Cascadia Discovery Institute

COMMENTS ON THE PSRC/SOUNDTRANSIT BNSF WOODINVILLE SUBDIVISION FEASIBILITY STUDY

Submitted
December 5, 2008

INTRODUCTION

THESE COMMENTS ARE PROVIDED AS the basis for possible changes or clarification to the Sound Transit 2 Planning, BNSF Eastside Corridor Commuter Rail Feasibility Study, Phase II Technical Memorandum: Feasibility Study prepared for Puget Sound Regional Council and Sound Transit by Parsons Brinkerhoff and dated November 17, 2008. The comments do not offer comparisons with the costs and assumptions previously provided by the Cascadia Center for Regional Development of Discovery Institute, of the Eastside Commuter Rail Service assumed to be between downtown Snohomish and Tukwila. That original report is included for reference.

In our opinion some review and prioritization of PSRC/ST cost estimates seem warranted. We suggest the inclusion of improved descriptions of the basis and philosophies on which the estimates are based. We also feel that a description of the "inter-relatedness" of the cost estimates should be discussed. (One prime example is the number and location of stations.)

The study report states that the number of stations listed and priced is a "relatively high number of stations for a commuter rail corridor of this length. Close stations (sic) spacing increases acceleration, deceleration and delay and increases operational and capital costs. It is possible that fewer stations might be implemented at service initiation." We agree, but the stations and costs to build and equip them will continue to be included in the estimate. As we will show later in these comments, the actual cost per station in the PSRC/ST estimates, with overhead and contingences approaches, $20 million per station. The "interrelatedness" becomes apparent when it is realized that the additional stations (more time for deceleration into, then accelerating out of each station) slows the overall system speed, adds vehicles necessary to serve the peak hour traffic, increases the size and cost of a service facility, may effect the location, number and length of siding needed, etc. Eliminating just five stations in the cost estimate could reduce the total estimated system cost by $150 million. We do not expect that a "value engineering" effort can be accomplished with the budget and time remaining, but believe that more explicit caveats should be included in the study report alerting readers of the true meaning of the cost estimate total produced.

Time and budget did not permit the PSRC/ST to disaggregate the cost estimates in the study report into their component parts. Our following comments are based on assumptions about the components of the aggregate costs provided.

The bulk of the following comments are related to the establishment of rail transit service in the corridor. The last section of this paper comments on the trail cost estimates included in the study.

SCOPE

WE BELIEVE there must be an "order" to the analysis for cost and ridership data to prove useful and valid. The first is to determine the ridership volumes and the operating demands that traffic will place on the system. Second, the physical extent to which this system needs to be constructed. Third, the nature of the facility to be built and the *standards* of construction to be applied need to be considered. These three items are interrelated. The fourth element is the degree to which non-rail costs should be included in the corridor budget. (Note: Ridership, or the demand for service that the public is likely to place on the system, is so important to the scope of the project, that our comments on ridership are considered in a section immediately following.)

The PSRC/ST and our original Cascadia Center documents made virtually identical assumptions as to the nature of the facility to be built and the standard of track construction. Both assume completely rebuilt track structure with concrete ties, and a new rail traffic control system. **The most important single difference between the Cascadia and PSRC/ST cost estimates is that PSRC/ST assumed repair of the existing timber trestles, while the Cascadia plan assumed replacement of all timber trestles with new concrete trestle structures.**

PSRC/ST assumed a smaller system length than did Cascadia. The difference is that PSRC/ST placed the south end of their assumed system on the north side of Renton at Gene Coulon Park, railroad milepost 4.1. Cascadia placed the south end of a possible system at the Sounder Station in Tukwila, assuming that at some point the service would interface with existing "Sounder" service at Tukwila. Both studies assumed on 30-minute headway on operating trains.

The Cascadia document did not include roadway or trail costs except at Snohomish, where we assumed system construction would absorb the cost of three quiet zone crossings. PSRC/ST included millions of dollars of highway and trail related costs in their rail budget. We assume these were included necessary for "political" reasons. Probably the single most recognizable example of using rail assets to reduce trail costs is the study recommendation to convert existing large bridges at Wilburton and Snohomish to trail use and build entirely new rail bridges.

RIDERSHIP

THE FOUNDATION OF ANY SYSTEM design is ridership. How many people will the system serve? How many people per peak hour? How many people per train? Peak traffic controls train size in terms of seats and train frequency. Train frequency drives track capacity, which in turn determines the *number* of sidings and where trains may meet each other. Schedule decisions set the *location* of the sidings.

The PSRC/ST feasibility study has two components: the physical/cost components provided by ST and the ridership/traffic study done by the PSRC. These two items were done simultaneously so ST and their consultant may not have had the advantage of the PSRC ridership/traffic projections.

The PSRC base case traffic on a Coulon Park-to-Snohomish system mapped to 5,015 boardings per day. Traffic on a Renton CBD to Snohomish (with the Redmond spur) system was projected at 6,730 boardings per day. We have requested, but were told a "peak hour" ridership estimate is unavailable. Consequently, we estimate that peak hour traffic will be 20 percent of daily boardings. Based on 6,730 daily boardings, peak hour boardings will be 1,350. Since Bellevue is the clear center of traffic, we can only assume that half of the traffic goes to or comes from the north and half to or from the south, for a total load of 625 persons per hour in each direction. In reality, if a system were connected with "Sounder" at Tukwila, the ridership flow from the south would probably exceed 50 percent of the total and the total ridership would be expected to be higher.

The system must have the capacity to meet peak period demand, which means having sufficient capacity to give everyone a seat. Cascadia assumed two-car trains of double deck equipment while the PSRC/ST study assumed trains made up of two, two-car mated pair, single level DMU vehicles. For discussion, this is assumed to be a four-car train.

A two-car double deck DMU train provides 376 seats. Such trains on 30-minute headway provide 750 seats per hour. This is a bit more than the expected peak hour demand, so there is sufficient capacity. While PSRC/ST did not disclose the number of seats per train, we believe that it is reasonably comparable to the number of seats per train that Cascadia calculated. Cascadia admits that single level cars are becoming a standard for this type of service and for sake of comparability will base these comments on that assumption.

One manufacturer allows any number of pairings and articulations and will "custom manufacture" any train set. By way of comparison, using single level trains as PSRC/ST proposed, trains of three paired cars could approach a capacity of 1,000 people per hour. Six pair trains double that to 2,000 people per hour. Going to 15 minute headways with 12 car trains could provide a capacity of 4000 people per hour. Double deck equipment would double capacity again to 8,000 people per hour holding platform length constant. These levels would provide ample future capacity. For comparison, a lane of freeway has only a capacity of 1,800 people per hour based on single vehicle occupancy and two-second headway at 60 MPH.

TRACK, SIDINGS & DRAINAGE

THE SCOPE OF TRACK WORK will have significant impact on the capital budgets. Cascadia's original cost approach was to do at system inception everything required to meet the service requirements. Because of disruptions and the extra cost of doing most track work elements under traffic, it seems prudent to do everything reasonable to avoid disruption and excess operating cost once the service is operating. PSRC/ST applied substantially the same standard, recommending "a permanent level of infrastructure investment quality."

In comparing the Cascadia and PSRC/ST cost estimates both Cascadia and PSRC/ST inspected the track and concluded that a total rebuild involving new concrete ties, rail and ballast was appropriate. Cascadia recommended removal and replacement of existing ballast with 12 inches of crushed rock ballast under the ties. PSRC/ST did not state what ballast depth they planned to specify, but we assume it would be the same.

New high quality crushed rock basalt or granite ballast now costs about $21 per ton, or $26.25 per yard delivered. A reconstruction of the corridor would use 4,050 yards per mile, which comes to $106,300 per mile. Concrete ties now cost $96 each. Concrete ties are usually placed on 24-inch centers, which equal 2,640 ties per mile. Concrete ties will cost $253,500 per mile. New rail will cost about $1,300 per ton delivered alongside the track regardless of rail weight. 141# rail is 248.16 tons per mile, 136# rail is 239.36 tons per mile, and 115# rail is 202.40 tons per mile, or $322,608, $311,168 and $263,120 per mile respectively.

Both Cascadia and PSRC/ST recommend relay of the entire line with new 115# continuous welded rail. Heavier rail is not a good economic choice because the axle loadings of passenger equipment are relatively light, and annual gross tonnage of continuing freight traffic is expected to be very light, compared to standard/normal freight railroad practice. Thus, reconstructing the corridor will not exceed $1,000,000, per mile including rail, ties, ballast, surfacing installation, removal labor and equipment and tie disposition costs. Scrap credit for rail and ties was not addressed in either cost estimate, but could provide for some contingency.

The PSRC/ST estimates assumed the same track structure (Page 1) as did Cascadia, but at a cost of $1,842,000 per mile (page A-9 item 10.11). PSRC/ST has indicated that their costs are based on their "Standard Cost Library" which was used for projects in the ST2 plan. Cascadia's figures were generated from conversations with large railroad contractors active in the Pacific Northwest. The PSRC/ST cost is 80 percent higher than that estimated by Cascadia. We cannot understand the discrepancy and believe a review of the track replacement costs are in order.

The PSRC/ST estimates included a budget line item for special track work that mostly includes turnouts and crossings. Cascadia included the cost of switches for new sidings but did not include the costs of upgrading existing turnouts. The PSRC/ST budget for special track work was $5.94 million. Cascadia agrees that a cost category for crossings and turnouts should be added after it is determined how many switches must be retained to serve freight customers. We feel an allowance of $2,500,000, for 10 turnouts is sufficient.

The Cascadia cost estimates included six sidings based on the schedule that results from operations on 30-minute headway. We assumed sidings of one and one half miles in length, which would take 90 seconds to travel at 60 MPH. The cost of $6,000,000, per siding includes $500,000, for switches, $1,000,000, for signals, $1,500,000, for track, plus $3,000,000, for the clearing and grading that will be required. Grade crossings within the sidings will increase cost.

Cascadia and the PSRC/ST analysis used different logic in placing the location of their sidings. Cascadia sought to locate their sidings *between* stations while PSRC/ST sought to locate their sidings *at* stations. Cascadia chose its approach to simplify station design and to avoid the cost of facilities to separate patrons from tracks upon which a second train could arrive. This difference in design philosophy caused Cascadia's sidings to be longer than PSRC/ST's would be, and were the reason why Cascadia's station costs and operating liability would be lower than PSRC/STs' approach. The PSRC/ST data is insufficient to identify the cost impact of these different approaches, but significant cost reductions would be obtainable.

The now-retired Division Manager for the BNSF, Read Fay, completed a previous report for Cascadia. Mr. Fay's report noted encroachment and drainage disruption between Bellevue and Woodinville. The current condition of the drainage is marginal on average and needs immediate work in places. Drainage is crucial to stability of the track. Correcting the drainage and clearing encroachments should be the first order of business for a new owner. The cost of drainage and ditching is independent of the degree of track work, and should be done before the track work is undertaken to avoid fouling new ballast. The cost for sub-grade and drainage issues in our original budget is an estimate based on spot inspections. The cost of drainage work will depend entirely on the current conditions and the standard of upslope ditching desired. We originally included $3,000,000, for drainage work in our budget.

The PSRC/ST did not identify the cost of drainage work. Since the ST2 project will be new construction, it is possible that ST does not have an item for "updated" drainage work in their standard cost library.

BRIDGES

ONE OF THE ITEMS CONTAINING the widest differences between Cascadia's original cost estimate and the PSRC/ST cost estimate involves bridges. There are several bridge issues, plus many wooden trestles and trestle approaches to otherwise steel or concrete bridges, and the individual long or high bridges at Snohomish, Wilburton, and over Interstate 405 near Bellevue.

The scope of work on the trestles and bridges will have significant impact on both capital and operating budgets, and on future disruption. Cascadia's original approach was to do today everything required to meet the service requirements for the foreseeable future. PSRC/ST applied substantially the same standard in recommending a permanent level of infrastructure investment quality. However wide cost disparities exist.

Cascadia's estimate contemplates replacing all timber trestles with new modular ballast deck concrete trestles having a rating of E80. Timber trestles are short lived, 40 years or so, and are susceptible to fire damage. They remain a weak point, and maintaining them under traffic would cause service disruption.

Cascadia's cost estimate used the BNSF's budget price of $3,000 per foot for concrete trestles. The trestles in the Snohomish River flood plain are only about 12 feet tall. It is probable that the cost to fill the many spans of trestlework across the flood plain South of Snohomish will be less than the price of new concrete trestles, IF environmental regulations would allow. This is an existing freight railroad and different environmental standards may apply. Filling where the wood trestles exist is the preferred course and should cost less than the $3,000 per foot in the budget. Cascadia's budget to replace all low trestles based on lengths from the BNSF's track charts is $10,170,000.

The PSRC/ST approach to the trestles was to replace the individual pieces showing signs of stress. The percentage of replacement ranged from 30 to 50 percent. This approach to the trestles is not consistent with the avowed standard of a permanent level of infrastructure investment quality, but would be both cheaper and expedient. The PSRC/ST analysis did not give any costs for individual bridges nor for the low trestles as a group, so no conclusions may be drawn as to the costs of repairs versus Cascadia's philosophy for replacement of wooden trestles.

The Snohomish River bridge (and attendant trestles) at Snohomish is about 1900 feet long and consists of four steel center spans over and adjacent to the river with a wooden trestle approach on each end. The north end trestle is about 25 spans that average about 45 feet tall, and the south end has about 75 spans that average about 35 feet tall.

The Snohomish River bridge may be analyzed in three parts: the existing steel spans and their associated concrete piers; the deck on the steel spans; and the approach trestles. Cascadia's estimate was based on the assumption that the steel bridge spans are structurally sound. A professional inspection would be required to confirm this to be the case because the bridge has not been used for any traffic for about 30 years.

After a visual inspection we concluded that the steel spans should be painted at a cost of $1,000,000, and that the decks of the steel spans would be replaced at a cost of $500,000. Cascadia's budget was based on replacing the wooden trestle approaches with concrete trestles and used a cost of $4000 per foot because of the height of trestle bents. Total length of the trestle is about 1500 feet. At 1,500 feet, the new trestle approaches will cost $6,000,000. This is a total cost of $7,500,000, for the Snohomish River Bridge, considerably lower than the PSRC/ST estimates. At a minimum the final study report should provide a range of costs and identify different "philosophies" involving this and other bridge replacement costs.

The PSRC/ST study declared the condition of the Snohomish River bridge to be "poor"' due to "poor condition of timber bulkheads and seats at abutments, and some of the timber trestle columns and diagonal bracings, which exhibit cracks, splits and rot." (Page 16) The study did not identify the load rating of this bridge, despite so doing for most of the other steel or concrete bridges. The ST consultant did not inspect the steel portion structure, instead they chose to "write it off" and assign it to trail use (page 17). This is indefensible considering that by simply cantilevering a wider than railroad standard walkway, the trail could be carried on the existing structure and both could enter the downtown area with minimum disruption. The PSRC/ST estimates include total bridge cost for the line segment that includes this bridge at $86.99 to $113.09 million (Table 4.1, page 39). This range compares to Cascadia's $7.5 million estimate.

PSRC/ST separately estimated bridge costs for the line segment between Bellevue and Woodinville of $4.25 to $5.52 million (Table 4.1, page 39) and for the line segment between Woodinville and Redmond of $1.57 to $2.04 million (Table 4.1, page 39). These costs appear reasonable to us. PSRC/ST identifies bridge 6.2 on the Redmond line as being the oldest on the lines under discussion, built in 1900, and more importantly rated at E40. They do not state any intention concerning this bridge.

Cascadia would replace bridge 6.2. The cost to replace this bridge is not included in our original estimate because we did not have access to the railroad's bridge ratings, or to the railroad's track chart for the Redmond spur. PSRC/ST states that bridge 6.2 is 225 feet long. In the photo on page D-25, bridge 6.2 appears to have a steel span of about 75 feet with 75 feet of trestle approach on each end. We would recommend increasing our original trestle replacement budget by $150,000 and add $300,000 to replace the steel span.

The existing Wilburton trestle is 975 feet long. The BNSF Engineering Department has advised that current bridge is suitable for rail service for about 25 years with only modest maintenance expense. However, the possible evacuation of riders from a passenger train on the current structure would be a slow, unpleasant and possibly dangerous process.

A current project most comparable to replacement of the Wilburton trestle is the "new Boone High Bridge" that Union Pacific is building in Iowa. The Boone High Bridge will be double track, 2,550 feet long and 190 feet high. It will cost $43,000,000. The Wilburton trestle is 975 feet long and less than 190 feet high. On the basis of proration by length, a new Wilburton double tracked bridge would cost $18,500,000. Since engineering and permitting may not be included in the UP reported cost, Cascadia's original budget included $20,000,000, for a new double track Wilburton bridge. Again this estimated cost is considerably different than the cost estimate included in the PSRC/ST study. We urge that our suggestion be identified as a "second approach" and be included in the final report.

It will be necessary to construct a replacement for the removed Wilburton Tunnel. The contemplated bridge over I-405 is "diagonally" 470 feet long. The bridge over I-405 is made more complex and more expensive than it should be because we understand a WSDOT requirement that it be a single span (no center columns) of 470 feet. BNSF bridge engineers estimate a plain *double* track box girder span would cost $6-7,000 per foot or $3,500,000. The BNSF has constructed a bridge of this type for a 500-foot span in this price range. (We can provide specifics)

One can question whether or not to double track on long bridges at Wilburton and over I-405 now, later, or never. Cascadia's original cost estimate was based on double track bridges in our original estimates. They may be required for meeting points and will be required if the line is eventually double tracked. It will be much cheaper to build double track bridges now than to build a single now and a separate single later, given the size of these structures. Both of these bridges could include at construction a wider than normal pedestrian walkway to accommodate trail users.

As at Snohomish, the PSRC/ST study would convert the existing Wilburton trestle to trail use and build a new bridge on a new alignment. Again, because of lack of detail in the study, it is impossible to determine the costs assigned to each structure. But the study bridge costs for the segment from Bellevue to Renton amount to $82-$106 million (Table 4.1, page 39), rather than our estimate of $23.5 million, a considerable difference. Again, we urge that the final study report include a range of costs and an explanation of alternative philosophies used in costing these alternatives.

Cascadia's total bridge costs are $41.2 million. Cascadia will add to our original estimate $500,000, for bridge 6.2 near Redmond, which brings its total bridge budget to $41.7M. In contrast, PSRC/ST's bridge costs are $174.81-$226.74 million. These costs may be overly exaggerated by "scrapping" perfectly good structures and using unreasonable, albeit undisclosed, unit costs for everything else.

PSRC/ST costs are 4 to 5 times Cascadia's bridge costs, despite the fact that our plan is to replace rather than repair all wood trestles on the line and to double track both the Wilburton Trestle and the new structure over I-405. Cascadia's costs are very conservatively based on heavy-duty freight railroad designs and practice, which should tend to bias them high, not low. Again, major review of the cost estimates, or adding a range of costs based on "philosophical" alternatives is suggested.

STATIONS

ANOTHER FUNCTIONAL AREA WITH MAJOR costs differences was stations. The Cascadia cost estimates for the corridor projected 11 stations. PSRC/ST assumed 16 stations. This difference in scope reflects Cascadia's attempt to develop the cost of a "most likely" system versus PSRC/ST's decision to include stations requested by every jurisdiction along the corridor. The PSRC/ST study describes this design approach on page 3, ". . . a full menu of potential project elements that may all not necessarily be included in a final, constructed project."

Cascadia included eight stations on our north segment, Snohomish to Bellevue and the Redmond spur. We assumed stations at: downtown Snohomish, Cathcart, Maltby, Woodinville, Totem Lake, Kirkland, Bellevue and Redmond. Cascadia planned for three stations on the southern segment: Coal Creek/Lake Washington Boulevard, Downtown Renton and Tukwila. In the Renton area, Cascadia proposed stations at Tukwila and the Renton central business district, while PSRC/ST had them at Coulon Park and Port Quendall. Cascadia's Coal Creek and PSRC/ST's Newport Park and Ride are functional equivalents.

Cascadia proposed locating a Bellevue station immediately north of NE Eighth Street. This location was selected to be north of the Wilburton bridge so that north end service could begin before rebuilding of the Wilburton bridge and the bridge over I-405. PSRC/ST had two Bellevue stations, one at NE Sixth and one at NE Twelfth. As a practical matter only one downtown Bellevue station is required and it logically should be located where the East Link line will cross the Woodinville Subdivision.

Cascadia's Kirkland station is the same as PSRC/ST's South Kirkland Park and ride. We see this as an important transfer point for cross Lake Washington bus service, but would not place a station at 85th Street in Kirkland as it is located in a moderate density residential area. Cascadia and ST consultants both planned for a station in the Totem Lake area of Kirkland. PSRC identifies this as a strong trip generating station.

Assumptions at Woodinville differed between our original estimate and that of PSRC/ST. Cascadia proposed a single station in the Woodinville central business district; PSRC/ST also included a station in the Woodinville CBD. They also planned, as Cascadia did not, two South Woodinville/145th Street transfer stations. Their transfer stations would be used to transfer passengers between the main line and the Redmond spur. The reasoning for this plan offered that this will reduce the redundant mileage incurred in riding into Woodinville CBD to transfer for passengers to and from the south, that is, Bellevue and Renton.

While PSRC/ST's observation is true on its face, this plan requires that all transferring passengers to walk at least 800 feet between a South Woodinville station on the Woodinville Subdivision and a South Woodinville station on the Redmond spur. Passengers would have to cross the Woodinville-Redmond Road to make the transfer. Parsons' proposed arrangement is shown on page 44 of Appendix B, Conceptual Alignment.

Time savings gained by reducing redundant mileage for passengers moving south would be more than lost in making this unnecessary walk, often in the rain. Passengers moving north would not save any rail travel time and would be subject to time loss in making this unnecessary walk. The PSRC/ST scenario would also adversely affect passenger convenience. Adding an 800-foot long "foot transfer," plus the cost of building two unnecessary stations should be reconsidered.

Allowing a cross for platform transfer at Woodinville CBD, the original Cascadia plan extended the Redmond spur to a stub end station track at Woodinville. This track will be about .25 miles long and extend from the existing junction of the Woodinville Subdivision with the Redmond line and the CBD station site. It will include a bridge over the Sammamish River, a grade crossing of SR 202, a bridge over SR 202, and a crossover. Including the bridges, crossover and road crossing, these improvements are estimated to cost about $2.25 million.

This extension and station track is necessary to keep the Redmond and Woodinville Subdivision trains separate for operational reliability and flexibility. The extension of the Redmond spur to Woodinville CBD allows a simple cross platform transfer between trains located about ten feet apart, a far move convenient and reliable arrangement for all passengers rather than an 800-foot walk.

The Redmond line extends 6.5 miles from Woodinville to downtown Redmond. The Redmond line will is important because it could be the beginning of the route to Microsoft's main campus in Redmond, and an eventual connection to a "520 Link" line. Both Cascadia and PSRC/ST plan to operate a single captive train in shuttle service between Woodinville and Redmond. PSRC/ST placed two stations on the Redmond spur-the transfer at 145th and one at the Redmond CBD. Cascadia had only a station to serve the Redmond CBD.

North of Woodinville, the PSRC/ST study assumed a station at 195th Street that Cascadia did not. As discussed in the introduction, we believe that it is important to limit the number of stations to limit the acceleration/deceleration and dwell time for stops. Cascadia assumed that reasonable feeder bus service would be provided in conjunction with any commuter rail service. In part to avoid a "trolley type" station density and the non-competitive trip time that would be associated with a high station density system. Both our assumptions and the PSRC/ST study assumed stations at Maltby and Cathcart.

Locating a station in Snohomish will be expensive and may be complicated. PSRC/ST assumed a station in the Snohomish CBD. Cascadia agrees that is the best, and possibly the only practical site in the area. However, the City of Snohomish is struggling with the visualization of the traffic and congestion that a downtown station may precipitate. They also wonder where bus interface and car parking will be provided. In addition, with a close packed CBD and close-in residential housing a typical commuter train and/or excursion train may "overpower" the small town feel.

There seems to be three reasonable places for a station in Snohomish. The first location is by the airport, on the connector between the former Northern Pacific line and the BNSF main line. The airport lies in a 100-year flood plain, and the railroad is elevated about 12 feet above the flood plain. The station would be on fill or on stilts. Motor vehicle access would be awkward and would interfere with the airport's current parking facilities. This can be mitigated somewhat by moving further west, but the track does not go as far as the west edge of the airfield. Motor vehicle access and parking anywhere near the airport would be in the flood plain and would be impossible in times of flood. A station near the airport has the secondary disadvantage that it would serve neither the commercial nor the residential area of Snohomish.

The second location for a Snohomish station would be north of Second Street. The right of way between Second and Fourth streets extends about 50 feet from the track to the street so there is room for a building, but not much parking. The rail line fronts a quiet residential street. Motor vehicle traffic impacts would be an issue.

The station could also be placed on the block between Fifth and Sixth now occupied by a salvage yard. This site is a block and a half wide which places its western boundary at Pine Avenue, a light duty arterial street. Traffic impacts would probably be less at the Pine Avenue site, allowing for more room for motor vehicle access. Potential sites between Second and Sixth are all quite convenient to an exit from US 2, east of Snohomish. Access from the North and Highway 9 would be via US 2, which is built to freeway standards between Highway 9 and the East Snohomish exits. The best station location appears to be the Pine Avenue site.

According to the May 2008 MOU between the Port of Seattle and the BNSF, the north end of the Port purchase is at MP 37.61. This is the point of the south wye switch at Snohomish south of the river and south of the BNSF main line between Everett and Wenatchee. This means that the BNSF's Snohomish River Bridge and right of way to Pine Avenue is excluded from the Port's purchase. The missing right of way extends for 1.5 miles. Cacadia's original cost estimate included $1,000,000 for the purchase of this right of way and the Snohomish River Bridge. The PSRC/ST study makes no mention of the need to purchase this right of way and the bridge.

Calculating PSRC/ST station costs involves aggregating from several accounts. Account group 20 is the station account and it totals $26.92 million, or an average of $1.68 million per station for 16 stations. Account group 40 "Sitework and special conditions", includes costs for site utilities, utility relocation, hazardous material cleanup, wetlands, pedestrian/bike access, landscaping, automobile, bus, and van accessways including roads and parking lots, and temporary facilities during construction.

Accounts 40.06, pedestrian/bike access, and 40.07 automobile, bus, van accessways including roads and parking lots can only be station related and total $41.75M. Cascadia assumed much less complex stations than did PSRC/ST. As have been developed in other systems, we contemplated simple, low cost station designs. We do recognize that the cost of motor vehicle access and parking may increase as more functional elements related to motor vehicles and bus transit access, and passenger amenities are added to stations. The other accounts, which total $28.13 million, could apply to both shops and stations. Included within these accounts are environmental mitigation for shop, bridge and siding construction. PSRC/ST projects $69.88M in construction costs for items in Account Group 40, excluding accounts 40.06 and 40.07. As explained earlier, we believe costs in these other accounts could reasonably be expected to be substantially lower, given that the "reconstruction" of an existing facility is involved.

The final station related item in the PSRC/ST estimate is fare collection system and equipment at $14.52 million, or $907,000 per station. Cascadia's estimate was for a $500,000 fare system at each station.

Cascadia used $1 million as the estimated cost per typical station, including a four-car platform. Cost elements included the platform and a small building. We assumed "kiss and ride" or bus transfer stations, with small parking lots on railroad right of way. Though not included in the initial cost estimate, it was anticipated that stations would be sited to allow for future expansion of platforms. Cacadia's typical cost for stations was $1.5 million.

Two of Cascadia's eleven stations, Tukwila and Renton CBD, would not incur major station costs but do require fare collection equipment. At Tukwila we included $250,000 to modify the existing plywood station platforms. At Renton CBD we assumed renting ground floor space in an existing building.

Our total station cost was $14,750,000. The total station cost (calculated by PSRC/ST) was $96,800,000 or more than 6.5 times that of Cascadia. Accepting fare collection costs and rounding it up to $1,000,000 per station adds $5,500,000 to our estimate for a total $20.25 million. The PSRC/ST estimate is still over stated by a factor of almost five.

Roadway Crossing Signals

SIGNALS FOR ROADWAY CROSSINGS COMPRISE another area of large cost, again related to the overall scope of the project.

Cascadia assumed that the existing road crossing signal system would remain in place, but that the electronic systems that control the crossings should be upgraded with state of the art technology. Most of the crossings are old and we assumed that the existing signal controls are obsolete. Upgrading the electronics is included in Cascadia's estimate for crossing surfaces. No changes to existing signals or gates were contemplated at any crossing.

PSRC/ST planned to remove the existing crossing protection at public crossings and replace them with more elaborate systems. Normally, a railroad would require the local jurisdiction to install that protection at its own expense, not the railroads. Politically that might not occur in this circumstance, but if that is the reasoning, it should be noted in the report.

There are two types of roadway crossings- public and private. The nature of the protection at public crossings is regulated by the Utilities and Transportation Commission. The long established and controlling Federal law requires that if the roadway owner wants active crossing protection, for that crossing, and in their jurisdiction, then that agency has to pay the capital costs of installing the system. The railroad is, however, obligated to maintain it thereafter. Accepted practice at Sound Transit appears to be that the Agency (ST) pays for the upgrade. That assumption has added to the cost projected here.

The crossing of State Highway 524, also known as Maltby Road, is the one crossing that does not have active crossing protection but should. Maltby Road is a busy crossing with ninety-degree turns onto it. Motorists would be likely to turn into the path of a fast train approaching from behind. However, common railroad practice suggests that the design and expense for signals and signal changes are a highway agency responsibility.

In Snohomish, the rail line within the city is intersected by grade crossings every block. The original Cascadia budget included the cost to install crossings built to quiet zone standards at First and Second Streets **in trade** for closure of Pearl, Rainier, Bowen, Third, and Fourth Streets. (Fifth Street does not cross). A crossing of Sixth Street should be maintained to enable later operation of longer trains. We did include a crossing of Sixth Street in our original estimate.

Private crossings (for example driveways) exist by contract between the owner of the crossing, typically the landowner who uses it, and the railroad. The cost of protection, typically a stop sign, is borne by the crossing owner. The typical contract provides that the railroad will maintain the crossing surface, but at the cost of the owner, and that the owner will provide protection and insurance to the railroad. We have assumed railroad standards in this situation. It may be unrealistic to assume however, that if the railroad were taken over by a public entity (even thought it continues to operate as a freight railroad) that the entity would not be expected to pick up these costs. The PSRC/ST estimates however, explicitly planned to install active crossing protection (gates and signals) at all private crossings, which has not been the obligation of the BNSF railroad.

The PSRC/ST cost of crossing signal work was $47.22 million; Cascadia's was $1.2 million for three quiet zone crossings at Snohomish. The PSRC/ST estimate is 40 times more than ours. Some compromise position or philosophy should be discussed or considered in the final report.

PSRC did not consider, but we included in our original estimate, the cost of rebuilding public roadway crossing surfaces in the item "Crossing Surfaces", which covers only public crossings. As a matter of state law, the railroad is required to maintain roadway surface of public roads for the width of the track structure. The cost shown in our original budget is based on the assumption of a complete track rebuild, the cost of which is included in the track budget.

Cascadia's original cost estimate assumed that all public crossings would be rebuilt with concrete panel surfaces, new ballast, new ties, and new drainage. The electronic systems that control the crossings should be brought up to date. Upgrading the electronics is included in the estimate given for crossing surfaces. Under the Northern Pacific's standard private crossing contracts, repair and upgrade is at the cost of the owner. With negotiation, this may enable some of the private crossings to be eliminated, the safest solution. PSRC/ST either did not recognize the crossing surface issue, or included the cost in another line item.

RAIL TRAFFIC CONTROL

THERE MUST BE A TRAIN control system. All of the lines proposed for operation of commuter trains are now dispatched by "Track Warrant Control," a formatted verbal authority issued by the train dispatcher. For this corridor, there is no automatic railroad signal system; the entire line is now what is known in the railroad industry as "dark territory."

Our original estimate included a "Centralized Traffic Control" system or CTC. In a CTC system the position of switches is controlled by the dispatcher and information about route and speed is conveyed to the train operator by fixed line side signals. The central office portion of the system is estimated at $3 million. Each of the six sidings will cost $1 million for signals. Each crossover will be $600,000 for signals, and one additional crossover at Woodinville. Each "dragging equipment detector" will cost $250,000, and each hotbox detector will cost $125,000. The budget includes one dragging equipment detector and one hotbox detector. Given these assumptions, the control system will cost $6,975,000-excluding the cost of signals at sidings. The cost of siding signals was included in our budget as part of the cost of sidings since siding signals are logically part of the cost of the siding. Our total estimate for the central office portion of the CTC system, including crossover signals and detectors and a building to house the administrative and dispatching offices is $7 million.

PSRC/ST's estimated cost is $8.65 million for central control plus $69.34 million for train control and signals. Cascadia's $7 million for central control and for signals not at sidings is reasonably comparable with Parsons Brinkerhoff $8.65 million. It is not clear if the PSRC/ST study associated the cost of siding signals with sidings. PSRC/ST assumed five sidings; we anticipated six sidings, so comparison of signals related to sidings is reasonably similar. However, PSRC/ST's $69.34 million for line side signals, budget line 50.01, is over 10 times our estimate, and should be validated.

Our estimate is for a basic CTC system. Cascadia's source was a meeting with a railroad consulting firm whose practice includes rail traffic simulation and signal system design. Due to Federal legislation enacted after Cascadia's original work, a Positive Train Control system appears to be required. That system may cost more that the system that we originally assumed, but a cost of 10 times the original estimate is very unlikely.

EQUIPMENT

FOR ITS EQUIPMENT COSTS CASCADIA used an informal quote that Colorado Railcar gave in June 2008 of $6M each for double deck DMU cars. (Almost $4M for a single level car) That is $12M for a two-car train. ($16M for a single level two car articulated train). Seven trains are required to meet main line schedules of 30-minute frequencies. One train is required to provide service on the Redmond Spur, and one train is in shop/spare, for a total of nine train sets, or eighteen single level, articulated units. Cascadia used two car trains of double deck DMU cars to estimate equipment cost. These cars may no longer be available and two single level articulated units replacing each two car double deck trains should be anticipated.

Cascadia's original equipment cost of $108 million was higher than PSRC/ST's $66.15 million. PSRC/ST has told Cascadia that they assumed trains made up of two, two car mated pair, single level DMU vehicles. As a practical matter this is a four-car train. While PSRC/ST did not disclose the number of seats per train, we believe that it is reasonably comparable to the number of seats per train on which Cascadia's cost is based. Based on the recent Oceanside/Escondido DMU purchase from Siemens, today's cost for 18 articulated single level units would be approximately $90 million.

Our research indicated that the cost per seat of single level equipment is a bit higher than that of double deck equipment. PSRC/ST did not discuss how they calculated their equipment needs, but on page 20 they indicate a fleet of 16 DMU vehicles. That is sufficient to provide eight train sets of equivalent seating capacity to the vehicles that we originally suggested. Our calculations contemplated nine train sets, while PSRC/ST estimated eight.

Given the shorter system suggested by PSRC/ST, it is possible to operate the service with eight sets of equipment. The number of vehicles and their configuration does not appear to be a significant cost driver, but should be highlighted.

SHOP

CASCADIA ORIGINALLY ESTIMATED A SHOP on a particular site at Maltby that has plenty of ground, is fenced, and has the main track switch installed. It is also more rural and this is possibly a less costly location than in Woodinville. The shop, including track, the shop building, tools, and opening inventory is estimated to be about $5.5 million.

PSRC/ST assumed a shop in the Woodinville area, which is a reasonable location. They estimated construction costs to be $17.99 million and land acquisition at $78 per square foot, or $3,351,348 per acre. Land and site costs for the shop were intermingled with such costs for stations. On page 21, PSRC/ST projects that the shop would require 2.5 acres and that would be a land cost of $8.378 million. It should be noted that all land costs in the PSRC/ST estimates use this $3,351,348, per acre cost.

After our estimates were made we found out that the Escondido shop had cost $25 million. We believe that shop costs should be increased to $25.5 million.

OVERHEAD ITEMS

The PSRC/ST estimates include an added 32 percent for Professional Services. These specific "overheads" include: Construction management at 8.5 percent, Environmental Clearance and PE at 2.0 percent, Final Design and Specs at 8.0 percent, Design Services During Construction at 2.0 percent, Permitting at percent, and Agency Administration (Calculated on subtotal of all budget items discussed so far) of 6.0 percent. This means that for every three dollars of construction cost another one dollar is added to the overall cost estimate.

Implicit in estimated cost is that everything is custom designed, reviewed, approved and built. Explicit in Cascadia's cost is that this project is heavy repair of an existing railroad and that all bridges except Wilburton will be built to established standard railroad designs. Our estimates did not include the cost of a large staff because there is no need for them given the nature of the project.

Cascadia recognizes that engineering and project management will be incurred in siding construction, signal system design, bridge design at Wilburton and I 405, station design, shop design, and obtaining environmental permits for some of the bridge work. In many cases the engineering and permitting has been included in the estimated contract price, and in no case will they be anywhere near, on a percentage basis, what PSRC/ST has estimated.

In some places, the estimate provided by PSRC/ST may be doubled. Line item 40.04, Environmental Mitigation, includes professional services to which the estimate applies another 32 percent markup. The 6 percent Agency Administration cost explicitly apples to the six overhead items that precede it. The cost estimated for all Professional Services overheads alone is $182.31 million of the $1.23 billion total. Our original cost estimates did not include project management. We do believe a reasonable amount should be added.

Finally the PSRC/ST estimate adds another 10% for unallocated contingency and change orders. We agree that this is reasonable on its face and a final budget should include a 10% contingency. We assume that PSRC/ST's standard cost library includes the excess costs of Davis Bacon since their work is all federally funded. Cascadia's original budget was $294.5 million with Davis Bacon labor. As a result of this review we have re-estimated our costs for the project.

- $ 2.5 million for freight service switches
- $ 0.5 million for bridge 6.2 on Redmond spur
- $ 5.5 million for fare collection equipment
- $10.0 million for auto and bus interface at stations
- $20.0 million for the shop
- $10.0 million for engineering and project management

These items total $48.5 million and bring the revised budget to $343 million. Cascadia should also incorporate a 10 percent contingency factor, or $34 million for a total of $377 million.

Cascadia did not include the Port of Seattle's purchase cost of the corridor since that sunk cost of $107 million had already been incurred. To make our cost comparable to PSRC/ST's in scope, that amount is added to our budget, bringing it to approximately $480 million. By comparison, the PSRC/ST cost estimate is in the range of $980 million to $1.230 billion.

Cascadia remains confident in the estimate we have produced, but it does reflect what we believe is necessary to actually establish an operable system. The PSRC/ST estimate reflects a complete and total replacement. We urge that the PSRC/ST costs be identified in that way in the report and that other cost "options," as those we have identified, also be mentioned.

TRAIL

AS A GENERAL COMMENT, CASCADIA believes that the trail cost estimates included in the study may be accurate and are comprehensive and complete, but reflect the top end maximum cost that a trail within the corridor could cost. One unfortunate conclusion that the study also reaches is that no trail concurrent to an active rail system may be possible south of I-90. This may be partly the result of private encroachments onto the right-of-way, politically impossible to reverse once the corridor is in public ownership. It also may reflect geographic and physical reality. These "realities" may force a conclusion that the only way to get a new trail south of I-90 would be to displace any rail service on the corridor. This conclusion would be in direct conflict with the "Rails to Trails" national legislative intent. Cascadia believes that the cost and ridership data emanating from this study leads to a clear conclusion that some type of rail transit service is not only feasible in the corridor, but is viable in the short rather than "medium" time frame. We still believe that both rail and trail can and should be developed concurrently in the corridor. Conclusions from the PSRC/ST study thus far would indicate that such a trail facility south of I-90 may however, be less than an ideal facility.

We believe that the study report should clearly indicate the extensive nature of the "higher cost (trail) option". This twenty-nine (29) foot wide option, proposed by the King County Parks Department, would be three times wider than most of the Burke-Gilman trail, would be wider than a normal two lane road, and be double the standard width pedestrian/bicycle trail adopted by the national RailsToTrails Conservancy in their publication *"Trails For The 21st Century"*. It is important for a reader of the report to be aware that given the restrictions outlined south of I-90, a 29 foot-wide facility would also be impossible there, and if built north of I-90, would require massive earth removal of the crown of the existing railroad bed. Normal rail, ballast and clearance is fifteen feet. Even with the removal of the existing rail bed, a 29 foot-wide facility would require the removal of the track, ballast and several feet of earth, actually depressing the existing elevation in many areas, to achieve the width necessary for a 29-foot trail. We cannot understand why this option was even considered.

Recent discussions regarding the Burke-Gilman trail have involved widening it to the national standard 12-feet plus two three foot shoulders, the facility proposed in the lowest cost option for the BNSF corridor. Even that has engendered property, environmental and cost concerns. The cost presented in the PSRC/ST study for trails range from $5.8 million to $8.6 million per mile for the high and low cost options considered, and that average is for the full 42-mile corridor. If analysis disaggregates the portion and costs for trail enhancement south of I-90, the costs projected for trail development north of I-90 from Bellevue to Snohomish (including to Redmond) average $7 million to over $10 million per mile.

Prior to the release of the PSRC/ST draft study, Cascadia had been gathering planning and cost data for trails in general, and specifically for trail being constructed either as part of a rail corridor or after a rail transit system was built. Two of the systems that we have included as comparison inter-urban commuter rail systems (see attached chart) are also building adjacent trails to the rail system.

A new rail system in Austin Texas will open spring 2009. The region has completed a bicycle and pedestrian trail feasibility study for the corridor and other regional rail rights-of-way. Initial construction has started in the new rail transit corridor. Initial cost estimates for construction include: clearing and demolition, rough grading, a 10 foot wide concrete trail plus compacted shoulders, landscaping, drainage, irrigation, fencing, signing and striping, and an information system, among other items. Also estimated is a very high mobilization, contingency and engineering overhead budget of an additional 48 percent, and a pedestrian lighting system (approx 66 lights per mile of trail). Their estimated cost for these items is $697,000, per mile. Included in their estimates, but unique to each mile of trail, are additional costs for specific bridges, road and railroad crossings and adjacent street improvements, drinking fountains and benches. Their plan appears to indicate that these costs are not expected to exceed an additional average of $300,000, per mile, forecasting an approximate $1 million per mile cost.

For the system in Oceanside/Escondido, Calif., adjacent trail has been built along the corridor with grading and other groundwork included in the main construction contract for rail development. As stated by the corridor's Project Manager, "these coincidental costs were just economies of scale" while building the rail system. Their separate contract for completion of the corridor adjacent trail is for $23M. This cost includes all bridges, signalized crossings, underpasses, fencing, landscaping, lighting and amenities for the expected 22-mile trail, bringing the cost to approximately $1 million per mile.

We believe these examples indicate higher than average cost for trail development in the BNSF corridor and urge the inclusion of qualifying language in the final report.