less than average.



The overall financial feasibility rating is considered to be slightly less than average.

**Alternative 5: Elevated (Monorail) – SR 518 Route**

The Monorail SR 518 route could be considered compatible with the Seattle Monorail project currently under final design. However, the adopted long-range plan for the Seattle Popular Monorail Authority only shows monorail routes within their service area (i.e., within the city limits of Seattle.) The combined capital and operating cost-per-passenger is very high, however, which would probably rate the project less than average attraction for federal funding.

The limited stop route has enough potential ridership value to attract limited public / private investments but it is not well situated to attract significant user fees.

The overall financial feasibility rating is considered to be less than average.

**Alternative 6: Elevated (Aerobus) – 188<sup>th</sup> Street Route**

The Aerobus 188th Street route is not considered to be compatible with any Puget Sound area transit agency operating division and has a relatively high combined capital and operating cost-per-passenger. This would probably rate the project much worse than average attraction for federal funding.

Because the route would operate along a potentially higher density corridor, there would be some potential for public / private partnerships and user fees, but generally less than average.

The overall financial feasibility rating is considered to be less than average.

**Alternative 7: PRT – SR 518 / 200<sup>th</sup> Street Loop.**

The PRT Loop – SR 518 / 200<sup>th</sup> Street route is not considered to be compatible with any Puget Sound area transit agency operating division. The combined capital and operating cost-per-passenger is potentially low, but the technology is not readily available and therefore the costs are largely unproven. Unless a “demonstration” type fund could be tapped, the project will rate much worse than average attraction for federal funding.

A PRT study conducted for the City of SeaTac in 1997 developed similar conclusions: “PRT technology is not operational in any location in the world; various private and public efforts over the past 25 – 30 years have not been successful. There is significant financial and technical risk in the implementation of PRT technology”.

Because the route would operate along a potentially higher density corridor, and because the technology would potentially offer superior service in terms of speed, directness and proximity to final destinations, the potential for public / private partnerships and user fees might be considered to be much better than average. However, again because of the uncertainty of the technology, it is unlikely that LID/TIF funding would be endorsed by private sector interests until a demonstration project was completed.

User fee potential is considered to be fairly good if the technology could be proven.

The overall financial feasibility rating is therefore considered to be less than average.

**Alternative 8/8A: PRT – 188<sup>th</sup> Street Route & 200<sup>th</sup> Street Extension**

















































The PRT Loop – 188<sup>th</sup> Street routes are considered to be comparable in ratings to the SR 518 / 200<sup>th</sup> Street Loop route. The project would probably rate as less than average attraction for federal funding and less than average for public / private partnerships and user fees due to the uncertainty.

The overall financial feasibility rating is therefore considered to be less than average.

## 10. COMMUNITY ENDORSEMENT / ACCEPTANCE

This Chapter summarizes a preliminary assessment of stakeholder attitudes for the eight different alternatives connecting the Sea-Tac Link LRT Station with Tukwila Station. It should be noted that the assessment provided here is presumptive for screening purposes and included no methodical survey of community attitudes. It is important to note that within an alternative some members of a particular stakeholder group may be affected differently than other members due to the alternative's location and design. The assessments are summarized on Table 9 and the highlights of each alignment follow.

**Table 9: Community Endorsement Potential**

| Alignment                              | Residents   | Business  | Hotels  | Visitors  | Property Owners   | Overall Rating  |
|--|---|---|---|---|---|---|
| Alt. 1: BRT – SR 518                   |    |    |    |    |    |    |
| Alt. 2: Trolley – 188 <sup>th</sup> St |    |    |    |    |    |    |
| Alt. 3: LRT – Southcenter              |    |    |    |    |    |    |
| Alt. 4: LRT – 200 <sup>th</sup> Street |    |    |    |    |    |    |
| Alt. 5: Monorail SR 518                |    |    |    |    |    |    |
| Alt. 6: Aerobus – 188 <sup>th</sup> St |  |  |  |  |  |  |
| Alt. 7: PRT Loop                       |  |  |  |  |  |  |
| Alt. 8: PRT Line – 188 <sup>th</sup>   |  |  |  |  |  |  |

| Legend | Much Worse than Average   | Average   | Much Better than Average  |
|--------|---|---|---|
|        |  |  |  |

### Alternative 1: BRT – SR 518 Route.

BRT will primarily use existing roads impacted by vehicular traffic. Residential impacts are minimal and mobility benefits are good. Business owners near the stops will benefit from additional mobility, although they may perceive the BRT as increasing congestion. Hotel operators will see minimal benefits. Visitors may benefit from the additional connectivity within the SeaTac/Tukwila corridor. Redevelopment opportunities will generally not be enhanced.

### Alternative 2 – At Grade Trolley – S. 188<sup>th</sup> Street Route

The trolley will impact residences on S. 188<sup>th</sup> where the steel on steel noise may be irritable but it will provide more mobility. Business owners in the TUC will benefit from additional mobility, although they may perceive the trolley as increasing congestion. Some hotel operators in SeaTac will benefit from additional mobility. Visitors will benefit from the additional connectivity within the SeaTac/Tukwila corridor. Redevelopment opportunities may be enhanced along S.188<sup>th</sup> Street and at the TUC.

**Alternative 3: LRT – Southcenter Boulevard Route**

Residential impacts are considered to be minimal. A small number of business owners in the TUC will benefit from additional mobility, particularly Southcenter Mall. Some business owners along Baker Street will feel impacts of the light rail on surface. Hotels by the Tukwila Station will benefit from additional mobility. Visitors will benefit from the additional connectivity between SeaTac and Southcenter. Redevelopment opportunities may be enhanced in the TUC.

**Alternative 4/4A: LRT – 200<sup>th</sup> Street Route**

LRT will use an elevated structure constructed on expanded right of way on S. 200<sup>th</sup> which will be a significant impact to residents. Business owners in the TUC will benefit from additional mobility, particularly those near the four new stops in TUC. Visitors will benefit from the additional connectivity within the SeaTac/Tukwila corridor. Redevelopment opportunities will be enhanced at the TUC.

**Alternative 5: Elevated (Monorail) – SR 518 Route**

The residential area east of the Lewis and Clark Theater area may be impacted by the visual features of the elevated structure. Business owners in the TUC will benefit from additional mobility, particularly Southcenter Mall. Hotel operators near the Tukwila Station will benefit from additional mobility. Visitors will benefit from the additional connectivity between SeaTac, Southcenter and Tukwila Station. Redevelopment opportunities will be enhanced at the Lewis and Clark Theater site and in the TUC.

**Alternative 6: Elevated (Aerobus) – 188<sup>th</sup> Street Route**

S. 188<sup>th</sup> Street traverses a neighborhood where the presence of the overhead cables may be intrusive. Business owners in the TUC will benefit from additional mobility. Hotels adjacent to the Tukwila Station may benefit from the additional mobility. Visitors will benefit from the additional connectivity within the SeaTac/Tukwila corridor. Redevelopment opportunities will significantly be enhanced at south TUC and in SeaTac.

**Alternative 7: PRT – SR 518 / 200<sup>th</sup> Street Loop.**

PRT will impact neighborhoods on S. 200<sup>th</sup> Street with the presence of the overhead structure but will provide greatly enhanced mobility with local stations. Business owners in the TUC and hotel businesses along International Boulevard would greatly benefit from additional mobility and may reduce parking requirements. Visitors would benefit from the additional connectivity within the SeaTac/Tukwila corridor. Redevelopment opportunities will significantly be enhanced at TUC and throughout SeaTac.

**Alternative 8/8A: PRT – 188<sup>th</sup> Street Route & 200<sup>th</sup> Street Extension**

The PRT Loop – 188<sup>th</sup> Street routes are considered to be comparable in ratings to the PRT SR 518 / 200<sup>th</sup> Street Loop route.



## 11. EXPANDABILITY

Two different criteria were used to evaluate “expandability”; the fit with approved plans and local delivery expandability. The first measures whether a particular alternative or a derivative of the alternative may be found in an existing approved plan. Examples include Sound Move, King County Metro’s Six Year Plan, City Transit Plan’s and/or CIP/TIP’s. The second measures the potential of adding future local access within the study area, as either increased frequency or additional stops. As none of the alternatives operate at their maximum feasible frequency, additional frequency to all alternatives is possible.

**Table 10: Expandability Evaluation**

| Alignment  | Approved Plans | Local Delivery | Overall Rating |
|--|----------------|----------------|----------------|
| Alternative 1:<br>BRT – SR 518   | ●              | ○              | ◐              |
| Alternative 2:<br>At-grade Trolley – S. 188 <sup>th</sup>              | ○              | ◐              | ◐              |
| Alternative 3:<br>LRT – Southcenter Boulevard                          | ●              | ◐              | ◑              |
| Alternative 4/4A:<br>LRT – S. 200 <sup>th</sup> Street                 | ○              | ◐              | ◐              |
| Alternative 5:<br>Elevated (Monorail) – SR 518                         | ○              | ◐              | ◐              |
| Alternative 6:<br>Elevated (Aerobus) – S. 188 <sup>th</sup> Street     | ○              | ◐              | ◐              |
| Alternative 7:<br>PRT – SR 518 / S. 200 <sup>th</sup> Loop             | ◑              | ●              | ●              |
| Alternative 8/8A:<br>PRT – S. 188 <sup>th</sup> / S. 200 <sup>th</sup> | ◑              | ●              | ●              |

| Legend | Much Worse than Average | Average | Much Better than Average |
|--------|-------------------------|---------|--------------------------|
|        | ○                       | ◐       | ●                        |

### Alternative 1: BRT – SR 518 Route

The BRT alternative fits with approved plans. A variant of the BRT alignment is currently being studied by the I-405 BRT study. In the approved Sound Move, an express bus route served both a Southcenter flyer stop and the Airport. In addition, King County Metro included this route alignment in its latest Six Year Plan. Because the majority of the BRT route operates in a freeway, adding additional stops is either geometrically infeasible or cost prohibitive. The potential to increase local access is poor, even if frequency is increased.

**Alternative 2: At-Grade Trolley – S. 188<sup>th</sup> Route**

The At-Grade Trolley is not found in any existing approved plans. The Trolley has the potential to increase local access by increasing frequency and by potentially adding stops. Due to the at-grade nature of the trolley, stops can be added along the alignment within a reasonable expense level.

**Alternative 3: LRT – Southcenter Boulevard Route**

This LRT alternative is described in approved plans. A variant of this alignment was studied extensively by Sound Transit as part of its Link light rail corridor planning process. The LRT has the potential to increase local access by increasing frequency. Because the majority of this LRT route operates adjacent to SR 518, adding additional stops is either geometrically infeasible or cost prohibitive. The direct connection with the proposed LINK line, however, gives this alignment tremendous access to the planned regional rail network.

**Alternative 4/4A: LRT – S. 200<sup>th</sup> Street Route**

This LRT alternative is not described in any approved plans. The LRT has the potential to increase local access by increasing frequency. Adding stops along the LRT route through the Tukwila Valley is readily feasible in segments where at-grade operation occurs. The direct connection with the proposed LINK line also gives this alignment tremendous access to the regional rail network.

**Alternative 5: Elevated (Monorail) – SR 518 Route**

This alternative is not described in any approved plans. The Monorail has the potential to increase local access by increasing frequency. Because the majority of this monorail route operates adjacent to SR 518, adding additional stops is difficult. Additional stops along International Boulevard, however, are possible and feasible.

**Alternative 6: Elevated (Aerobus) – S. 188<sup>th</sup> Street Route**

This alternative is not described in any approved plans. The Aerobus has the potential to increase local access by increasing frequency and adding local stops. Additional local stops are possible and feasible in either South Tukwila or along S. 188<sup>th</sup> Street.

**Alternative 7: PRT – SR 518 / S. 200<sup>th</sup> Street Loop**

In 2004, PRT was placed into the SeaTac Transportation Improvement Program (TIP). This PRT alternative may be considered a variant of the SeaTac TIP project. Tukwila, however, does not have a corresponding project in its TIP or Transit Plan. The PRT has the potential to increase local access by increasing frequency and adding local stops. Additional off-line stops may be added without sacrificing the speed/convenience of other passengers.

**Alternative 8/8A: PRT – S. 188<sup>th</sup> Street Route & S. 200<sup>th</sup> Route**

The PRT Loop – 188<sup>th</sup> Street routes are considered to be comparable in ratings to the PRT SR 518 / 200<sup>th</sup> Street Loop route.

## 12. SUMMARY AND RECOMMENDATIONS

The following summary (Table 11) includes the evaluations of each alignment alternative by each of the eight criteria. A conclusion and recommendation for each alignment alternative follows the summary table.

**HCT Connections Feasibility Study Screening Summary**

|   | Capital Cost<br>(comparative use only) | Construction Feasibility | Annual O&M Costs<br>(comparative use only) | Ridership Potential<br>(daily trips) | Environmental /<br>Community Impact | Financial Feasibility | Community Acceptance | Expandability |
|---|--|--------------------------|--|--------------------------------------|-------------------------------------|-----------------------|----------------------|---------------|
| <b>Alternative 1:<br/>BRT – SR 518 Route</b>                                      | ●                                      | ●                        | ●  | 2,000                                | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 2:<br/>Trolley – 188<sup>th</sup> Street Route</b>                 | ●                                      | ●                        | ●  | 6,000                                | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 3:<br/>LRT – Southcenter Blvd Route</b>                            | ●                                      | ●                        | ●  | 6,000                                | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 4:<br/>LRT – 200<sup>th</sup> Street Route</b>                     | ●                                      | ●                        | ○  | 10,000                               | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 4A:<br/>LRT – 200<sup>th</sup> Street to SeaTac</b>                | ○                                      | ●                        | ○  | 12,000                               | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 5:<br/>Monorail – SR 518 Route</b>                                 | ○                                      | ●                        | ●  | 6,000                                | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 6:<br/>Aerobus – 188<sup>th</sup> Street Route</b>                 | ○                                      | ●                        | ○  | 12,000                               | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 7:<br/>PRT Loop – SR 518 / 200<sup>th</sup> Street</b>             | ○                                      | ●                        | ○  | *                                    | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 8:<br/>PRT Line – 188<sup>th</sup> Street Route</b>                | ○                                      | ●                        | ●  | *                                    | ●                                   | ●                     | ●                    | ●             |
| <b>Alternative 8A:<br/>PRT - 188<sup>th</sup> with 200<sup>th</sup> Extension</b> | ○                                      | ●                        | ●  | *                                    | ●                                   | ●                     | ●                    | ●             |

|               |       |   |         |   |        |
|---------------|-------|---|---------|---|--------|
|               | Worse |   | Average |   | Better |
| <b>Legend</b> | ○     | ● | ●       | ● | ●      |

*\* PRT ridership estimates are not available. Travel time variables may be unrealistic, and system capacity limits may introduce factors that affect ridership.*

## ***Summary and Recommendations of the Individual Routes***

### **Alternative 1: BRT – SR 518 Route.**

The proposed Bus Rapid Transit route is considered to be highly compatible with existing Sound Transit operating divisions and can be readily constructed on existing rights-of-way. However, the route is projected to attract only 2,000 passengers per day and the operating cost per passenger is relatively high compared to other route alternatives.

A variation of the BRT route that requires less capital investment and planning approvals might include a deviation of the existing Route 560 to the Tukwila Station and Tukwila Urban Center. The capital costs would be very low to modify this route and allow testing of rider response while considering the more extensive BRT application.

It is therefore recommended that the BRT – SR 518 Route be forwarded to the Sound Transit Phase 2 Study Process for further evaluation and that ST Express Route 560 be considered for interim improvements.

### **Alternative 2: At-Grade Trolley – 188<sup>th</sup> Street Route**

The proposed Trolley route is also considered compatible with Sound Transit operating divisions if it is operated similar to the Tacoma Link line. Because the route would operate along a potentially higher density corridor it is projected to attract about 6,000 passengers per day which is relatively low considering the length of the route. It is expected that the on-street operation of the trolley would also create significant community opposition.

It is therefore not recommended that the Trolley – 188<sup>th</sup> Street Route be considered any further.

### **Alternative 3: LRT – Southcenter Boulevard Route**

The LRT – Southcenter Boulevard route is considered to be very compatible with Sound Transit's operating division as it would be essentially considered as an extension of the Link LRT currently under construction. The alignment is also included in the current Sound Transit Long Range Plan. Although the route would only attract 6,000 passengers per day and would not serve the potential high density of the south Tukwila corridor, the capital and operating costs are reasonable and the route has potential for expandability east and west.

An east-west LRT route from Burien to Renton is being considered in the Sound Transit Phase 2 Study Process. It is therefore recommended that the LRT – Southcenter Boulevard Route be forwarded to the Sound Transit Phase 2 Study Process for further evaluation.



#### **Alternative 4/4A: LRT – 200<sup>th</sup> Street Route**

The LRT – 200<sup>th</sup> Street route is also considered to be compatible with Sound Transit's Link operating division as a long-term project. Because the route would operate along a potentially higher density corridor of the south Tukwila corridor, it could attract 10,000 to 12,000 passengers per day. While the capital and operating costs of the Trolley alternative are lower, the higher ridership potential of this LRT alternative would be considered the more productive of the south route alternatives.

However, it is expected that there would be considerable community opposition to this route on S. 200<sup>th</sup> Street. The concept of tunneling this section was briefly considered, but that option would significantly increase the capital costs and construction impacts.

While this alignment may be feasible and has good ridership potential, it is not recommended that the LRT – 200<sup>th</sup> Street Route be forwarded to the Sound Transit Phase 2 Study Process for further evaluation.

#### **Alternative 5: Elevated (Monorail) – SR 518 Route**

The Monorail SR 518 route is not considered to be compatible with any Sound Transit operating division but it could be very compatible with the Seattle Monorail project currently under final design. The limited stop route would generate the same 6,000 riders per day that the similar LRT – Southcenter Route would generate, but at a higher cost. While the Monorail technology is proven in several locations and would have the capacity and operating parameters to accommodate the passenger demands, the LRT alternative was found to provide a more seamless connection at a lower cost on this route.

It is therefore not recommended that the Monorail – SR 518 Route be considered any further.

#### **Alternative 6: Elevated (Aerobus) – 188<sup>th</sup> Street Route**

The Aerobus 188<sup>th</sup> Street route is not considered to be compatible with any Sound Transit Link operating division and has very high projected capital and operating costs. Because the route would operate along the potentially higher density corridor of south Tukwila it could attract the same 10,000 to 12,000 riders per day that the LRT- 200<sup>th</sup> Street Route would attract. However, it is expected that there would be considerable community opposition to the visual impacts of this elevated this route on S. 188<sup>th</sup> Street.

It is therefore not recommended that the Aerobus – 188<sup>th</sup> Street Route be considered any further.

### **Alternative 7: PRT – SR 518 / 200<sup>th</sup> Street Loop.**

The PRT Loop – SR 518 / 200<sup>th</sup> Street route is not considered to be compatible with any Sound Transit operating division. The combined capital and operating cost per passenger is potentially low, but the technology is not readily available and therefore the costs are largely unproven. Unless a “demonstration” type fund could be tapped, the project will rate very low in competition for any implementation funds.

A PRT study conducted for the City of SeaTac in 1997 developed similar conclusions: “PRT technology is not operational in any location in the world; various private and public efforts over the past 25 – 30 years have not been successful. There is significant financial and technical risk in the implementation of PRT technology”.

Because of the uncertainty of the operating parameters and costs, PRT must be proven in a demonstration project before the technology could be considered further in the Sound Transit process. It is noted that further studies of PRT may be pending in the SeaTac area through funding obtained through the Volpe Center.

It is therefore concluded that the PRT technology is not feasible at this time and it is recommended that Sound Transit monitor any new information and studies that may be developed by others regarding this technology.

### **Alternative 8/8A: PRT – 188<sup>th</sup> Street Route & 200<sup>th</sup> Street Extension**

The PRT Loop – 188<sup>th</sup> Street routes are considered to be comparable in ratings to the SR 518 / 200<sup>th</sup> Street Loop route. However, if the PRT technology was proven in a demonstration project, the PRT 118<sup>th</sup> Street Route would be considered the likely candidate.

## ***Summary and Recommendations***

### **Sound Transit Phase 2 Planning Study Alternatives**

It is recommended that the following alternatives be considered for further evaluations in the Sound Transit Phase 2 Planning Study process:

- BRT – SR 518 Route
- LRT - Southcenter Route

### **Demonstration Projects and Other Studies**

It is recommended that the following alternative be considered for further evaluation in other studies, such as the potential SeaTac/Volpe Center study, and particularly after a successful demonstration project has been completed:

- PRT – 188<sup>th</sup> Street Route