

How Sound Transit Abused the Planning Process to Promote Light Rail

and also

CETA Comments on DSEIS for Sound Transit's "Regional Transit Long-Range Plan"

by

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This report in its entirety is submitted as one of the Coalition for Effective Transportation Alternatives (CETA) comments on Sound Transit's DSEIS for their Regional Transit Long-Range Plan as solicited in Sound Transit's news release dated Dec. 2, 2004 and on the web as:

http://www.soundtransit.org/newsroom/releases/pr_20041202_1.asp

Abstract

Areas of weakness and apparent bias in the planning process behind Seattle's planned "Link" light rail system are identified. Problems with Sound Transit's one and only alternatives analysis – a 1993 FEIS comparing rapid rail and bus alternatives-- are documented. It is concluded that there is no valid alternatives analysis behind Link light rail. Link's performance is summarized using objective data and qualitative comments. Key advantages of BRT are described. Particular attention is given to the issue of rail versus bus capacity, and how it was mishandled in the 1993 FEIS in order to favor rail. Raw cost-effectiveness data in the 1993 FEIS is reformatted and presented in a way that better communicates the relative merits of the rail and bus alternatives. The bus alternative is modified to overcome alleged capacity deficiencies, and then re-compared with the rail alternative. It is found that a modified bus alternative would have had more than enough capacity to meet long-term needs and could have achieved the same ridership as rapid rail, at far lower cost. Results are brought forward in order to estimate the costs of the full regional light rail system envisioned by Sound Transit versus a BRT alternative. It is concluded that switching to the BRT alternative would save the Puget Sound region about \$900 million dollars a year over a 30 year period. It is argued that Link is the failed result of a faulty planning process. The effects on public trust in government are documented with newspaper quotes, as are requests made of Sound Transit to consider alternatives to light rail. Detailed recommendations are offered on how to improve the process and conduct the proper alternatives analysis that is still needed.

Funding and Sponsors

This report was written by the author as a community service. There has been no outside sponsorship or funding.

Author's Background

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Web Sites for additional information on Link light rail

<http://www.effectivetransportation.org/> (CETA site)

<http://www.globaltelematics.com/pitf/index.htm>

Copies of this report

Copies of this report can be obtained from Sound Transit since Sound Transit is required to publish comments received on the DSEIS. Copies may also be obtained from CETA. See CETA web site for contact information.

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Key Abbreviations:

- ST = Sound Transit, the agency charged with detailed planning, implementation of high capacity transit in the Puget Sound area, known officially as the Regional Transit Authority or RTA.
- RTP = Regional Transit Project, the name of the planning project taken over by RTA and whose main product was the 1993 FEIS for rapid rail (the author uses the terms RTA and RTP somewhat interchangeably)
- PSRC = Puget Sound Regional Council, the agency responsible for strategic transportation planning, and the regions official MPO
- EIS = Environmental Impact Statement, FEIS = Final EIS, as opposed to draft EIS
- DSEIS= Draft Supplemental EIS, in this case for Sound Transits “Regional Transit Long-Range Plan”

Specific requests to Sound Transit concerning its response to these CETA comments on the DSEIS

As Sound Transit knows, CETA members have almost certainly spent more effort over the last several years scrutinizing Sound Transit's light rail plans than any other organization.

Due to the importance of Sound Transit's Draft Long-Range Plan DSEIS a large amount of effort has gone into preparation of this document and CETA would appreciate a commensurately detailed and through response.

Individual and specific responses are requested to the following:

- * Parts 1.5 thru 1.15 pertaining to specific deficiencies in the 1993 FEIS
- * Parts 3.1 through 3.16
- * Each of the eight points in Part 5.4.9
- * Each of the reports three key recommendations at the beginning of Part 7.4
- * Parts 8.2.2 and 8.3
- * Each of the report's main conclusions as listed in the Executive Summary and Part 9.

In responding we would urge Sound Transit to consider not only what existing regulations may or may not require the agency to do, but also Sound Transit's moral obligation to provide citizens and public officials with the sufficient and objective information they need to make intelligent decisions about mass transit.

Executive Summary

Sound Transit's Board is increasingly committing this region to use light rail, as opposed to bus rapid transit, for the region's mass transit backbone. In 1996 voters approved spending \$1.8 billion for a 21-mile light rail system. In 2001 Sound Transit admitted their initial cost estimates were wrong and shortened the line to 14-mile miles. However ST still hopes to eventually build over 125 miles of light rail and is taking administrative steps toward doing so.

Sound Transit justified its choice of light rail technology on an alternatives analysis done in 1993 by Sound Transit's predecessor the RTP. That particular study compared a 125-mile rapid rail system costing \$11.5 billion against an express bus alternative costing \$4.7 billion.

During the course of that study RTP predicted year 2020 ridership for both alternatives, and then evaluated their capacity to handle the predicted ridership. In looking at bus system capacity through downtown Seattle the RTP assumed the bus tunnel could only carry 100 buses per hour in each direction, although six previous studies had concluded its capacity was significantly higher than that.

At this point the RTP had a choice. Either it could verify that 100 was the correct value, and if so, apply one of the remedies that staff had already identified. Or it could penalize the bus alternative. It chose the latter, and proceeded to reduce predicted ridership for the bus alternative and claim it didn't have enough capacity to meet the region's needs. In addition, because the bus alternative now had lower ridership the RTA also down-rated it on all other ridership related benefits, such as its ability to improve mobility and support land use goals.

In short, the RTP compared a robust rapid rail alternative against a deliberately hobbled bus alternative and used the results to rule-out bus technology for the region's main transit spine along I-5. In its recently released Draft Long-Range Plan Sound Transit still relies on that corrupted and now obsolete study to justify proceeding with light rail.

Fortunately, it is possible to estimate what would have happened if RTP had elected to remedy the alleged capacity problem rather than penalize the bus alternative. However, to compare apples-to-apples it was necessary to have two alternatives that are either equal in benefit or equal in cost. Therefore the author elected to modify the bus alternative so it would attract the same ridership as the rail alternative, then compare costs. The first step was to remove the alleged capacity bottleneck using –to be conservative-- the most expensive remedy identified by staff, namely building a second parallel bus tunnel costing \$600 million. This allowed the bus alternative to carry its originally predicted ridership, which was 93 % of what the rail system was predicted to carry. To get that last 7% the author used an RTP estimate for the cost of attracting extra riders.

The result is that a modified bus alternative would be \$400 million per year less expensive (in 1991\$) than the rapid rail system chosen by RTP. This is the picture that the RTP

could have produced using information available at that time. However, RTP chose not to do so because officials wanted rail to win. What can that study tell us today when we are concerned with light rail, not rapid rail?

Today there is every indication Sound Transit's Board wants to build at least 125 miles of light rail. There has never been an apples-to-apples comparison between bus rapid transit (BRT) and any of the different size light rail networks that Sound Transit is contemplating, much less a 125-mile system. However; it is possible to make an approximation.

First, it was assumed that 125 miles of Link light rail would attract as many riders as 125 miles of rapid rail. Clearly, it wouldn't because Link's slower, but this is the conservative approach. The remaining task was to estimate the cost of a 125-mile version of Link and compare that with an all-bus or BRT alternative. The 1993 cost comparison can be reused, but only after adjusting it for the facts that Sound Transit's early rail cost estimates were 44% too low and that many of the HOV lanes needed for the bus alternative have now been completed. The results show that a 125-mile light rail system would cost about \$900 million (02\$) per year more than a comparable BRT system. This cost differential would continue over the 30-year period needed to repay the construction bonds. It's also likely that BRT could replace the 14- mile Initial Segment or the 21-mile Central Link system for less than half their costs.

This information about a potential \$900 million per year savings opportunity is new, and it needs to be published widely so taxpayers can decide whether it makes better sense to abandon Sound Transit's light rail strategy and switch to an equally effective BRT alternative.

It's unfortunate that knowledge of this opportunity has been suppressed. The best explanation may be the major disconnect that exists between what most citizens of this region want (reduced traffic congestion at the lowest possible cost) versus what the members of Sound Transit's Board want (light rail regardless the cost and despite the fact it won't reduce congestion).

To paper-over the gap, Sound Transit has systematically and continually resorted to disseminating biased, misleading, and even false information about the merits of Link light rail in order to bolster public support and justify Federal funding. One result is deterioration in the public's trust in government to spend scarce tax dollars wisely. It's also evidence that the current transportation planning process in Puget Sound is broken. The process is not providing the thorough and objective information officials and voters need to make multi-billion dollar decisions.

This report finds that the very foundation of Sound Transit's Draft Long-Range Plan is invalid because it's based on one corrupted and obsolete study done in 1993. It recommends that Link be placed on hold until and unless a proper, honest alternatives analysis demonstrates it's superior to BRT and other alternatives. This report further recommends that federal and local officials take steps to fix the process.

Extended Summary

The main purpose of this report is to trigger a reconsideration of Sound Transit's light rail plans, and the FTA's willingness to fund them by challenging the fundamental basis for Sound Transit's entire rail-centric strategy including their recently released Draft Long-Range Plan. A secondary purpose is to trigger improvements to the planning process that will: 1) help ensure taxpayers get the most "bang for the buck" from their investments in transportation, and 2) eliminate deceptive and manipulative practices on the part of agencies such as Sound Transit. Still a third objective is to give planning students and citizens in other cities a case study example of ways in which a transit agency has abused the planning process in order to promote a favored outcome.

There are three key reasons Sound Transits light rail strategy should be reconsidered:

- 1) Link light rail costs too much for what little it accomplishes. At the same time there appear to be better alternatives such as Bus Rapid Transit (BRT).
- 2) Sound Transit has never proven in any logical or business-like manner that Link is superior to these other alternatives.
- 3) Decisions to approve Link have been based on incomplete, misleading, biased, and false information which Sound Transit disseminated in order to garner support for its light rail plan.

These observations are not new. Sound Transit has heard, and ignored, them many times before. What this report adds to the record is a detailed and carefully footnoted analysis of how Sound Transit has abused the planning process to promote light rail, and, for the first time, a dollar estimate of just what pursuit of Sound Transit's light rail strategy would probably cost this region in relation to a bus rapid transit (BRT) alternative.

In short, the reader of this report will be privy to information that has not been available to date. It will show that the emperor (Sound Transit) has no clothes as regards its rationale for proceeding with light rail.

The full story of Sound Transit's abuse of the planning process is beyond the scope of this report. This report focuses on the alternatives analysis and environmental impact study (EIS) that supposedly justified the choice of rail technology over bus technology for this region's mass transit backbone. The alternatives analysis and closely related EIS are equivalent to a "business case" in the transportation-planning arena. They provide just about the only cost and performance information available to those trying to decide whether or not to fund projects like Link.

Background and context—

The Puget Sound Region is becoming committed to a light rail-centric strategy. Sound Transit recently began construction on Links 14-mile "Initial Segment". Sound Transit's

Board is already committed to extending it to Northgate, although they lack the money. In addition, Sound Transit has just published a Draft Long-Range plan which envisions extending Link into a regional system over 125 miles long. Over two billion dollars are already committed to the first 14-mile miles of light rail, and it would take many billions more to construct the full system.

Unfortunately even at this late date there is no solid analysis showing that light rail makes sense. The main failing is that there has never been a proper apples-to-apples alternatives analysis that compares the merits of light rail against an all-bus alternative based on bus rapid transit or BRT technology.

Therefore, even as the region increasing commits to Sound Transit's multi-billion dollar rail strategy, neither public officials nor taxpayers know whether spending X billions on light rail would yield more benefit than spending the same amount on buses, or on other alternatives such as car and van pools, demand management, and so forth. The relevant data needed to make intelligent decisions simply does not exist.

The region is being led unwittingly into a light rail plan that will influence the quality of life in this region for decades and be the largest public works project in local history, without having done the same due-diligence homework that MBA schools teach businesses to use on far smaller investments. The public's trust in government to spend transportation dollars wisely is among the casualties.

This issue is highly relevant at present because Sound Transit is beginning to plan for a Phase 2 that would seek more federal and local money to expand Link's Initial Segment, and because it is still not too late to stop light rail and switch to a to a different strategy if new information –such as in this report-- shows that would make more sense.

The initial stimulus for this report was the fact that Sound Transit's current light rail plan didn't reduce congestion and didn't seem cost-effectiveness as an alternative to driving. Sound Transit's stubborn resistance to all criticism, its misrepresentations, and its failure to resubmit its much altered plan to a public vote of confidence –making all of us feel manipulated--have also been motivators. Perhaps most fundamental, was the knowledge that Sound Transit had abused the planning process by never having done a proper alternatives analysis. This greatly offended this planner's sense of what's right.

Link didn't just happen by accident; it emerged as the end result of a planning process. A key part of that process is the alternatives analysis.

Unfortunately, the alternatives analysis had been rigged to justify rail. In short, the process had been abused. Unfortunately that's not obvious to the casual reader of Sound Transit's 1993 FEIS and alternatives analysis report. It's an impressive and seeming well-written document. Most would assume it was competent and objective. Reluctantly the author came to conclude that the 1993 FEIS was essentially a sham. Something that appeared objective, but wasn't. Something intended more to sell, than to inform.

Part 1: Sound Transit has never done a proper alternatives analysis

In the transportation arena the alternatives analysis is critical. It's equivalent to a business case and is supposed to identify and evaluate the most promising alternatives available to solve a given transportation problem. It's about all that elected officials and voters have to rely on, if they wish to make rational decisions.

Sound Transit maintains that the region's one and only rail/bus alternatives analysis provides adequate rationale for selecting rail rather than express bus for the backbone of the regions transit system. However, for a wide variety of reasons this study – documented in a 1993 Final Environmental Impact Statement (FEIS) prepared by Sound Transit's predecessor the RTA-- is inadequate and misleading. Nothing more up to date or more relevant has been done since, as Sound Transit recently made clear in its DSEIS for the Regional Transit Long-Range Plan.

The 1993 FEIS compared rail and bus technologies for the region's main transit corridors. Four alternatives were studied. One was the baseline or do nothing scenario called "No Build". Next was an extensive system of express buses operating on HOV lanes. This \$4.7 billion scenario was called "TSM". A second all-bus alternative – called "Transitway/TSM" and costing \$5.5 billion-- was similar to TSM but used exclusive busways in lieu of HOV lanes. Finally, there was a hybrid rail/bus alternative called "Rail/TSM". This \$11.5 billion scenario called for 125-miles of rapid rail on a 100% grade separated right-of-way. It also included many of the TSM improvements, except those that would compete with rail.

There are two broad reasons why decisions about Link should not be based on this 1993 FEIS. First, the 1993 FEIS was neither adequate nor honest at the time it was completed. Second, what we are planning today is not what the 1993 alternatives analysis studied. In addition, circumstances have changed in the intervening 12 years.

A fundamental problem with the 1993 FEIS is that it compared alternatives that differed in both cost and benefit. In theory this can be dealt with by careful focus on cost-effectiveness, but RTA botched the job. Essentially, RTA concluded that an \$11.5 billion rail alternative would perform better than a \$4.7 bus alternative. This was simple-minded, and is essentially like comparing proposals to build a brick wall costing \$20,000 with a concrete wall costing \$10,000; then deciding bricks are a better technology since the \$20,00 wall would be higher than the \$10,000 wall.

The 1993 FEIS contained very little on cost effectiveness but what it did contain was presented in a biased fashion. Essentially, it masked the high cost of using rail as a means to increase transit ridership, and thus made the cost of the rail alternative appear more competitive with the bus alternative than it really was. Also it failed to show that the high marginal cost of rail riders was reasonable, or to put them in the context of costs in other cities or of other alternatives. In short, it didn't provide the kinds of information needed to make wise decisions. This topic is expanded in the explanation of Part 6 below.

Another serious shortcoming of the 1993 FEIS is that it didn't quantify or emphasize the impact of the alternatives on traffic congestion. This is critical because polls have repeatedly shown that the public's main transportation concern is reducing traffic congestion.

However, the main fault of the 1993 FEIS is that the bus alternatives were deliberately designed to fail. In particular, the RTA unfairly alleged they lacked sufficient capacity through downtown Seattle and then did nothing to rectify the problem. The RTA used "inadequate capacity" as their primary reason for dismissing the bus alternatives, even though they were more cost-effective. This topic is further pursued in the summary of Part 5 below. The sum, the 1993 FEIS was neither adequate nor fair at the time it was completed.

The 1993 FEIS is even less a valid alternatives analysis for Link light rail.

The 1993 FEIS was an alternatives analysis for rapid rail not light rail. This fact was stated explicitly and repeatedly in the final report, and is not just a matter of semantics. Certainly there were similarities between the rapid rail in the 1993 FEIS and Link today in that the main rail corridors and station locations were similar and the train sizes were identical. However, the train speeds, capacities, rights-of-way, and network sizes were not the same. The maximum speed of the rapid rail in the 1993 FEIS was 70 mph, whereas Link's maximum speed is 55 mph. Rapid rail had an average speed of 36 mph whereas Link's would be 26 mph. The rapid rail system in the 1993 FEIS was asserted to have a maximum capacity of 22,000 persons per hour (pph) whereas Link's maximum is 16,400. The ridership forecasts in the 1993 FEIS were based on a system that was 100% grade separated, whereas Link runs down the middle of the street in the Rainier valley and may have additional at-grade street crossings on the Eastside. These differences obviously affect ridership, reliability, and safety. In all these respects the Link system is different from, and inferior to, the rapid rail system studied in the 1993 FEIS.

In addition, the 1993 FEIS evaluated only one particular 125-mile long rapid rail network. This does not provide a comparison between the 14-mile system Sound Transit is presently constructing, or the 21-mile system approved by voters in 1996, versus BRT alternatives. Nor does it provide a comparison with any of the various networks that may emerge from Phase 2 planning: like Central Link extended to Everett and Tacoma but not to the eastside, or Central Link extended to the Eastside but not Everett and Tacoma, or to all those but not to Issaquah and Totem Lake. The 1993 FEIS did not even compare the ultimate light rail system envisioned by Sound Transit in their recent Draft Long-Range Plan. That Plan includes a curious, never before contemplated loop following the monorail from downtown Seattle to Ballard and then east to the University District. It also contains light rail along I-405 in spite of prior decisions that BRT be used in that corridor.

Since it's not clear how much light rail it makes sense to build, how much is affordable, or how much voters would ever approve, it is not adequate that the only rail/bus alternatives analysis this region has to rely on studied just one particular 125-mile long

configuration. In fact, rational decision-making requires that a range of possible light rail networks –any of which might represent the optimum or final configuration—be compared against BRT alternatives.

An important circumstance that has changed dramatically since the 1993 FEIS is the assumed cost of constructing light rail. In the material handed to voters at the time of the 1996 ballot Sound Transit said: “Sound Move is based on extremely conservative cost and ridership assumptions and methodologies reviewed by an independent expert review panel appointed by the governor, the state Legislature and the state Transportation Department.” However, this became front-page scandal in 2000 when Sound Transit was forced to admit this was all-wrong, and had to increase the project budget by over one billion dollars, or roughly 44%. For this reason any rail cost assumptions made prior to 2000 were probably grossly underestimated. This fact alone makes the 1993 FEIS, as it stands, obsolete and misleading.

Still another reason the 1993 FEIS is obsolete is that over half the HOV network --whose costs were included in the TSM or bus alternative—has since been completed. Those are sunk costs. Thus the all-bus alternative is now less expensive than it was in 1993.

The net effect of the underestimated rail costs and partial completion of the HOV network is to make the cost difference between the rail and all-bus alternatives even greater today that it appeared to be in 1993. To be even roughly relevant today, the 1993 FEIS cost estimates would need to be updated. They haven't been. In fact Sound Transit hasn't even published an updated cost estimate for the 21-mile system approved by the voters in 1996.

Sound Transit's recent release of a Draft SEIS states quite clearly that its Long-Range Plan is based on the 1993 FEIS. However, since the 1993 FEIS was not a valid exercise in the first place, and is now obsolete, the entire foundation for Sound Transit's Long-Range Plan –not to mention the part already under construction-- is faulty. The FTA should recognize this and force Sound Transit to conduct the proper alternatives analysis that is long overdue and which is recommended so often throughout this report.

Part 2: Sound Transit morphed rapid rail into light rail

Sound Transit has not wanted to do an alternatives analysis for Link, so they have maintained that the 1993 FEIS for rapid rail was really about light rail. In one recent presentation the agency falsely states that the 1993 FEIS compared light rail and BRT. In fact the 1993 FEIS never mentioned BRT, but it did address light rail (LRT) in a cursory fashion along with monorail and other alternatives the RTA wasn't interested in. This is what the FEIS said about light rail.

"Surface LRT options were analyzed to the point that it became clear that these options did not adequately serve the goals and objectives of the Regional Transit Project. Because of the superior performance of the grade-separated RTP system in terms of consistency with land-use objectives, level of service, and ridership, it was recommended as the rail technology in the recommended draft Systems Plan." (Ref 1: page 2-61)

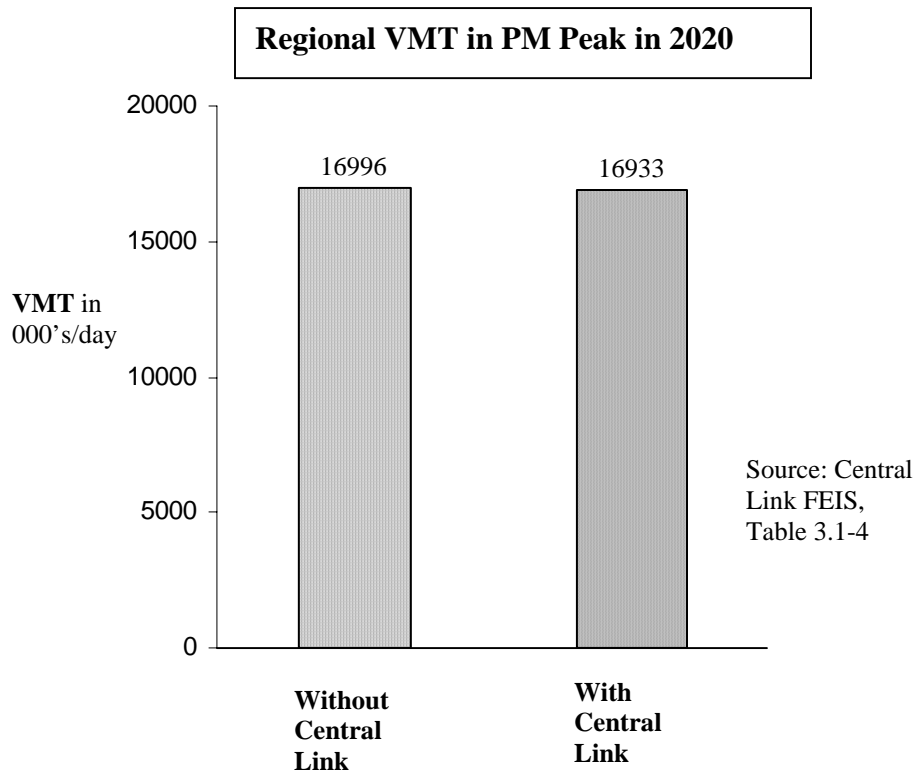
In spite of their one and only alternatives analysis having recommended against it, Sound Transit plans to put some “surface LRT” into the very backbone of the light rail system they are building. How then is it possible for Sound Transit to claim that the 1993 FEIS supports their decision to make light rail the technology of choice?

Part 3: The shortcomings of Link Light Rail

Light rail has many appeals to the superficial observer. It promises fast effortless trips bypassing congestion. Many hope it will lure others off the road thus leaving more room for them. Some believe it’s a way to control sprawl, clean the air and reduce energy consumption. As visitors we’ve all benefited from riding rail systems in other cities. Civic boosters think Seattle can’t be world class without rail. Unfortunately, at least in the Puget Sound setting, light rail is one of those things where the less you know about it; the better you probably like it.

Link’s fundamental problem is that it costs too much and does too little.

Polls consistently show that traffic congestion is one of the public’s highest concerns. Link was sold to voters by implying it was a solution to traffic congestion. Yet Sound Transit’s own studies prove Link would have almost no effect. The FEIS for the 21-mile Central Link shows that the \$2.6 billion (in 95\$) system would only reduce road traffic about 1/3 of one percent. This is equivalent to taking two and a half cars off a lane on 520 that is packed bumper to bumper with cars from Montlake to the east shore of Lake Washington. It’s hardly noticeable, as the bar chart below illustrates.



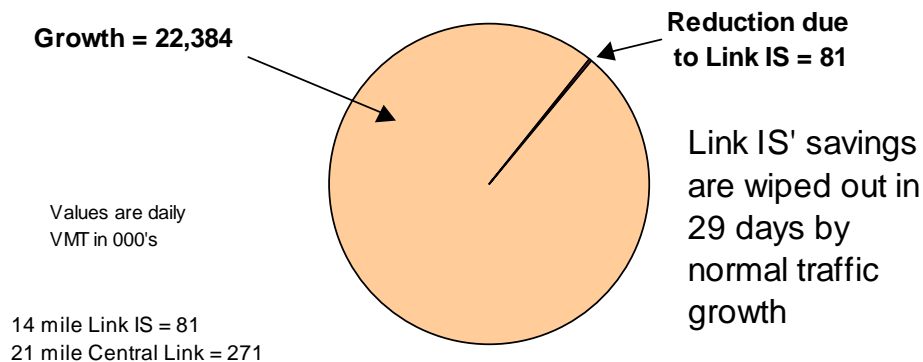
The \$1.5 billion (95\$) Initial Segment now under construction would accomplish even less. It would only reduce traffic 1/10th of one percent.

Even auto traffic into the Seattle CBD is minimally impacted.

It turns out the miniscule traffic reduction effects of Link's 14-mile Initial Segment would be wiped out within 29 days of its opening by the normal growth trend in regional traffic as the following chart shows. The 21-mile Central Link has greater ridership, but its traffic reduction effect would be wiped out in about three months.

LRT effect on daily regional VMT growth between 1998 and 2020

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Sound Transit has repeatedly implied that Link would reduce traffic congestion even while knowing it wouldn't. This was done with pictures, innuendo, and carefully chosen wording so there was never any direct statement that could be challenged legally. It was done extensively during Sound Transit's pre-vote marketing campaign and continues today. The statements that Link will not reduce traffic congestion are brief and don't stand out in the EIS's, which very few voters read anyway. Sound Transit never acknowledged publicly that light rail wouldn't reduce congestion until, in December 2000, the author used Sound Transit's own data to publicize that knowledge in a Seattle Times OP ED. Unfortunately Sound Transit's admission came years after the 1996 vote.

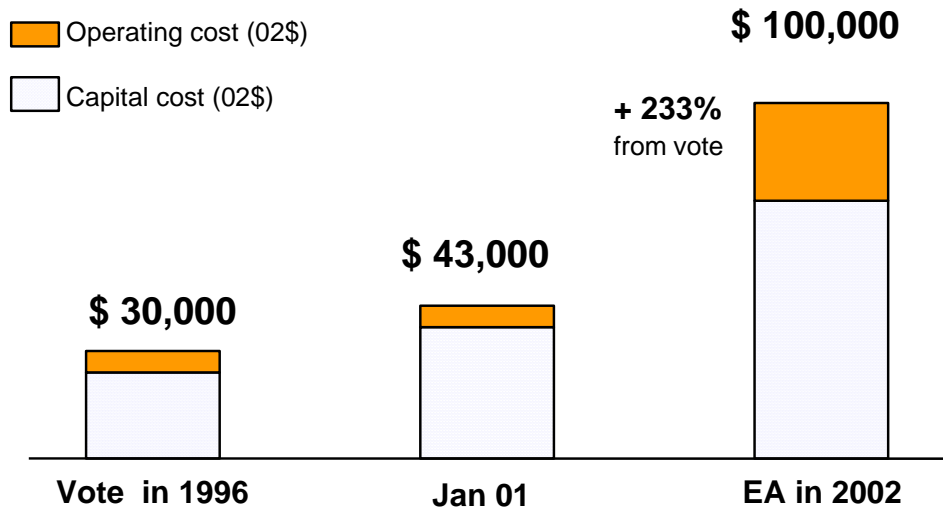
Light rail: There will never be a better time Richard Harkness got one thing right in a guest column (The Times, Dec 22): Light rail will not ease traffic congestion. Yes, that's a fact. (Dave Earling, OpEd, Seattle Times, Dec 26, 2000)

The effects light rail could have on environmental issues like air pollution or energy use are proportional to its impact on traffic, and thus similarly miniscule.

As a way to get cars off the road Link is notably costly. If that's the primary aim of the project then it's fair to divide the project's cost by the number of cars it removes to get a sanity check on Link's cost-effectiveness. The result is that it would cost taxpayers \$100,000 per year for each car which Link IS removes from peak period traffic. This cost would continue every year until the bonds were paid off in about 30 years.

The chart below shows how much this particular cost metric increased from the time voters approved Link. The left bar is based on Central Link costs at the time of the vote. The center bar is based on Central Link costs after Sound Transit admitted having underestimated them and raised Link's cost by \$1 billion in Jan 2001. The right bar is based on Link IS costs as reported in the Feb. 2002 Environmental Assessment.

Annual cost per vehicle removed from peak period traffic



In stark contrast, a recent Seattle Times article reported on a company that had significantly increased car pool use by giving employees just \$75 a month per person to carpool. And, for \$100,000 per year, it may be cheaper to simply pay people to quit their day jobs and stay home.

Once the congestion reduction myth was publicly debunked, rail advocates –such as King County Executive and Sound Transit Board Member Ron Sims-- switched to claiming that light rail offers an alternative to driving. They said it provides “choice”. Indeed it does offer choice to a favored few, but again that gift costs society roughly \$80,000 per year for each individual who –according to Sound Transit’s ridership estimates for 2020-- would find Link IS attractive enough to stop using a car. In this case the cost of choice is huge. To paraphrase Winston Churchill: Never in the region’s history will so many, have paid so much, to benefit so few.

Link light rail has other deficiencies beside cost-ineffectiveness. It is highly inequitable in that it provides service to a relatively narrow corridor while the cost is borne across a wide region. Capacity on the south line –due to the decision to run on the surface along Rainier Avenue—is only one third the capacity of the north line, and thus forever shortchanges the entire south Puget Sound area.

The Initial Segment serves only one of the region’s 21 designated urban growth centers. Even a full 100+ mile light rail system –which is not guaranteed and which the region may never be able to afford-- would bypass many important commercial and employment centers such as South center, Renton, Bothell, Tukwila, West Seattle, south Lake Union, Bell town, Seattle Center, Ballard, Magnolia, south Seattle below the stadiums, West Seattle, key Boeing sites, the Sammamish plateau office park, the emerging biotech area on Elliott Bay, and so forth.

Link’s central control system and extensive tunneling make it vulnerable to power outages and terrorism.

If Link is not extended into a full regional system its preemption of the Downtown Seattle Transit Tunnel would compromise the remaining express bus system and dim prospects for a regional BRT system.

Some of the region’s most precious resources are its preexisting rights-of-way (ROW), and those should be used efficiently. Having the center lanes on I-90 devoted solely to the occasional light rail train is not a good use of ROW since it would reduce the total people moving capacity of the bridge relative to having a mixture of BRT buses, car and vanpools, emergency vehicles, etc. use those lanes. Adding light rail would actually reduce capacity in this corridor.

Currently over ten times more daily trips are made by car pool than by mass transit in this region. (283,000 by transit, versus 3,554,000 by car/van pool) Arguably it is far more important to maintain and expand car/van pooling than to expand an already excellent mass transit system. Displaced them into less protected lanes than they have today is not progress.

In short, upon close inspection of the facts, Link light rail doesn’t seem to be a good idea, or to be worth the money. This would be true even if there were no obvious alternatives.

In economic terms, one must examine the “opportunity costs” of going with light rail when there appear to be less costly ways to achieve much the same benefit. What else could the region do with the money that could be saved? Alternately, if taxpayers are willing to spend the same amount, how much further might we get toward reducing congestion and improving the environment if some more cost effective technology were employed? What if we could have 200 route miles of BRT for what – according to the GAO study-- 14 miles of light rail is costing? What if some of the light rail money could be diverted to accelerate the Alaska Way viaduct and 520 bridge replacements?

Part 4— BRT and Other Alternatives to Light Rail

If the objective is to reduce congestion or travel delay, the author has identified about 50 alternatives to light rail. They include things like widening roads, increasing car and vanpool usage, telecommuting, and clearing accidents and breakdowns faster. However, if only various forms of mass transit are of interest, then bus rapid transit or BRT is the most likely contender to light rail. If light rail is “Plan A”, then BRT is “Plan B”.

BRT is actually a systems solution comprised of several elements. The core would be express buses operating on HOV lanes, essentially what we have today, but more and better. Dedicated busways are possible but probably not necessary. Service frequencies would match that of rail. A BRT alternative would also involve bus priority lanes on certain arterials, bus priority signalization, off-bus fare collection, direct access ramps, and a range of other things all intended to make bus travel more rapid and attractive.

BRT hasn’t gotten much publicity here in Puget Sound. However, BRT has been implemented elsewhere, particularly overseas, with great success. The U.S. General Accounting Office published a report comparing it to light rail and encouraging cities planning light rail to give BRT serious consideration as a less expensive alternative. It’s proven technology and the advent of hybrid buses makes it even more attractive.

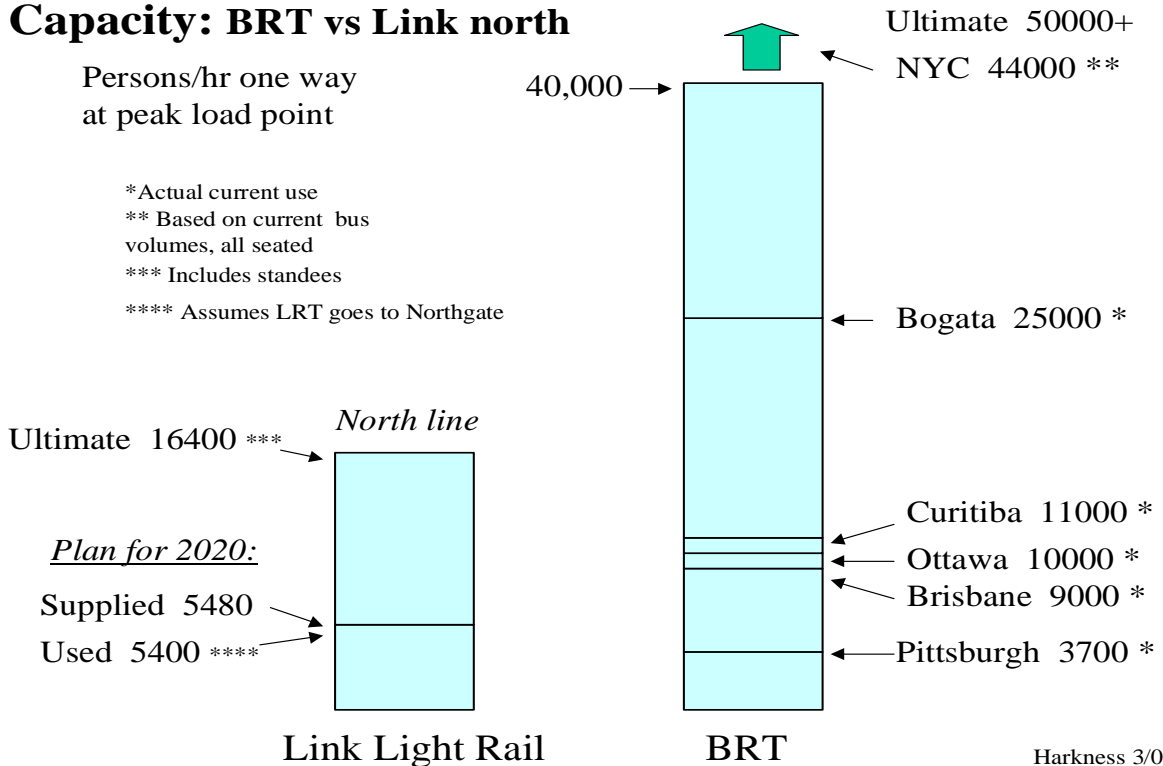
There is no question that BRT has enough capacity to handle the regions mass transit needs. As shown in the chart below, BRT routes operating in other countries already carry far more people than Link could carry, or that Sound Transit estimates Link would need to carry.

Figure 5.12a

Capacity: BRT vs Link north

Persons/hr one way
at peak load point

- *Actual current use
- ** Based on current bus volumes, all seated
- *** Includes standees
- **** Assumes LRT goes to Northgate



In terms of ability to meet future needs it is worthwhile to note that there is no way to increase the capacity of Link light rail since train lengths would be limited by stations already in place and headways can't be reduced. For these reasons even a second rail tunnel through downtown in some distant year wouldn't help. In other words the limits on rail system capacity are systemic and not subject to local remedies. In contrast bus capacity can be increased by building short parallel paths around local bottlenecks, and then only when needed.

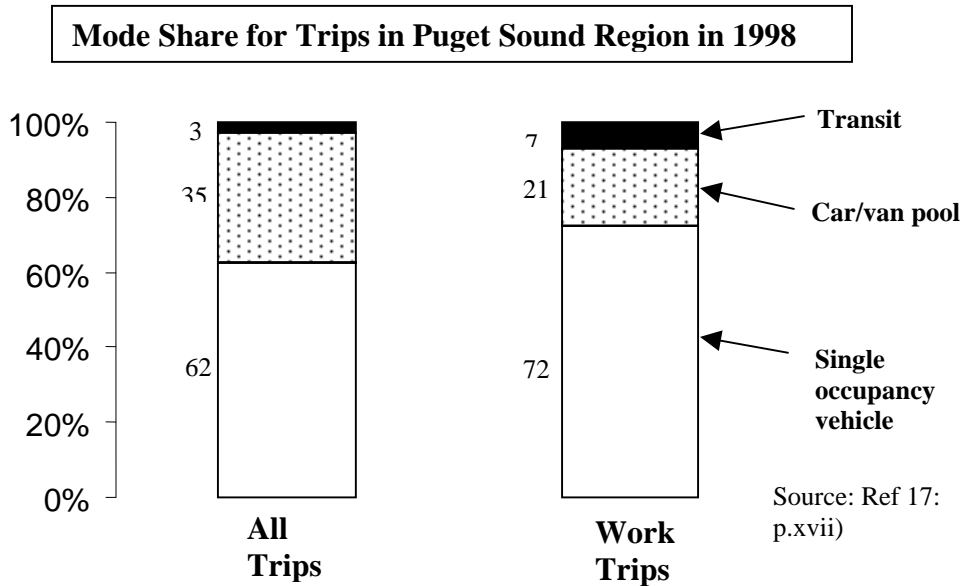
Based on ST's 1993 FEIS the highest volume that a BRT system would need to carry by 2020 is 12,000 persons per hour between downtown Seattle and the U District. This volume could be handled by about 110 articulated buses per hour. This volume of buses would use about 10% of the capacity of a single express lane along that stretch. Elsewhere BRT would need much less than 10% of the capacity of an HOV lane.

BRT should also be faster. BRT buses can operate in express non-stop mode once loaded whereas light rail must stop at every station.

BRT would probably require fewer transfers. Buses can circulate in neighborhoods picking up passenger before entering the HOV lanes for non-stop travel to major destinations.

Still, the most compelling reason for BRT is that much of the "guideway" needed for BRT already exists in the form of the region's 200 miles of HOV lanes. And every investment made in expanding or improving these guideways for BRT has the double benefit of encouraging more car and vanpooling.

Car and Van pooling—This report focuses on BRT versus light rail. However, car/van pooling is probably even more cost effective than BRT, and should be among the alternatives considered most carefully as the region charts its transportation strategy. There are currently about 250,000 people car or van pooling to work. Car and vanpools are already far more effective in getting people out of single occupancy vehicles than is mass transit, as the following chart based on PSRC data makes clear.



If the number of people car or van pooling to work could be increased by just 5% it would take the same number of cars off the road as would building the 21-mile Central Link light rail system.

At last estimate Central Link would cost \$2.6 billion in 02\$. Simple calculations show it would cost \$43,000 per year to take a car off the road using Central Link. Many people who don't car pool today could probably be induced to do so for considerably less than \$43,000 per year. If so, car and van pooling would be a far more cost-effective way to relieve traffic congestion than building Link light rail.

Part 5—The capacity issue

Part 5 investigates the capacity issue in depth because back in 1993 the RTP alleged that buses had insufficient capacity to meet the regions needs and dismissed bus alternatives largely for that reason. Ever since, buses or BRT have remained off the table as far as the core portion of the regional transit network is concerned.

RTP's treatment of the capacity issue in the 1993 FEIS appears to have been deliberately manipulated to favor rail. Basically, RTP postulated an all-bus alternative called TSM and compared it against a hybrid rail/bus alternative called Rail/TSM. During their evaluation RTP estimated year 2020 ridership for both alternatives and concluded that the Downtown Seattle Transit Tunnel (DSTT) could not handle the number of riders the bus alternative would attract. RTP's response was to reduce the predicted ridership of 518,000 daily riders to what they said the tunnel could handle, namely 474,000. This significantly degraded the cost-effectiveness of the bus alternative as well as reduced other ridership dependent benefits, such as impacts on air pollution.

What the RTP did not do –after recognizing that a capacity problem might exist—was to verify the assumptions they had made about tunnel capacity and/or seek ways to modify the bus alternative so as to eliminate the alleged capacity problem. In short, RTP put a knowingly and deliberately hobbled bus alternative into competition with the rail alternative.

The key assumption that RTP did not verify concerned tunnel capacity. There had been six prior paper studies that each reached different conclusions, ranging from 125 to 192 buses per hour in each direction. The RTP chose to assume 100, a value based on operating buses inefficiently. About 135 buses per hour were needed to carry the predicted demand. Why --when capacity was so critical-- didn't RTP assume the tunnel would be managed efficiently? Why --with the whole multi-billion dollar rail vs. bus decision hanging in the balance-- didn't RTP take the trouble to verify the tunnels true capacity with real world trials? This could not have been oversight or incompetence, it must have been deliberate.

If the RTP had properly verified tunnel capacity and still found it below 135 buses per hour they could, and should, have found other remedies so capacity problems in this 1.5-mile segment of a 125-mile network didn't become the tail that wagged the dog.

In prior studies, a range of fixes had been identified. They ranged from increasing bus capacity on downtown streets to building a second parallel bus tunnel, which RTP staff had estimated would cost \$600 million. As a worst case, RTP could have added this second tunnel to the bus alternative thus completely eliminating the downtown bus capacity problem. Failure to do so was apparent bias or manipulation. It seems especially egregious since the RTP elected to provide 20 miles of tunnel for the \$11.5 billion rail alternative yet was unwilling to provide even a mile or two for the \$4.7 billion bus alternative.

In short, had RTA resolved the alleged bus capacity constraint –either by finding it didn’t exist, or fixing it-- the RTA could not have claimed the bus alternative was unable to handle its predicted ridership, and –able to carry its full ridership-- the TSM alternative would have been much more competitive in its comparison against rapid rail.

Part 5 also addresses ridership forecasts that appear to conflict. In 1993 RTP estimated that by 2020 the peak load on the rail system would be 15,000 persons per hour at the peak load point just north of the DSTT. Sound Transit still asserts the long term demand for rail transit would create a peak load point demand of 15,000 persons per hour on the north line, and that we need a system able to handle it. However, the much more recent forecast for Central Link predicts a peak load of only 5415 persons per hour. This discrepancy is something the large difference between the 125 and 21-mile systems does not appear to explain.

This is an important issue in that if 15,000 is the correct number it appears that Link would run out of capacity soon after 2020 and is therefore not a long range solution for the region’s capacity needs. Indeed one of the reasons RTA gave for choosing rapid rail in 1993 was that its assumed capacity of 22,000 gave it headroom for growth well beyond 2020. In addition, if 15,000 is correct, Link may not be enough capacity on its south line to even meet demand in 2020.

On the other hand if 5415 is correct, it is possible that system ridership is simply lower than originally thought.

It seems that no matter which forecast is correct, Sound Transit faces an embarrassing situation. If the higher forecast is correct, light rail is inadequate. If the lower forecast is correct, it completely destroys Sound Transit’s claim that buses lack sufficient capacity through downtown, even if the tunnel could only handle 100 buses per hour.

Sound Transit’s claim that light rail “would provide the same people moving capacity as a 12 lane highway” is simply false. Just one freeway lane pair full of buses could carry far more people than Link. Rather than compare what these systems could carry, it is more meaningful to compare what highways actually carry on a daily basis versus what light rail is actually expected to carry. Sound Transit’s ridership forecasts for Central Link –at the ship canal where it is heavily loaded-- show it would carry only slightly more people in 2020 than a single lane pair on I-5 carries today. Along the bulk of its

route Central Link would carry only a fraction of what one lane pair on I-5 is now carrying.

Part 6: The cost issue

Part 6 has two broad objectives. One is to demonstrate how the 1993 FEIS was inadequate and biased in the way it addressed cost-effectiveness. The second objective is to use the raw data in the 1993 FEIS and related documents to produce an estimate of what Sound Transit’s current rail-centric strategy might end up costing this region in relation to the all-bus alternative they rejected.

The 1993 FEIS gave very little attention to either cost or cost-effectiveness. Almost everything that large report had to say was contained in a single small table listing cost and ridership totals for each of the four alternatives. (Table 4 in the 1993 FEIS)

Table 4. Summary of System Alternatives Characteristics.

Alternative	Capital Cost (billions of 1991 \$)	Operating and Maintenance Cost (millions of 1991 \$)	Daily Ridership (Year 2020)	Annual Ridership (year 2020) (millions)	Cost per Rider (1991 \$)	Cost per New Rider (1991 \$)
No-Build	\$1.2	\$274	388,500	109.4	3.67	N.A.
TSM	\$4.7	\$399	473,900	133.7	5.92	N.A.
Transitway/ TSM	\$5.5	\$406	480,000	135.4	6.36	11.39
Rail/TSM (includes Commuter Rail)	\$11.5	\$492	560,500	157.3	7.94	12.52

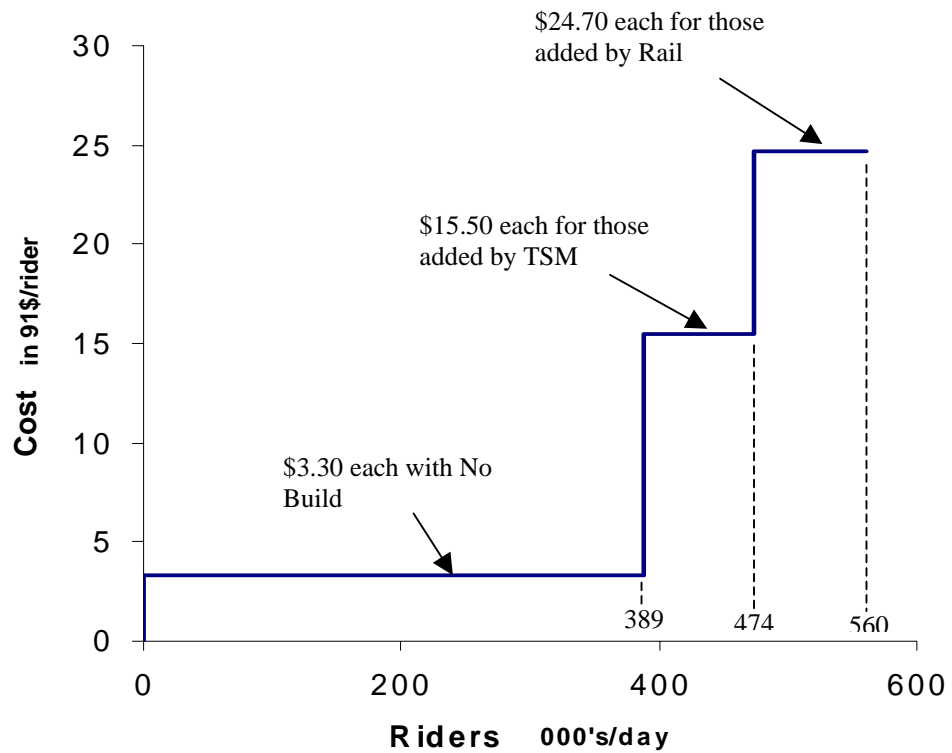
No-Build Alternative

This form of presentation was deceptive. The difference between the rail and bus alternatives, shows in the numbers, but it doesn’t appear dramatic. This author, probably like many others, saw that table and felt that while the bus alternative was more cost effective, it was not dramatically so. This was because the cost per rider figures RTP chose to present were averaged across all riders and thus did not allow the cost-effectiveness of the rapid rail element to be separated out and examined for reasonableness. It could be claimed this information was deliberately hidden.

To better illustrate what could have been done, and what should have been done, the data in that FEIS Table 4 has been reformatted into Figure 6.1 below. Remember, this is the picture as it would have appeared in 1993, with all costs in 91\$ and before the rail cost estimates were found to have been underestimated.

This chart conveys a very different message. Not only would it cost much more than we are paying today to increase transit ridership by implementing TSM, but it would cost dramatically more still for those additional riders that rapid rail could add above and beyond what TSM could attract on its own.

Figure 6.1



As to the detail, transit would attract 389,000 daily riders by 2020 if we did nothing but grow the existing bus system. RTP called this the “No Build” alternative. The chart shows that society is now paying about \$3.30 for each one-way bus ride, less the 80 or so cents recovered at the fare box. (The transit industry calls a one-way ride a “rider”.) Next, it shows that implementing just the TSM alternative would increase daily transit ridership by about 80,000, and that these extra 80,000 rides would cost society about \$15.50 each. Finally, it shows that if we build the 125-mile rapid rail system it would attract an additional 85,000 riders above and beyond what the all-bus TSM alternative could achieve. However, these extra rides would cost \$25 each.

If the RTA had elected to fix the alleged capacity bottleneck by building a second bus tunnel this cost picture would have changed to that shown in Figure 6.2c.

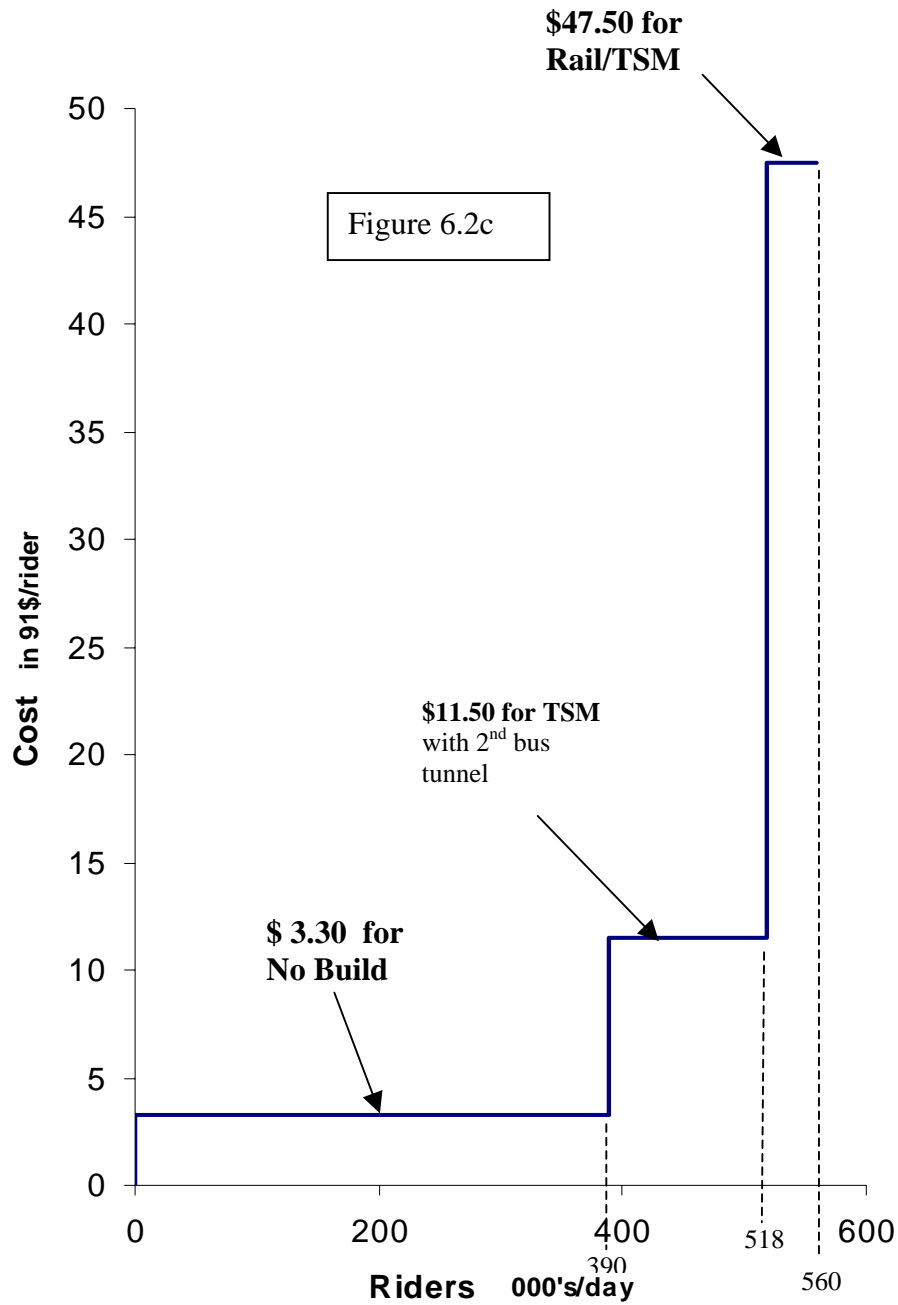
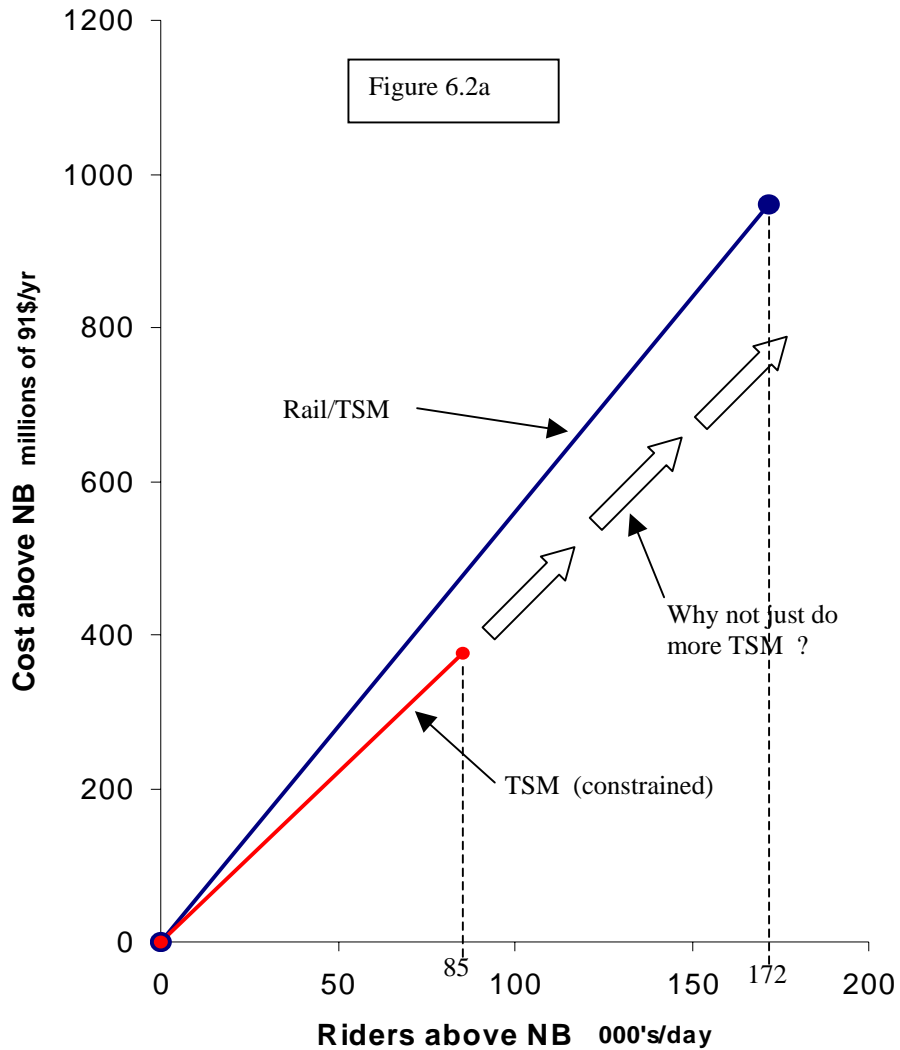


Figure 6.2c emphasizes the point that society would need to spend far more to attract these new riders than it has been willing to spend in the past. The upsweep of the bars illustrates very dramatically the law of diminishing returns. Once those with relatively little choice have gotten aboard, it becomes increasingly expensive to improve transit service enough to attract others. This raises the questions of affordability and reasonableness. There is some point where the cost of making transit more attractive so it will attract more riders begins to exceed the benefits. To make rail worthwhile the benefits of each rider it adds would need to exceed \$47.50 per one-way ride. Again, that

is what would have been visible in 1993. After accounting for ST's underestimated rail costs, and inflating to current dollars, that \$47.50 becomes \$93. The 1993 FEIS did not get into any of this, perhaps because they felt it would have worked against their desire to promote rail.

Figure 6.2a is another chart –based on Table 4 in the FEIS--that would have been helpful.



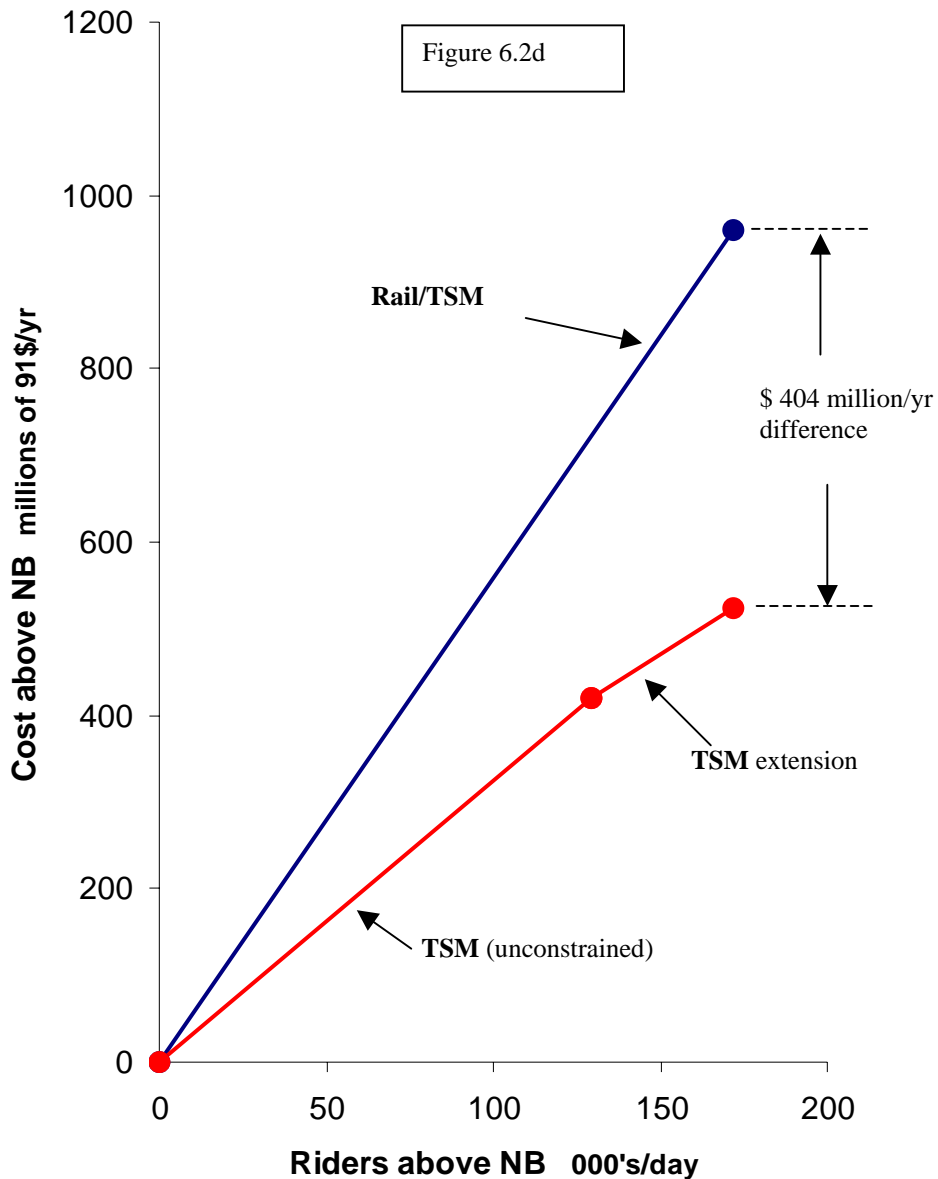
The cost (\$960 million/yr) and ridership (172,000/day) of the Rail/TSM alternative is represented by the dot at the end of the Rail/TSM line. The same is true of the TSM line. This chart shows that while the Rail/TSM alternative costs more and does more, the TSM alternative is actually more cost effective since its “trend line” is not as steep.

NOTE: If the RTA's goal had been to increase ridership by just 85,000 above the NoBuild baseline, rather than 172,000, this chart shows that the original TSM alternative would have had adequate capacity, as well as being less expensive. Alternately if the goal had been to reach 300,000 riders the rapid rail alternative itself would have failed for lack of capacity. Thus, where the goal is set can sometimes determine which alternative wins. Planners can manipulate this to get the answer they want. In the case of the 1993 FEIS the goal was set high enough to (allegedly) break the bus alternative but not high enough to break the rail alternative. This is one reason Part 8 calls for a range of different size rail networks to be compared with bus alternatives.

Presenting the data with a chart like Figure 6.2a is useful because it graphically suggests the following: Why not just intensify or extend the TSM alternative until it achieves the same ridership as rail, because it looks as though the savings would be worthwhile? In other words, whatever we were doing in the TSM alternative, just do more of the same. In practice this would have meant more frequent bus service, more routes, and perhaps more HOV lanes, direct access ramps, and park & ride lots. The arrows suggest this idea. RTP staff was aware of this option and had already estimated its cost.

However, the TSM alternative can't be extended until the alleged bus capacity constraint in downtown Seattle is dealt with. Maybe the RTA's assumption about tunnel capacity was wrong and there really isn't any bottleneck. However, to be conservative the author assumed that the bottleneck was real, and that it takes the most costly of the available remedies—namely a second bus tunnel—to fix it. This was an option that RTA staffers had already identified and estimated would cost \$600 million. The RTA had also estimated the cost of extending TSM services so as to achieve greater ridership. It short the RTA had shown how the TSM alternative could be extended to achieve more ridership, and they had estimated the costs of doing so. However, all this information was hidden in backup technical reports and none of it was used to fix the bus alternative's alleged capacity problem. Instead the 1993 FEIS presented a hobbled bus alternative unable to match rails ridership or achieve its other benefits.

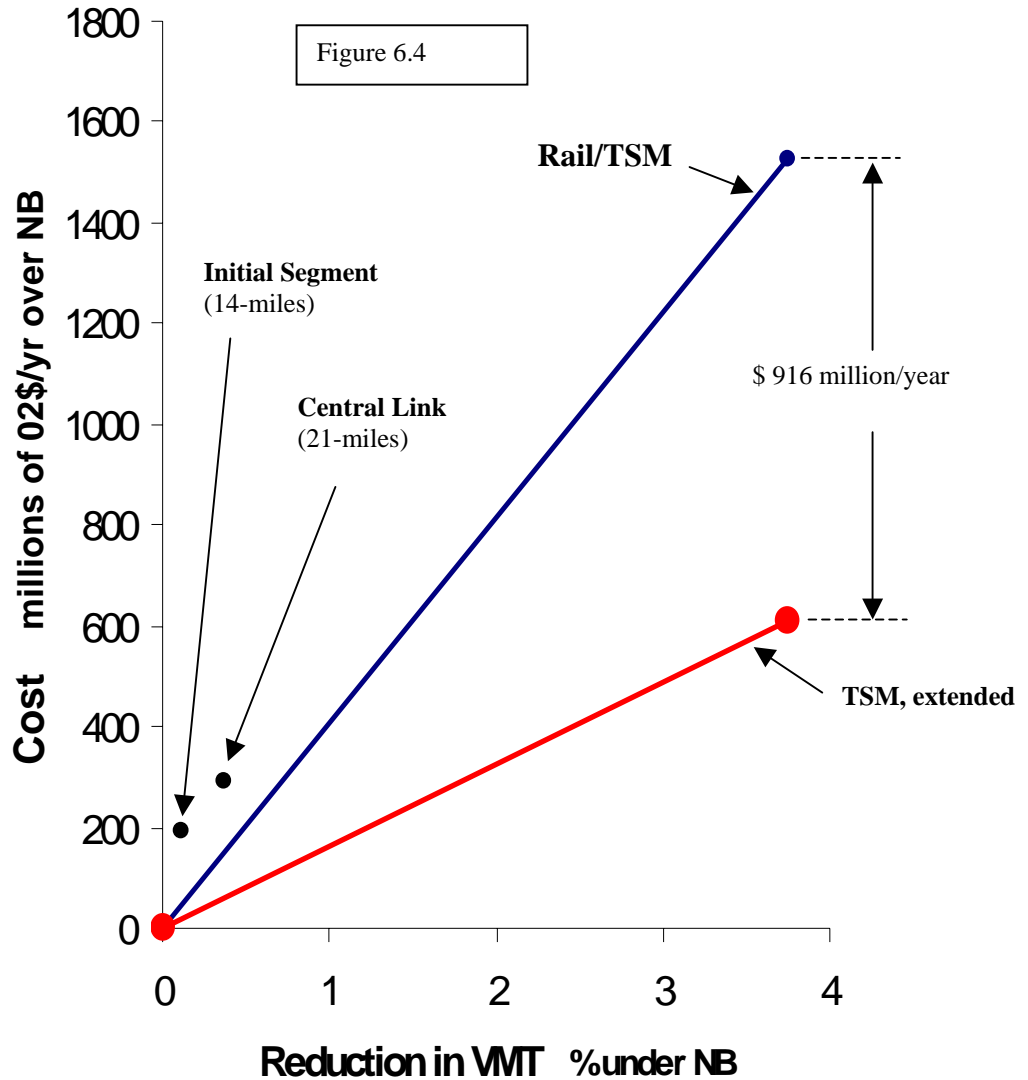
The chart below shows what would happened if the RTP had un-hobbled the bus alternative. The first part of the TSM trend line shows the result of including \$600 million for a second tunnel, which allows TSM to achieve the "unconstrained" ridership forecast by the RTP. The second part of the line is based on RTP's cost estimate for extending it so as to attract and handle as many riders as the Rail/TSM alternative.



At this point it is apparent that fixing the alleged TSM capacity constraint and extending TSM is a good idea. It would save taxpayers about \$400 million (in \$91\$) per year. The RTP could have done this analysis and included it in the 1993 FEIS. Was their failure to do so a matter of incompetence, or of deliberate bias? Again, this is the picture that RTP should have presented in 1993. But what does it mean for Link light rail today?

The above analysis can be updated and used to show the implications of proceeding with Sound Transit's light rail-centric strategy, which calls for building as much as 125 miles of light rail along with supporting TSM elements such as bus feeders, HOV improvements, and park and ride lots. In other words the RTP created and evaluated a

“Rapid Rail/TSM” alternative with 125 miles of rapid rail. What the author does in this report is create a “Light Rail/TSM” alternative with 125 miles of light rail, and then compare it against an all-bus or TSM alternative using BRT. Figure 6.4 shows the result.



It now appears that Sound Transit never intends to make this comparison, but it’s essential information because the region’s at a fork in the road. It can either proceed to implement Sound Transit’s light rail-centric strategy, working out along the Rail/TSM line in Figure 6.4 to build as much light rail as possible. Or it can switch to an equally effective all-bus or BRT strategy while there’s still time. The public needs to understand the dramatic difference in cost.

Thus Figure 6.4 compares the cost of Sound Transit's light rail-centric strategy with the cost of an all-bus or BRT alternative able to reduce regional Vehicle Miles of Travel or VMT by the same amount. (Reduction in VMT is a better metric for comparing benefit or effectiveness of the alternatives than is transit ridership. Travel delay would have been a better metric yet, but the RTP did not provide that data.)

Figure 6.4 is based on conservative assumptions. For instance the author assumed that a 125-mile light rail system would attract the same ridership as the 125-mile rapid rail system studied by RTP. Actually, light rail would probably attract fewer riders since it's slower. On the cost side, Figure 6.4 is based on light rail costing an average of \$120 million/mile whereas Link IS is actually costing \$138 million/mile and Central Link is expected to cost \$158 million/mile. (All these are in 02\$) Also, it was assumed that the all-bus alternative would require a second bus tunnel costing \$600 million (91\$) through downtown Seattle, although the existing bus tunnel may well suffice, and if not there are probably less expensive remedies than a second tunnel. In other words, the Tail/TSM line in Figure 6.4 is probably steeper than shown, the TSM line is probably flatter, and the difference between them is probably greater than \$900 million/yr.

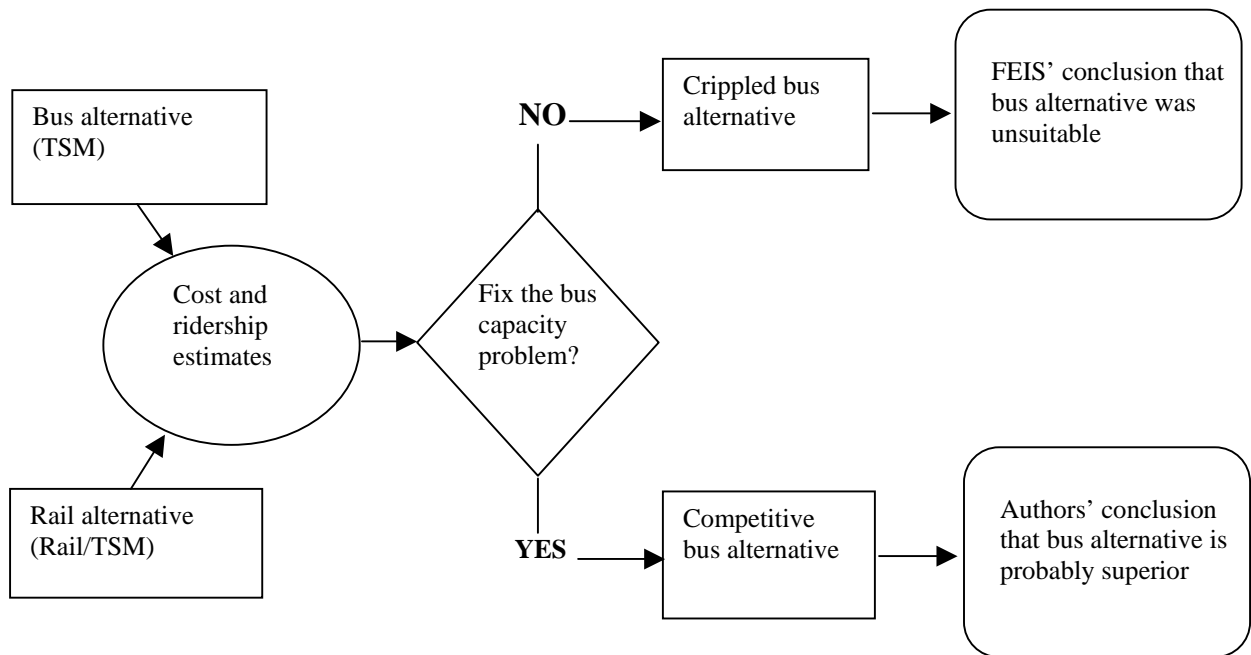
As to details, the RTP originally estimated the 125-mile rapid rail system would cost \$7.9 billion in 91\$. The construction bids Sound Transit received a few years ago showed that actual costs were 44% higher than originally estimated. Figure 6.4 assumes the 125-mile light rail system would cost 1.44 times that \$7.9 billion, or \$11.4 billion in 91\$. In 02\$ the 125-mile light rail system would cost \$15 billion. (This is probably the best estimate publicly available today for what the light rail system in ST's Long-Range Plan might cost) The original TSM costs were updated in two ways. The cost component allocated for building HOV lanes was cut in half since half the HOV network has now been completed. Second, \$600 million was added for the second bus tunnel. All capital costs were annualized by assuming a 30-year, 6% bond. Annual O&M costs from the RTP table were included without modification. Finally, cost totals were inflated from 91\$ to 02\$ to make them more timely.

The dots at the end of the Rail/TSM and TSM lines show the annual cost of these two alternatives. For instance it would cost about \$1.5 billion per year to fully implement Sound Transits light rail-centric strategy by building 125 miles of light rail. The lines from the origin to the dots give some rough indication of the costs of smaller systems. For instance, a system with 63 miles of light rail rather than 125 might cost about \$750 million per year. By the same token a BRT system able to achieve the same VMT reduction might cost about \$300 million per year. The actual cost and performance of Link IS and Central Link are shown for reference.

Figure 6.4 is probably the most important chart in the entire report. What does it tell us? It shows that to achieve the same level of transit ridership estimated for a 125-mile rail system, switching from light rail to an all bus strategy would save taxpayers about \$900 million per year. This would continue over the 30-years life of the bonds.

The huge cost difference between Link light rail and BRT simply reflects the fact that the best technology for one region is not necessarily the best for another. Light rail doesn't have an easy fit in this region because we lack the abandoned railroad rights-of-way or flat terrain that makes constructing light rail relatively easy in other cities. On the other hand our excellent bus system and extensive HOV network makes BRT particularly attractive.

The diagram below attempts to clarify any remaining confusion as to how the RTA concluded buses were unsuitable while the author reached the opposite conclusion.



The flowchart reads as follows. The RTP started by designing an all-bus alternative called TSM and a 125-mile rapid rail plus feeder bus alternative called Rail/TSM. Consultants then estimated the cost and ridership for each alternative. At that point it became apparent that predicted bus ridership would exceed RTP's assumption for tunnel capacity. RTP elected not to fix the capacity problem using any of the remedies that staff had previously identified. This resulted in a crippled bus alternative being compared against the rail alternative, and thence to RTP's conclusion that buses couldn't meet the regions needs, whereas rapid rail could.

In this report the author starts with RTP's bus and rail system designs, and with RTP's cost and ridership forecasts, but reaches a different conclusion. He did that by adding a second bus tunnel to "fix" the alleged bus capacity bottleneck downtown, then adding more bus service so it would attract the same ridership as the rail alternative. The cost of these modifications was added in. He then concluded that the modified bus alternative could equal rail in ridership, have sufficient capacity for long-term growth, and be much less expensive.

Part 7: Evaluation and recommendations

Part 7 tries to explain why things have gone astray, and some of the broader implications that Sound Transit's preoccupation with light rail is having on public trust and on competing uses for scarce tax dollars. This report presents new information that will hopefully trigger action. Part 7 recommends several specific actions that seem appropriate based on this new information.

Why things went wrong- There is a huge disconnect between the problem (traffic congestion) and the proposed solution (light rail).

This disconnect shows that what drives officials and decisions in this arena was not an honest attempt to find congestion remedies based on solid analysis. Instead, what has happened is best explained by some complex mixture of myth, fact, wishful thinking, uninformed opinion, altruistic and not so altruistic motives, hard-ball politics, ego, psychology, bureaucratic maneuvering, and most of all, money. When all this enters the mix it is not surprising that actually spending taxpayer money wisely so as to make the most progress against traffic congestion fell by the wayside.

As to motives, one must acknowledge the superficial appeal of rail transit. Emotionally rail seems like a simple "silver bullet" solution for a complex and intractable problem. Promoting it appears to be "doing something".

But elected officials have another set of reasons to favor rail. They revolve around power and money. If it proceeds, Link light rail will be among the largest public works projects in Puget Sound history. Billions of dollars will be spent. Officials can feel important making decisions about how billions are spent. They can proudly leave a legacy of concrete and steel. They can please certain powerful parties on the receiving end of those billions. They can be seen as providing jobs and stimulating the economy. Perhaps most of all they can be seen as bringing in "free" money from Washington D.C. Fundamentally Link is a "pork barrel" project.

In terms of who pays and who benefits, Link is a clever way to transfer money from the pockets of many to the pockets of a few. Not enough is taken from the pockets of the average taxpayer (in the form of sales tax and auto registration tax) to cause him or her to 'fight city hall'. On the other hand the relative few directly benefiting from Links design, financing, and construction maintain a behind-the-scenes pressure to keep Link going.

Another reason Sound Transit's a clever mechanism for wealth transfer is that taxpayers have practically no way to stop it. The State Legislature created Sound Transit, but forgot to make Sound Transit's Board members directly elected, and they forgot to give voters in the Sound Transit taxing district any practical control over Sound Transit via initiative. As a result the only way local voters can control Sound Transit is by mounting a costly statewide initiative. This self-confidence in its own untouchability gave Sound

Transit's attorney the hubris to say in open court that Sound Transit recognized no limits on how much it could spend or how long it could take building light rail.

Key officials have long wanted a rail transit system in Puget Sound, period. In the early 1990's consultants were hired to prepare the necessary paperwork in order to get federal funding and meet state law. Although alternatives analyses are supposed to be objective studies, consultants are generally fairly astute at figuring out what the client really wants, and repeat business means delivering it. The client wanted rail. As a result the 1993 FEIS or alternatives analysis became a pro forma exercise meant to justify this preordained conclusion.

In short, the 1993 FEIS is a sham; a document meant to satisfy legal requirements, but almost totally useless in providing objective information that would help officials or the public make a wise decisions about spending billions of dollars.

The FTA colludes with Sound Transit in these abuses of the planning process. FTA overlooks faulty work such as the 1993 FEIS, and their requirements for funding projects like Link appear lax. FTA is probably among those Federal agencies that have been accused of being in bed with the organizations they are supposed to regulate.

It is also clear that Sound Transit's board has little concern for spending tax dollars efficiently. In other words achieving the "most bang for the taxpayer buck" is not a high priority with that group. If the Sound Transit Board really wanted cost effective solutions they would have scrutinized the 1993 FEIS in the way the author has done and probably chosen BRT, since it appears BRT would save billions. After finding that Link's costs had been underestimated and needed to be increased by 44%, they would certainly have revisited their choice of rail, rather than simply looked for additional money. They would have published and agonized over, rather than hidden, the high cost-per-rider data for Sounder and Link. They would have calculated the approximate cost of fully implementing their current rail centric strategy and compared that against BRT. These are the minimum things a board really concerned with spending tax dollars wisely would have done.

The Puget Sound Regional Council (PSRC) must also take considerable blame. If that organization were sincerely concerned with getting the most bang for the taxpayer buck it would have eagerly embraced and practiced Least Cost Planning --as State Law requires-- rather than trying so hard to avoid it. It would have analyzed Sound Transit's light rail plans and ensured they were cost effective relative to other alternatives rather than simply downloading them intact into the Metropolitan Transportation Plan (MTP). It would consider van and car-pooling as a major stand-alone alternative to investing billions in mass transit and highways, rather than just as window dressing attached to the main transit and highway alternatives.

In fact, it is not exaggerating to state that if the PSRC had obeyed the law as regards Least Cost Planning (LCP), Sound Transit' light rail plan would probably never gotten this far.

The importance of trust-- It has become increasingly clear that voters don't trust Sound Transit and Sound Transit doesn't trust voters. In fact, Sound Transit has become the poster child for why voters distrust government to spend their transportation tax dollars wisely. There are good reasons for this mistrust.

Voters overwhelmingly voted to rescind Sound Transit's tax on vehicle registration, but ST still fights to overturn that expression of public will in the courts. ST changes the project greatly from what voters approved in 1996 but vigorously fights a lawsuit that would have put the much altered plan back on the ballot for a vote of confidence.

Sound Transit wants more money. However, while claiming it has a public mandate and support for light rail, ST is deathly afraid to ask voters to increase the existing light rail tax. Thus ST supporters used political strong-arm tactics to force light rail into a broad package of regional transportation projects where voters couldn't reject it without rejecting everything else as well.

On this November's advisory ballot voters were asked if they supported that package, which the ballot explicitly said was intended to reduce congestion and improve safety. Since Sound Transit had already admitted Link wouldn't reduce congestion, putting it into that package was a remarkable example of cynical manipulation and deception.

The problem is magnified since that ballot --which still implies Link would help reduce congestion-- was seen by millions, while few have seen the truth.

When one party has the funds to broadcast misleading statements through a megaphone while their critics have only the occasional Op-Ed or letter to the editor to whisper a rebuttal, there is simply no way the public will get a balanced story. Critics, such as CETA, have found the facts don't matter when there's no money to get them disseminated. This has been a fundamental structural problem throughout the entire light rail debate here in Puget Sound.

The role that trust, or lack thereof, plays in reaching any solution for Puget Sound's transportation problems is hard to overstate. Part 7 contains a long list of newspaper quotes like the following:

Sound Transit: a matter of trust The 10-year plan for increasing transportation system capacity in the Central Puget Sound area was dubbed "Sound Move" by its creators at the regional transportation authority, Sound Transit. ...

...Half of those ten years are now past, and the Sound Move plan has fallen well short of its billing. The most visible culprit of course is the light rail project, which is \$1 billion over budget, three years behind schedule and the subject of a federal audit.

...It's the sort of indecision that makes one wonder, despite the agency's official denial, just how much of the 10-year plan was completed in a vacuum, without input from the very people it is meant to serve. It's the kind of day to day waffling and mismanagement that wastes time, overruns budgets and over time, causes people to lose trust. Some of us in the Legislature have noticed the loss of trust in Sound Transit.

... Why should taxpayers support long term financial commitment to transportation when Sound Transit provides such a convenient example of a commitment gone sour?

...The second offers revote on the grounds that the Sound Transit board's actions have significantly altered the proposition citizens approve in 1996.

...Because of Sound Transit's lackluster performance so far, any taxes directed toward transit and transportation projects from here on out need to be the best spent money in state government.

...At the heart of the public trust, President Abraham Lincoln once wrote, is trusting the public. Government should not be – and cannot afford to be – afraid of letting the people judge how well their money is being spent. Let's Vote. (Op Ed by 15 members of the State Legislature, Seattle Times, Feb. 20, 2001)

Requests that Sound Transit consider alternatives- There have been numerous requests that Sound Transit reconsider its light rail plans. Again this story is told via articles quoted from local newspapers. Two examples are:

Sound Transit Board: It's time to do your job After the overwhelmingly negative wave of recent events, you would think a board that calls itself "Sound" would stop shelling out our money to move forward on such a monumental undertaking as a \$4.2 billion light rail plan. You would think they would call a timeout not just to patch up the holes that have been revealed, but a timeout to actually rethink whether this flawed vessel, light rail, is going to get us to the vital goal of reducing traffic congestion in central Puget Sound. Yet in response to the damaging report issued last week by the US Inspector General's office... all we get here at home is more patch-up.

... My response is this: Is there *any* event or combination of facts, any misgivings about cost, funding, ridership, or concerns over the Inspector General's criticisms, *anything* at all that would finally cause the Sound Transit Board to ask, "Is proceeding with light rail still a good idea?" It seems no issue exists that's significant enough to prompt the board's serious review of alternative solutions.

...The board's irresponsibility is found in the decision to remain silent despite their growing awareness of that misinformation, including possession of significant evidence that light rail may not be a cost-effective transit alternative.

Civic groups, critics and other elected officials are calling ever more loudly for a complete review of the project including available alternatives... (Booth Gardner, former Governor Washington State, Op Ed Seattle Times, April 11, 2001)

Full speed ahead for light rail In a hasty attempt to secure \$500 million in federal funding before the Clinton administration steps down, Sound Transit will move forward with light rail despite mounting objections about costs, the agency's leaders say.

...But Sound Transit Executive Director Bob White and board Chairman Dave Earling say they already know what the board will decide on that pivotal day: The agency will not explore alternatives to light rail... (Chris McGann, Seattle P-I, Jan. 5, 2001)

Recommendations-- This report recommends the following actions:

- 1) The FTA should reject the DSEIS for Sound Transit’s Long-Range Plan and should withhold any additional money for Link until a proper alternatives analysis has been completed, its results fully communicated to the public, and a public vote of confidence confirms voter support for continuation of Sound Transit’s light rail strategy. Part 8 of this report outlines key requirements for conducting a proper alternatives analysis.**
- 2) The Sound Transit Board of Directors should voluntarily undertake the above actions with or without the FTA requiring same. They should do this to confirm they are on the right path and to restore public trust.**
- 3) Congress should investigate the manner in which mass transit grants are approved to ensure that FTA controlled planning processes are not abused in the ways chronicled throughout this report. They should investigate Sound Transit as one case example. Congress should insure that the process is redesigned to obtain the most “bang for the taxpayer buck”. That is: greatest improvement in transportation at least cost to Federal and local taxpayers.**

The Sound Transit Board has no good reason to balk at taking these actions. If Board members are confident they are on the right path, a proper alternatives analysis can do nothing but confirm it, silence the critics, and help restore public trust. There is no reason why Link can’t be put on hold since its completion wouldn’t have much beneficial effect.

Vetting-- Authorities should immediately cause this report to be reviewed by an objective team of experts to confirm or refute the logic, calculations and conclusions herein. This could be done in about six weeks. If those are upheld by the team of experts then there would exist reasonably credible, but still not conclusive, evidence that an all-bus strategy could achieve much the same benefits as light rail, and do so at a far lower cost. Such vetting would justify temporally halting construction on Link until a full-fledged alternatives analysis is complete in 12 to 18 months. Finally, Link could be restarted if the full-fledged analysis is favorable, or terminated if it is not.

Does it matter if the region spends billions more on mass transit than it needs to?-- This report concludes that pursuit of Sound Transit’s light rail strategy could end up costing the region roughly a billion dollars a year more than switching to an all-bus alternative.

So what? Does anyone care?

The answers are not obvious. It will be interesting to see if anyone gets concerned enough to act. Perhaps the best way to make the cost of Sound Transit’s rail plans meaningful is to list some of the other good projects that are being shortchanged because they are, in the ultimate analysis, competing with light rail for limited tax dollars.

School-renovation fund \$11 million short A Seattle School District review shows that its school-renovation programs are running deficits that could mean some projects will be delayed, trimmed or eliminated. (Sanjay Bhatt, Seattle Times, Aug. 4, 2004)

\$878 million more sought by Bergeson for schools Terry Bergeson, state superintendent of public instruction, yesterday asked for an additional \$878 million for public schools over the next two years, an amount she says is essential to reach the goals of the state's decade old education reform law. (Linda Shaw, Seattle Times, Sept. 23, 2004)

Legislators Brace for Extra-Hungry Interest Groups ...There will be pressure to expand colleges and universities and pay for multibillion-dollar transportation projects such as replacing the Alaskan Way viaduct.

Much of this year's problem is pent up demand. Colleges, for instance, have not kept pace with population growth and many state workers have gone years without a pay increase. But it comes at a time when the state projects a budget deficit of around \$1.8 billion, after already struggling through several years of huge shortfalls. (Seattle Times, Jan. 10, 2005)

Sound Transit's 2004 Financial Plan says that \$2.437 billion will be spent on Link's Initial Segment between 1997 and 2009. In 2004 alone Sound Transit will collect \$271 million in taxes.

The amount of money going to even the Initial Segment of Link light rail would make a big dent in the funding needed to reconstruct the Alaska Way viaduct and rebuild the 520 bridge. But the Initial Segment is just the first step in Sound Transit's ambitions for light rail. Clearly the \$900 million per year difference between a 125-mile version of Link versus an all-bus alternative would be more than enough to pay for both projects.

In short, the money that might be wasted on Sound Transits rail-centric strategy is not an abstraction; it comes at the expense of opportunities foregone, and of other good ways to spend tax dollars.

Nor is the impact on the Federal budget, of questionable projects all across the country like Link, something to ignore.

Congress lift debt ceiling New borrowing to avert default

Congress last night sent President Bush an \$800 billion boost in the federal borrowing limit, spotlighting how the budget has lurched out of control in recent years and how difficult it will be to afford future initiatives. ... "I want someone to explain to me how it can be moral for a father to stick his kids with his bills," said Rep. Gene Taylor, D-Miss. (Seattle Times, Nov. 19, 2004)

Part 8: Guidelines for a proper alternatives analysis

Sound Transit is beginning to plan for Phase 2 of Link light rail. The DSEIS Long-Range Plan shows this will include a limited version of an alternatives analysis, but the only alternatives being looked at are the alternative ways to expand HCT above and beyond the 24-mile Central Link line which Sound Transit is taken as a given.

Limiting Phase 2 to just consideration of ways to expand Central Link does not provide voters and officials a full view of the alternatives before this region. Since Link construction has hardly begun, one option is to halt its construction and shift to a more cost effective alternative like BRT. Another is to build Link IS but truncate it south of the bus tunnel so it wouldn't interfere with a regional BRT system. Still another option concerns the full 100+ mile version of Link called for in Sound Transit's draft Long-Range Plan, and in PSRC's Metropolitan Transportation Plan. This 100+ mile version of Link needs to be compared apples-to-apples with a BRT alternative that is either equal in cost, or equal in benefit.

Part 8 describes these and other options in more detail along with technical guidelines to ensure the rail/bus comparisons are done objectively.

Early indicators for Phase 2-- Part 8 concludes with a litmus test that will give voters an early indication of whether or not Sound Transit plans to conduct an adequate and objective alternatives analysis as part of their Phase 2 planning.

Part 9: Main conclusions of this report:

- 1) The existing planning process is not producing the kind of information needed by officials and the public to make intelligent decisions about major mass transit projects. Important information is missing or obscured. Promising alternatives are ignored. Reports seem intended more to sell than to inform.
- 2) Sound Transit and its predecessor agency the RTA have abused the planning process in order to promote light rail. They biased key studies by making inappropriate assumptions and masking key information. They compared a robust rail alternative against a deliberately hobbled bus alternative. They disseminated misleading information to the public.
- 3) ST justifies its choice of light rail on the one and only rail vs. bus alternatives analysis conducted here since the 1980s. However, that study was deliberately biased to favor rail. When that bias is removed the underlying data shows that an all-bus solution could probably achieve the same level of benefit at far lower cost.
- 4) ST and RTP dismissed bus alternatives largely on false claims that buses lacked adequate capacity. Their analysis was deliberately manipulated to support these claims. BRT has more than adequate capacity to meet the region's long-term needs. Light rail has less capacity than BRT and is therefore less strategic.

- 5) As construction begins on Link there is still no study which compares the benefits of spending \$X billions on light rail plan versus spending the same amount on bus rapid transit.
- 6) If the money now intended for light rail were instead redirected toward other projects such as BRT, car and vanpool enhancement, and other transportation projects the region could probably make considerably more progress in solving our transportation problems, because these other alternatives are more cost-effective.
- 7) By objective measures Link does not seem like something worth pursuing. Among other faults it would have almost no effect on traffic congestion and is not cost-effective as an alternative to driving.
- 8) BRT is a viable alternative to light rail in the Puget Sound Region. It could achieve the same benefits at a much lower cost and has more than adequate capacity to handle long term growth.
- 9) Link is the failed result of a faulty planning process. The process can and has been manipulated to favor preordained outcomes. It is not objective. It does not produce the type of information needed to make intelligent decisions. It fosters distrust. It is a process that needs to be fixed. This would take local and Federal action.
- 10) The region is embarking on a rail-centric mass transit strategy, which could result in over 125 miles of light rail. If fully implemented, that strategy will probably cost the region about a billion dollars per year more than an all-bus (BRT) strategy having the same level of transit ridership and related benefits. Meanwhile Link IS and Central Link are probably costing over twice what comparable all-bus alternatives would cost.
- 11) Link light rail is an example of the “waste, and abuse” that is driving up the Federal budget deficit, because it was sold on the basis of misleading information and because there are more cost-effective alternatives.
- 12) There has been insufficient public discussion about the merits or consequences of committing the region to this multi-billion dollar rail-centric strategy, and there is no solid analysis demonstrating it’s the best strategy.
- 13) Transportation planning in the Puget Sound region has not placed a high priority on spending taxpayer money efficiently or in finding the lowest cost solutions.
- 14) Link should be put on hold and further Federal funding withheld until and unless a new and honest alternatives analysis is completed, and that analysis demonstrates that light rail is superior to BRT and other options. On the basis of available evidence, such a conclusion seems unlikely.

- 15)** The FTA should review, and if appropriate withdraw, its prior acceptance of the 1993 FEIS as meeting FTA requirements for a proper alternatives analysis, since that particular analysis is faulty in so many respects and contains no apples-to-apples comparison between Sound Transit's light rail plans and all-bus alternatives. By the same token FTA should not allow Sound Transit to proceed with any Phase 2 planning until a new and proper alternatives analysis has been completed.
- 16)** Sound Transit's planning process for Phase 2 will not provide the information needed for this region to make intelligent decisions about massive investments in mass transit unless the recommendations listed in Part 8 of this report are adopted.
- 17)** The PSRC should be forced to obey the State Law requiring Least Cost Planning because imposition of that planning technique is the single most important thing that can be done to help ensure that scarce transportation tax dollars are spent wisely.
- 18)** Sound Transit's latest Long-Range Plan should not be approved because it's very foundation, the 1993 FEIS, is obsolete and corrupt.

--end--

Part 1: Sound Transit has never done a proper alternatives analysis.

1.1 Overview

Part 1 will document the fact that Sound Transit has never conducted a proper alternatives analysis for Link light rail". In particular Sound Transit has never done an apples to apples comparison of the light rail system they intend to build against other alternatives such as bus rapid transit. As a result there still exists no factual basis for asserting that light rail is a better solution for this region than other alternatives might be. In fact, Parts 3,4,5 and 6 will provide strong indications to the contrary.

To be even more specific there exists no apples to apples comparison between:

- a) The 14-mile Link “Initial Segment” (Ref 2) now under construction versus an all-bus alternative
- b) The 21-mile Central Link (Ref 18) voters approved versus an all-bus alternative
- c) The 24-mile Central Link to Northgate version of Link (Ref 2) versus and all-bus alternative
- d) The 100+ mile, fully built-out version of Link described in Sound Transit’s Long-Range Vision (Ref 49), Draft Long-Range Plan (Ref 65), and in the PSRC’s Metropolitan Transportation Plan (Ref 17: p. 73) versus an all-bus alternative

At the time of this writing Sound Transit has just released diagrams of the alternatives it plans to evaluate for Phase 2. One alternative is a light rail network that includes all of Central Link plus extensions to Northgate, Totem Lake, Redmond, and to the east of Issaquah. It appears to involve between 50 and 70 route miles of light rail. There will be two rail/bus alternatives, one using busways, the other using HOV lanes.

Sound Transit intends to conduct an alternatives analysis of the rail extensions per se, but not the entire rail network. In other words they plan to take the core light rail network from SeaTac to Northgate as a given in all three of the alternatives they plan to examine for Phase 2. Thus when this Phase 2 planning exercise completes there will also be no apples to apples comparison between:

- e) The 50 to 70 mile (Phase 1 + Phase 2) version of Link versus an all-bus alternative.

Because none of these alternatives analyses have been done, Sound Transit has no scientific or analytic basis for its choice of light rail. Neither elected officials nor the public has the data needed to see whether or not Sound Transit’s preoccupation with light rail makes sense.

In lieu of a proper alternatives analysis, what Sound Transit uses to justify light rail is an outdated, irrelevant and biased FEIS/alternatives analysis completed in 1993. (Ref:1) That study compared a 125-mile, fully grade separated rapid or heavy rail system against two bus alternatives. It is referred to frequently throughout this report as the "1993 FEIS". See the attached Maps for the rapid rail and bus alternatives studied in the 1993 FEIS.

There is apparently no other, or more recent, alternatives analysis. The PSRC's "Summary of Prior All-Bus and Integrated Rail/Bus Alternatives Analysis" dated April 5, 2001 states: "The most recent and comprehensive system-wide analysis that evaluated the relative costs and benefits of a rail/bus alternative and an all-bus alternative was conducted as part of the Regional Transit System Plan (RTSP), completed in 1993." (Ref 28, p.2)

Nor are any other alternatives analyses mentioned in "Documentation of Major Investment Study", dated March 12, 1996 (Ref: 3), or in a short report called "Sound Transit Link light rail project, Transit Technology Review" dated 2/2/99 (Ref: 5), or in a comprehensive listing of all high capacity transit studies conducted from 1967 to June 2001. (Ref 36, Appendix P) Moreover a very recent Sound Transit presentation called "SEIS/Long-Range Plan Scoping Summary Report and Definition of Phase 2 Alternatives", Office of Policy and Planning, June 24, 2004 points back to the 1990-1993 alternatives studies but mentions nothing more recent. (Ref: 8) Finally, the just released DSEIS for ST's Long-Range Plan states definitively that it's based on the 1993 FEIS.

In short, the 1993 FEIS is the one and only rail versus bus alternatives analysis this region, and Sound Transit, has to rely on.

Unfortunately the rapid rail system studied in the 1993 FEIS is not like the light rail system Sound Transit plans to build. The sizes of the networks are different, the speeds of the trains are different, the capacity and levels of service are different, and the cost estimates have proven wrong. In addition, the bus alternatives considered in 1993 were not well designed; in fact they were designed to fail.

In short, the 1993 study does not provide adequate rationale as to why light rail should be Sound Transit's technology of choice, nor does it demonstrate that Sound Transit's plan to spend about \$2 billion on a 14-mile Initial Segment of light rail is more beneficial than spending an equivalent amount on some other alternative such as bus rapid transit. The public needs to know. Public officials need to know. It is the essential and fundamental question that the millions spent on planning should have answered. Yet it remains unanswered as Sound Transit begins construction on Link's "Initial Segment".

Sound Transit is now beginning "Phase 2" planning that would extend that 14-mile initial segment, and it appears the agency plans to rely again on that same irrelevant, obsolete 1993 study. That must not be allowed.

Before beginning any Phase 2 planning, and indeed before spending any more on Phase 1, our region needs an honest apples to apples comparison wherein Sound Transit's plan to spend \$X billion on light rail is compared with spending the same amount on BRT and/or other alternatives. (Or alternately the costs of achieving a given level of benefit using different plan alternatives are compared.) Equal cost or equal benefit is what is meant by apples-to-apples.

The author believes the way Sound Transit has abused good planning practice is not unique and has happened elsewhere. If so, what's needed at the national level is a change in FTA regulations or enforcement thereof that forces transit agencies to conduct honest and adequate alternatives analyses whenever new rail systems or extensions are contemplated. For information on abuse in other cities, see References 12, 13, 21, 24 and 50.

Having a proper alternatives analysis is not the only requirement for a good planning process, but it's an essential one. If there is one part of the process that should be singled out and fixed, this may be the one with the highest leverage. That's why it's the focus of this report.

1.2 Alternatives analyses are required

According to the FTA's Office of Planning and Program Management:

"FTA's FY 2003 Strategic Business Plan identifies a commitment to delivering the highest value for Americas investment in public transportation..." (Ref 31, p. 3)

"The name "alternatives analysis" has as its basis the New Starts planning provisions contained in federal legislation..." (Ref 31, p. 10)

"Regardless of what the study is called, its intent is the same: to identify and compare the costs, benefits and impacts of a range of transportation alternatives as a means of providing local decision makers with the information necessary to implement the most appropriate transportation solutions in priority corridors." (Ref 31, p. 10)

Additionally, common sense, taxpayer interest, the principles of business analysis, and urban planning techniques taught in graduate schools all require proper alternative analyses. Decision makers and taxpayers need to know what options are available for solving their transportation problems. And, they need some way to compare the costs and benefits of the different options so as to spend money wisely.

Much of this report is devoted to detailing the deficiencies in the 1993 FEIS which is Sound Transits one and only alternatives analysis and apparently the one with Sound Transit submitted to the FTA in support of their full funding grant agreement for Link. The FTA apparently accepted this flawed document because their formal acceptance of the grant states:

WHEREAS, the Government has determined that the Project is based on the results of an alternatives analysis.... (Ref 60)

This author is not familiar with the details of FTA requirements as to how alternatives analyses should be conducted. He does not know if they are so loose that practically anything that a transit agency says is an alternatives analysis will be accepted by the FTA; but considering what Sound Transit has been able to get away with that must be the case. I leave it to others to determine whether or not Sound Transit has met the "letter of the law" in terms of FTA's formal requirements. It's clear they have not met the spirit of the law, or the needs of those wanting objective information.

1.3 Author's definition of a minimal alternatives analysis

In this letter I define an alternatives analysis as a study wherein one fairly detailed transit system plan is compared against other detailed transit or non-transit system plans such that the costs and benefits, including environmental impacts, of each alternative are quantified. The systems plans must be detailed enough to show routes, stations, and frequency of service. The analysis must include running mode split and other models so as to predict transit ridership, impacts on road usage, and other relevant impacts and benefits. These are what I consider the minimal requirements for something to be called an alternatives analysis.

A qualitative description of the pros and cons of different alternative technologies does not comprise an alternatives analysis. Sound Transit and the RTA have produced a number of these. Most are very short. See for instance the Appendix in Ref 5.

Using my definition there has been only one alternatives analysis relevant to major regional mass transit planning in the Puget Sound region since 1990; namely the Final Environmental Impact Statement Regional Transit System Plan, dated March 1993. (Ref: 1) It was produced by Sound Transit's predecessor, the Regional Transit Authority or RTA.

1.4 Author's definition of a proper alternatives analysis

To be a proper alternatives analysis other common sense requirements apply. For instance the systems alternatives compared should include the one actually planned to be built not some obsolete or irrelevant plan, the cost data should be timely and not proven wrong, the analysis should be objective and not biased, the analysis should show how well each alternative contributes to solving the main transportation problem the community wants solutions for, a decent range of alternatives should be considered, and so forth. In a nutshell the alternatives analysis should attempt to seek out the best solution to the problem based on objective performance criteria, not serve as a sales pitch or biased justification for some politically predetermined outcome.

In other words it should actually and honestly seek to: "delivering the highest value for Americas investment in public transportation" (Ref 31, p. 3)

Using this definition Sound Transit has never conducted a proper alternatives analysis for the light rail system they plan to build.

The specific reasons that the 1993 alternatives analysis (Ref 1) should not be accepted as the basis for Sound Transit's light rail planning are detailed in the remainder of Part 1. They fall into two general categories. First, the 1993 FEIS was in itself flawed and did not even constitute a proper alternatives analysis for the rapid rail system being proposed in 1993. Second, about 12 years have passed since the homework behind the 1993 FEIS was completed. In the interim Sound Transit has switched from rapid rail to light rail, initial cost estimates have proven wrong, and a host of other things have changed. All these factors would render the 1993 FEIS obsolete and irrelevant to today's situation, even if it had been done correctly back in 1993.

1.5 The 1993 alternatives analysis is irrelevant because it addressed heavy or rapid rail, not light rail.

The 1993 alternatives analysis that ST has used to justify its light rail plans was not an analysis of light rail vis-a-vie other alternatives, but rather an analysis of heavy or rapid rail, which has significantly different characteristics.

There can be no doubt that the 1993 FEIS evaluated rapid or heavy rail since the term was used so widely and defined so precisely: (underlining by author)

“The fifth plan element is a regional rapid transit system...” (Ref 1: p.xiii)

"This (Rail/TSM) alternative includes about 125 miles of rapid rail running on an exclusive, grade-separated right-of-way and a 40-mile diesel-operated commuter rail line. For planning and modeling purposes it has been assumed that the rapid rail system would have operating characteristics similar to recently built system in other cities and that it would have similar environmental impacts. Within the range of other North American rail lines, the rail system that is proposed would fall into the definition of "heavy rail", since it would have a relatively high capacity and would operate almost entirely on an exclusive guideway completely separated from automobile traffic." (Ref: 1, page xxxii). *In contrast, parts of Sound Transit's light rail will operate at grade in the Rainier valley thus limiting its speed and capacity. It also has different safety characteristics than the grade-separated system in the 1993 FEIS.*

"A rapid rail line operating in exclusive right-of-way has the theoretical capacity to carry over 22,000 persons per hour in each direction past a single point. These numbers represent the rail capacity of the downtown Seattle transit tunnel; capacity would be higher in segments with less frequent station stops." (Ref: 1, page xviii) *In contrast, the maximum capacity of Link light rail is claimed to be 16,000 pph in downtown Seattle and on the north line. South and east lines would have a much lower capacity.*

“The capital improvements analyzed in the system Plan FEIS include a proposal for a rapid rail system...” (Ref 1: p. 1-2)

“A rapid rail line with 4-car trains....” (Ref 1: p.1-10)

“2.2.3 Rail/TSM Alternative The Rail/TSM alternative overlays an extensive rapid rail system and a commuter rail line onto....” (Ref 1: p.2-24)

“2.2.3.1 Technology This alternative would be based on an rapid rail system on exclusive, grade separated right-of-way...Maximum speeds would be 55 to 70 MPH, with average speeds (including station stops) around 35 to 40 MPH.” (Ref 1: p.2-24)

Because the 1993 FEIS compared rapid, not light, rail with bus alternatives it does not constitute an adequate alternatives analysis for Link, in spite of Sound Transit’s assertions that it does. It offers no proof that spending \$X billion on light rail would bring more benefit to the region than spending the same amount on other alternatives such as bus rapid transit.

1.6 Link light rail is much slower than the rapid rail studied in the 1993 FEIS.

The rapid rail in the 1993 FEIS had an average speed of 36 MPH whereas Link will have an average speed of only 26 MPH. (Ref 38: p.16 and Ref 1: p. 2-58) The rapid rail in the 1993 FEIS also had a higher top speed. “Maximum speeds would be 55 to 70 mph, with average speeds (including stations stops) around 35 to 40 mph.” (Ref 1: page 2-24) In contrast Links maximum speed is 55 mph. (Ref 2: page 3-9).

As another point of reference, WASHDOT policy requires that HOV lanes be managed so average speeds equal or exceed 45 MPH.

The fact that Link is slower than the rail system in the 1993 FEIS means that all the benefits asserted for rail in that study would be diminished if light rail were used instead of rapid rail. In other words, the 1993 FEIS makes the “rail” alternative look better than it should be, if rail now means light rail whereas before it meant rapid or heavy rail

Because it is slower Link would attract fewer riders than rapid rail, even if the routes and stations were the same. With fewer riders the cost-effectiveness measures computed in the 1993 FEIS would not apply to a fully mature 100+ mile version of Link. Link would look worse.

In addition, all the other benefits that are related to ridership, such as impacts on traffic, air pollution, energy consumption, and the degree to which the alternative supports land use goals would be lower.

The fact that Link is slower will diminish whatever advantage the 1993 FEIS asserted that rail would have over bus. Perhaps it would disappear entirely. In other words, if Link speeds were plugged into the models used to estimate ridership in the 1993 FEIS, perhaps the bus alternatives would have attracted MORE riders than the rail alternative and left no basis to claim rail was superior.

In sum, by basing today’s decisions on a dated alternatives analysis that makes rail look better than it should, we are not making rational decisions based on relevant data.

1.7 The rail network used in the 1993 alternatives analysis differs considerably in size and routing from the network options Sound Transit intends for Phase 1 and 2.

A proper alternatives analysis needs to compare the actual configuration an agency plans to build against other feasible alternatives, rather than compare hypothetical or irrelevant configurations. If an agency is allowed to compare hypothetical network configurations it might as well also compare them in the context of hypothetical land use patterns or even use comparisons from other cities. Clearly there are places in the world where heavy rail is clearly superior to light rail, or where light rail is superior to bus rapid transit, or where bus rapid transit is superior to light rail. It all depends on the specifics, including the size and shape of the proposed networks.

The 1993 FEIS compared one specific 125-mile rail network with several bus-based alternatives.

This network is not similar in size or shape to any of the light rail networks that Sound Transit may end up with. Currently, Sound Transit only has FTA approval to build a 14-mile starter system. That may be all that ever gets built. Or maybe it will be extended to SeaTac but not to the U District, or vice versa. Or maybe to Northgate. Or maybe it will be extended across Lake Washington, perhaps with a branch to Issaquah, or maybe not. The merits of these potential end-state LRT networks vis-a-vie BRT are not addressed by a prior study of one particular 125-mile rapid rail network. See attached Maps for details.

Common sense argues that there should have been an alternatives analysis comparing Central Link with other alternatives before ST asked voters to approve it in 1996. They would have been better informed. And it should have been required before the FFGA was approved for the starter system. One could also argue that the current FFGA is invalid because a proper alternatives analysis was never completed. The need for one remains as long as the community could still change its mind and Phase 1 contracts be cancelled, or as long as it is still possible to terminate the Initial Segment south of the DSTT.

Phase 2 planning is now started and Sound Transit must not be allowed to maintain that the alternatives analysis has long since been completed, as they do in the Draft Long-Range Plan. Instead, common sense argues that we should now have an alternatives analysis for each of the main end-state scenarios that may emerge so we can determine which if any make sense. Thus we should have an apples to apples comparison of at least the following light rail scenarios vis-a-vie an equal amount spent on other alternatives:

- 1) a truncated Initial Segment that stops south of the Downtown Seattle Transit Tunnel so it doesn't interfere with a regional BRT system.
- 2) 14-mile Initial Segment as currently approved
- 3) 21-mile Central Link
- 4) 24-mile version of Central Link going to Northgate
- 5) ?-mile version of Link from Everett to Tacoma

6) the 125+-mile light rail system that constitutes Sound Transit's fondest dream for Phase 2 (see Ref 8: page 4 and Ref 65) See also PSRC's MTP which envisions 125 miles of light rail. (Ref 17: p.73)

All these potential light rail end-state scenarios should be studied since, while a short starter system may not make sense, perhaps a more extensive system would. Alternately, perhaps a larger system would exceed the point of diminishing returns, whereas a short "skim the cream" system would make sense. If light rail makes sense at all, there will be an optimum balance between that part of the transit network served by rail versus that best served by bus. This sweet spot can only be located by bracketing it with the evaluations of various end-state scenarios such as outlined above.

Beside route length, the layout of the 125- mile rail network used in the 1993 Plan differs substantially from the light rail network ST now envisions for Phase 2. For instance the 1993 rail alternative included a North-South line running east of lake Washington from Everett to Sumner, whereas Phase 2 "Development Options" include no such route. (Ref 2: Figures 2-10 and 3.20) (Ref 8: page 4) The alignment chosen for estimating ridership in the 1993 FEIS may also have been the Duwamish alignment, although that isn't clear. (Ref 2: page 2-32) If the Duwamish alignment were used, that would be another difference between what was studied in the 1993 FEIS and what Sound Transit wants to build.

In sum, the cost, ridership, and impact data collected in the 1993 FEIS are not relevant to impending decisions about building or extending light rail because the shape and size of the rail network analyzed in the 1993 FEIS is not equal to any of the Link's network scenarios. It is therefore necessary to conduct an alternative analysis, in other words a mode against mode "fly-off", for each potential end-state scenarios for light rail to determine which, if any, make sense.

1.8 The bus alternatives in the 1993 FEIS don't reflect the best design for bus alternatives. They are obsolete in terms of what can now be done, and may have been designed to fail.

There are several reasons why the bus designs in the 1993 FEIS do not reflect the best that buses could do today, and therefore render the 1993 FEIS obsolete.

First, the 1993 FEIS makes no mention of BRT. Therefore the bus alternatives in that study are unlikely to have incorporated all the recent innovations in Bus Rapid Transit. As explained in the extensive BRT literature these include a host of ways for making bus service more efficient and attractive. (see References 9, 10, 11, 12, 13, 14)

Second, there was no knowledge at the time that the Alaska Way viaduct needed to be replaced due to earthquake vulnerability, nor that there would be a major effort to redevelop the south Lake Union area. These offer the opportunity to build an elevated "BRT/HOV way" that would branch off the I-5 HOV lanes at Mercer St., cross the south

Lake Union Area, tie into SR 99, and head south along what is now the Alaska Way viaduct. Just one story up, this "BRT/HOV-way" could probably be architecturally integrated into the planned new buildings so wouldn't be visually intrusive.

Providing another major new N-S transit/HOV corridor through the city would remove much of the capacity limitation held against the TSM option. With a south Lake Union station this new busway could provide high quality transit service to this emerging employment center. In addition, by heading west toward the Seattle Center then south along the waterfront this BRT route could improve transit service to Ballard, Belltown, the biotech development on the north shore of Elliot Bay, the commercial/industrial area south of the stadiums, the Duwamish valley, and West Seattle. These areas are all ignored by light rail. The attractiveness of this addition would not have been apparent in 1993 and is another reason the 1993 FEIS is obsolete in terms of the light rail versus BRT choice facing us today.

Third, the 1993 FEIS claimed that bus alternatives didn't have enough capacity thru downtown Seattle. However, the RTP failed to consider a scenario where through buses would be accommodated by extending the I-5 HOV lanes through downtown, or solve the capacity problem in a variety of other ways that staff had already identified. In this respect the bus alternative in the 1993 FEIS was a strawman alternative deliberately designed to make the bus alternatives look bad. This complex subject is treated in detail in Part 5 of this report.

The point here is that Sound Transit's choice of light rail over bus cannot legitimately be based on an alternatives analysis wherein the bus alternatives were deliberately designed to fail. For this reason alone the FTA should have refused to accept the 1993 FEIS when processing Sound Transits request for a Full Funding Grant Agreement (FFGA).

Fourth, the 1993 FEIS did not contemplate the hybrid bus technology that is now available. The availability of this technology has operational, cost, and environmental implications different from buses evaluated in the 1993 FEIS.

In sum, the bus alternatives in the 1993 FEIS are dated, biased, and do not represent bus technology at its best. The 1993 FEIS is therefore irrelevant to impending decisions about if and how to extend Link light rail. To be relevant in today's environment, new alternative analyses -- that compare Sound Transit's light rail plans against several modern well-crafted BRT alternatives-- are needed. This is a most fundamental point.

1.9 The 1993 alternatives analysis is irrelevant because it is based on obsolete and incorrect cost assumptions

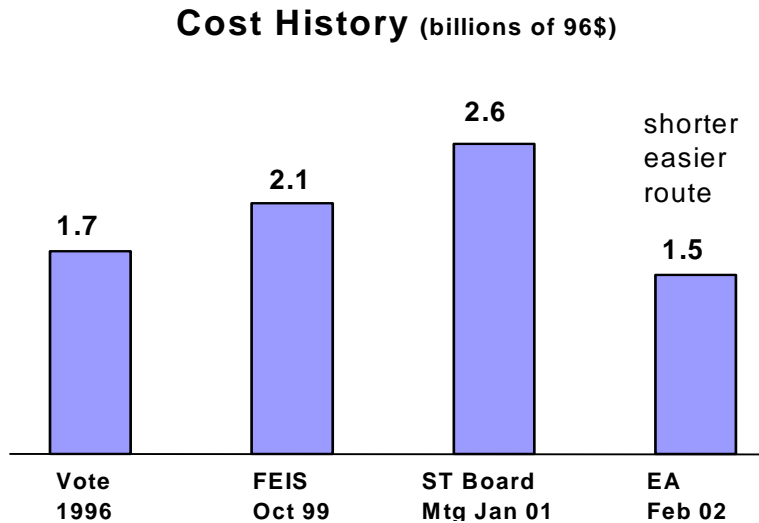
Since virtually any transit technology can be made to work, one of the most important reasons for doing an alternatives analysis is to determine relative costs.

Officials currently leaning on the 1993 FEIS to help justify their choice of light rail over bus are looking at obsolete and incorrect cost data. History shows that cost per mile assumptions made in the early 1990s were wildly optimistic. Since time has proven that the cost assumptions in the 1993 FEIS were incorrect, that document is not relevant to today's decision making.

The author would like to show the magnitude of this error, in other words quantify the difference between rail costs assumed in the 1993 FEIS and the latest figures based on actual construction cost bids, which in turn reflect a much greater level of engineering analysis than had been done in 1993. Unfortunately this is very difficult for several reasons. First Sound Transit has not stated all their cost estimates in a consistent manner, such as 1995\$. Second, they have started using YOES\$ which appear to vary depending on the latest implementation schedule. Third, some estimates include reserves and other relevant expenses whereas others do not. Fourth, the "plan" has changed from the 125-mile system, to a 21-mile system to a 14-mile system so it is difficult to say what would now be the cost of the original 125-mile system. What follows are the best indications of percentage cost escalations since the 1993 FEIS that the author has been able to locate.

First, some data in constant dollars: When voters approved the original 21-mile light rail plan in 1996 the cost was estimated to be \$1.736 billion (in 95\$), or \$86 million per mile. (Ref 2: p. S-49) (Ref 15: p.34). Sound Transit's May 1996 Sound Move brochure said: "Sound Move is based on extremely conservative cost and ridership assumptions." (Ref 15: p. 31) Voters no doubt relied on that statement.

However, by the time the FEIS for Central Link was published in November 1999 the cost had risen to \$2.1 billion (95\$) or \$100 million per mile, and by Sound Transit's board meeting in Jan. 2001 it was up to \$2.6 billion (95\$) or \$123 million per mile, a full 44% higher than what voters approved. (Ref 2: p. S-49) (Ref 27, Section 13, p.1-8) Then, since the original plan was no longer affordable, Sound Transit decided to shorten the route and eliminated the most costly portions. In short, these sources show costs increased 44% (in 1995\$) from the mid-1990's to January of 2001. An earlier chart by the author shows this visually:



Second is a view in YOES: On 2/2/01 Sound Transit published a table labeled "Updated 2001 Financial Plan". (Addendum G) The table shows that light rail (the Phase 1 system to NE 45th) changed from \$2.161 billion (YOES) in the Sound Move plan to \$4.0 billion in the 2001 Updated Financial Plan. The \$4.0 billion figure also appears in the Central Link Board Briefing Book dated Jan 11, 2001. (Ref 27: Section 13, p. 7-8) In sum, this YOES data shows the costs of Central link jumped 85% during the period from 1996 to 2001.

Third is a June 2004 analysis by transportation planner Jim MacIsaac: Mr. MacIsaac found that the total cost for the 24.8-mile Central Link has risen from \$2.3 billion at the time of the vote to somewhere between \$5.335 billion and \$6.75 billion. These are YOES. This means cost per mile has doubled or tripled from \$93 million per mile back in the 1996 timeframe to somewhere between \$215 and \$272 million per mile today. Mr. MacIsaac's table is inserted below.

Link Capital Cost Estimates Excluding all Reserves and Financing Costs

Segment	Length (miles)	Sound Move (YOE\$)	Capital Cost Estimates		Cap Cost per Mile	Maclsaac Estimates	
			2001 Est ¹	Current ²		2009\$ ⁸	2012\$ ⁹
Link North:			(YOE\$)	(YOE\$)			
Northgate - U-District ³	3.2	13.8 mi	\$600	\$775	\$242	\$937	\$1,070
U-Dist - CPS (Montlake) ⁴	4.9		\$1,720	\$1,945	\$397	\$2,353	\$2,685
CPS - Lander & Maint Base ⁵	3.1		\$680	\$715	\$231	\$790	\$790
Lander - McClellan ⁵	1.0		\$300	\$300	\$300	\$330	\$330
McClellan - Boeing Acc ⁵	4.8		\$580	\$580	\$121	\$640	\$640
Total North	17.0	\$1,871	\$3,880	\$4,315	\$254	\$5,050	\$5,515
Link IS North Only	8.9		\$1,560	\$1,595	\$179	\$1,760	\$1,760
Link South:							
Boeing Acc - S.154th (Link IS)	4.9	\$427	\$480	\$610	\$124	\$670	\$670
S.154th - Airport Term ⁷	1.7		\$250	\$210	\$124	\$255	\$290
Airport Term - S.200th	1.2		\$200	\$200	\$167	\$245	\$275
Total South	7.8	\$427	\$930	\$1,020	\$131	\$1,170	\$1,235
TOTAL CENTRAL LINK	24.8	\$2,298	\$4,810	\$5,335	\$215	\$6,220	\$6,750
Link IS Extensions only	11.0	(21.2 mi)	\$2,770	\$3,130	\$285	\$3,790	\$4,320

¹ ST April 2001 Capital cost estimates in YOE\$ based upon 2009 opening (excluding all reserves and financing costs).

² Most recent estimates per 2004 financial plan for Link IS; per footnotes 3-7 for extensions (assumes all completed by 2009).

³ 40% of CPS to U-District segment, per ratio of Base Construction estimates presented in North Link DSEIS.

⁴ May 2004 ST disclosure of total capital excluding reserves = \$1775 in 2002\$ x 1.095 to YOE (2006)\$.

⁵ CPS - Boeing Access = \$1534m in YOE\$ per ST 2004 Link IS estimates. Add \$61 for DSTT ROW.
Broken down into three subsegments by JWM estimates aided by the ST 2001 breakdowns.

⁶ The 2001 estimate reflected alignment in median of SR-99. Since changed to mostly elevated "Tukwila route".

⁷ This segment was originally to be elevated. The revised POS drive plan now makes it possible to build much at-grade.

⁸ Includes 10% project reserve for all segments plus inflation factor of 1.1 for 3-year delay of all Link IS extensions.

⁹ Includes an inflation factor of 1.2 for 6-year delay of all Link IS extensions plus 15% project reserve for extensions.

It is clear from the record that between May 1996 and January 2001 Sound Transit had learned enough --from more detailed engineering and input from construction firms-- to realize their initial cost estimates were off by about 44%. What we don't know is whether or not Sound Transit learned anything before May 1996 or after January 2001 that would have also changed their cost estimates. In other words were the underlying unit cost assumptions used in the 1993 FEIS the same as those used to estimate the cost of Central Link in the Sound Move brochure, and are the unit costs used in Jan 2001 still valid today? If there were increases during those periods they would be in addition to the 44%. A new alternatives analysis based on the latest unit cost data is needed in order to get a reasonably accurate estimate of what the 125-mile system would cost today.

However, in the meantime the author will simply assume --for the analyses in Part 6--that the only change is 44%. In other words, the author will assume that the cost of the 125-

mile rail system in the 1993 FEIS is not the \$7.9 billion (95\$) it was then thought to be, but --based on what we know today-- is more like \$11.38 billion (95\$).

To summarize, cost assumptions made in the early 1990's have proven grossly inaccurate, partly because the difficulties of construction in Seattle's difficult terrain were underestimated. Light rail is much more expensive than was anticipated in the 1993 FEIS. It is at least 44% higher and perhaps more. This makes the cost-effectiveness measures in the 1993 FEIS obsolete. A new alternatives analysis based on updated costs is needed.

Part 6 of this report continues this analysis of cost issues, and ends up with a cost comparison between building a mature 100+ mile version of Link and building a BRT system having equal ridership.

1.10 The 1993 alternatives analysis is irrelevant and obsolete because employment patterns have changed

Since 1993 employment patterns have changed significantly, very likely in ways not anticipated in land use inputs to the modal split modeling behind the 1993 FEIS. For instance, employment at Boeing has dropped and shifted. Microsoft employment has grown dramatically. Paul Allen has relatively recent plans for dramatic growth and redevelopment in the South Lake Union area. Biotech employment has grown in the north Elliot Bay area. There has been much residential high-rise construction in Belltown. There is significant employment and residential growth planned on the Sammamish Plateau just north of Issaquah. These land use changes affect the relative merits of light rail versus BRT since light rail would not serve many of the new growth areas whereas BRT could.

In summary, a FEIS based on 10 or 15-year old land use assumptions is no suitable basis for today's light rail planning.

1.11 The 1993 alternative analysis is inadequate because it did not quantify the impact of each alternative on the region's main transportation problem, namely traffic congestion.

For the last decade at least, virtually every newspaper article about Puget Sound's transportation problem emphasized that "THE" problem is traffic congestion. Not air-quality, not energy consumption, not inadequate mobility for the poor, but rather the traffic congestion suffered by individuals and by companies trying to conduct business. One of the many examples is Seattle Times lead editorial of July 16, 2001 entitled "Legacy Time: Congestion is the No. 1 Issue".

Polls echo this finding. For instance the PSRC's Puget Sound Household Travel Survey concluded: "Respondents agree that reducing traffic congestion should be the primary goal of transportation plans." (Ref 16, p. ii) A Sound Transit Poll said: "It is also very

important to the majority (62%) of the respondents that the projects remove single occupancy vehicles from the roadways, even if they do not plan on using the services themselves." (Ref 22, p.15). A Mineta Institute Report entitled "Why Campaigns for Local Transportation Funding Initiatives Succeed or Fail" says: "Results from the (Evans) poll indicated that a majority of respondents were highly concerned with the issue of traffic and congestion..." (Ref 21, p.89) The Evans McDonough poll is also summarized in Ref 27, Appendix B, p.4-8.

The fact that traffic congestion should be the main metric for evaluating transportation system performance is reinforced by the fact that the Puget Sound Regional Council (our MTO) used "delay" on freeways and arterials as the main comparison metric in the alternatives analysis behind the Metropolitan Transportation Plan. (Ref. 17, p. xvii) (Ref 30, p.24) Delay is a good proxy for traffic congestion.

Even RTP (Sound Transit) acknowledged the primacy of congestion reduction on the first page of its 1997 Documentation of Major Investment Study (Ref 3)

"Chapter I. Planning Process

The problem is traffic congestion, including its effect on transit performance. The goal is to provide a cost-effective public transportation system in the Central Puget Sound Region that provides an attractive alternative to the single occupant automobile." (Ref. 3, p. i)

However, in spite of all this, the effects of the different alternatives on traffic congestion was never measured in the 1993 FEIS, as evidenced by the lack of a congestion or delay metric in the 'evaluation criteria' listed on pages xxvii and xxviii or in the key results found in Table 3.9.3. (Ref 1, p. 3-95) Nor is reducing congestion mentioned in the goals listed for the project on page 1-44 of the FEIS. The 1993 FEIS sidestepped the issue with a few innocuous statements. For instance, under "Purpose and Need" the report simply said "Implementing the System Plan by itself will not solve congestion on the region's freeways and arterials or environmental problems associated with automobile use." (Ref 1, p. xvi). Nor would one expect it to. The point is to understand the magnitude of its contribution. This the 1993 FEIS did not do.

By way of context, in its pre-vote public hearings Sound Transit continually implied that light rail was a solution for the congestion problem. That became the myth and a probable reason why voters approved the system in 1996. The myth seemed to linger so in a December 22, 2000 Seattle Times OP ED the author attempted to widely debunk it with data from Sound Transit's own documents. (Ref 20). Within days the Chairman of the Sound Transit Board finally admitted in a responding OP ED that light rail would not fix traffic congestion.

Sound Transit has continued to avoid the embarrassing issue of how little its rail system would reduce traffic congestion. Neither the more recent 1999 FEIS for the original 21-mile Central Link Light Rail (Ref 2), or the 2002 Environmental Assessment for the 14-mile Initial Segment (Ref 18, p. x) measure the effect of the light rail system on traffic congestion. What little Sound Transit does say is hidden well back in the report. For instance page 23 in the 2002 FEIS says: "Overall congestion levels for the downtown

intersections would likely remain the same compared to the No-Build Alternative." (Ref 18, p.23)

The way in which Sound Transit uses traffic congestion as a driving rationale yet fails to say specifically whether or not light rail reduces it is neatly illustrated in Appendix B of the Dec 2000 Sound Transit Board briefing book. (Ref 27, Appendix B) Here, under "Why Link", Sound Transit lists its reasons why "Light Rail is critical for Central Puget Sound". None of the reasons listed include anything about reducing traffic congestion. Yet three pages later they describe a public opinion poll finding that "Reducing Traffic Congestion" is the third highest regional priority, outranked only by providing a quality education and maintaining a strong economy. In short, there is a serious disconnect between what people want, what Sound Transit would like them to believe they are getting, and what Sound Transit knows it's delivering.

It is also interesting to note how the "purpose and need", or "goal" of the rail project has evolved away from trying to help solve the congestion problem. The 2002 EA now says: "The purpose of the project is to construct and operate an electric light rail system connected to the region's major activity centers." (Ref 18, p. 2) This is tantamount to saying the purpose of the project is to build the project.

In sum, the 1993 FEIS cannot be considered a proper or relevant alternatives analysis since it did not quantify the degree to which each alternative helped solve the region's primary transportation problem, namely traffic congestion. Additionally, Sound Transit continues to manipulate thinking by citing traffic congestion as a rationale for action while at the same time protecting themselves legally by not committing in writing that light rail will do anything about it.

1.12 The cost data in the 1993 FEIS is now obsolete because much of the HOV network needed for the bus alternatives has since been completed and represents a sunk cost.

The 1993 FEIS estimated the capital cost for each of the four major alternatives. (Ref 1, p. xxxiii) The cost to "complete, expand, and enhance" the HOV network was included in the cost of TSM for each alternative. (Ref 1, p. 2-7)

The three build alternatives each included \$1.5 billion to complete the HOV network. (Ref 1, p. xxx) However, because much of the HOV work has since been completed some or all of that \$1.5 billion can now be subtracted from the cost of the alternatives. That shifts the relative costs of the rail versus bus alternatives making the bus alternative --which was half the cost of the rail alternative-- even more attractive. (see Ref. 1, Table 4, p. xxxiii for specific values). Having better data on relative costs is germane. This is another reason the 1993 FEIS is obsolete and irrelevant in making a light rail vs. BRT modal choice in today's environment.

1.13 The 1993 FEIS, and the FEIS's for Link IS and Central Link, are all seriously flawed because the stated "Purpose and Need" was either vague or not tied directly to solving the regions main transportation problem, which is traffic congestion.

1993 FEIS: First, the statement of purpose is not clear. There is no sentence in the Purpose and Need section that clearly and unambiguously says: 'The purpose of the Plan is to....'

Instead, under Purpose and Need the 1993 FEIS begins by stating:

"The System Plan presents an effective mass transit alternative to problems associated with automobile use..." (Ref. 1 ,xvi)

One can get very confused trying to parse this poorly written phrase and determine what it really means. I would simply say that such a vague and undefined statement of purpose is not adequate to justify a multi-billion dollar project.

A much clearer expression of purpose could have been made, and should be required. For instance the Purpose could have been: 'reduce traffic congestion by diverting auto users onto mass transit' or 'improve mobility for the young, old, and poor by improving public transit service', or whatever.

Secondly, the Purpose for the region's largest transportation project is not linked to the regions major transportation problem. The Purpose and Need section lists three problems, which are held forth as justification for the Plan. Congestion is the common element in each:

"Congestion constricts travel on most major freeways..."

"Slower and less predictable travel times result from congestion"

"Transit and HOV modes are caught in congestion..."

Again, if congestion is the acknowledged problem should not the main Purpose of the Plan be that of reducing congestion? If the Plan is directed toward solving some lesser problem that should be made clear and the project should be of lower priority.

It should not be acceptable that an FEIS seek justification and support by, on the one hand, pointing to a problem of great public concern --and thus implying that somehow the Plan is a solution to that problem--, while on the other hand refusing to make clear just how the Plan helps solve the problem or officially commit that it will do so.

In sum, the Purpose and Need section in the 1993 FEIS is defective in two ways:

First, the "Purpose and Need" statement does not make clear either the problem the Plan is intended to help solve or the way in which the Plan (or project) would help solve it. It says there is a problem, and it says there is a Plan. What it does not do

is show the relationship between them. In other words it does not commit that the plan will solve, or help solve, the problem.

Second, the "Purpose and Need" does not commit the Plan to help solve the regions most pressing transportation problem, which in this case is traffic congestion. A project that is not so committed should have a relatively low priority for FTA funding.

Central Link FEIS: The "Purpose and Need" section in the 1999 FEIS for Central Link starts out with a very clear albeit useless statement: "The purpose of the proposed light rail project is to construct and operate a starter electric light rail system designed to connect several of the regions major activity centers:..." (Ref 2: p.1-1)

This is tantamount to saying the purpose of the project is to build the project. This ridiculous statement does not commit the project to solving any particular problem or adding any particular benefit. However, if Sound Transit can get away with such a statement they are legally or perhaps morally bound to deliver nothing other than a completed project.

Subsequent paragraphs say the plan "would deliver substantial time savings", "would greatly improve transit capacity" "would connect Northgate to the University District" and so forth. (Ref 2: p. 1-6 thru 1-8) These are purported benefits but they are not stated as the Purpose for project and presumably Sound Transit is not promising or committing that they will result.

Link Initial Segment: Under Purpose and Need the 2002 EA for Link IS says: "The purpose of the project is to construct and operate an electric light rail system connecting the region's major activity centers." (Ref 18: p.2)

Clearly Sound Transit's lawyers missed this one because it says rather directly the purpose is to "connect the regions major activity centers". There are about twenty officially designated Urban Growth Centers in the Puget Sound region. Link IS does not even connect two of them together. Per the FEIS, Link stops at South 154th street, which is north of the SeaTac airport and north of the SeaTac Urban Growth Center. The South 154 street station is within about a half mile of the South Center Urban Growth Center but separated by a freeway and completely inaccessible. See attached maps.

However even if the purpose statement was just an innocent mistake, the larger criticisms apply; namely: As it reads the Purpose of the project is to build the project, and the Purpose does not commit to helping solve the traffic congestion problem.

1.14 The 1993 FEIS mishandled the capacity issue in a way that penalized the bus alternative.

This was a critical deficiency in the 1993 FEIS that has had serious consequences. However it is a complex subject, which is addressed at length in Part 5 of this report.

1.15 The 1993 FEIS mishandled the cost-effectiveness issue in a way that penalized the bus alternative and hid important information from officials and the public.

This is also a complex point. Part 6 is devoted to explaining it. Part 6 also takes data from the 1993 FEIS and uses it to project the cost of building a mature 100+ mile version of Link versus the cost of building a BRT system having comparable transit ridership and ridership dependent benefits.

Part 2: Sound Transit morphed rapid rail into light rail.

2.1 The 1993 alternatives analysis specifically dismissed light rail as not being suitable for the region.

Light rail was, along with other technologies like monorail, given cursory consideration in the 1993 FEIS, then dismissed as inappropriate. The FEIS contained the following statements:

"A surface LRT system like MAX in Portland would operate at average speeds of 18 to 20 mph, relatively slow compared to the grade-separated Rail/TSM Alternative, which would average 35 to 40 mph." (Ref 1: page 2-50)

"Surface LRT operating across intersections is typically limited in terms of train length and frequency. ... Conventional transit practice and highway standards suggest that when train frequencies are under 6 minutes, cross traffic on arterials will be affected to the extent that grade separation is necessary....These constraints limit the capacity of surface LRT systems, as compared to grade-separated systems." (Ref 1: page 2-50)

"While surface LRT has been very successful in some systems due to low-cost right-of-way or a very dense urban setting, its operating performance relative to grade-separated systems is generally characterized by slower speeds, lower ridership, lower capacity, and lower reliability. These characteristics mean that surface LRT is unlikely to satisfy the demand of a three-county system." (Ref 1: page 2-50)

At the time of the 1993 FEIS a group called the Puget Sound Light Rail Society or PSLRTS proposed a 78-mile light rail system as an alternative to the 125-mile rapid rail system favored by the RTP. Pages 2-51 through 2-61 discuss that alternative. The RTP concluded that:

"Surface LRT options were analyzed to the point that it became clear that these options did not adequately serve the goals and objectives of the Regional Transit Project. Because of the superior performance of the grade-separated RTP system in terms of consistency with land-use objectives, level of service, and ridership, it was recommended as the rail technology in the recommended draft Systems Plan." (Ref 1: page 2-61)

See also the RTP's disparaging remarks about a light rail system -proposed by R2B2- that included a route in Rainier Valley. (Ref 1, p.2-62)

The term "rapid rail" was used consistently throughout the 1993 FEIS to describe the Rail/TSM alternative. Thus there can be no question that's what the 1993 FEIS analyzed in the form of the Rail/TSM alternative.

It is curious, if not indeed disingenuous, that Sound Transit should so disparage light rail in their one and only alternatives analysis, only later to say --as they do in the Long-Range Plan-- that this same analysis now justifies their selection of light rail as the technology of choice. (Ref 65)

The distinction between the "heavy" or "rapid" rail studied in the 1993 FEIS and "light" rail is not just semantic. Sound Transit will argue that some of the characteristics of the rapid rail in the 1993 FEIS, such as train length, are identical to that of the light rail now being planned. That's true. However, the rapid rail in the 1993 FEIS never ran at grade down the middle of a street whereas parts of Link light rail does. Not all the way, but far enough to affect headways and capacity on the entire south route and forever shortchange the entire south end in terms of capacity. Nor are we certain that proposed Phase 2 Link routes east of Lake Washington would be entirely grade separated as they were in the 1993 FEIS. All the ridership projections, and the cost effectiveness measures in the 1993 FEIS were based on a 100% grade separated network.

Surface running light rail will result in more accidental deaths and injuries, and have different impacts on street traffic that would the rapid rail in the 1993 FEIS. What was said or not said in the 1993 FEIS about these topics would not apply to Link. There are also differences in speed and capacity between the rapid rail in the FEIS and Link light rail. In short, the "rapid rail" in the 1993 FEIS was not just light rail under a different name.

In sum, the 1993 alternatives analysis for rapid rail does constitute a valid alternatives analysis for Link light rail.

2.2 Sound Transit morphed the heavy rail it studied into the light rail it wants.

State, Federal, and common sense all require that ST have an alternatives analysis for Link. But the way ST has handled this requirement was to begin asserting that the 1993 alternatives analysis for rapid rail was actually an alternatives analysis for light rail. They morphed an alternatives analysis for rapid rail into one for light rail. This was not done by actually modifying or redoing parts of the 1993 FEIS to account for the difference, but rather just by changing what they said.

This has been an effective tactic, sometimes called the "big lie". History has some chilling examples. The big lie is that when supposedly knowledgeable and credible persons or organizations repeatedly assert that something is true, many people will come to believe it's true, even if it isn't. Thus when Sound Transit and RTA assert the 1993 FEIS was an alternatives analysis of light rail, many will accept that as fact. Some example quotes where the term light rail is being used to describe the rapid rail system studied in the 1993 FEIS:

“Regional Transit Project (RTP) ...The analysis recognized the limited ridership potential because of the shoreline location of the rail line, especially in comparison with the high cost, fully grade-separated light rail alignment along I-5 between Northgate and Everett.” (from RTA report dated 1997, Ref 3: p. 20)

“1992 Regional Transit Project—Transit Technology Overview. Recommendation: Light rail, commuter rail and buses.” From a Sound Transit brochure called FACT dated Aug 2002 (Ref 6)

“3.1 Conclusions of Past Systems Planning Work

All previous work leading to the adopted Long-Range Transit Vision generally concluded that, outside the corridors with existing rail lines where commuter rail or DMU technologies were possible, the most viable HCT options for the region were LRT and BRT.” (from a 2004 ST report, Ref 7: p.7)

The most important “previous work” was the 1993 FEIS, which specifically dismissed light rail. See the actual quote in the following subsection. The deceit continues in a Sound Transit presentation where one slide said:

“1990-1993 System Alternatives

- * Final Alternatives:
 - * Enhanced bus,
 - * Transitway/Busway (BRT)
 - * Rail
 - * Commuter
 - * LRT “ (on a slide presented June 24, 2004 by Sound Transit) (Ref 8)

This slide is particularly egregious since it clearly refers to the 1993 FEIS and it clearly says one of the final alternatives was light rail (LTR). That’s just not true.

There is another deception in the above-mentioned slide where it says "Transitway/Busway (BRT)" was also one of the final alternatives. In fact BRT, while similar in many respects, is not synonymous with the Transitway/TSM alternative constructed by the RTP. BRT can include a host of innovations designed to make buses more attractive. See References 9, 10, 11, 12, and 13. The 1993 FEIS never mentions the term “BRT” and thus is unlikely to have incorporated all these innovations. It is therefore also deceptive for Sound Transit to state in this slide that their one and only alternative analysis considered BRT.

In short, this 2002 Sound Transit slide says that light rail and BRT were given a competitive “fly-off” back in the 1990 to 1993 period. Unless there was a phantom alternative analysis done between March of 1993 and YE 1993, this is an outright lie. Albeit in light of similar "misstatements" by Sound Transit it's not surprising.

The PSRC has also written deceptively in this regard:

- 2. What elements were included in the Regional Transit System Plan (RTSP) adopted by the JRPC in 1993?** ... Overall, the long-range RTSP, as subsequently modified into Sound Transit’s long-range “Vision Plan”, proposed the following components for the regional transit system:
- * approximately 125 miles of light rail....(Ref 28: p.2)

The Regional Transit System Plan (RTSP) published in March of 1993 did not include any light rail, it actually denigrated light rail. (Ref 2) What it did propose was 125 miles of rapid or heavy rail as the quote below clearly states:

“Elements of the System Plan ...The fifth plan element is a regional rapid transit system, with either buses running on a combination of HOV lanes and transitways...or a regional rapid rail system... (Ref 2: p. xiii)

Sound Transit, with some help from the PSRC, has a behavior pattern of slowly morphing the record into showing what it wants, and misleading officials and the public into thinking something other than the truth. Its latest attempt, as of August of 2004, is to change the definition of high capacity transit (HCT) to mean transit running on an exclusive right-of-way. Exclusive right of way is not a necessary condition for HCT. In fact, BRT intermixed with car and vanpools could carry far more passengers than Link light rail. (See Part 5 for details.)

If Sound Transit is successful in so redefining HCT it will be a clever trick for ruling out any alternative that would mix BRT buses in with car and vanpools on, for example, the I-90 center lanes. It will nicely dovetail with Sound Transit's other current maneuver to officially re-designate those lanes for exclusive use by HCT only. The consequence of these seemingly innocuous maneuvers is clear. If HCT means exclusive right-of-way and I-90 center lanes are dedicated to HCT, then all alternatives that would mix BRT with car and van pools are simply taken off the table and never even studied. This will help make the selection of light rail across Lake Washington almost a foregone conclusion of the Phase 2 studies. This appears to be Sound Transit's intent.

2.3 Why did the FTA let Sound Transit finesse the alternatives analysis?

The author has no direct knowledge of the answer and hopes the Congress will investigate. However, to an outsider it seems that the FTA would be motivated to increase its statement-of-work and thus budget by establishing and moving applicants through the most elaborate planning process possible. This keeps staffs happily employed. However, at the end of the day the FTA would have no incentive to deny marginal projects and return money to the treasury. All bureaucratic incentives for agencies like Sound Transit and the FTA would seem to mitigate against finding the most cost-effective solutions, but rather would encourage pursuing the most expensive projects sellable to the public. Hence Sound Transit's refusal to conduct a proper alternatives analysis. Hence FTA's failure to demand one. At root it boils down to pork barrel politics at taxpayer expense. Harsh words perhaps, but a plausible explanation for observed behavior.

References 12,13, 21, 24 and 50 discuss this matter from a national perspective. They show that Puget Sound is not alone in the way rail boosters and transit agencies have abused the planning process. The author highly recommends Martin Wachs excellent article on the ethics of forecasting. (Ref 24) Part 7.1 of this report ends with a long and interesting quote from that article.

Part 3: The shortcomings of Link Light Rail

All would agree the vision of a rail system whisking people from place to place is appealing. However, many other things are appealing too: things like replacements for the Alaska Way viaduct and the 520 bridge, things like more and better paid teachers, things like more parkland, things like fixing Seattle's deteriorating streets or the Mercer mess. There is never enough money to satisfy all the region's needs so the main issue is not whether light rail is appealing, but rather whether it is appealing enough to be worth its enormous cost. In other words, is light rail the least cost way to help solve the regions transportation problems? It's doubtful. Analysis shows there is good reason to question Link's cost-effectiveness relative to other alternatives. As former Washington State Governor Booth Gardner said about Link:

"It costs too much and does too little" (Op Ed, Seattle Times)

Beside being critical of Link per se, the author is of course critical of Sound Transit for not providing the public with objective information about Link's performance. In the sections below the author presents some of that information, using bar charts to graphically explain the points.

Sound Transit has tried to hide this type of information. The skeptical reader is invited to try to find the performance measures revealed below (such as cost per car removed from traffic) in any of Sound Transit's Environmental Impact Statements or brochures. What little information ST provides about effectiveness or cost-effectiveness is hidden in technical tables far back in Environmental Impact Statements. There are no bar charts communicating the main points so they stand out and can readily be grasped. It is clear by their absence that Sound Transit does not seek to inform the voter and help him or her reach rational decisions. Instead most of what ST publishes is marketing material meant to sell and manipulate.

Link light rail is one of those things where the less you know about it, the better it appears. What follows is a list of Link's specific shortcomings. They support the notion that Link is the failed result of a faulty process.

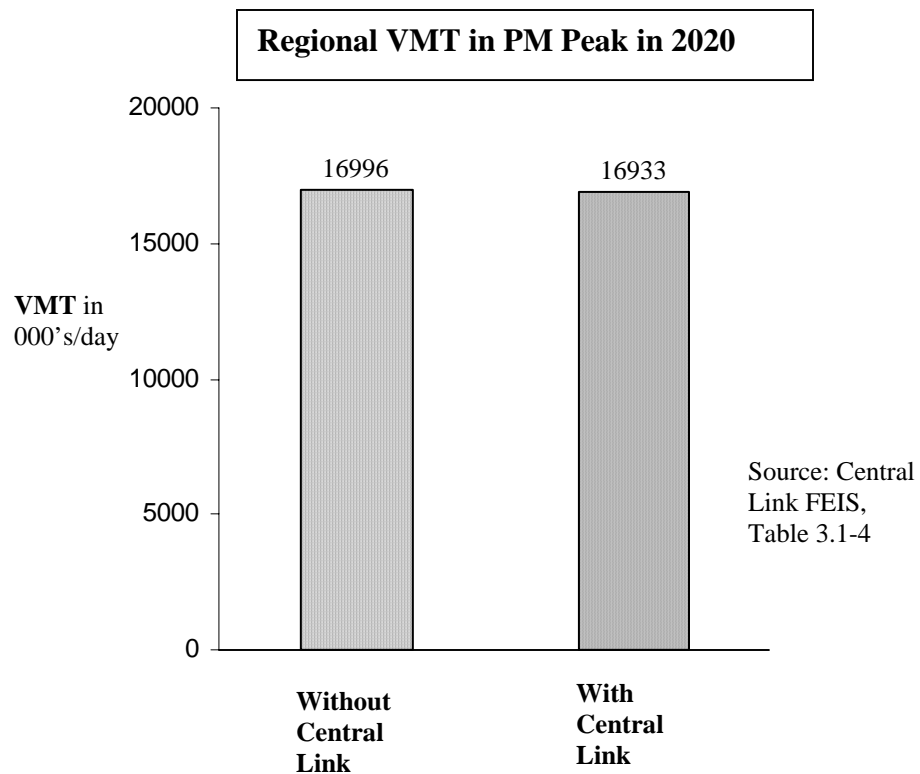
3.1 Link does almost nothing to reduce congestion

Data in Sound Transit's EIS's show that Link light rail system won't even make a dent in Puget Sound's traffic congestion problem.

Given that Sound Transit says "traffic congestion is the problem", one might expect the agency to publish data showing how much Link would contribute toward solving the congestion problem. However, Sound Transit did not publish in their EIS's any estimate of Links effect on traffic congestion, or on travel delay, which is a fairly good proxy for congestion. Instead we are left to infer Links effect on traffic congestion from the only relevant measure ST does provide; namely, Links effect on regional vehicle miles of travel or VMT. To the extent Link reduces the load on the road system, in other words

reduces VMT, then delay and congestion should drop also. (This is an admitted oversimplification since congestion is a complex phenomenon involving latent demand, long term home and work location decisions, and other behaviors.)

Without light rail, PM peak period traffic on area roads and freeways is forecast to be 16,996,000 vehicle miles of travel (VMT) in 2020. With Central Link light rail this would be reduced to 16,933,000 VMT. (Ref 2: p.3-4) These figures are accurately plotted in the chart below. Central Link would reduce peak period traffic a little over one third of one percent. It is equivalent to removing one car of every 370. These VMT figures are the best available measure of Central Link's ability to help solve the region's vexing traffic congestion problem.



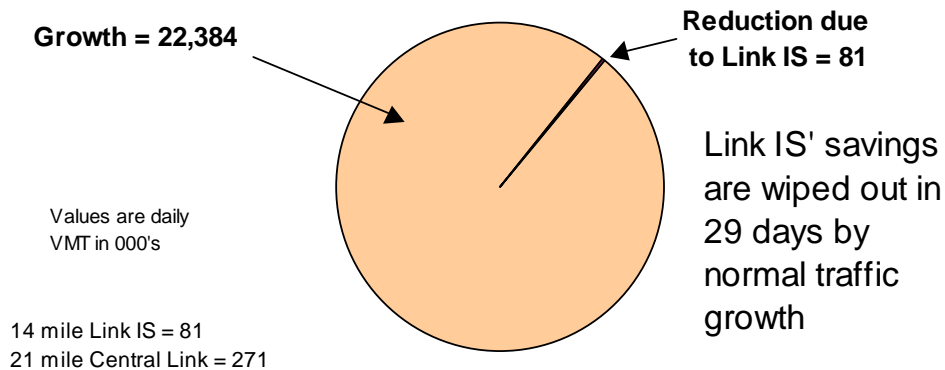
One way to put 1/3 of 1% into perspective is imagine the 2.75- mile long Evergreen Point bridge, covered with cars stopped bumper to bumper from the Lake's eastern shoreline to Montlake Blvd. At 20 feet per car there would be about 725 cars in each lane. Reducing traffic by 1/3 of 1% is equivalent to removing about two and a half cars from each lane.

Even where rail should have its greatest impact, the numbers are disappointing. For instance, the number of peak hour vehicles crossing the ship canal in 2010 would only decline from 45,789 to about 45,740. The number of peak period auto trips leaving downtown Seattle would only drop from 30,800 to 30,100. Both are incredibly small impacts.

Figure 3.1.2 is another way to put Link’s minuscule effect on traffic congestion into perspective. The total “pie” represents the amount by which regional travel, measured in VMT/day, is expected to grow between 1998 and the year 2020; namely by 22,384,000 VMT. This is due to population growth and other factors. The small wedge shows how much of that growth increment would be taken away by drivers giving up their cars to ride Link IS. Basically Link IS would reduce the growth in VMT by 81,000 daily VMT. Unfortunately, this savings would be wiped out in only 29 days by the normal growth in regional traffic. In other words, after spending about 13 years (1996 to 2009) and \$1.5 billion (02\$) building Link IS, travel will be back to pre-Link levels only a month after the system opens for business.

LRT effect on daily regional VMT growth between 1998 and 2020

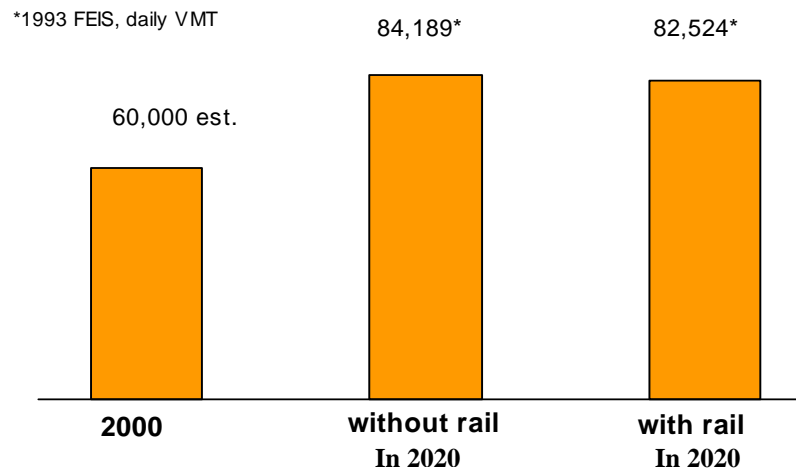
9



Central Link would reduce traffic by 271,000 daily VMT, so its effect would take about three months for growth to overcome.

Some argue Link’s Initial Segment is only a starter system, which will grow and eventually produce more meaningful results. Here again the data show otherwise. The 1993 EIS prepared for a \$11.5 Billion (in 91\$) transit plan shows a 125-mile rapid or heavy rail system would only reduce 2020 traffic volumes 1.9% more than a bus solution costing a fraction as much. (Ref 1: Table 3.9.3) Figure 3.1.3 illustrates this graphically. If the reader can’t see the difference between the “rail” bar and the “without rail” bar, it’s apparent that drivers wouldn’t notice any difference on the roads either.

Effect of 125 miles of Heavy Rail on Regional Traffic



3.2 Light rail is not a cost-effective way to get cars off the road.

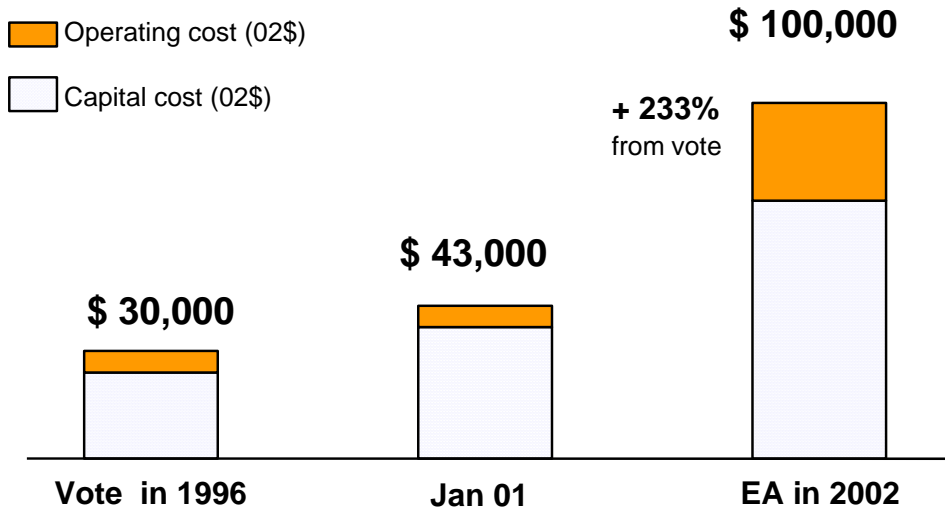
Sound Transit continually states that Link is cost-effective, as for example in a press release/handout entitled “Light Rail Benefits” wherein one of the six benefits listed is “Cost Effective Transportation” (Ref 64) This seems quite deceptive in light of the following.

Capital and operating costs for Central Link total \$291 million/yr in 02\$. (See Tech Notes for details) Central Link would remove about 6320 cars from peak period traffic in 2020. (See Tech Notes for details). If the main objective of Link is to remove cars from peak period traffic then it’s fair to assign Link’s full cost to that benefit. Doing so means it would cost \$46,000 per year for each car Central Link removes from peak period traffic. This per year cost would continue for the 30-odd years it would take to pay off the construction bonds.

Capital and operating costs for Link IS total \$191 million per year in 02\$. The Initial Segment would remove 1890 cars from peak period traffic. This means it would cost \$101, 000 per year for each car Link IS removes from peak period traffic.

Figure 3.2 shows these costs graphically; however, values in the figure came from an earlier study by the author and differ slightly from those given above. The “vote” bar is for Central Link and is based on the cost estimates Sound Transit published at the time the vote was taken in 1996. The “Jan 01” bar is based on the latest cost estimate for Central Link, which was made in Jan 2001 and which was \$2.6 billion in 02\$. The “EA” bar refers to Link IS. The chart shows that the cost of one of Link’s main benefits (i.e.: taking cars off the road) increased 233% over what voters approved, yet the Sound Transit Board has never agreed to go back and ask voters if they still wanted to proceed.

Annual cost per vehicle removed from peak period traffic



The idea of paying \$46,000, or even \$100,000 per year for each car Link removes from traffic is clearly a ridiculously expensive way to reduce traffic congestion. It is ridiculous because the Seattle Times reported on a local company that increased carpooling by offering their employees just \$75 a month to carpool. It is ridiculous because one can imagine how many people would car or van pool if offered, to pick a number, just \$500 a month or \$6000 a year. It is ridiculous because it would simply be cheaper to pay people to quit their jobs and stay home.

In spite of Link being one of the most expensive light rail systems in the country and costing tens of thousands of dollars a year for each car it removes from traffic we still have curious statements like the following from Sound Transit Board member and Wash. State Secretary of Transportation Doug MacDonald in a memo to Norman Mineta, Secretary of U.S. Dept. of Transportation:

“Every transportation investments in our region must be tested for its cost-effective long range contribution to moving people and goods in the region. Link Light Rail meets that standard.” (Ref 58)

3.3 Light rail is not cost-effective as an alternative to driving.

Some officials, like Ron Sims former chair of the Sound Transit Board, trumpet that light rail provides an alternative to driving. Indeed it does for the relative few that, according to Sound Transit’s ridership forecasts, would give up driving to ride light rail.

Each car taken off the road takes about 1.25 people off the road. Thus the 6320 cars that Central Link would take off the road by 2020 would be providing about 7900 peak period commuters an alternative to driving. This is only two-tenths of one percent of the 4,100,000 people forecast to live in the Puget Sound region by 2020. (Ref 2: p1.3).

If the main objective of Link is to give people an alternative to being stuck in traffic like everyone else then it's fair to assign Link's full cost to that benefit. This means it would cost taxpayers \$37,000 per year for each commuter who gives up using an automobile to ride Central Link.

It is questionable whether the 4,100,000 persons living in Puget Sound would like to build a \$2.6 billion rail system just so 7900 would have a way to bypass congestion. If so, to paraphrase Winston Churchill: never before will so many, have paid so much, to benefit so few.

These figures look even worse for Link IS since it has only one third the predicted ridership of Central Link. The per-person cost for the 2365 auto users that would switch to Link IS comes to \$81,000 per year.

In this, as in many other areas, Sound Transit seeks to deceive the taxpayers. On the one hand they say a main objective of light rail is to provide people with an alternative to driving. On the other hand they do not say how many people will take advantage of this benefit or what this benefit will cost everyone else.

3.4 Link is far more expensive than a bus rapid transit (BRT) system having comparable benefits

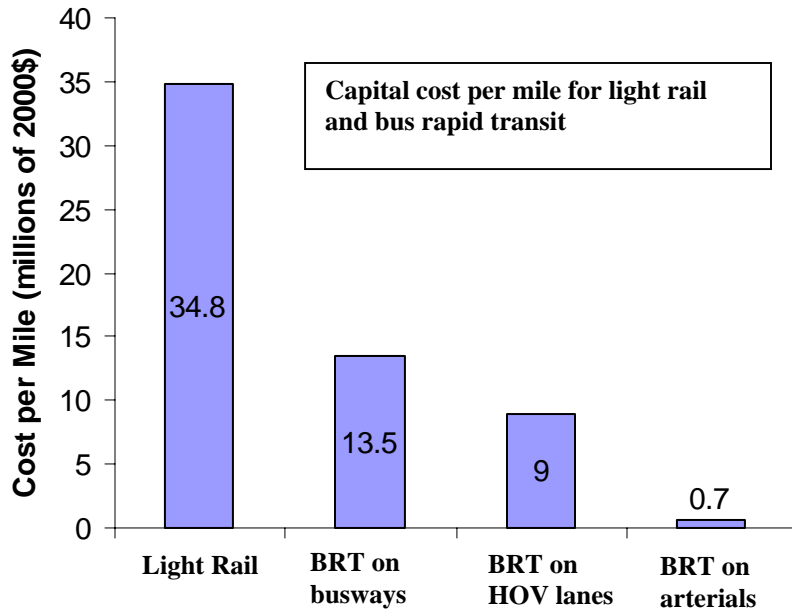
This conclusion is mainly based on the detail provided in Parts 5 and 6 of this report. Part 5 establishes in considerable detail that an all-bus alternative based on bus rapid transit (BRT) could attract and carry the same number of transit riders as light rail. This is true whether the light rail system be a short one such as the 14-mile Initial Segment of Link, or a fully mature version of Link extending over 100 or more route miles.

Part 6 establishes that a fully mature version of Link would probably cost Puget Sound taxpayers about \$900 million per year more than an all-bus system capable of attracting and carrying the same number of riders, and thus having comparable benefits.

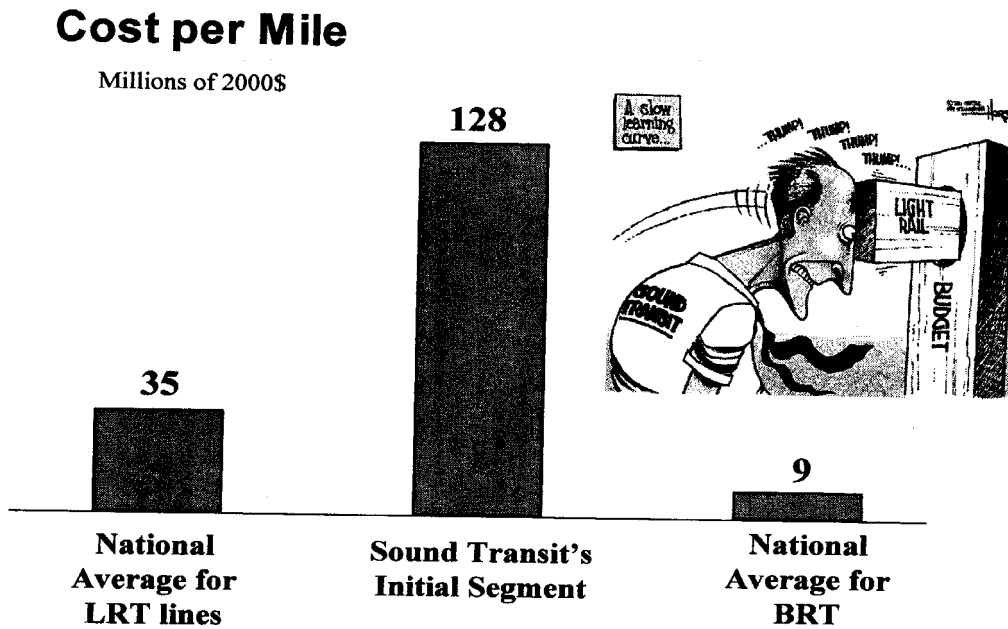
What follows is some information from a completely different source that confirms this reports conclusion that BRT is less expensive than light rail.

Studies, such as one by the US General Accounting Office, have concluded that BRT is usually less expensive than light rail and should be taken more seriously as an alternative to light rail.(Ref 9) Figure 6 from the GAO report is reproduced below as Figure 3.4. To build this chart GAO surveyed 18 light rail lines built since 1980, 9 busways, and 8 HOV facilities. It shows the average light rail system costs about \$35 million per mile.

Figure 3.4a



The following presentation slide compared the cost of Link's Initial Segment with the national average for light rail systems and BRT using data from the GAO report. It included a cartoon by Seattle area's outstanding cartoonist Dave Horsey, which along with other articles of that period, called public attention to Link's high cost.

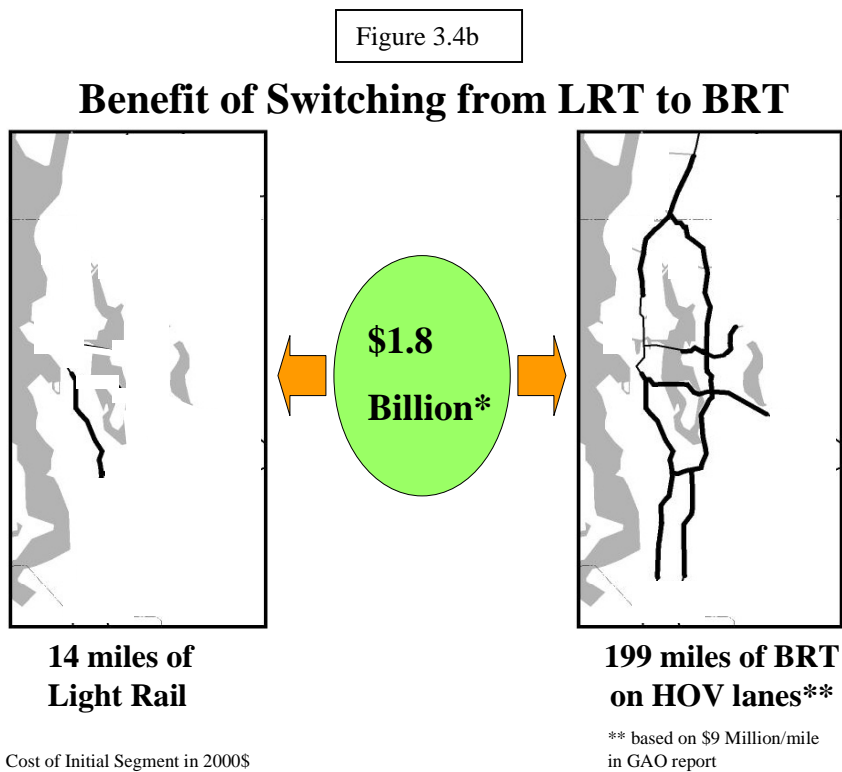


This slide simply illustrates that Link IS, at \$ 128 million per mile, is far more expensive than the national average for light rail; perhaps because Puget Sound’s terrain is not “light rail friendly”. We have water barriers and hills that require extensive tunneling. Additionally, we do not have the abandoned railroad rights-of-way that make constructing light rail in other cities relatively economic.

What the Puget Sound region does have, however, is an extensive HOV network. There were 191 lane miles of HOV open to traffic as of Jan. 2001, and another 100 miles are in various stages of construction or planning. (Ref 46: p.2)

These completed HOV lanes are the region’s most precious transportation resource. They provide an already paid for “guideway” for bus rapid transit, as well as a guideway for car and van pools, school buses, emergency vehicles, and other multi-occupant vehicles. They can be managed so traffic flows at a relatively high speed, and they have enormous people moving capacity. Unlike the “guideways” for Link light rail that will take years to build, these HOV “guideways” already exist, and BRT service on them could be implemented fairly quickly. In fact, some BRT service already exists in the form of express bus routes.

Figure 3.4b helps visualize the tradeoff this region is making by going with light rail. The figure shows that we could have about 199 miles of BRT on the regions HOV lanes for about what the 14-mile Initial Segment of Link is costing.



Of course, the \$9 million per mile figure cited by the GAO might not apply here, so this is a very rough approximation. (The data in Part 6 is considered more accurate) It does however suggest the wisdom of conducting a proper alternatives analysis to see just how extensive a BRT system could be built for what Link IS is costing. Certainly 199 miles of freeway BRT would attract far more transit riders and do much more to reduce congestion, clean the air, control sprawl, etc. than would 14 miles of light rail.

3.5 Link will require more transfers

Express bus or BRT routes will typically circulate through residential areas picking up riders, then enter an HOV lane for a non-stop trip downtown. In many cases riders do not need to transfer. If Link is built many of the express bus routes will be redirected to feed riders onto light rail. This will increase the number of riders who need to transfer.

3.6 Many of the regions employment centers and key destinations would not be served by Link.

The Puget Sound Region has over 15,000 miles of local roads and streets and 185 miles of freeways.(Ref 43: p.A4:3) In contrast the Link network would be somewhere between 14 and 125 miles in length. With such a sparse network Link will not be able to provide convenient service to many of the regions employment and activity centers.

For instance, 14-mile Link IS, which runs from Westlake Station to South 154th Street, only serves one of the region's major employment centers: downtown Seattle. 21-mile Central Link would serve only downtown Seattle, the University District, and SeaTac.

However, Central Link will not serve a host of other important places including: West Seattle, Bellevue and the entire eastside, Renton, Southcenter, Magnolia, Ballard, Bothell, the south Seattle industrial area along the Duwamish, Harbor Island, the emerging south Lake Union biotech center, the north Elliott Bay biotech center, and so forth. None of Boeing's plants or offices will be served: not Auburn, not Kent, not Renton, not Plant 2, not the Longacres complex, not Bellevue, not even Boeing Everett.

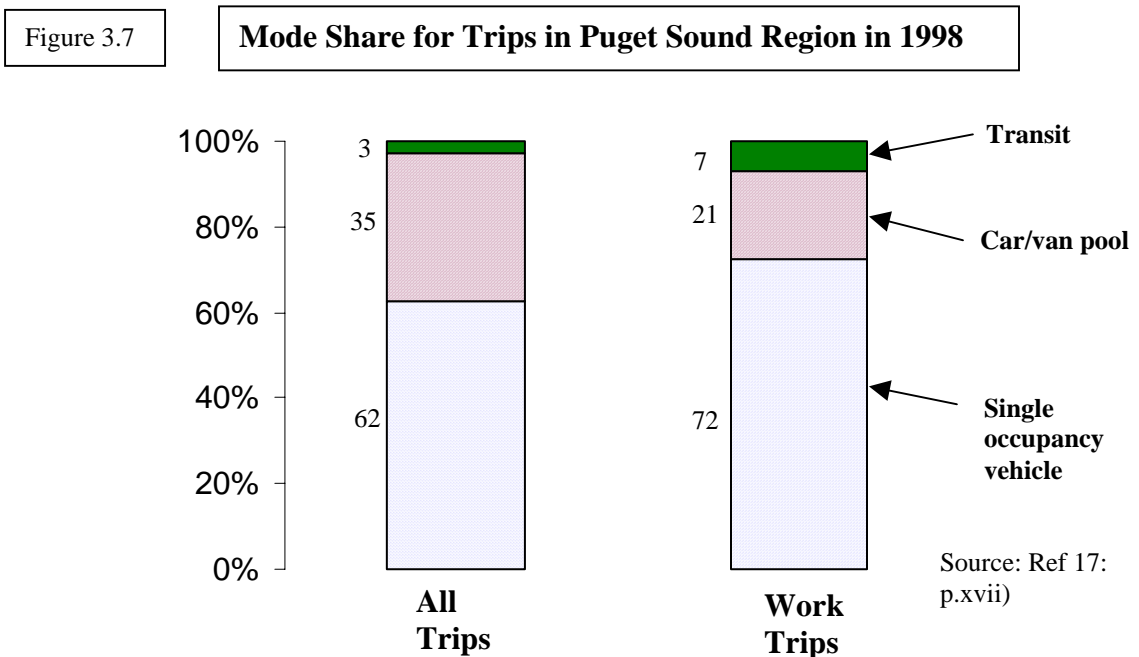
Even if Link is someday extended into the mature network Sound Transit envisions, it will still bypass many of these locations.

NOTE: References 8, 43 and 49 have maps showing where Sound Transit plans to extend "high capacity transit", which officially could mean either light rail or BRT. In practice, there is little doubt that Sound Transit officials have already decided informally that HCT really means light rail. One piece of evidence is that Sound Transit has been maneuvering to have the center lanes on I-90 designated for exclusive use by HCT, even before doing an alternatives analysis. However, if the agency were objective it would not ask for exclusive use until that alternatives analysis is complete, because if the answer were BRT, exclusive use would not be needed, indeed it would be counterproductive.

Another piece of evidence is that the baseline Technical Report for PSRC’s 2001 Update to the Metropolitan Transportation Plan makes the assumption that the HCT network will be almost entirely light rail. (Ref 30: p. 75) Finally, there is the Fleet Management Plan for Central Link which says: “While design work is progressing for the initial system from NE 45th Street to S 200th Street, plans for rail system extensions are underway. ...Additional extensions include an Eastside extension to Bellevue and surrounding communities.” (Ref 38: p.10)

3.7 Investments in Link do nothing to encourage car and van pooling.

Car pooling and van pooling are actually more effective than mass transit as a way of reducing the number of peak period cars on the road. Figure 3.7 shows modal share in the 3-county area in 1990 and 2000.



Building light rail does nothing to encourage car and vanpooling. On the other hand, implementing an all bus alternative would include not only finishing the HOV lanes, but spending a considerable sum to build HOV to HOV connector ramps at major freeway interchanges, and to build flyovers so HOV vehicles could enter and exit the HOV lanes without cutting across several general purpose lanes. All this concrete will not only benefit BRT, but would also make car and van pooling more attractive.

In other works the investment in HOV lanes, which are the “guideways” for BRT, has a double payoff. This incidentally, is just one more thing that that the 1993 FEIS ignored and that a new and proper alternatives analysis should address.

3.8 Placing Link on I-90 would reduce bridge capacity, compromise safety, and impair car/van pooling.

Right-of-way is perhaps the scarcest resource in Puget Sound, and there is a need to get the highest utilization out of it.

This topic of I-90 capacity will be treated in more detail in Part 5.16. However, the short version is that the I-90 bridge will have more capacity if the center lanes are used for a mixed stream of BRT buses, carpools, van pools, school buses, etc. than if they are turned over to light rail. This is true because mass transit, whether BRT or rail, will have a relatively light loading on I-90. Neither can really keep the center lanes fully occupied. Even in peak periods there will be either the occasional train, or the occasional BRT bus. Best to use a technology where car and van pools can fit in between transit vehicles.

Sound Transit is currently pushing for a reconfiguration of the lanes on I-90 from Bellevue into Seattle that would not only preempt the reversible center roadway for mass transit but also add a pair HOV lanes into the space now occupied by 6 general purpose lanes. To do this the 6 GP lanes would be narrowed and re-stripped into 6 GP and two HOV lanes. Lane width would drop below interstate standards and shoulders would be narrowed. This in turn would have two deleterious effects. First, the narrower lanes would compromise safety for all bridge users. Second, the narrower HOV lanes and inability to provide a buffer strip between the GP and HOV lanes would slow car and van pools and thus make them less attractive. (See Reference 33 pages 6-16 and C-1 for leads into the technical literature relative to HOV lane design and related safety issues.)

3.9 If not extended, Link could result in underutilization of the DSTT

This is a risk with light rail, not a certainty. The issue is getting maximum people moving benefit from King County's investment in the DSTT. If light rail does not go across Lake Washington the DSTT will be able to deliver a maximum of about 21,000 persons into downtown during AM peak hour (or out in the PM). This would be comprised of 16,400 from the north and 5500 from the south. In contrast buses in the tunnel could move about 32,000 persons per hour into the downtown, half from the north and half from the south and east. This topic, of potential interest to property owners in downtown Seattle, is treated in more detail in Part 5.17.

3.10 If not fully extended, Link will compromise the regional BRT system.

The Downtown Seattle Transit Tunnel is critical for either a regional light rail system or a regional BRT system. But the tunnel can't easily serve both.

If Link's Initial Segment is all the light rail that ever gets constructed, Link will simply become a local intra-Seattle people mover. By default the regional HCT solution will become an extension of the existing regional express bus system, in other words BRT. However, if Link IS operates in the DSTT, the regional bus system will be compromised.

Either BRT buses will be forced onto surface streets, or not as many will be able to use the DSTT as may be required.

This is a good reason for keeping light rail out of the DSTT until it is absolutely certain that taxpayers are behind extending Link into a full regional system. The cost of extending Link into a full regional system is given in Part 6 of this report. It is so large that voters may not approve the necessary tax increases.

3.11 Light rail would be less effective at controlling sprawl than an all-bus system

Assertions in the 1993 FEIS that rapid rail supports the goal of reducing sprawl seem questionable. One assertion prominent in the FEIS's executive summary was:

“The Rail/TSM Alternative would also fully support regional land-use plans limiting urban sprawl and concentrating new growth in existing centers.” (Ref 1: p.xxxv)

The RTA provided no rationale, cited no sources, to justify the notion that rail transit helps limit sprawl. What follows is a very brief analysis.

First, there is the question of just why rail is said by some to be a means of controlling sprawl. History shows that rail can actually cause sprawl. Anyone familiar with the bedroom communities that have grown up along the rail lines radiating from Manhattan or Chicago knows that building these lines enabled or encouraged people to move to rural areas and create the suburbs. The same is true with BART's extensions over into the east bay. By the same token building light rail to Redmond or Issaquah would encourage sprawl by making it convenient for people to move to the Sammamish plateau or Northbend, then drive to the end of the light rail line for a commute into Seattle. Logic says that anything that makes road or transit travel easier will probably lead to the spread of housing and economic activity. The 1993 FEIS admitted this:

“Stations with park and ride lots located near the urban growth boundaries many encourage some urban sprawl.” (Ref 1: p. 3-130)

The only scheme whereby an improvement in transportation would seem able to limit sprawl is if road and transit travel within the urban growth boundaries were made easy, while travel outside the urban growth boundaries were made difficult. Presumably this would be an incentive to live within the urban growth boundary. Of course, under current law there would be nothing to stop people living outside the boundary to drive over the boundary line and enjoy the same travel benefits as those living within. And the idea of not improving roads outside the growth boundary, or preventing those outside from driving across the boundary line is politically impractical. In other words, this whole scheme seems unworkable. What then is the mechanism by which mass transit might control sprawl?

Rail fans claim that high-density development will occur around rail stations. Research questions the accuracy of that, finding that high densities are more the result of tax incentives than the existence of rail transit. However, assuming it were true, why would

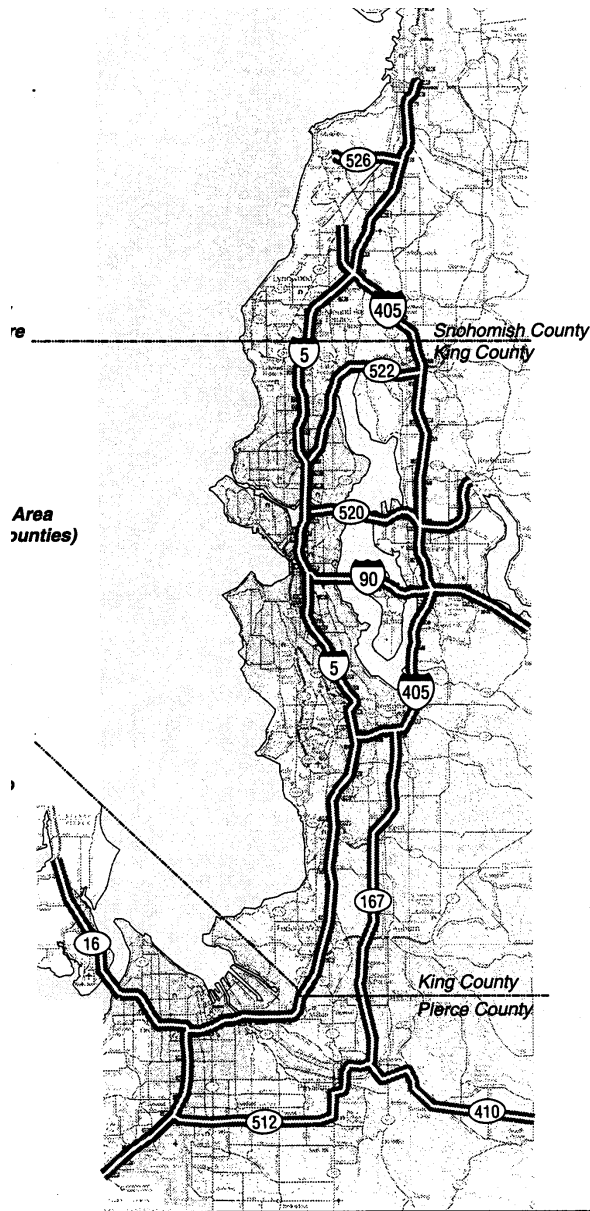
more development occur around a rail station than would occur around a BRT stop? An even bigger question is why would high-density development around a mass transit stop or station be of any significance in controlling sprawl? Presumably the issue with sprawl is the expansion of housing and other development outside the urban growth boundary and into rural areas. If so, then whether the new development occurs as high-rises adjacent to mass transit stations, or as moderate density development spread throughout the urbanized area, makes no difference.

In conclusion, it appears that any improvement in transportation, including building light rail, will allow if not encourage sprawl. The possibility that high capacity transit might encourage development to occur in high rise clusters strung like beads along a rail or BRT route, as opposed to letting that development spread out within the designated urban growth boundary, seems somewhat irrelevant.

There is one additional point to make along this line. If society wants development to cluster in high rises along transit lines, what difference does it make if the transit is steel wheeled light rail or rubber tired BRT? A mature light rail network would probably have about the number of route miles, and follow the same corridors, as a mature BRT network.

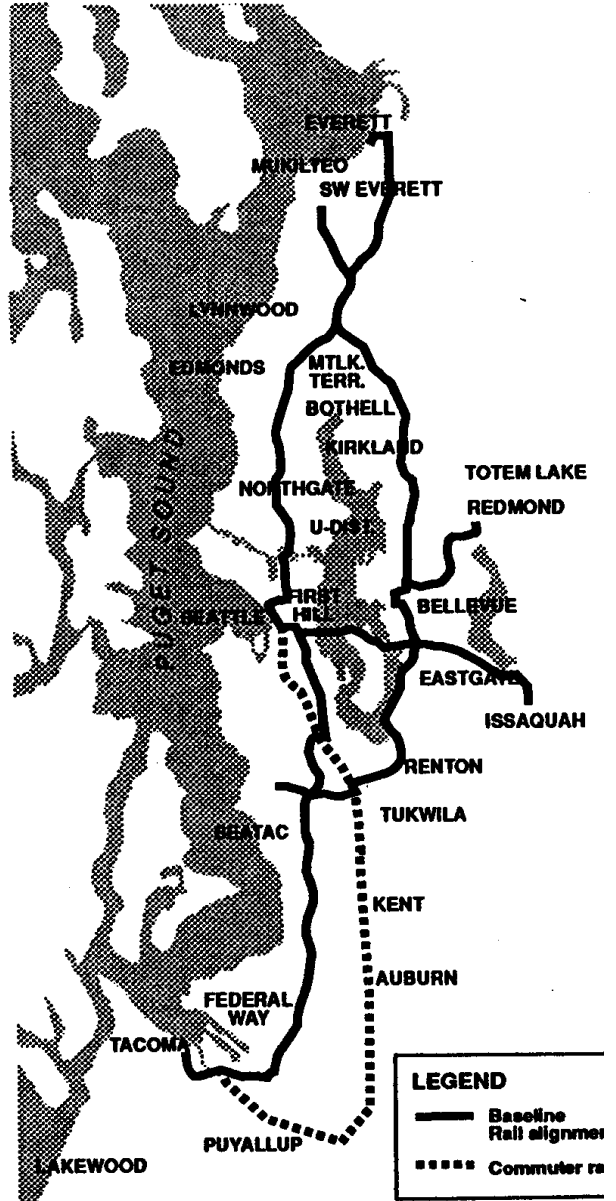
This is illustrated by comparing a map of Sound Transit's vision for a fully mature light rail network with a map of the region's HOV network. (The left-hand map below shows the region's freeways. HOV lanes are either in place or planned for most freeways. The right hand map shows the rapid rail network studied in the 1993 FEIS. A fully mature light rail network would be similar. Ref 49: p. 10-11 maps it, but the map was too large to scan into this report.)

Figure 3.11



Study Area Corridor
 Puget Sound HOV Pre-Design Study
 Final Report
 FIGURE

**Rail/TSM Alternative
 (Includes TSM system)**



The second line of reasoning has to do with timing. Voters approved light rail in 1996. It is now 13 years later and not an inch of rail has been laid. It will be 2009 before even the first 14 miles of light rail becomes operational. There are serious funding problems to overcome before Link could even be extended to Northgate. (Mr. MacIsaac has written about the financial impediments to expanding Link.) Yet more years will pass before

Link could be extended into the full regional network Sound Transit envisions. Even if a mature version of Link were able to control sprawl, much more sprawl will have occurred before Link could become that mature network and begin to reduce it.

Here BRT has an advantage. The guideways for BRT are partly in place. BRT-like service already exists and could be intensified into a fully functional BRT system fairly quickly.

This leads to the following conclusions:

- 1) There is no apparent reason why either light rail or BRT would help limit sprawl outside Puget Sound's designated urban growth boundaries.
- 2) There is no apparent reason why a light rail network would control the pattern of density within the urban growth boundary (e.g.: make beads of high density development along transit lines) any better than a BRT network having about the same number of route miles and serving the same corridors.
- 3) The higher cost for light rail means that the region is more likely to build a large BRT network than to build a large light rail network, and more likely to build X-miles of BRT years sooner than X-miles of light rail. Therefore in the foreseeable future pursuing BRT would probably have more effect in concentrating development along transit lines than would pursuing light rail, again assuming it has any effect at all.

3.12 Link is inequitable in whom it taxes versus whom it benefits

Sound Transit taxes everyone within the "RTA District", which comprises most of the urbanized areas within Snohomish, King, and Pierce Counties, stretching from Ft. Lewis to Everett. (Ref 49: p.6 has map) Yet Link's benefits are largely confined to the narrow corridor along which Link runs. Thus many of the people who are taxed for Link will not benefit, either directly or indirectly. They will not benefit directly since Link routes will not come near their communities, West Seattle and Capital Hill being good examples. They will not benefit indirectly since Link will have almost no effect on traffic congestion.

3.13 Link is inequitable in where it provides for safe operation and where it does not.

When the Sound Transit Board decided to provide tunnels for Link's north line but not provide tunnels in the Rainier Valley they established an inequity in terms of safety. The history of light rail has been characterized by collisions between trains and pedestrians, and between trains and cars. Sound Transit has plans to mitigate such accidents, but they will still occur, and that harm will occur to Rainier valley residents, not residents of north Seattle. Transportation consultant John Niles has investigated and written about this matter, but Sound Transit shrugs it off.

3.14 Link is susceptible to terrorism, power outages and earthquakes.

Link is susceptible to single point failures, bus systems are not. Link will have a complex control system, rails and tunnels all of which could be disabled relatively easily by terrorists. A couple pounds of explosives or a few cut wires would bring the entire system to a standstill. An area wide power outage would take the system down. An earthquake could damage rail and BRT structures, but rail would be more susceptible because damage to underground tunnels would take a long time to repair and the trains have no way to drive around problem areas. Any train that stalls on the track, for whatever reason, blocks the entire line.

In contrast, bus systems are comprised of independent little units called buses. They don't rely on a centralized control system. They contain their own power source. They can drive around obstacles.

3.15 Link is a whole new technology to manage and maintain.

It will take a whole new and different maintenance infrastructure, and a different set of skills, to support light rail. This will be expensive. In contrast, BRT would simply mean an incremental expansion of the bus maintenance infrastructure already in place. ST's consultants said the following about automated guideway technologies but it applies equally well to light rail.

“Potential expansion of ST's various lines of business will require expansion of supporting facilities. ...any new technology such as automated guideway that is beyond what is currently in place within ST's service area will require more substantial supporting efforts. These supporting efforts will include major new facilities such as maintenance bases, layover track, control center, etc. In addition the interfaces between any new technologies and ST's existing system will require expensive infrastructure to allow passenger transfer between the modes. ...Introduction of automated guideway technology would require a new layer of administrative support....” (Ref 7: p.3)

3.16 Light rail is not compatible with Puget Sound's topography and local circumstances

Steel wheel on steel rail limits light rail to a maximum of 5% grades. The author has seen the route profiles for Link. The 5% grade limitation forces Link to be far below the surface on Capitol Hill so it can climb up from the DSTT then dive deep enough to go below the unconsolidated glacial till at the bottom of the ship canal. It then struggles to climb the hill in the University District, but can't handle the grade so again requires deep underground stations in the U District. In other words light rail is fighting our relatively unique terrain.

The turn radius of rail system is larger than bus and thus rail systems cannot be routed around buildings and other obstacles as easily as bus routes.

Puget Sound also lacks the abandoned railroad rights of way that light rail has benefited from elsewhere.

These factors are probably responsible for light rail costing more here than in other cities. For instance, according to Joni Earl, ST's Executive Director: Portland's light rail cost \$54 million per mile, Denver's \$20 million per mile, Sacramento's \$35 million per mile, Dallas' \$41 million per mile, and San Diego's \$61 million per mile. (Ref 39) In contrast Central Link would cost \$150 million per mile.(Ref 39). (Reference 9 also contains cost comparisons.)

In short, just because light rail was an easy fit in some cities does not make it the right technology for Puget Sound's unique conditions.

3.17 Dedicating the center lanes on the I-90 bridge would compromise traffic flow and apparently disadvantage pedestrian and bike users.

Sound Transit is actively maneuvering to have the lane configuration on the I-90 bridge drastically altered so as to free up the center roadway for light rail. ST has published diagrams of the various options. (Ref 59) According to those diagrams the westbound roadway is currently 52 feet wide and has three 12-foot wide traffic lanes. However Sound Transit wants the R8a option, which calls for the roadway to be 58 feet wide, and for it to be divided into 4 lanes. The extra 6 feet would apparently come from making the pedestrian and bike path narrower.

The width of the lanes would not be consistent; some would be 12 feet while others would drop to a sub-standard 11 feet. That should cause some confusion, especially as trucks shift from one to the other. Shoulders would also be narrowed.

The ST handout also warns (in very small type font) about traffic problems that may result from these narrower lanes and shoulders:

“A number of operational strategies to address safety concerns associated with reduced-width travel lanes and shoulders will be evaluated. These include speed management through variable posted speeds and/or reduced speed limits, shoulder rumble strips,....” (Ref 59)

What ST is admitting is that automobile traffic will be adversely impacted, both by forcing speed reductions and by introducing the kinds of safety issues that call for rumble strips.

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Part 4: Bus rapid transit (BRT) and other alternatives

4.1 Some background

4.1.1 A brief definition and rationale for BRT

Scott Rutherford, Professor of Civil Engineering at University of Washington, along with others, has offered the following:

“Bus Rapid Transit (BRT) is growing in popularity throughout the world. The reasons for this phenomenon include its passenger and developer attractiveness, its high performance and quality, and its ability to be built quickly, incrementally, and economically. BRT also provides sufficient transport capacity to meet demand in many corridors, even in the largest metropolitan regions. In the United States the development of BRT projects has been spurred by the Federal Transit Administrations BRT initiative. These projects have been undertaken, in part, because of the imbalance between the demand for “New Starts” funds and available resources.

Decisions to make BRT investments should be the result of a planning process that stresses problem solving, addressing needs, and the objective examination of a full range of potential solutions, of which BRT is only one.

...The FTA defines BRT as a “rapid mode of transportation that can combine the quality of rail transit and the flexibility of buses”

A more detailed definition, ..., is:

BRT is a flexible rubber tired rapid transit mode that combines stations, vehicles, services, running way, and ITS elements into an integrated system with a strong positive image and identity. ... In many respects, BRT is rubber tired light rail transit (LRT), but with greater operating flexibility and potentially lower capital and operating costs.” (Levinson, Zimmerman, Clinger, Rutherford, “Bus Rapid Transit: An Overview”, Journal of Public Transportation, Vol 5, No.2 2002)

4.1.2 Seattle is not alone in ignoring the bus alternative.

Consider the following:

“Strong views exist on the merits of light rail as a preferred alternative to dedicated bus-based transitway systems. Why did many of these cities supporting and building light rail not consider having a very flexible bus system on the dedicated alignment, which has the capability of offering much better door to door service than a very inflexible fixed rail system? The answers are relatively simple -- the adage that ‘trains are sexy and buses are boring’ (quoted from the Mayor of Los Angeles) says it all. We have previously described this as ‘choice versus blind commitment’ (Hensher and Waters 1994).

When the evidence suggest that one can move three times as many people by dedicated bus-based transitway systems for the same cost, or the same number of people for one-third the cost as light rail, one wonders about the rationality of urban planning. For example, Wentworth (1997) concludes, from a review of the proposal to extend the light rail system in Sydney between Central Railway and the Circular Quay that a redesigned bus system would provide a better immediate result at a greatly reduced cost. He asks:

...perhaps the investors themselves may have been taken for a ride by professional promoters... Or is it just an innocent mistake? The only thing clear is that there is something fishy about the whole affair.” (Ref 23; p.5)

4.1.3 BRT is proven technology.

The reader is referred to Addendum I for an excellent overview of bus rapid transit or BRT, and how it would fit in the Seattle context. The US General Accounting Office (GAO) has published a report, which describes BRT and compares it with light rail. (Ref 9) The Transportation Research Board has a short brochure entitled: BRT: Why more communities are choosing Bus Rapid Transit. (Ref 11). The Journal of Public Transportation devoted an entire issue to BRT. (Ref 14) A BRT versus light rail case study was conducted in Los Angeles and reported in the Transportation Research Record. (Ref 12)

Here in Puget Sound King County Metro developed a “Six year Transit Development Plan” for BRT. (Ref 48) Unfortunately there must have been political pressure on Metro to avoid studying any BRT routes that would have competed with Sound Transit’s light rail. Thus Metro’s report says: “Would the BRT service compete for riders with current or planned future Sound Transit Express bus, commuter rail or light rail...? Corridors that do or would compete were eliminated.” (Ref 48: p.4)

As a result Metro only studied a number of innocuous locations for BRT, mostly on arterials. Still the report is useful because it shows there is local familiarity with BRT, and because it describes what can be done to make arterials BRT friendly. This is important because BRT not only provides a high level of service along the high volume parts of the route where light rail might be used, but it also provides a higher level of service than traditional local buses after it branches onto arterials and into neighborhoods. Put another way, a mature light rail network might have 100 route miles, whereas a mature BRT network might have twice or three times that.

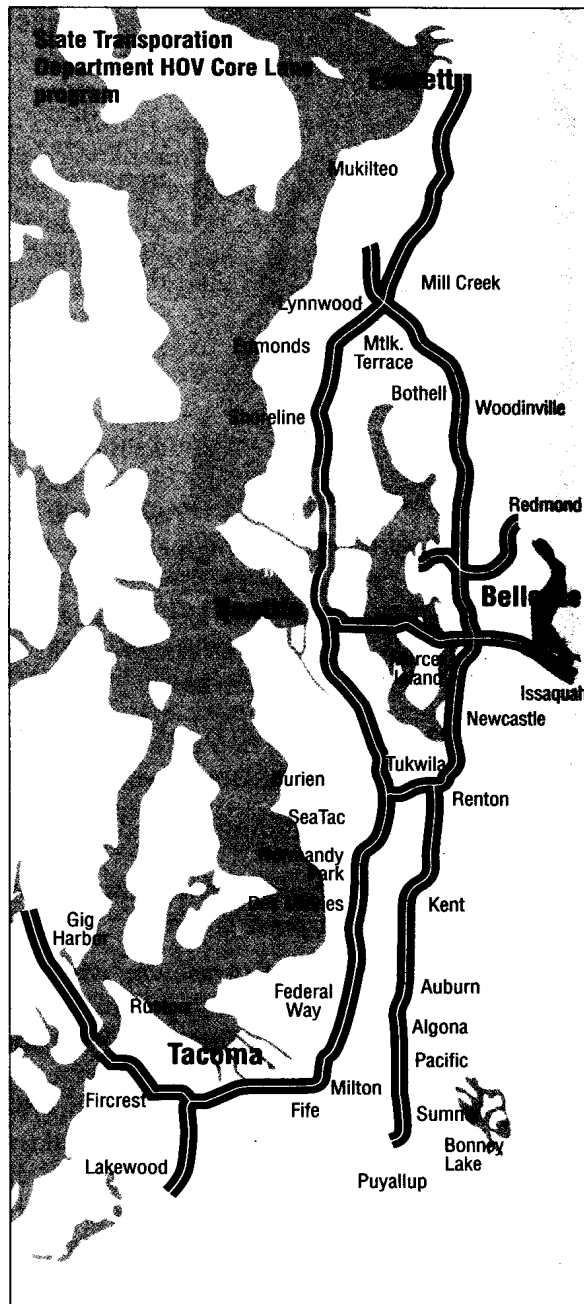
4.1.4 The key advantage of BRT is that much of the “guideway” already exists and is already paid for.

As of January 2001 Puget Sound had 191 HOV lane miles open to traffic. The total “core HOV” system will have 297 lane miles when complete.

The central Puget Sound region has one of the most extensive HOV systems in the world.” (Ref 47: p.6)

If the region implements light rail almost every inch of “guideway” (tunnels, elevated structures, rails and surface right-of-way) must be constructed from scratch, or taken from its current users (e.g.: the DSTT, the center lanes on I-90) Even in the DSTT the existing rails must be replaced because they were designed incorrectly.

BRT can use existing and already planned HOV lanes. Below is a map of those lanes.



Completed or funded HOV core
 Unfunded HOV core

4.2 The BRT alternative

Plan B or the BRT alternative to Link light rail would build on the existing express bus system. It might employ a large number on the new hybrid buses. It would operate on existing HOV lanes and be similar in many respects to the TSM alternative studied in the 1993 FEIS.

Plan B would probably start out with a fairly extensive BRT route structure, first because the express bus network is already fairly extensive, and second because for what even the Initial Segment of light rail is costing, a rather large BRT system could be built right away.

BRT would continue to use the DSTT as express buses do today. Chapter 5 describes a number of alternatives for increasing bus capacity through downtown Seattle if that becomes necessary. The most extreme of those is to construct a second bus tunnel parallel to the first. This would probably not be needed for years.

South Lake Union busway?-- The south Lake Union area is poised for major redevelopment as a important employment/residential center, but Link light rail ignores it completely. But it could be well served by BRT, and vice versa. One intriguing possibility would be to construct an elevated bus way for BRT from the Mercer Street express lane exit, across the south Lake Union area, and tying into SR 99. BRT buses could then proceed south using the Alaska Way viaduct or its replacement.

Such a busway, including a south Lake Union station, could probably be physically integrated into the new buildings. As such it would not be a visual blight, and would definitely make the area more accessible.

In addition, some of the BRT buses crossing the busway might continue west to serve two other important destinations, which Link ignores; namely, Seattle Center and Belltown.

Clearly if the region decided to scrap Sound Transit's light rail strategy, there would be plenty of money for such a busway. In addition, Link money, being transit money, could probably be used to fund HOV lanes in the tunnel proposed to replace the Alaska Way viaduct. That infusion of money might help accelerate the project.

Network Size and shape-- The high speed portion of a fully mature BRT network would probably use most of the region's HOV lanes and thus have the general shape shown in Figure 4.1.4. However, there could be other major extensions such as the abovementioned south Lake Union busway, BRT on SR 99 in south Seattle, and BRT over into West Seattle. In addition, the BRT system would extend out along various arterials. The idea would be to pick up riders in the neighborhoods, then use the HOV lanes to make fast trips to various employment centers.

Because BRT has a different cost structure than light rail the BRT network might start out being very extensive, whereas light rail would start out with just the 14-mile Initial Segment and grow slowly thereafter. What might change over time with BRT, as more money is spent, is not network size but rather network quality and service frequency. In other words over time the quality (or speed) of the BRT network would be increased by adding more HOV to HOV interconnections, and more flyovers that give HOV's direct access to HOV lanes. Network quality could be increased on arterials with a variety of relatively mundane signal and lane improvements that would increase bus speeds. The frequency of service is just a matter of buying more buses and operating them more frequently.

What this means in terms of the alternatives analysis called for in this report is as follows. Per Part 8 of this report, it is proposed to create a number of light rail alternatives that differ either in cost or in the degree to which they reduce delay, then design a BRT alternative with comparable cost or benefit to each of the rail alternatives. If the pairs of alternatives were designed to be equal in cost we would be looking for how they differed in benefit. If they were designed to have equal benefit we would want to know how their costs differed.

The rail alternatives are likely to differ in the length of the light rail line, so there would be one alternative having 14-miles of light rail, one with 21-miles, and so forth up a fully mature scenario having 100+ miles of light rail. However, we would not be creating a BRT alternative with 14-miles of BRT to compare against 14-miles of light rail. Instead, all the BRT alternatives would probably have a very extensive (100+ route miles) BRT network since the "guideways" already exist. The difference between a low cost or low benefit BRT alternative and a high cost or high benefit BRT alternative would be in network quality and service quality. For example, a BRT alternative designed to cost the same as Link IS (\$1.5 billion 02\$) might have 150 route miles of BRT but no additional HOV to HOV connectors and relatively infrequent bus service. In contrast, a BRT alternative designed to cost the same as a 60-mile version of Link (roughly \$6 billion) might have the same 150 route miles, but include HOV to HOV connectors everywhere, lots of flyover direct access ramps, and very frequent service.

In other words these alternatives analyses would not be comparing a 14-mile light rail alternative against a 14-mile BRT alternative. Instead they might compare a \$1.5 billion dollar light rail alternative against a \$1.5 billion BRT alternative. The \$1.5 BRT alternative might have 100 route miles of BRT, but perhaps fewer HOV to HOV connectors and perhaps a lower number of buses and thus less frequent service than might be possible.

4.3 The "buses will be stuck in traffic" issue

Critics of bus solutions claim BRT will be stuck in traffic and therefore not able to compete with light rail able to move freely on its own dedicated guideway. Is that criticism valid?

The first thing to note is that transit networks come in two parts, the line haul sub-network, and the feeder sub-network. The line haul sub-network for light rail is of course the light rail system itself, but light rail must be fed by bus routes that operate on arterial streets. The line haul sub-network for BRT is where buses operate on freeway HOV lanes. The feeder sub-network for BRT is when the buses depart HOV lanes to operate on arterials. Actions that can be taken to speed BRT on arterials could be taken to speed buses feeding light rail. Clearly there is no intrinsic difference between bus and rail feeder networks, both are equally susceptible to being stuck in traffic.

As to the line haul sub-network, it is true that HOV lanes need to be kept moving at a good speed to make BRT competitive with light rail. That can be done by policy. It may mean changing the minimum carpool occupancy from 2 to 3 persons sometime in the future. If such a change is needed it would not just be needed for BRT, but also to keep car and van pooling attractive.

Current DOT policy is to manage HOV lanes to maintain an average speed no less than 45 mph during the peak commuting hours. Many of the BRT buses would be express buses that would make few if any stops once entering the HOV lanes. Thus their average speed would be about the same speed as the HOV lane is moving.

On the other hand light rail must stop at all stations. Thus while Link has a maximum speed of over 50 MPH, it will only average 26 MPH. (48 minutes from NE 45th to South 200th per Ref 38: p.16)

In short, the feeder buses for light rail, and the feeder buses for BRT are equally susceptible to being stuck in traffic. The line haul portion of the BRT network will not be stuck in traffic because the HOV lanes can be managed to flow at a reasonable speed.

But all this is not something people should be arguing about. It is an argument about engineering details at the 5000-foot level akin to arguing whether steel wheels are better than rubber tires. The correct thing to do is go up to 40,000 feet and look at what the models predict in terms of ridership and effect on travel delay. The models take into consideration the speed with which HOV lanes operate, bus speeds on arterials, the delay while loading and unloading at stops or stations, maximum vehicle speeds, acceleration rates, any inherent preference people may have for rail, and a whole raft of other factors. These models are calibrated with data from actual systems in other cities. When the model says X people will ride light rail, or Y people will ride BRT, things like the degree to which buses are stuck in traffic will have already been included in the analysis. As will be explained in Part 5, Sound Transit's predecessor the RTA, did model an extensive BRT like bus network and found it would attract 518,000 daily riders in 2020. (Ref 42: p. 3-8) This would not have been possible if "buses were stuck in traffic". In contrast, Central Link is estimated to attract 133,000 daily riders in 2020. (Ref 2: p.7-11)

In conclusion, the claim that "buses will be stuck in traffic" is an irrelevant red herring. Run the ridership models, and do it honestly. If any buses are stuck in traffic that will

have been cranked into the models, and will have affected the predicted ridership. If the ridership looks good, one can ignore all the low level issues.

4.4 Plans C, D, and E

If the objective is to increase transit ridership the only alternatives are probably light rail, heavy rail, monorail, and bus. But if the objective is to reduce travel delay there are many other alternatives to consider, such as car and van-pooling, transportation demand management (TDM), and road improvements. Should these be plans C, D, E and so forth?

There are two ways these other alternatives can be considered. One is to construct hybrid alternatives, which combine BRT and one or more of these other alternatives. For instance, construct a \$2 billion alternative where \$1.5 billion goes to BRT and \$500 million goes for van pools. The other alternative is to construct pure alternatives where all the money in a given alternative goes for one type of remedy, such as van pools.

To make a long story short, the thing the region should really do is apply “least cost planning” or LCP. The essence of LCP is to take an objective like reducing travel delay and determine the least cost way to achieve it. Probably that least cost way would be a market basket of different remedies; for instance an optimized mixture of BRT, car and van pools, TDM, and selected road improvements. However, in theory, it could be 100% van pools, or 100% roads. (See description of LCP and end of this report)

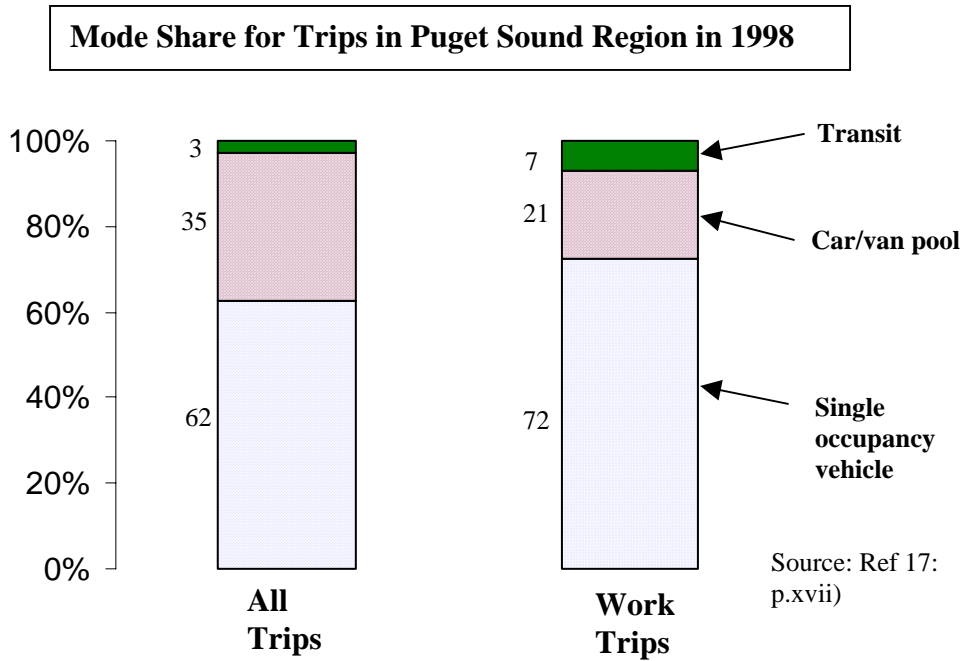
If the region decides to force ST into conducting a proper alternatives analysis, one of the scenarios or alternatives that must be evaluated is Sound Transit’s vision for a fully mature 100+ mile light rail system. Such a system would cost roughly \$15 billion. If it were decided to do an “equal cost” alternatives analysis that would mean designing a BRT alternative also costing \$15 billion. It is hard to imagine how \$15 billion could be spent on BRT no matter how large the network or how lavish the service. Thus if an equal cost approach is used, the only practical thing to do would be to construct only hybrid scenarios where BRT is combined with car and van pools, and other remedies so as to get up to the cost of the rail alternatives.

In sum, the alternative to light rail or “Plan B”, may be pure BRT, but it is more likely an optimized combination of BRT and other remedies. The best approach is to use Least Cost Planning to find the optimum combination of remedies.

4.4.1 Car and Van Pooling

This report focuses on the bus versus rail issue because that has been the focus of most planning activities to date. However, BRT is not the only alternative. Car/van pooling is probably even more cost effective than BRT and should be among the alternatives considered most carefully as the region charts its transportation strategy. This is true

because car and vanpools are already far more effective in getting people out of single occupancy vehicles than is mass transit, as the following chart makes clear.



To put this in perspective consider the following. Central Link is only expected to reduce PM peak period VMT by 3.7% in 2020. (Ref 2: p. 3-4) This is a reduction of 63,000 VMT during the peak period. The average work trip is a little over 10 miles long so Central Link would be taking 6300 cars out of the morning commute, and the same 6300 out of the evening commute. One could say Link removes 6300 cars from peak period traffic.

However, in 1998 there were already 459,690 work trips being made by car/van pool, presumably half in the morning and half in the afternoon (Ref 17: p.xvii) This means there were about 230,000 persons commuting to/from work by car/van pool. If we assume every car/van pool carried two persons this would mean that there were 115,000 carpools in operation, each of which removes one car from the evening commute, and one from the morning commute. In short, car/van pooling is now taking 115,000 cars out of peak period traffic. This is 18 times more than Central Link is expected to remove.

Expressed differently every two people deciding to car pool takes at least one vehicle out of peak period traffic. (Actually it would be more than one vehicle since some car pools and most bus pools have over two persons. But two is a conservative estimate.) Link takes 6300 vehicles out, so it would take a maximum of 12,600 additional people deciding to carpool to have the same impact as Central Link. 12,600 is 5.5 % of the 230,000 people now car/van pooling.

In short, increasing the number of people who car or van pool to work by just 5.5% would remove as many cars from the commute as building 21-miles of light rail at a cost of \$3.6 billion (YOES).

A recent article in the Bellevue Reporter indicates just how cost-effective car and van pool programs can be, and at the same time indicates the paltry sums being devoted to encourage them.

“The Commuter Challenge offered by the Regional Smart Commute Program, pays those who typically drive to work alone to instead ride the bus, join a car pool, bicycle or walk to the office or work from home.

...The program pays \$3 for every day a participant leaves his single occupancy vehicle (SOV) at home.

...Flexible and profitable. The program pays participants up to \$192. It is funded by a \$100,000 WSDOT grant.” (Amy Roe, Bellevue Reporter, Nov. 24, 2004)

To put this in perspective, \$3 per day times 200 workdays per year comes to \$600 per year for each car this program removes from peak period traffic. In contrast Central Link will cost \$43,000 per year for each car it removes from the road. (See Part 6 of this report for details) The \$100,000 this program gets is just 1% of what Sound Transit spends on public relations alone each year.

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Part 5: The Capacity Issue

5.1 Introduction

5.1.1 Overview: ST and the RTP used capacity as a major criterion in their selection of rail as opposed to bus technology for the region's HCT network. However RTP's analysis was incomplete and biased. Their reasoning was not valid at the time and is even less valid today. This is partly because we are now dealing with light, not heavy or rapid rail. Based on what's known today, bus alternatives would not only have adequate capacity but may in fact be superior in meeting the region's long term capacity needs.

In one very serious case of bias RTP officials knew capacity was a key consideration and potential weakness of the TSM (bus) alternative, nevertheless they: 1) chose to assume a worst case assumption about bus capacity in the DSTT rather than make a serious effort to determine an accurate value, and 2) failed to fix any remaining capacity shortfall using any of a number of previously identified remedies. In short, RTP deliberately created a hobbled bus alternative to compare against rail.

The consequences of putting forward this designed-to-fail bus alternative were pervasive and long-lived. It led to a lower ridership forecast for the bus alternative, less attractive economics, and a long series of negative assessments claiming buses lacked adequate capacity to meet the region's needs. It was therefore decisive in essentially ruling out buses as the core technology for the region's HCT network back in 1993. There has been no serious reconsideration of the issue since. Thus the current light rail strategy continues to rest on the flawed and misleading way capacity was treated in the 1993 FEIS.

The essence is as follows. The maximum load ST claims a rail system would need to handle by 2020 is 15,000 persons per hour through downtown Seattle. About 20% of this would be used by persons traveling to nearby Capitol Hill. Because a freeway BRT system would bypass Capitol Hill it would need a capacity of only 12,000 persons per hour through downtown to accommodate the same overall transit demand. It would take about 110 buses per hour to provide this capacity. There have been six separate studies of bus capacity in the downtown Seattle Transit Tunnel (DSTT). Although the results ranged from 125 to 192 buses per hour, Sound Transit's predecessor the RTP assumed that the tunnel could handle only 100 buses per hour. Even if that were correct and the tunnel could not handle the entire load, there are several other ways to increase bus capacity through downtown. When all this is taken into consideration it appears ST's assertions that an all-bus alternative would not have enough capacity are unfounded. To the contrary, buses would have considerably more capacity to meet the regions long term needs than would Link light rail.

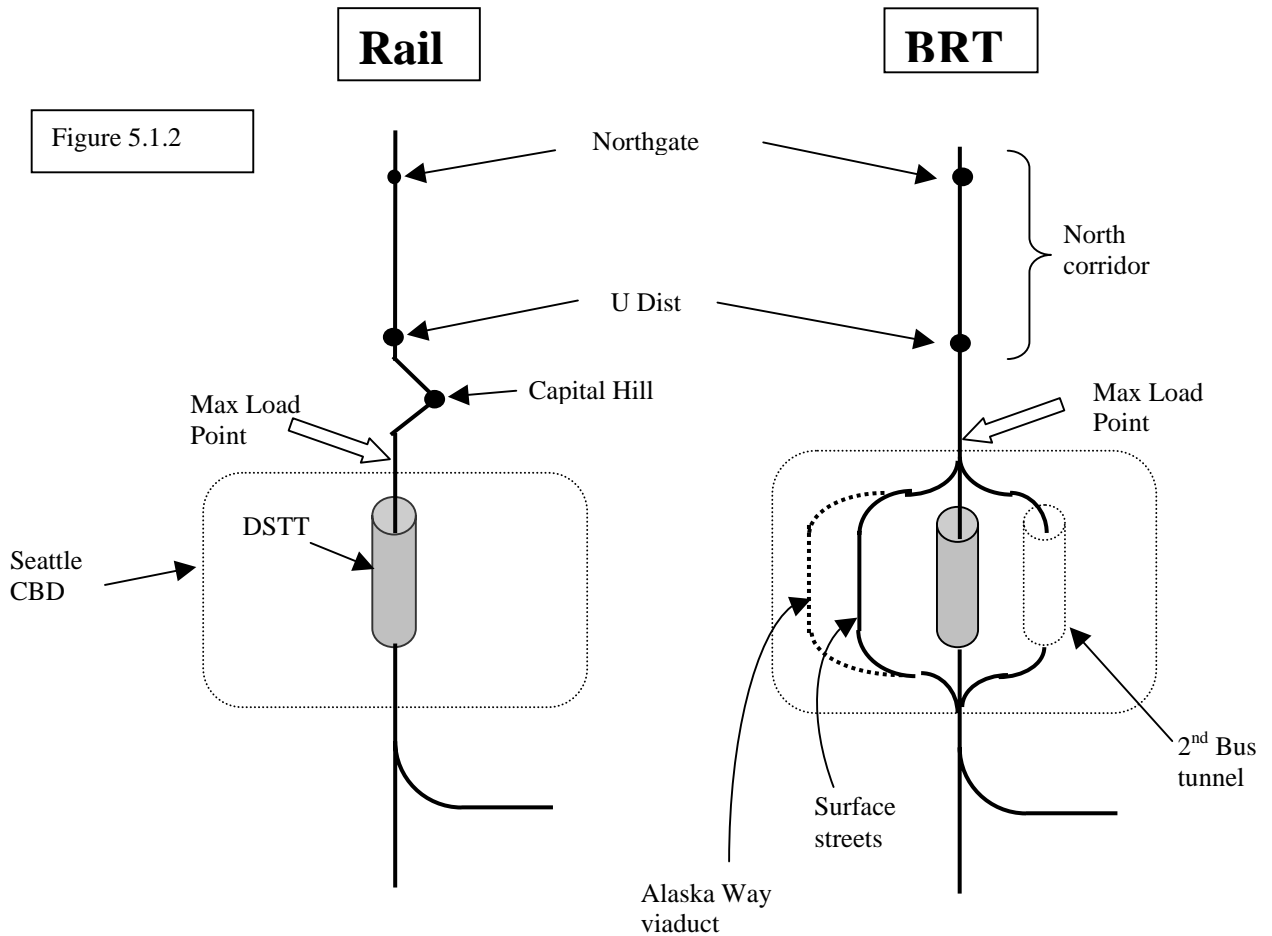
Light rail has other capacity-related deficiencies: There is a fixed upper limit on Links capacity whereas bus capacity is relatively open ended. Placing light rail on the I-90 bridge would reduce the people moving capacity of the bridge relative to having the center lanes shared by buses, carpools and vanpools. There is an equity issue in that Link's design shortchanges the region's south-end in terms of transit capacity. There is

some risk that Link’s south line may not have enough capacity. The ability of the DSTT to move people in and out of downtown Seattle would be reduced if rail is not extended across Lake Washington.

Because the 1993 FEIS mishandled the capacity issue in a biased manner, dealt with heavy not light rail, and failed to address the full range of capacity issues, a new alternatives analysis is needed. It needs to compare not only the currently planned 24-mile Central Link against bus alternatives, but also the 100+ mile version of Link envisioned by ST.

5.1.2 Visualization of capacity issue

Figure 5.1.2 helps visualize key aspects of the capacity issue. The light rail line would come south from Northgate with a station in the University District and one on Capital Hill before entering the Seattle central business district (CBD) and going into the Downtown Seattle Transit Tunnel (DSTT). There are other stations between the U District and Northgate but they aren’t shown since they aren’t relevant to this discussion. The Capitol Hill station is shown as a jog because it’s east of I-5.



Ridership forecasts show that the maximum passenger load point on the entire rail system would be just north of the DSTT. Maximum load is measured as passengers per hour (pph) in the peak direction. Rail would need enough capacity to carry this maximum load.

The main bus or BRT line serving the north corridor would share an HOV lane on I-5, and would not serve Capitol Hill. There are four different ways to get buses through downtown. Today some go through the DSTT while others use north-south streets such as 3rd Avenue. The maximum capacity of the DSTT remains uncertain at this time as will be explained later, but estimates range from 100 to 192 buses per hour. The capacity of surface streets is also somewhat uncertain, although RTP has identified ways to increase the number above today's levels. A third potential way to increase bus capacity through downtown would be to divert some buses off I-5 at Mercer, cross the south Lake Union area on a new busway and tie into SR99. Once on SR 99 the buses could proceed south on whatever facility replaces the existing Alaska Way viaduct, especially if that replacement includes HOV lanes. A fourth possibility was identified by the RTP back in 1993, namely to build a second bus tunnel. In short, if the DSTT in combination with the existing number of buses on surface streets does not have enough capacity, there are three ways to add additional bus capacity through downtown.

A bus alternative would also need enough capacity at the max load point to carry its projected ridership. The maximum load point on freeway BRT would be just north of Mercer if some of the southbound bus stream were diverted at that point to some future south Lake Union busway, otherwise it would be just north of the DSTT. The remainder of Section 5 assumes the latter since none of the projected ridership scenarios is high enough to demand a south Lake Union busway. It's just an option.

The bulk of section 5 deals with the issue of whether rail has an advantage over bus in terms of capacity at the peak load point, or vice versa. This only becomes an issue with a fully mature or fully built-out rail or bus system. Shorter systems, such as the 24-mile Central Link or a BRT system with equivalent ridership, would not have enough passenger volume to make capacity an issue. A fully built out light rail system would have 100+ route miles, as did the Rail/TSM alternative in the 1993 FEIS and as ST envisions Link growing to. A fully built out bus system as I define it here is a BRT system having the same geographic coverage and ridership as the fully built out light rail system. In other words it would include 100+ route miles of freeway BRT.

Thus Section 5 will focus on these key questions:

- 1) Would a fully built out light rail system have enough capacity to handle forecast demand at the peak load point in 2020?
- 2) Would a fully built out light rail system have enough capacity to handle the region's long term needs for growth in demand well beyond 2020? In other words, is light rail "strategic"?

- 3) Would a fully built out bus or BRT system have enough capacity to handle the forecast demand at the peak load point in 2020?
- 4) Would a fully built out bus or BRT system have enough capacity to handle growth in demand well beyond 2020? In other words, is BRT “strategic”?

NOTE: The author uses the following terms to describe bus alternatives: “all-bus”, bus rapid transit or “BRT”, and “TSM”. They all mean pretty much the same thing: namely a mix of express buses operating on freeway HOV lanes and on arterials where they are given bus only lanes, signal priority and so forth. The bus alternative would also include Park and Ride lots. In other words the bus alternative is an integrated system built around buses. As was the case with the 1993 FEIS’s TSM alternative, the bus alternative would be an extension to or overlay on the current local bus system. The BRT or express bus-on-HOV portion of a bus alternative could be thought of as light rail with rubber tires using an existing right of way rather than carving a new one. Whether BRT or light rail, the networks would follow the region’s main freeway corridors. The largest light rail network might have somewhat over 100 route miles. A BRT network might extend over the region’s 200+ route miles of HOV lanes.

5.1.3 Capacity has been used as a discriminator against the all-bus alternatives.

The probability that an alleged capacity limitation was used as a major reason for dismissing the bus alternatives is illustrated by the large number of times it was mentioned in various RTP and ST documents. The following quotes are from the 1993 FEIS:

“A rapid rail line operating in exclusive right of way has the theoretical capacity to carry over 22,000 persons per hour in each direction...These numbers represent the rail capacity of the downtown Seattle transit tunnel... In comparison the bus passenger capacity of the downtown tunnel is about 13, 400 persons per hour...” (Ref 1, p. xviii)

“TSM Alternative bus traffic levels would meet or exceed the capacity of the downtown Seattle transit tunnel and the street network in downtown Seattle at rush hour, resulting in a constraint to meeting the demand created by the TSM Alternative.” (Ref 1, p. xxxiv) The same is said about the TSM/Transitway Alternative on page xxxv.

“Bus volumes to meet ridership needs would exceed street capacity in downtown Seattle...” (Ref 1, p. xliii)

“Neither the TSM nor the Transitway/TSM Alternative could accommodate the transit demand associated with implementing the Visions 2020 land use concept and consequently would not fully support its land use goals.” (Ref 1, p. 4-5)

“The Rail/TSM alternative would provide enough capacity to meet the high end of projected transit demand.” (Ref 1, p. xxxv)

The October 1992 “System Plan Technical Report” said:

“In the long term, neither of these (TSM or Transitway/TSM) alternatives offers the mobility or capacity necessary to support growth management policies, control sprawl or provide the mobility necessary for sustained economic viability.” (Ref 45: p.89)

The Nov 1993 “Central Corridor Project Justification Report” said:

“The TSM and Transitway/TSM alternatives were found to provide only a temporary solution to the transportation needs of the region. In the long term neither of these build alternatives offered the mobility or capacity necessary to support the adopted growth management policies, control sprawl or prove the mobility necessary for sustained economic vitality.” (Ref 19: p.23)

“Finally, only the Rail/TSM Alternative had sufficient capacity to accommodate transit demand in key areas such as the Seattle CBD...” (Ref 19: p. 25)

The Nov. 1999 FEIS for Central Link reiterated the theme as follows:

“The benefits that led to the selection of the rail alternative were its capacity to meet the high end of projected transit demand.” (Ref 2: p. P-1)

“Criteria such as capacity, operating speeds, ...were considered” (Ref 2: p. S-19)

“1.1.2 How were the alternatives identified and narrowed for the EIS? ...Evaluation criteria included capacity, ...” (Ref 2: p 7-3)

The PSRC’s Summary of Prior All-Bus and Integrated Rail/Bus Alternatives Analyses report dated 2001 quoted the Expert Review Panel as saying

:

“...only rail provides the capacity, speed, and reliability to meet growing demand.” (Ref 28: p.3)

The Summary goes on to say:

“Probably one of the most significant factors that tipped the scales toward the rail/bus alternative was the long term effectiveness and relative efficiencies that rail services would provide over the 20 year planning period. In addition to faster speeds and greater reliability in direct service to the high demand transit markets, the rail bus alternative was found to provide a substantially higher level of long term future capacity than either of the all bus alternatives.”

Finally, the recent “Summary of Prior All-Bus and Integrated Rail/Bus Alternatives Analyses” dated April 5, 2001 and appended to the June 14, 2001 “Central Link Board Workbook” says:

“As mentioned previously, the bus capacity constraint in downtown Seattle was one of the major reasons for selection light rail in the central I-5 corridor” (Ref 36, Appendix Q, p.7)

In sum, it is clear that an alleged capacity shortfall in the bus alternatives was a key factor in the selection of rail. The sections below examine whether this alleged shortfall was in fact real.

5.2 How the capacity issue was mishandled in the 1993 FEIS

5.2.1 Overview of what RTP did and didn't do in the 1993 FEIS

The RTP ran ridership forecasting models to estimate year 2020 ridership for the rail alternative. The models predicted that rail ridership during the peak hour at the peak load point just north of the DSTT would be 15,000 persons per hour in the peak direction. (Ref 1: p. 2-58) RTP then assumed the rapid rail system could operate at 90-second headways giving it an ultimate capacity of 22,000 persons per hour. (Ref 1: p.2-58) From this RTP concluded that rail had enough capacity to meet 2020 demand, plus plenty of excess capacity for growth.

RTP also ran the models to predict ridership in the DSTT for the TSM and Transitway/TSM alternatives. The result was that the TSM alternative attracted 518,000 daily riders. (92% of what the rail alternative attracted) In parallel RTP reviewed six previous studies of tunnel capacity. Those studies had each come to different conclusions, ranging from 125 to 194 buses per hour. However, RTP decided to assume a maximum capacity of 100 buses per hour. One hundred buses per hour would not handle the 518,000 riders so RTP reduced the predicted TSM ridership to what they said 100 buses could handle, namely 473,000 daily riders. (Ref 42: p.5-2) This was an 8.7% reduction.

Table 3.2
Existing and 2020 (PSRC Adopted) Constrained Versus
Unconstrained Total Daily Transit Trips

Alternative	Unconstrained	Constrained
1990	284,100	284,100
No-Build	419,500	388,500
TSM	518,100	473,900
Transitway	524,300	480,000
Rail	564,800	560,500

Scanned image of
Table in Ref 42

This “constrained” ridership was the one reported in the 1993 FEIS and became the basis for calculating all the ridership related benefits and cost-effectiveness measure for the bus alternative. Obviously the bus alternative would have fared much better in its fly-off against rail if the RTP had found some way for the bus alternative to achieve its unconstrained ridership, either by double-checking its assumption about bus capacity in the DSTT, or if this failed, finding some workaround.

However, the RTP did not attempt to narrow the range of uncertainty about the true capacity of the tunnel, but instead assumed worst case. Neither did the RTP attempt to fix the alleged DSTT capacity bottleneck with any of the remedies they had identified elsewhere, even though the \$6 billion difference between the bus (TSM) alternative and

the rail alternative provided plenty of money for such remedies. Thus the RTP deliberately entered a capacity deficient bus alternative into competition with the rail alternative. Naturally, the bus alternative didn't do as well as it might have. Thus in higher level summaries prepared for policy makers the RTP repeatedly asserted that the bus alternatives were deficient in terms of capacity, and this was given as one of the major reasons the bus alternatives were dropped in favor of rail.

In a nutshell, an alleged capacity bottleneck in a 1.5-mile segment of a 100+ mile BRT network became the tail that wagged the dog.

Specific ways in which RTP mishandled the capacity issue are further described below.

5.2.2 The 1993 FEIS and subsequent studies did not define or quantify the capacity benchmark the alternatives were being judged against.

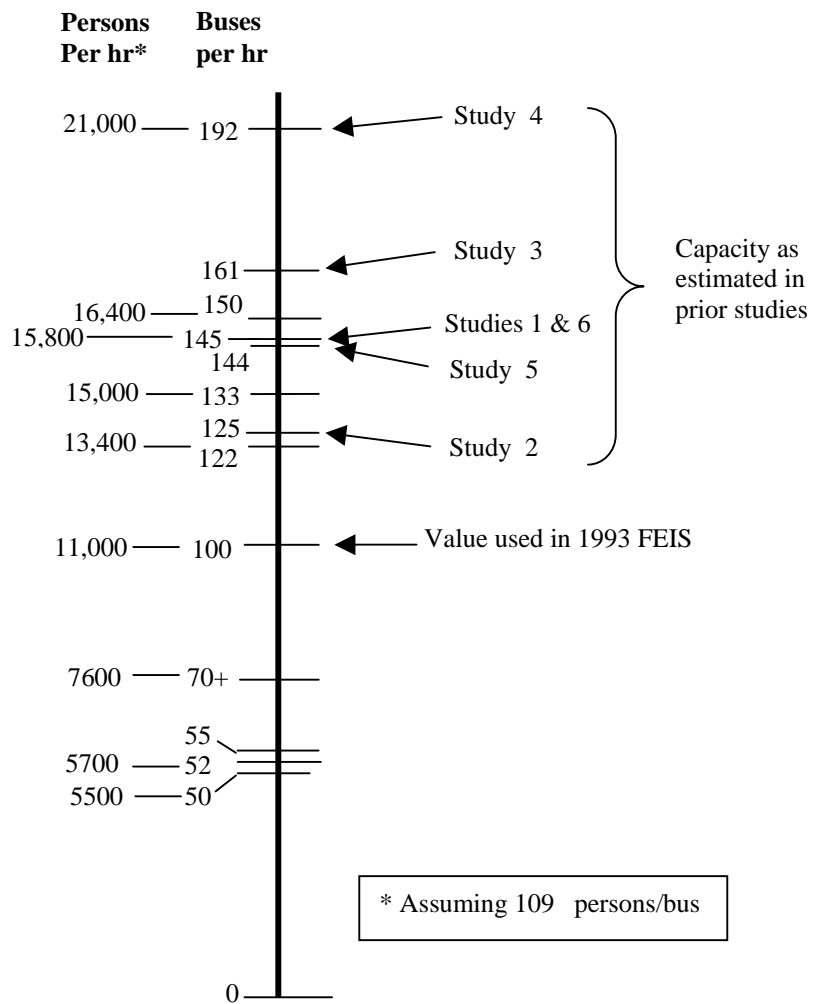
The following benchmarks are mentioned in the quotes in Section 5.1: “transit demand associated with implementing the Visions 2020 land use concept”, “ high end of projected transit demand”, “ capacity necessary to support the adopted growth management policies, control sprawl or prove the mobility necessary for sustained economic vitality”, “ capacity... to meet growing demand”. Unless these benchmarks are quantified how is it possible to rule that one system meets them and another does not?

5.2.3 The 1993 FEIS assumed a lower bus capacity for the DSTT than all prior studies had estimated as being possible.

Prior to the 1993 FEIS, six paper studies had attempted to estimate the bus capacity of the DSTT. (Ref 34) The results ranged from a low of 125 buses (one way) to a high of 192, and are plotted in Figure 5.2.3. (Other values in the Figure will be described later.) Study #6, an “internal Metro technical memorandum” cited on page 12 of Reference 34, says the following:

“ ‘tunnel capacity for outbound revenue service leaving downtown is approximately 100 buses per hour per direction...’ as one of its major conclusions. The phrase “leaving downtown” is important as approximately 45 buses per hour per direction also operate in the tunnel for deadheading (10 per hour), inbound terminating (35 per hour) or unscheduled trips. Thus the capacity of the tunnel was taken to be 145 buses per hour per direction. The DSTT’s capacity was based on the DSTT’s stated peak hourly capacity of 145 buses per hour per direction and the opinion of Metro’s operating staff.” (Ref 34: p.12)

Figure 5.2.3



In other words this report indicated that the tunnel could handle 145 buses per hour if managed for maximum useful capacity but only 100 buses per hour if managed inefficiently.

Nevertheless RTP chose to assume a capacity of only 100 one-way (or 200 two-way) for the 1993 FEIS. This is documented in a Technical Memorandum dated May 1992. (Ref 26: p.3) (It is also confirmed by applying the same ratio of peak load point traffic to total daily traffic used for rail to the estimate of constrained daily traffic for the TSM alternative. For rail the ratio was 15,000/124,000. For bus 11,100/92,000 gives the same ratio. Source Ref: 1 p. 2-58, 3-108, and 3-115. A peak load of 11,100 would require about 102 buses per hour, assuming each carried 109-passengers.

In addition, the various paper studies clearly evidenced a great range of uncertainty. Given the importance of this parameter the RTP should have conducted real world experiments to find the correct value.

The downstream consequences of this low-ball assumption—on ridership, on all ridership related metrics, and on qualitative statements made denigrating the bus alternatives for

not having enough capacity-- were significant. If capacity was such a critical issue why didn't RTP assume the tunnel would be managed efficiently? This failure proves RTP's bias against the bus alternatives.

The consequences of having picked 100 rather than 145 can hardly be overstated. If RTP had used 145:

- the bus alternatives could have carried the forecast demand, and RTP could not have dismissed the bus alternatives because they lacked sufficient capacity
- the bus alternative would have had the capacity (15,800) to carry the same 2020 passenger load predicted for rail in the 1993 FEIS, namely 15,000. The 15,800 comes from 145 buses per hour times 109 persons per bus.
- the bus alternatives with a capacity of 15,800 would have almost as much capacity as the current light rail (16,400) thus largely negating any current claim that rail has a capacity advantage over buses.
- the TSM ridership estimate would have risen from the constrained value of 473,000 daily riders reported throughout the 1993 FEIS to the unconstrained value of 518,000 reported in the technical documents. (Ref 1: p. xxxiii) (Ref 42: p.3-8 and 5-2)
- all TSM benefits or metrics for cost-effectiveness that were a function of ridership would have risen accordingly

In the sections below the author assumes that buses would be operated efficiently in the tunnel and, for simplicity, assumes the tunnel could handle something in the mid range of what prior studies indicated, namely about 145 buses per hour each way. If these were 60 foot articulated buses with a capacity of 109 persons, 145 buses per hour translates into a bus capacity in the DSTT of 15,800 persons per hour each way. In short, from here on the author will assume the true bus capacity of the DSTT is 15,800 pph in each direction. However, if the DSTT really could not handle 145 buses per hour, there are other ways to increase bus capacity through downtown Seattle. These will be addressed presently.

5.2.4 The 1993 FEIS appears to have assumed an unreasonably low headway for rail thus artificially inflating its capacity.

The 1993 FEIS said:

“A rapid rail line with 4-car trains operating in exclusive right-of-way on 90 second headways has the capacity to carry over 22,00 persons per hour past a single point in each direction” and “These numbers represent the rail capacity of the downtown Seattle transit tunnel” (Ref 1: p.1-10)

Later this was cited as a point in favor of rail:

“The forecast peak demand in 2020 is about 15,000 passengers per hour. Thus the (rapid rail) system design incorporates an “expansion factor” of about 50% to accommodate future growth in ridership” (Ref 1: p. 2-58)

However, 90-second headways have apparently never been achieved on US rail systems according to rail expert Tom Rubin. It seems especially problematic since the east and south lines would need to merge with perfect timing.

5.2.5 The RTP failed to fix the alleged bus capacity problem by applying already identified remedies.

If the bus tunnel can't carry 145 buses per hour there are a variety of fixes the RTP could have applied. They involve finding parallel paths through downtown. One set of solutions places more buses on surface streets, another routes buses that don't need to stop in the DSTT through the CBD on HOV lanes that could be constructed on I-5 through the downtown. These are briefly described in a 1992 report (Ref 26) and were therefore known at the time of the 1993 FEIS. The author has also seen an internal staff memo dated May 21, 1992 addressed to Bob White (the RTP director at that time), which mentions some of these other remedies and suggests they could have, but weren't applied. Excerpts from this memo follow:

“This note reviews “Analysis of Capacity Constraints in Selected Activity Centers”, Draft Technical Memorandum, May 13, 1992. ...”

“The subject memorandum does not address appropriate margins of bus capacity in the Seattle CBD for the system planning issues before the RTP and the JRPC.”

“The peak hour bus capacity of the Seattle CBD is critical to the system planning effort.”

“They do not answer the question of how much surface bus capacity would be increased through the 1993 TSM alternative of transit only use of Third Avenue or contra flow lanes on Second and Fourth Avenues.”

“Imagine the extremely steep slope of a line on the Ben Porter graph representing the cost effectiveness of capital projects (contra flow or exclusive use of Third Avenue at only 40 to 50 million 1993 dollars) which removed the capacity constraint from the TSM ridership.”
Underlining by Harkness.

This last quote indicates that staff had determined that inclusion of the relatively inexpensive contra flow or exclusive use of Third Avenue remedies would have at least allowed the bus alternative to reach its unconstrained ridership forecast. Consider also the following quotes from another staff memo written during that time:

“A few of the assumptions that have particularly significant policy and performance implications are: ...What the table (Table 4 in the 1993 FEIS)rh does not show is the unconstrained TSM daily ridership which was forecast to be 518,081 or 92% of the Rail alternative. ... The (ridership)rh constraint is based on a limit on the number of buses the model indicated could serve the Seattle CBD. ... Perhaps even more crucial is that low cost improvement in Seattle, such as contra flow transit lanes on Second and Fourth avenues were not included in the analysis (though analysis by Metro in the 1980's had shown the validity of the concept). As a result even though the TSM alternative includes hundreds of millions of dollars for roadway improvement it does not include

the small improvements that would have done the most to alleviate the assumed (capacity) problem.” (from transit agency staff memo dated 1993 with underlining and parens initialed “rh” inserted by Harkness)

“It is particularly unfortunate that the TSM alternative, with all its flexibility (and so many assumptions open to question) is being set up as a straw man by which to measure the rapid rail element.” (from same staff memo)

Bus travel through downtown Seattle could be improved by constructing an HOV lane through the CBD. This possibility is described in one of the State DOT reports on HOV. (Ref 33: p.16) There is also the possibility of diverting some of the buses to or from the north-end at the Mercer St. exit and building a busway through the south Lake Union area over to SR 99 and then south on the Alaska Way viaduct, which is planned for reconstruction. Still another alternative is a second parallel bus tunnel, which METRO estimated would cost about \$600 million. (Ref 26: p.8)

“The cost of another tunnel and the access and egress to it necessary to successfully operate a two tunnel system in the CBD have been conceptually explored. The cost of a Forth Avenue tunnel would be about \$600 million dollars.” (Ref 26: p. 8)

Besides increasing capacity, parallel paths have the added benefit of providing walking access to transit over a wider area than the DSTT stations allow.

If none of the simpler remedies were found sufficient, in the worst case RTP could have added \$600 million to the TSM alternative for a second bus tunnel thus decisively eliminating the bus capacity problem and all negative consequences thereof. This would have reduced the \$6 Billion difference between the TSM and rail alternatives but still left the TSM alternative billions less costly than the rail alternative.

Section 6 will show how adding a second bus tunnel affects the cost effectiveness of the bus alternative. It will be shown that although costs increase, ridership gains more than compensate. In other words, adding a second tunnel, if in fact one is needed, improves the cost effectiveness of the TSM alternative by allowing the TSM alternative to carry its full predicted ridership.

In the Rail/TSM alternative between 16 and 20 miles of the 125-mile rail network were in tunnels. (Ref 1: p.3-91,92) The extra investment in tunneling bought an increase in capacity and performance for the rail alternative. It must have been a conscious decision to include intensive tunneling in the rail alternative, and a conscious decision not to include any in the bus alternative, not even 1.5 miles in the form of a second bus tunnel.

In short, RTP management knew there were various options to fix the capacity problem in the TSM alternative, but failed to apply them. In this way they knowingly put forth a hobbled or weakened bus alternative to compete against the rail alternative.

A related consideration is that “fixes” to bus capacity problems can be applied incrementally, if and when future transit demand grows to the point they are needed. Since the DSTT is currently operating at only half capacity this is a long way off. From a

cash flow or discounted return-on-investment (ROI) perspective this is an important point, and should have been addressed in the FEIS.

The cost advantages of creating what might be called an “enhanced TSM” alternative -- that is fixing the bus capacity problem and then simply expanding TSM until rail ridership was equaled-- should have been explored in the 1993 FEIS. Since it wasn’t, the author does so in Section 6 by estimating how an “enhanced TSM alternative” would compare with the Rail/TSM alternative in terms of cost-effectiveness.

5.2.6 Subsection Conclusions:

The capacity issue was skewed in the 1993 FEIS in a way designed to favor rail. On the one hand the capacity attributed to rail was probably too high. On the other hand the capacity attributed to the bus alternative was certainly too low. This was because the RTP make what appears to be an unreasonably low, and certainly unverified, assumption about how many buses could operate in the DSTT. Then, asserting that buses lacked adequate capacity, RTP failed to fix the problem using any of a number of remedies they had already identified. Thus the RTP pitted an overly optimistic rail alternative against a deliberately hobbled bus alternative. This led to the bus alternative being rated lower in ridership and ridership related benefits than it should have been, and to false assertions that buses didn’t have enough capacity to meet the regions needs. The still lingering end effect has been to take bus or BRT off the table, as far as the core parts of the region’s HCT network are concerned. Because the 1993 FEIS mishandled the capacity issue, it did not then and does not now constitute a valid basis to discriminate against buses from a capacity viewpoint.

5.3 From today’s perspective there is even less reason to dismiss bus alternatives for an alleged capacity deficiency than there was in 1993.

What follows is a current view of the capacity issue, especially as it relates to capacity in the DSTT. It takes into consideration the fact that we are now dealing with light rail, rather than the rapid rail studied in the 1993 FEIS. Section 5.3 starts by establishing some basics, then goes on to examine the implications of an apparent conflict between different ST forecasts and statements of demand at the peak load point. Section 5.4 treats some additional capacity issues that are less related to downtown Seattle and the DSTT.

5.3.1 Light rail has less capacity than the rapid rail studied in the 1993 FEIS.

The 1993 FEIS assumed rapid rail could operate on as short as 90-second headways thus giving it a capacity of 22,000 persons per hour. (Ref 1: p. 2-58) The maximum capacity now claimed for Link light rail is 16,400, which assumes 2-minute headways.

5.3.2 Link’s capacity can never be increased, except perhaps on the east line.

The capacity of Link light rail in the DSTT and along the entire north line is limited by the headway, which can't be reduced below 2-minutes, and by the length of the trains. Train length is limited to 360 feet both by the length of the platforms in the DSTT and the need to keep trains short enough so as to not block street intersections in Rainier valley. Link's capacity is therefore permanently limited to 16,400 pph on the north line and about 5470 pph on the south line, assuming 2 and 6-minute headways respectively.

The east line is limited to 10,930 pph, unless a second rail tunnel is built downtown. The second tunnel would not increase rail capacity on the north line since capacity along the entire north line is limited to the 4-car trains that the then existing stations could handle, and by 2-minute headways. Nor would it increase capacity to the south, where headways are limited by at-grade operations in Rainier Valley and train lengths are limited by the length of the then existing station platforms. However, trains from the eastside could run more frequently if dead-ended into a second tunnel, and if there were no on-street operations on the eastside.

In short, light rail has systemic capacity limits. In contrast bus capacity can be increased to almost any value desired by building parallel paths in high demand areas.

5.3.3 BRT has far more ultimate capacity than Link could ever have.

Buses operating on an exclusive busway or occupying an entire HOV lane have truly enormous capacity. Theory suggests 60, 000 or even 80,000 persons per hour. A BRT system in Bogotá actually carries 25,000 persons per hour and a busway in New York moves 44,000. The author has documented this in a separate paper. (Addendum F). However, even if a single lane of buses could deliver say 60,000 pph into Seattle's downtown the existing streets and bus tunnel would not be able to handle it.

However, if a second bus tunnel or parallel busway were someday built through downtown Seattle – thus doubling the capacity of the DSTT—a single freeway HOV lane dedicated to BRT could bring in over 30,000 pph from the north, 15,000 from the south and 15,000 from the east. Again, this assumes the DSTT could handle 145 buses per hour in each direction thus giving it a directional capacity of 15,800 pph. In contrast, light rail is forever limited to 16,400 from the north, 5500 from the south. The east is limited 10,000 unless a second rail tunnel is built.

If, there is a desire to implement technology that will meet the region's long term capacity needs, BRT is the better choice.

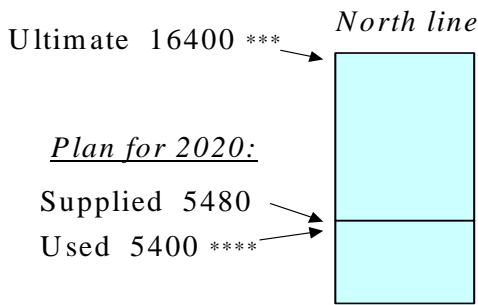
Figures 5.3.3a, 5.3.3b and 5.3.3c portray the capacity story graphically. They compare the capacity of Link versus BRT along the north, south and east corridors. Strictly speaking they compare the capacity of Link with BRT operating on a dedicated freeway lane. The author topped the BRT bar at 40,000 pph even though the theoretical limits are much higher. 40,000 is more than enough to make the point. The actual volumes on several BRT systems are shown to reinforce the point using real world examples.

Figure 5.3.3a

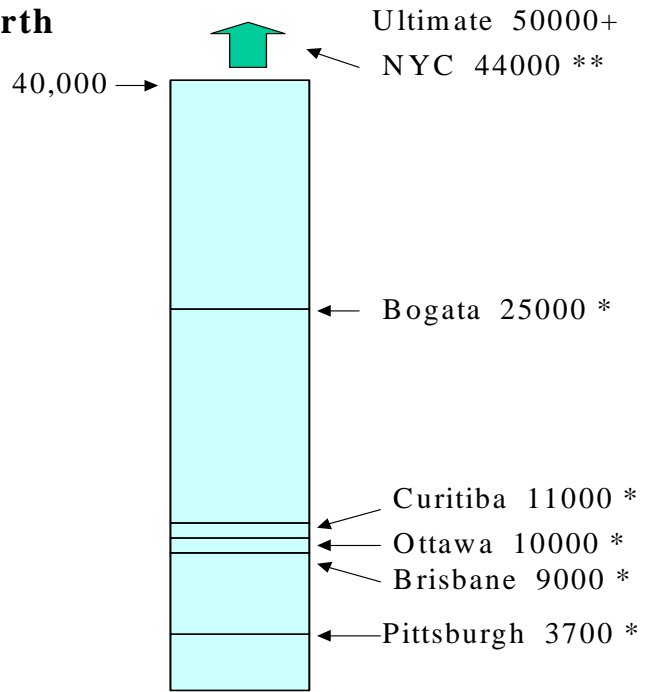
Capacity: BRT vs Link north

Persons/hr one way
at peak load point

- *Actual current use
- ** Based on current bus volumes, all seated
- *** Includes standees
- **** Assumes LRT goes to Northgate



Link Light Rail



BRT

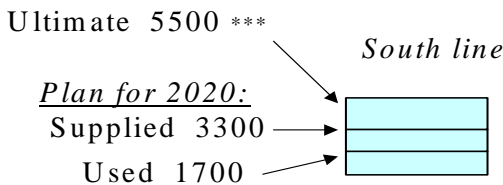
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Figure 5.3.3b

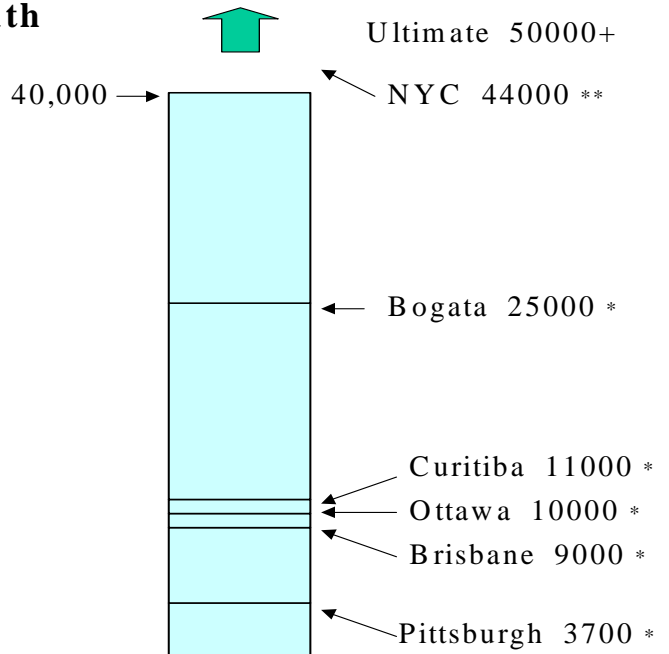
Capacity: BRT vs Link south

Persons/hr one way
at peak load point

- *Actual current use
- ** Based on current bus volumes, all seated
- *** Includes standees



Link Light Rail

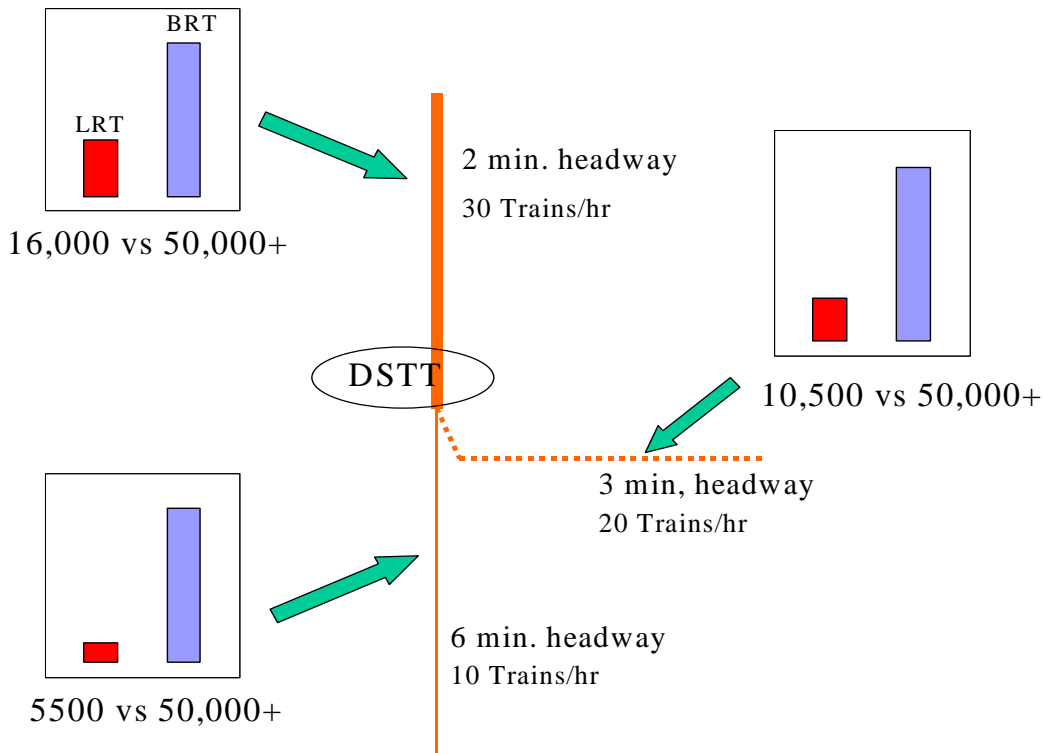


BRT

Harkness 3/03

Figure 5.3.3c

Ultimate capacity: Link LRT vs. BRT



Harkness 3/03

Again, note that BRT capacity in an HOV lane stretching north from downtown Seattle is not realistically limited by what the HOV lane might carry down across the ship canal (perhaps over 40,000) but rather what can be handled downtown by the DSTT, surface streets, and possibly by a second bus tunnel and/or busway over to SR 99. Just the addition of a second bus tunnel would raise what downtown could handle from 15,800 (assuming the DSTT could handle 145 buses per hour) to nearly 32,000. This is far more than any forecast for future demand.

It is immediately apparent from the height of the bars that an HOV lane devoted entirely to BRT would have far more capacity than Link could ever have.

In addition, the forecast ridership on Central Link (SeaTac to Northgate) is shown. For instance the chart shows that Sound Transit's Operating Plan for 2020 envisions operating trains at a frequency that would supply a capacity of 5480 pph on the north line, of which 5415 pph would actually be used if Sound Transit's ridership prediction is correct. It is obvious that the ridership predicted for Central Link is much lower than what BRT routinely handles in other cities. Again, BRT has more than enough capacity.

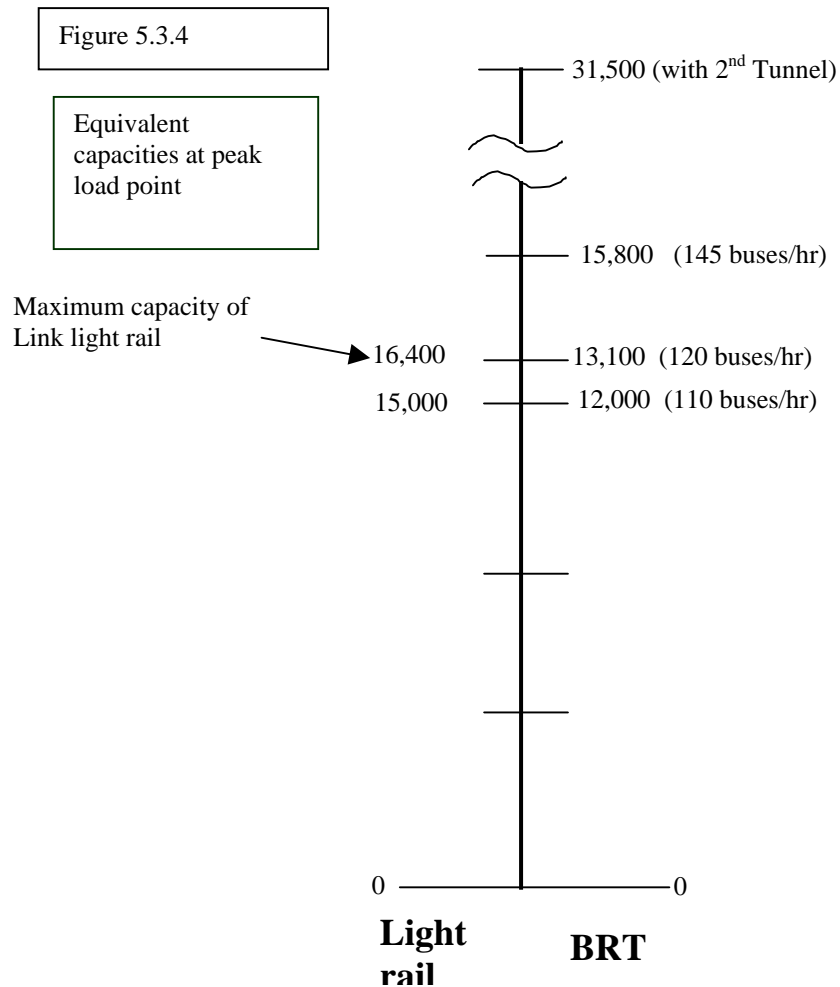
The main message from these charts is that BRT on a dedicated HOV lane would have far more capacity than Link, and could easily handle the number of passengers predicted to use Link in 2020.

A second important point is that it would not be necessary to devote an entire HOV lane to BRT because BRT simply wouldn't need that much capacity. Instead BRT buses would share HOV lanes with car and van pools.

5.3.4 BRT does not need as much DSTT capacity as rail to handle the same regional traffic load.

If bus and rail both had the same capacity in the DSTT the bus alternative would actually have more effective capacity to serve the north corridor than rail. This is because about 20 % of light rails capacity going north from the DSTT is used up by persons getting off in nearby Capital Hill (Ref 1: Fig. 3.21) (Ref 38: p.13) In contrast, a freeway based BRT system would leave Capital Hill patrons on short local bus routes as they are today, thus reserving all its capacity for the north corridor.

More specifically, light rail could move 16,400 persons per hour north out of the DSTT, but only about 13,100 pph worth of that capacity would be available to serve patrons going north of Capital Hill. In contrast freeway BRT would have its entire capacity available to serve the north corridor. Thus a BRT system able to operate 120 buses per hour in the DSTT –giving it a capacity of 13,100 pph—would have as much effective capacity to serve the north corridor as light rail with its DSTT capacity of 16,400.



These facts are plotted in Figure 5.3.4. The rail side of the figure plots various values of rail capacity, while the right side shows how much capacity BRT would need in order to move the same number of people up and down the north corridor. For instance, a BRT system able to operate 120 buses per hour at the peak load point would have the same maximum capacity in the north corridor as Link light rail. Moreover, an enhanced TSM (BRT) alternative requiring just 110 buses per hour in the DSTT would have been able to handle the same regional transit ridership as the Rail/TSM alternative with its peak load of 15,000.

This is an important point. If just 110 buses per hour were able to operate in the DSTT, as opposed to the 100 assumed by RTP, then:

- 1) The TSM alternative would have been able to handle its full “unconstrained” ridership, and negative comments like the following could not have been made in the 1993 FEIS:

“Neither the TSM nor the Transitway/TSM Alternative could accommodate the transit demand associated with implementing the Visions 2020 land use concept and consequently would not fully support its land use goals.” (Ref 1, p. 4-5)

- 2) An extended version of the TSM alternative could – even without increasing the number of buses on surface streets or building a second bus tunnel—have handled the same number of transit riders as the rail alternative. And negative comments like the following could not have been made:

“The TSM and Transitway/TSM alternatives were found to provide only a temporary solution to the transportation needs of the region. In the long term neither of these build alternatives offered the mobility or capacity necessary to support the adopted growth management policies, control sprawl or prove the mobility necessary for sustained economic vitality.” (Ref 19: p.23)

“Finally, only the Rail/TSM Alternative had sufficient capacity to accommodate transit demand in key areas such as the Seattle CBD...” (Ref 19: p. 25)

In sum, the effect of Capitol Hill on the capacity issue is not an obvious point and must be remembered when comparing bus and rail capacities in the DSTT. It means that if bus and rail alternatives are both designed to achieve the same regional transit ridership, the bus alternative needs only 80% as much capacity in the DSTT as the rail alternative.

5.3.5 Uncertainty about demand at the peak load point places ST in a bind.

We now turn from discussing capacity to discussing demand, and how demand relates to capacity.

There are three statements in the RTP and ST literature that address demand at the peak load point. First, the 1993 FEIS said that a 125-mile rapid rail system would have a peak one-way load in the year 2020 of 15,000 persons per hour just north of the DSTT. (Ref 1: p.2-58)

Second, the Feb. 2002 EA for Link’s Initial Segment said: “Long range ridership projections for Sound Transit estimate up to 15,000 Central Link riders in the peak hour peak direction at the peak load point (assumed to be in the DSTT).” (Ref 18: Appendix L, p.23).

There are several problems with this statement. First, although ST said “Central Link” they must have meant a mature 100+ mile version of Link. Nothing else makes sense since they had previously estimated peak ridership on Central Link was only 5415 pph.

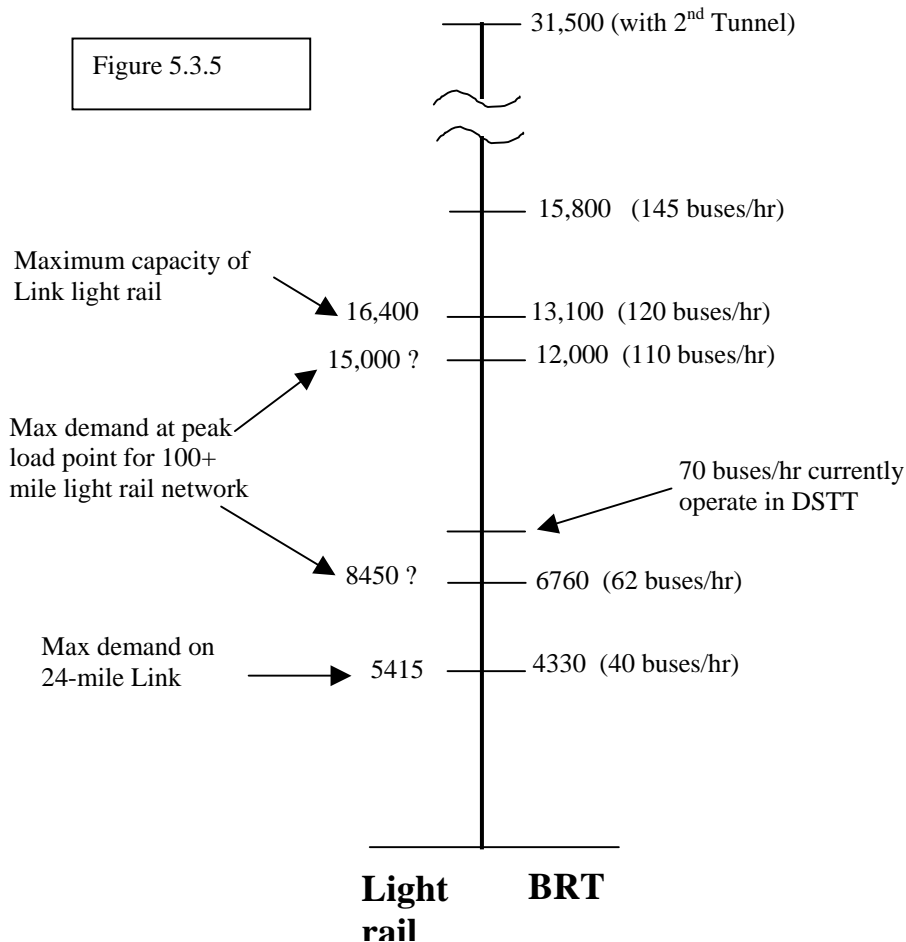
Second, the 15,000 number appears to be just blind repetition of the 15,000 number in the 1993 FEIS, and is probably wrong for a variety of reasons. For one thing Link is slower than rapid rail so a mature light rail network would attract fewer riders than a mature rapid rail network. Second, it is very unlikely ST has modeled a mature version of Link, and even more unlikely that such modeling would have produced exactly the same 15,000 value. Despite these problems ST did publish this number and we need to examine its consequences.

The third data point is the Fleet Management Plan for the 24-mile Central Link, which states that the peak load would be 5415 pph in 2020. (Ref 38: p.13) This is not directly useful since it applies to a 24-mile subset of what could be a 100+ mile light rail network, and we need the value for that mature network. Nevertheless it is a useful number. As it came from a relatively recent modeling exercise for Central Link it is probably fairly accurate.

This presents a dilemma. We need an estimate of peak loading on a fully built out version of Link in order to determine whether Link would have enough capacity, as well as to see whether or not a BRT system carrying the same overall number of transit riders would have enough capacity. We can either accept ST's statement that 15,000 is correct, or derive an estimate from other data. This is done below, but since the results differ a great deal and I can't prove which is correct, I will describe the implications of both.

Author's estimate of peak load on a mature version of Link-- Rather than accept ST's figure of 15,000 there is another way to estimate the peak load point volume on a mature or fully built out version of Link. That way is to take ST's forecast for the peak load on the 24-mile version of Central Link and factor it up based on ridership patterns on RTP's 124-mile rapid rail system. The peak load predicted for Central Link was 5415 pph in 2020. (Ref 38: p.13) An analysis of ridership on RTP's rail system indicates that peak load point volumes on the full 124-mile rail network would be about 1.58 times the peak load point volume on a portion of that network equivalent to the 24-mile version of Central Link. Details for computing that ratio are given in the Tech Notes.

Assuming this same ratio applies to Link, a mature 100+ mile version of Link would probably have a peak load of about 1.58 times the peak load on the 24-mile Central Link. This comes to 8450 pph. (5415 x 1.58) The author fully acknowledges that 8450 is a rough estimate, but it is probably accurate enough to support the points that follow. These demand figures are plotted in Figure 5.3.5 along with their BRT equivalents.



Implications of the two conflicting estimates-- The entire capacity issue hinges on whether rail and buses have enough capacity to handle projected demand in 2020, and beyond. The preceding paragraph revealed two conflicting estimates of projected year 2020 demand: 15,000 and 8450. It's not clear which is correct. Therefore:

If 15,000 is correct:

- 1) Although light rail with its capacity of 16,400 could handle the 2020 demand of 15,000, it could not meet the region's long term needs since it would not have enough excess capacity to handle demand growth much beyond 2020. In other words light rail is not strategic.
- 2) Buses do have adequate capacity so they can't be ruled out as being inadequate to handle 2020 demand or meet the region's long term needs. Therefore an all-bus solution like BRT is strategic.

If 8450 is correct:

- 1) Light rail could handle 2020 demands with extra capacity for growth.

- 2) The bus capacity issue clearly disappears, but by an even wider margin. It would only take 62 tunnel buses per hour to service this demand, and that is fewer than operate in the tunnel today.
- 3) Buses clearly can't be ruled out as being inadequate to handle 2020 demand or meet the regions long term needs. Again BRT is strategic.
- 4) The TSM bus alternative in the 1993 FEIS could probably attract and carry more transit riders than a mature version of Link. The TSM alternative in the 1993 FEIS had 85% (474,000/560,000) as many riders as the rapid rail alternative. In contrast a mature light rail network with a peak load of 8450 would have only about 57% (8450/15000) as many riders as the rapid rail alternative with its peak load of 15,000. In other words, the original TSM design, without extension and certainly without a second bus tunnel, could probably out-perform a mature light rail system in ridership. This intriguing theme won't be pursued further since doing so would overly complicate this report and isn't necessary to support the report's main conclusions. It is simply one more reason why an apples-to-apples comparison is needed between a fully mature version of Link and an all-bus alternative. Until then we can only estimate the relative merits of a mature version of Link vis a vis an all-bus alternative by extrapolating from data in the 1993 FEIS for rapid rail.

This “if, then” analysis places ST in an embarrassing bind. If ST sticks with the 15,000 figure it must admit that Link is not strategic and therefore disappoint supporters who justify Link on the assumption it will meet the needs of our children and grandchildren. In addition, ST must admit that bus alternatives –if properly designed-- do have enough capacity and should have never been taken off the table for capacity reasons. On the other hand if ST accepts that 8450 may be more accurate, ST is forced to admit --even more assertively and without qualification-- that buses could easily do the job since it wouldn't even require more buses in the DSTT than currently operate there.

5.4 Other capacity issues

5.4.1 Even before 2020, Link may not have sufficient capacity to handle demand on the south line

The peak load point on Link's south line would be just south of the International District station. Capacity at this point depends on headway. Although elsewhere ST claims to be able to operate on as little as 5-minute headways in the Rainier Valley this may be overly optimistic (Ref 38: p.iii). The 1993 FEIS says: “Conventional transit practice and highway standards suggest that when train frequencies are under 6 minutes, cross traffic on arterials will be affected to the extent that grade separation is necessary.” (Ref: 1, p.2-50) Even then 6-minutes requires merging eastside trains perfectly so as to achieve 2-minute headways in the DSTT. In any case the author assumes for purposes of this report

that 6 minutes is the best Link could do. Six-minute headways would give the south line a maximum capacity of 5470 persons per hour.

One potential way to provide extra capacity at the peak load point on the south line would be to run trains on three minute headways down past the peak load point and then reverse every other train at Beacon Hill so headways in the Rainier valley stay at 6-minutes. ST mentions this idea but says that any reversal north of Henderson is impossible. (Ref 38: p.11) Thus capacity of the south line can be no more than 5470 through the peak load point.

The “Fleet Management Plan” for Central Link shows year 2020 peak loading on the south line would be about 4300. (Ref 38: p.24) However, it is relatively hard to say what peak loading on the south leg of a mature network might be based on that figure. However there are two other ways to estimate it. Again, both are based on ridership patterns in the 124-mile rapid rail network. Again, both depend on whether the peak load on a mature version of Link would be 15,000 or 8450.

The first uses the map of route volumes in the 1993 FEIS. Figure 3.21 in that report shows that daily demand on the most heavily used portion of the north line is 124,000 riders per day, whereas the most heavily used portion of the south line carries 59,000 persons per day. The ratio between them (2.1 to 1) should also apply to peak loads at their respective peak load points. Thus if peak load on the north line is 15,000 peak load on the south line would be 7140 pph. If peak load on the north line is 8450 then peak load on the south line would be 4020.

The second approach assumes the ratio between passengers going into the north corridor (from the CBD east and south corridors) and passengers going into the south corridor would be the same as the ratio between the peak loads into those corridors. The RTP's Travel Forecasting Results Report says that 88,600 daily trips go to the north corridor while 61,000 go to the south corridor. This is a ratio of 1.45 to 1. Thus if peak load on the north line is 15,000 peak load on the south line would be 10,340 pph. If peak load on the north line is 8450 then peak load on the south line would be 5830.

The author has no way to determine which of the four estimates above is best. However, in three of four cases, demand exceeds capacity at the peak load point on the south line.

Once again, the uncertainty about demand places ST in a bind. If ST asserts that 15,000 is correct, then Link would not have enough capacity to meet even year 2020 demands on the south line. On the other hand, if ST finds that 8450 is more nearly correct, then once again ST can't claim buses lack sufficient capacity.

Given the uncertainty, it is important to conduct a new and proper alternatives analysis wherein one of the alternatives is a fully built out 100+ mile version of Link, per the dreams of ST management. This would provide a much better estimate of peak load point volumes than we have today and provide a more definitive answer to the capacity questions posed earlier.

5.4.2 Link's design shortchanges the south corridor in terms of capacity

At great expense, officials decided to tunnel and otherwise entirely grade-separate Link north of the DSTT. Besides improving safety, this allowed 2-minute headways in the north corridor. In contrast, they decided to save money by running parts of the south line on surface streets. As a result the south corridor gets only one-third the people moving capacity afforded the north corridor. This may be an equity issue since taxpayers in the south corridor pay at the same rate as those in the north.

5.4.3 Sound Transit's EIS makes the false claim that light rail can move as many people as a 12-lane freeway.

The 1999 FEIS for Central Link contains the following statements:

“ For example a light rail line can move the same number of people at peak travel hours as a 12 lane highway,....” (Ref 2 p.1-9)

“The proposed light rail line would provide the same people moving capacity as a 12 lane highway...” (Ref 2: p. 1-9)

Sound Transit board members have further distorted the truth with statements like the following:

“When this system is up and running - Northgate to SeaTac - in 2020, it will carry as many people every day as I-5 does today.” (ST Board member Cynthia Sullivan's statement on Dave Ross's March 12, 2003 radio show)

This issue must be dissected in two parts. First, is to compare how many people light rail can or could carry versus what a 12-lane highway can or could carry. This type of comparison is essentially irrelevant and meaningless, but that is how the EIS statements were worded and a response is warranted. The second, is to compare what highways actually carry with Sound Transit's predictions of what light rail is actually expected to carry. The latter is far more relevant.

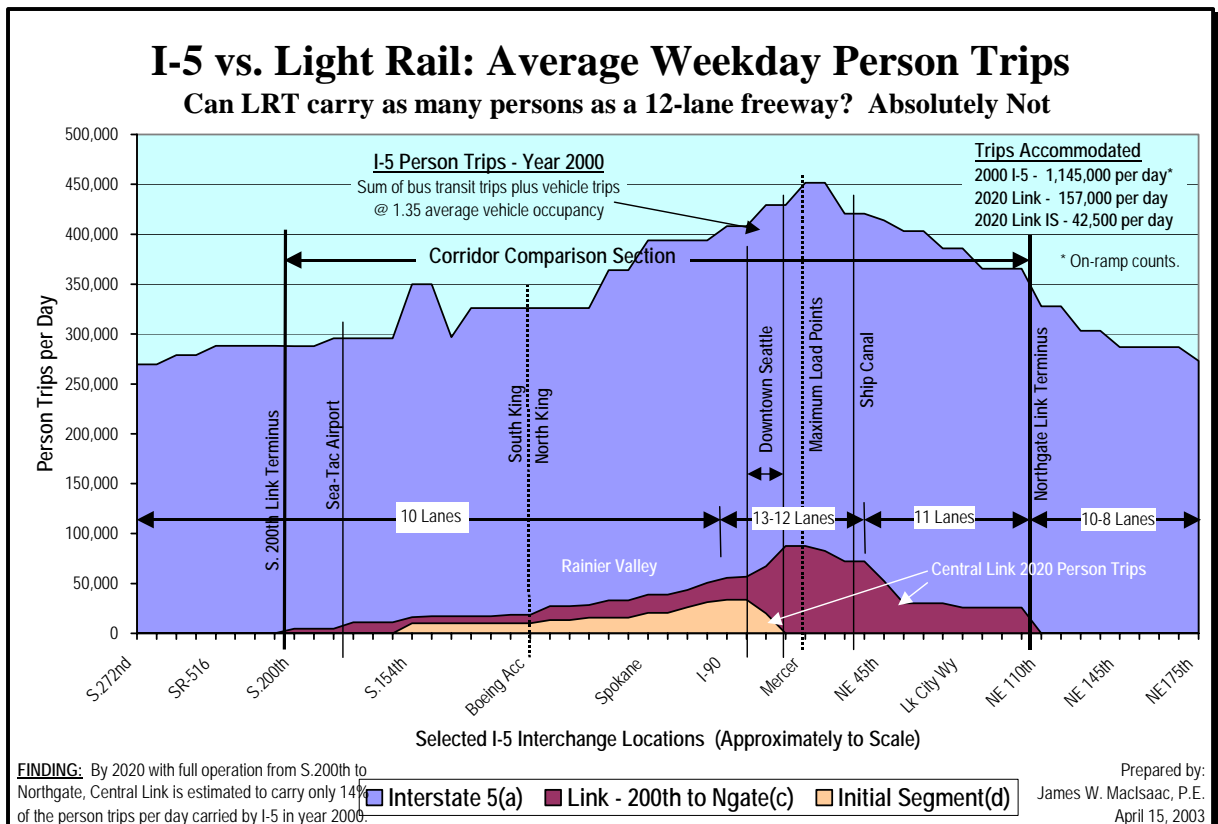
The first is simple. Link light rail has a maximum one-way capacity of 16,400 persons per hour. As explained in Addendum F a single highway lane devoted to BRT could carry well over 50,000 persons per hour. The theoretical maximum is probably over 70,000, but it seems pointless to seek an exact number since no busway in the world requires much over 40,000. If a single lane devoted 100% to buses could carry over 50,000 pph it is obvious that even a single highway lane devoted to a mixture of buses, carpools and vanpools could carry more people than Link. Thus Sound Transit's EIS statements are patently false, and are simply meant to mislead. They typify Sound Transit's habit of using Environmental Impact Statements to sell rather than to inform.

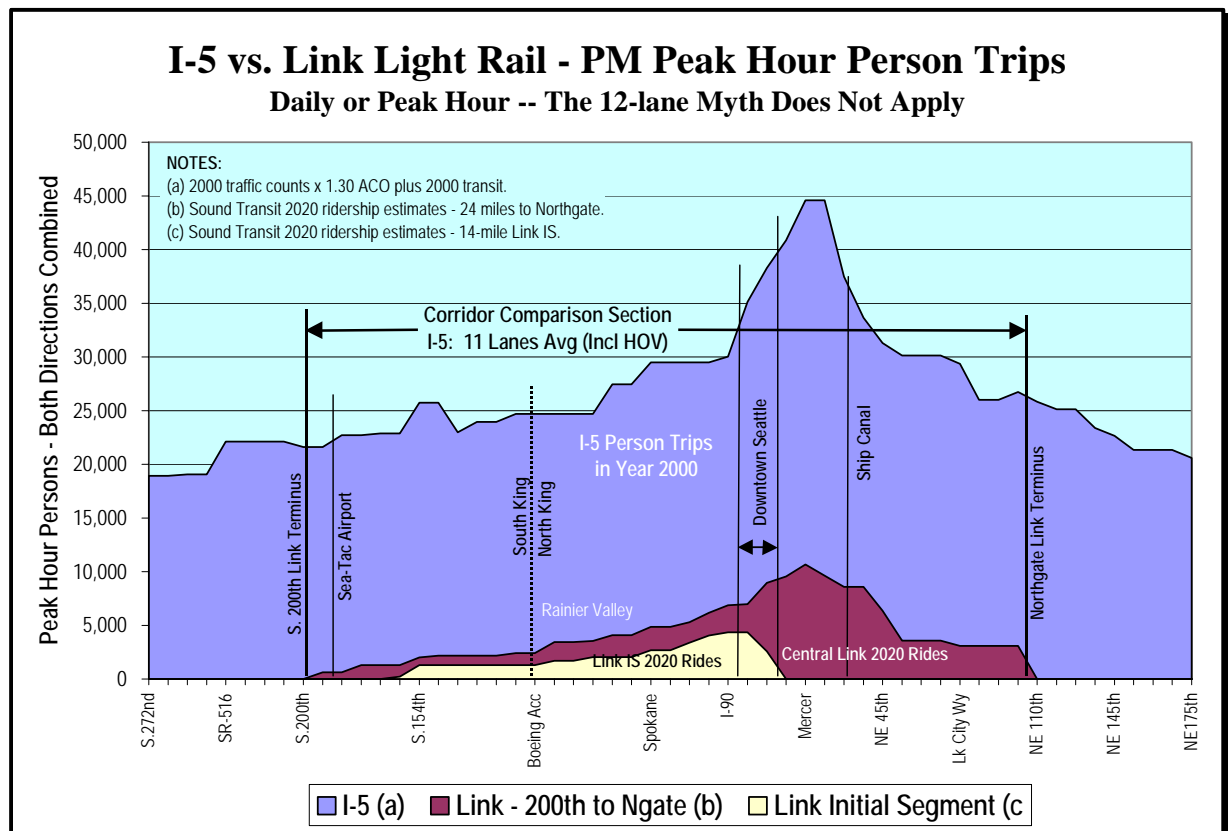
Transportation consultant Jim MacIsaac has compared the actual number of people carried on I-5 today with the number Sound Transit predicts would ride light rail in 2020. His charts are reproduced below.

Mr. MacIsaac found that in the year 2000 Interstate 5 carried 412,700 persons per day across the Ship Canal, in contrast to the 72,200 predicted for Link in 2020. (these are bi-directional daily volumes) Since Interstate 5 has 12 lanes across the Ship Canal it is quite apparent that Link would not be carrying as many people as a 12-lane freeway even here where Link is heavily used.

The overall utility of a facility can better be shown by looking at the total number of people it serves along its entire length. In this respect Mr. MacIsaac found that 1,145,100 persons “boarded” I-5 along the 23-mile stretch paralleling Central Link. In contrast Central Link would have 157,000 boardings. This clearly shows that the Board member’s statement “...in 2020, it will carry as many people every day as I-5 does today” was vastly incorrect.

In sum, Sound Transit’s claim that Link is equivalent to a 12-lane freeway is simply false. Based on Sound Transit’s predictions for Link ridership the best it would do by 2020 is carry somewhat more than a single lane pair on I-5 carries today through downtown Seattle. Along most its route Link would carry less on a daily basis than a single freeway lane pair (ie: 2-lane freeway).





5.4.4 The planned redevelopment of the Alaska Way viaduct and south Lake Union area offer a new possibility to establish a second major “busway” through downtown Seattle.

A quick look at the Seattle map shows that it might be possible to construct a grade separated “busway” extension from the Mercer St express lane exits, go west a few blocks through the south Lake Union area, then tie into SR 99. Buses may need to mingle with cars for a short distance on SR 99 but then if the new Alaska way “tunnel” contained HOV lanes they could proceed south to serve the Duwamish and West Seattle corridors, and even loop back into I-5. This would effectively create a second major route for bus HCT through Seattle. The busway could be aesthetically integrated with the planned construction in south Lake Union and provide service to that important emergent growth center, which light rail completely ignores. It could also better serve the growing Belltown area. This would give buses another major route through downtown and probably eliminate any capacity constraint imposed by the DSTT. These possibilities were not apparent at the time of the 1993 FEIS, another reason that document is obsolete.

5.4.5 Placing light rail on the I-90 bridge will reduce the bridge’s usable capacity.

Sound Transit is currently maneuvering to have the center roadway on the I-90 bridge designated for exclusive use by high capacity transit or HCT. To Sound Transit HCT

really means light rail. Such an action would reduce the capacity of the bridge. The reason is not complex. According to the 1993 FEIS during peak periods there would be 11 trains per hour on the bridge by 2020. (Ref 1: p. 3-112) At 537 persons per train this amounts to only 5900 persons per hour. There is little reason that light rail would attract any more transit riders than would BRT in that corridor (the author knows from experience express buses provides excellent service) so one can assume BRT would also carry at least 5900. It would take about 54 buses per hour or roughly one per minute to carry this load. There would be plenty of room to fit other HOV vehicles between the occasional buses. Thus if the center roadway were used by a combination of BRT buses (carrying 5900 pph) + van and car pools + school buses + emergency vehicles + other HOVs its capacity would be considerably greater than if dedicated to light rail carrying just 5900. Given that right of way is probably the most precious transportation resource in an urban area, maximizing its use would seem a high priority.

Sound Transit might argue that it is not removing any lanes—by taking the two wide center lanes while adding two more narrow lanes on the outside of the bridge—and is therefore not reducing bridge capacity. However, ST is reducing bridge capacity below what it would be if the center lanes were put to the mixed use described above.

A proper FEIS would address this issue.

5.4.6 Unless light rail is extended to the eastside, devoting the DSTT to light rail will reduce the capacity of that facility to handle commuters to and from Seattle's CBD.

The issue here is getting maximum people moving benefit from King County's investment in the DSTT. If light rail does not go across Lake Washington the DSTT will be able to move a maximum of about 21,000 persons into downtown during AM peak hour (or out in the PM). This would be comprised of 16,400 from the north and 5500 from the south. In contrast buses in the tunnel could move about 32,000 persons per hour into the downtown. This assumes tunnel buses are operated efficiently (145 buses per hour) and can therefore move in 15,800 from the north plus 15,800 from the south and east.

There is no guarantee that Link's Initial Segment, much less Central Link, will ever be extended. This, plus the fact that a partly completed light rail system would compromise the bus system, are among the type of risks that a proper alternatives analysis would address.

5.4.7 In the far distant future the region might need heavy rail, not light rail.

There is no capacity crisis that demands or deserves rail in the foreseeable future. BRT can easily handle the demand for many years to come. In the unlikely event the region ever gets dense enough to outgrow BRT it would take a completely grade-separated heavy rail system like BART, not light rail, to solve the problem. BART-like systems

use long trains and have one-way capacities in the 40,000 pph range as opposed to Link maximum of 16,400.

Such a system could always be built later. (Although not across the I-90 bridge for structural reasons.) The rights of way are not disappearing forever. The subsoil under Capitol Hill, under the Ship Canal, and along the proposed rail line is not being pre-empted for other uses. Tunneling technology will continue to advance.

In short, there's no urgency to build the ultimate system as an investment for our grandchildren, and the ultimate system wouldn't be light rail in any case.

5.4.8 Putting the capacity issue in perspective.

The above analysis has shown that a fully mature version of Link light rail, extending over 100 route miles would probably have a peak load point volume of roughly 8500 persons per hour in the peak direction by 2020. This is the best estimate we have at this time since it is based directly on the ridership forecast for Central Link factored up with ratios from the rapid rail studies. As explained above a comparable BRT system would need about 80% as much capacity as light rail at the peak load point, or 6800 pph. This translates into about 63 buses per hour, a small fraction of what an HOV lane could carry. According to the Transit Capacity and Quality of Service Manual published by the Transportation Research Board, an HOV lane used exclusively for buses could carry 800 to 1000 buses per hour. Sixty three buses per hour can easily be carried by the existing express lanes on I-5 and the existing DSTT. This very, very netted down summary begs the question: Given what we know today, why should there be any concern about bus capacity?

The following comments from the METRO Six-Year Plan dated Dec.1995 also help put the capacity issue in perspective:

“The existing transit system has a significant amount of underutilized capacity.

* Less than 3 percent of currently scheduled bus trips run more than 90 percent full.

* During the PM peak commuter period (3:00 to 6:00 pm), only 56 percent of the seats on the buses leaving downtown Seattle are filled. Utilization is even lower on buses departing Bellevue and the University District.”

In other words, the problem is lack of demand not the shortage of capacity.

Another key point re capacity is that there is no specific benchmark, target or figure that represents the region's need, even in a particular year like 2020. The larger or more intensive (frequency of service, number of routes) the rail or bus system is, the more ridership it would attract and thus the more capacity it would need to carry that ridership. However, the size or intensity of the transit system is simply a variable, which depends on how much society decides to spend on it. If the RTP had chosen to propose a 50-mile

rail system costing say \$6 billion rather than a 125-mile system costing \$11.5 billion the maximum load would have been much less than 15,000. And a bus system with the same overall ridership would have had a max load in the DSTT so low as to raise no concern. As it was the RTP chose to study alternatives whose ridership was just large enough to make bus capacity an issue, but small enough to keep rail capacity from becoming one.

In short the amount of capacity we need depends on the level of demand, which in turn depends on how large a transit system we intend to build. And how large a system we intend to build depends on how much additional transit ridership we want to buy. It all comes down to the cost and affordability of generating additional demand. Thus the two key policy questions are these:

- 1) Which is the least expensive way to buy added transit ridership, bus or rail?
- 2) How much should we buy? (How much is affordable? Given the law of diminishing return, at what point does the ever increasing cost of buying additional transit ridership outweigh the benefit?)

The focus should be on answering those questions. Capacity should be relegated to its proper place, which is just one of the underlying technical details addressed along the way.

5.4.9 Main conclusions for Part 5

- 1) The RTP unfairly manipulated the 1993 FEIS in a way designed to make the bus alternatives appear to have insufficient capacity. This was done, in part, by putting forth a bus alternative with known but correctable capacity limitations.
- 2) Statements in the 1993 FEIS alleging that an all-bus alternative would not have sufficient capacity are misleading and incorrect.
- 3) A properly designed all-bus alternative would have more capacity than Link light rail. It would have enough capacity to handle forecast transit ridership in 2020, and far beyond.
- 4) There has been no ridership forecast nor capacity analysis done for a mature or fully built-out version of Link light rail, therefore it is somewhat uncertain such a network would have sufficient capacity to handle its projected ridership.
- 5) Although it purports to, the 1993 FEIS does not provide proper justification for continuing on a rail-centric strategy for capacity reasons. This is one reason the FTA should not accept the DSEIS for ST's Long-Range Plan, since the DSEIS is based on the 1993 FEIS.

- 6) The capacity issue is a red herring that has diverted attention from more important issues, especially the relative cost-effectiveness of rail and bus alternatives as means to increase transit ridership and reduce travel delay.
- 7) The faulty findings of the 1993 FEIS appear to have been instrumental in directing the region toward choosing rail rather than bus technology for the backbone of the region's high capacity transit network.
- 8) A new and proper alternatives analysis is needed in order to officially confirm or deny these findings, provide more accuracy to the various numbers estimated herein, and stimulate reconsideration of the regions current rail-centric strategy. To accomplish this the analysis would need to consider a number of different size light rail networks ranging from Links 14-mile Initial Segment up to a fully mature 100+ route mile version of Link. Each of these different size light rail networks should be compared against bus or BRT alternatives designed to achieve equal ridership.

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Part 6: Cost Effectiveness Issues

6.1 The 1993 FEIS masked the poor cost-effectiveness of rail

The voluminous 1993 FEIS contained very little information on cost-effectiveness. What little it did contain was summarized in Table 4, which is scanned in just below.

Table 4. Summary of System Alternatives Characteristics.

Alternative	Capital Cost (billions of 1991 \$)	Operating and Maintenance Cost (millions of 1991 \$)	Daily Ridership (Year 2020)	Annual Ridership (year 2020) (millions)	Cost per Rider (1991 \$)	Cost per New Rider (1991 \$)
No-Build	\$1.2	\$274	388,500	109.4	3.67	N.A.
TSM	\$4.7	\$399	473,900	133.7	5.92	N.A.
Transitway/ TSM	\$5.5	\$406	480,000	135.4	6.36	11.39
Rail/TSM (includes Commuter Rail)	\$11.5	\$492	560,500	157.3	7.94	12.52

No-Build Alternative

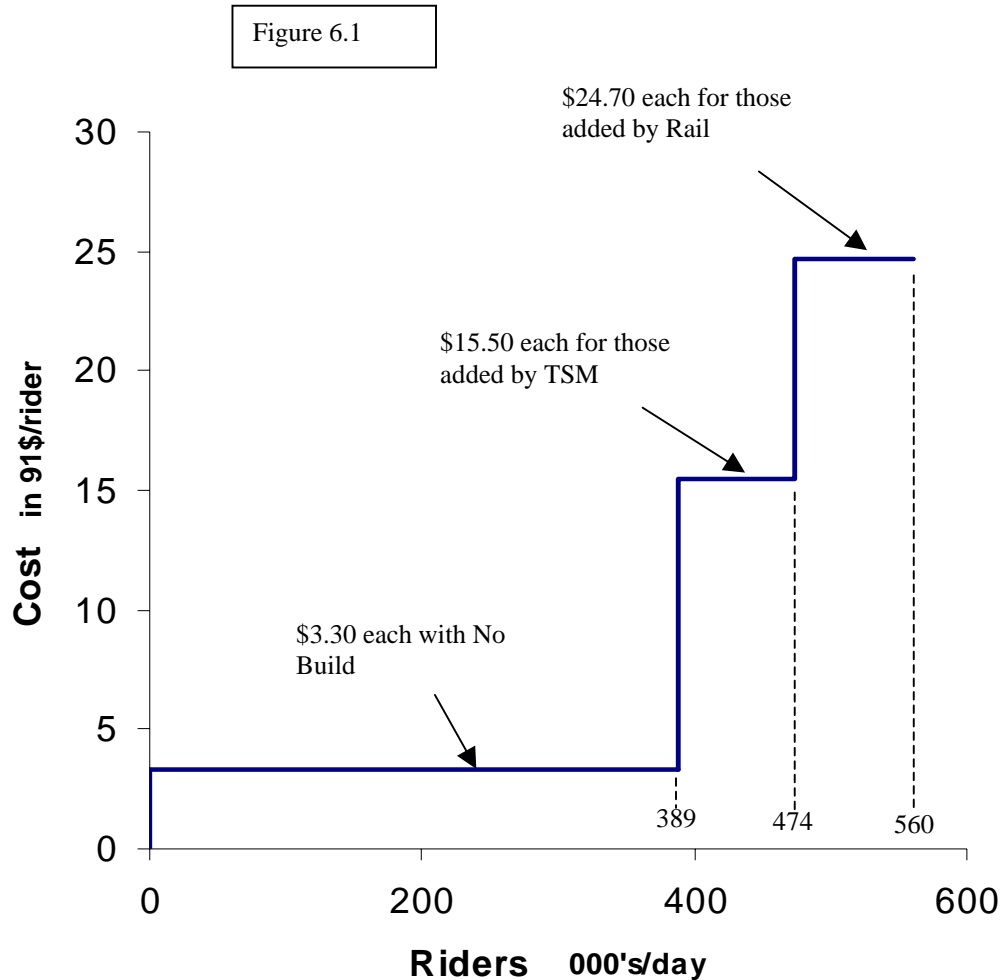
Whether by ineptitude or design the way the information was presented in Table 4 masked the fact that rail is much more expensive than buses as a way to increase transit ridership. Just looking at the \$7.74 versus \$5.92 values in Table 4 doesn't shock the reader into realizing that.

Figure 6.1 takes the information in Table 4 and presents it in a way that does highlight this information. What Figure 6.1 shows is that if nothing special is done to improve transit, by 2020 the existing bus system (NoBuild) will attract and serve 389,000 daily riders at a cost of about \$3 each. (Each so called "rider" is actually a single one-way trip) However society could increase ridership another 85,000 by implementing the TSM bus alternative. Those extra 85,000 riders would come at a cost of about \$15 each. Then, if still more riders were desired, society could add the 125-mile rapid rail system in addition to TSM. This would add a still additional 86,000 riders, at a cost of about \$25 each.

NOTE: The data sources and calculations behind the charts below can be found in the Tech Notes at the back of this report. The author's No-Build cost per rider differs slightly from that in Table 4 due to differences in the way capital costs were annualized.

Presenting the information in this way properly calls attention to several important policy issues. First, it shows that adding riders using rail as about twice as expensive as adding them using TSM. This begins to call attention to rails high cost, relative to bus, as a way of increasing transit ridership. It also it shows that increasing ridership by investing in massive transit projects such as Rail/TSM is quite expensive relative to what society has

been willing to spend on transit historically. Finally, it begs the question: “Is it worth it?.” Is it worth spending \$15 or \$25 per ride just to increase transit ridership?

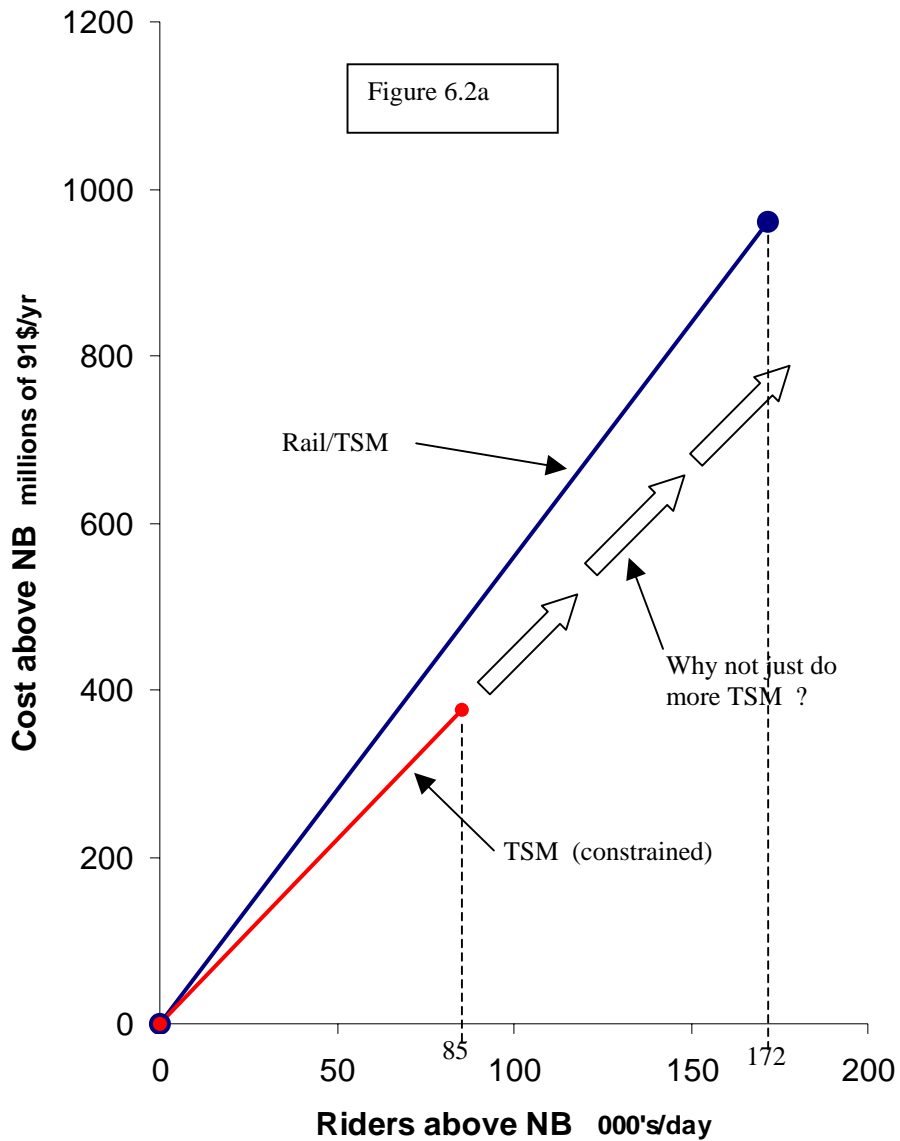


The 1993 FEIS was deficient, if in fact not deliberately deceptive, in not having presented cost and ridership information in a way that highlighted these points.

6.2 The 1993 FEIS failed to explore the possibility of extending TSM to higher ridership levels.

A plot to visualize key performance versus cost relations can be useful. An FEIS that genuinely attempts to educate should make use of such graphics.

Thus Figure 6.2a simply plots the data in Table 4 to show graphically how ridership increases in proportion to money spent. The dot at the end of each line shows the cost and ridership that would occur if the alternative



were fully implemented. In other words if the Rail/TSM alternative described in the 1993 FEIS were fully implemented it would involve building 125-miles of rapid rail, cost \$960 million/year more than the No Build alternative and attract 172,000 more daily transit riders than would the NoBuild alternative.

However, it is possible to implement scaled-back versions of the alternatives, such as a shorter rail system or a smaller TSM system. These would cost less and attract less ridership but be incremental steps toward the mature systems.

Thus each of the lines in Figure 6.2a can be thought of as a strategy thrust, something starting at lower left (the No Build base) and expanding incrementally along the line until either the money runs out or the ridership goal has been obtained. This is because the HOV segments, park and ride lots, and increased bus services that comprise the TSM

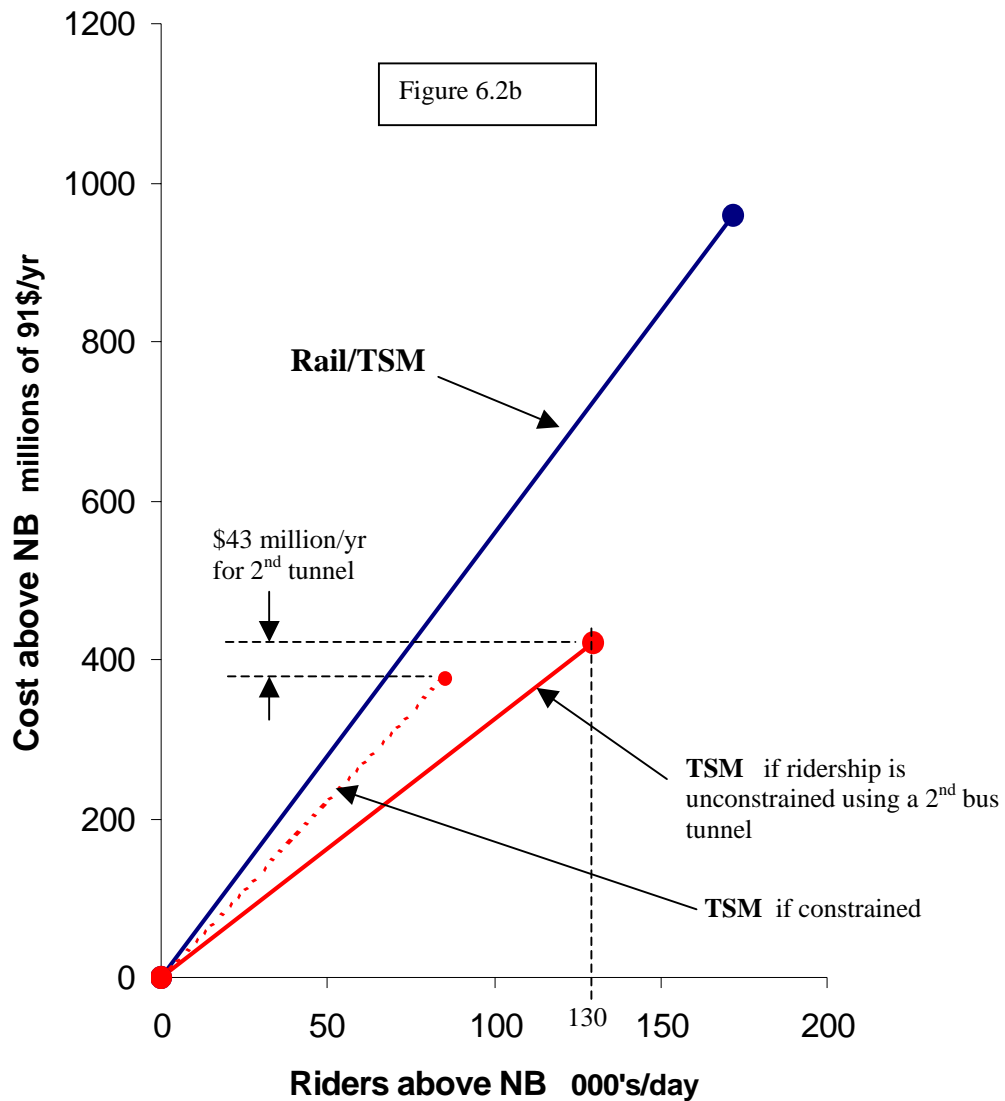
alternative can be built incrementally, with each improvement bringing more TSM ridership. Likewise the 125-mile rail system can be built a leg at a time or even a station at a time, each improvement leading to increased ridership. The general relation is clear, the more money spent on each of these strategic thrusts, the more ridership it will attract.

A glance at the arrows in Figure 6.2a shows why extending TSM seems attractive; namely it appears TSM could reach the same ridership as rail, but at less cost. The RTP acknowledges that extending TSM is possible. In one report RTP addresses the “Incremental Cost to Expand Capacity” saying: “The cost to expand the No Build, TSM, and Transitway/TSM Alternatives is identical at an estimated \$2.1 billion per additional 100,000 passenger carrying capacity.” (Ref 45: p.46)

However, the FEIS didn’t consider this possibility. Instead, as was explained in Section 5, the FEIS claimed TSM ridership was capped at 474,000 (85,000 over no build) due to an alleged 100 bus-per-hour capacity limitation in the DSTT. (An internal Metro memo from 1992 obtained by the author indicated a level of staff concern about this, and might be relevant if there is any investigation of wrongdoing. See Section 5.4.3 for quotes from this memo.)

The author has therefore constructed Figure 6.2b to show how the cost picture would have looked had the RTP removed the capacity constraint using what is probably the most expensive option; namely building a second bus tunnel costing \$600 million. This would have allowed TSM to achieve its “unconstrained” ridership level of 518,000 daily riders (130,000 above No Build), rather than its constrained ridership of 474,000.

The end result in Figure 6.2b is a scenario wherein TSM -- with 518,000 riders-- has gotten much closer to rails ridership without a dramatic increase in cost. The cost of the tunnel appears relatively insignificant in the big picture.



At this point, and with the second tunnel in place, TSM has no further capacity limitations. However, since TSM is doing more, there is less remaining for rail to contribute. The number of additional riders rail could add above and beyond TSM has diminished from 86,000 to just 42,000. In other words adding the 125-mile \$7.9 billion rail system would only increase ridership by 42,000 riders. Above and beyond what the unconstrained TSM alternative would attract.

Figure 6.2c shows what that means in terms of cost per rider. Figure 6.2c is essentially Figure 6.1 updated to show the impact of adding the second bus tunnel or some other way to relieve the capacity bottleneck so TSM can achieve its unconstrained ridership. Figure 6.2c shows it would cost \$48 (in 91\$) per ride for each of the 42,000 additional daily transit riders rail attracts. Again Figure 6.2c begs the question: how much is it reasonable to pay to expand transit ridership? Today bus fares average 80 to 90 cents, perhaps rail

fairs would be higher, but the remainder (probably \$45+per ride) would be a public subsidy. (Later Figure 6.3b will show how Figure 6.2c looks when updated to current conditions.)

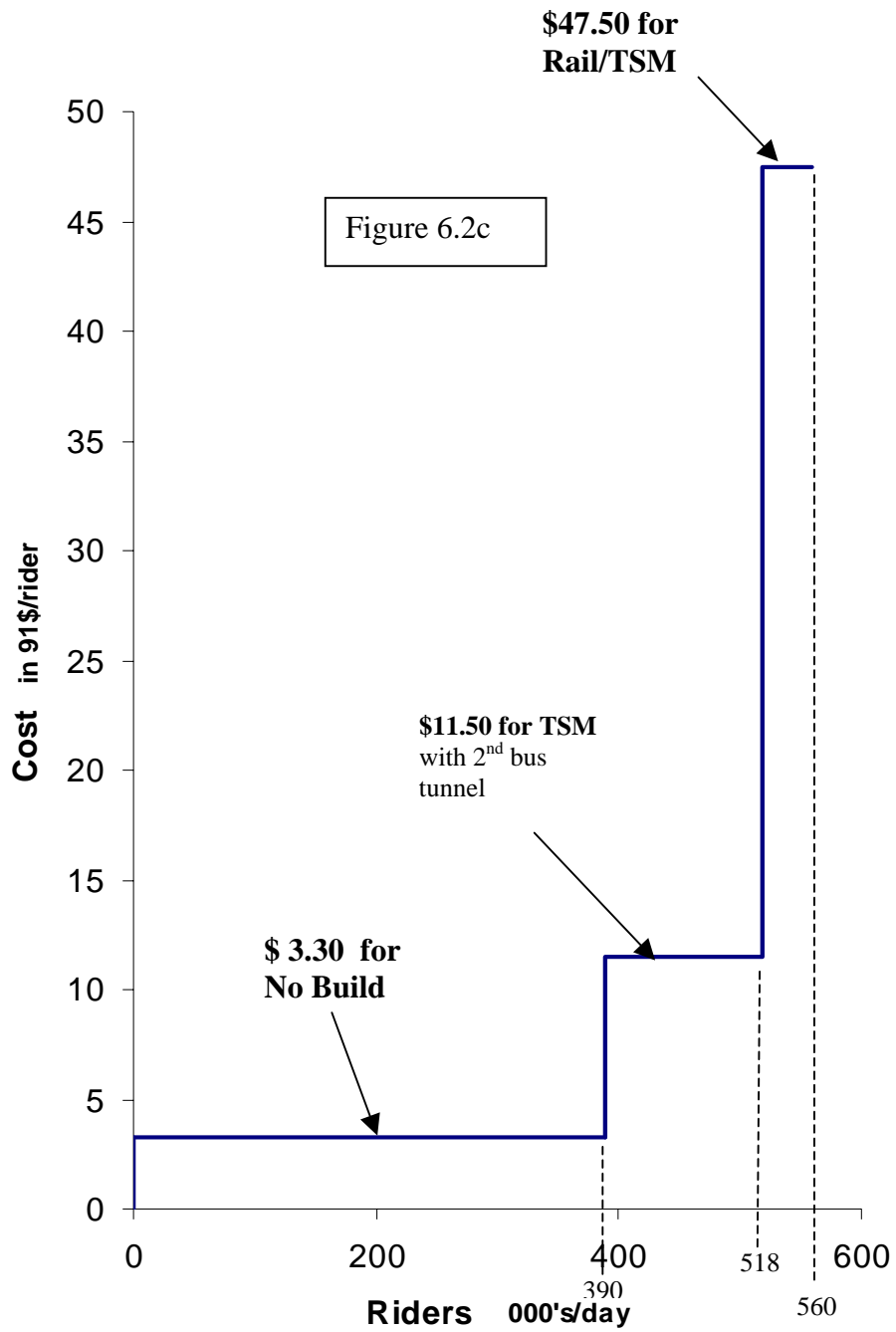
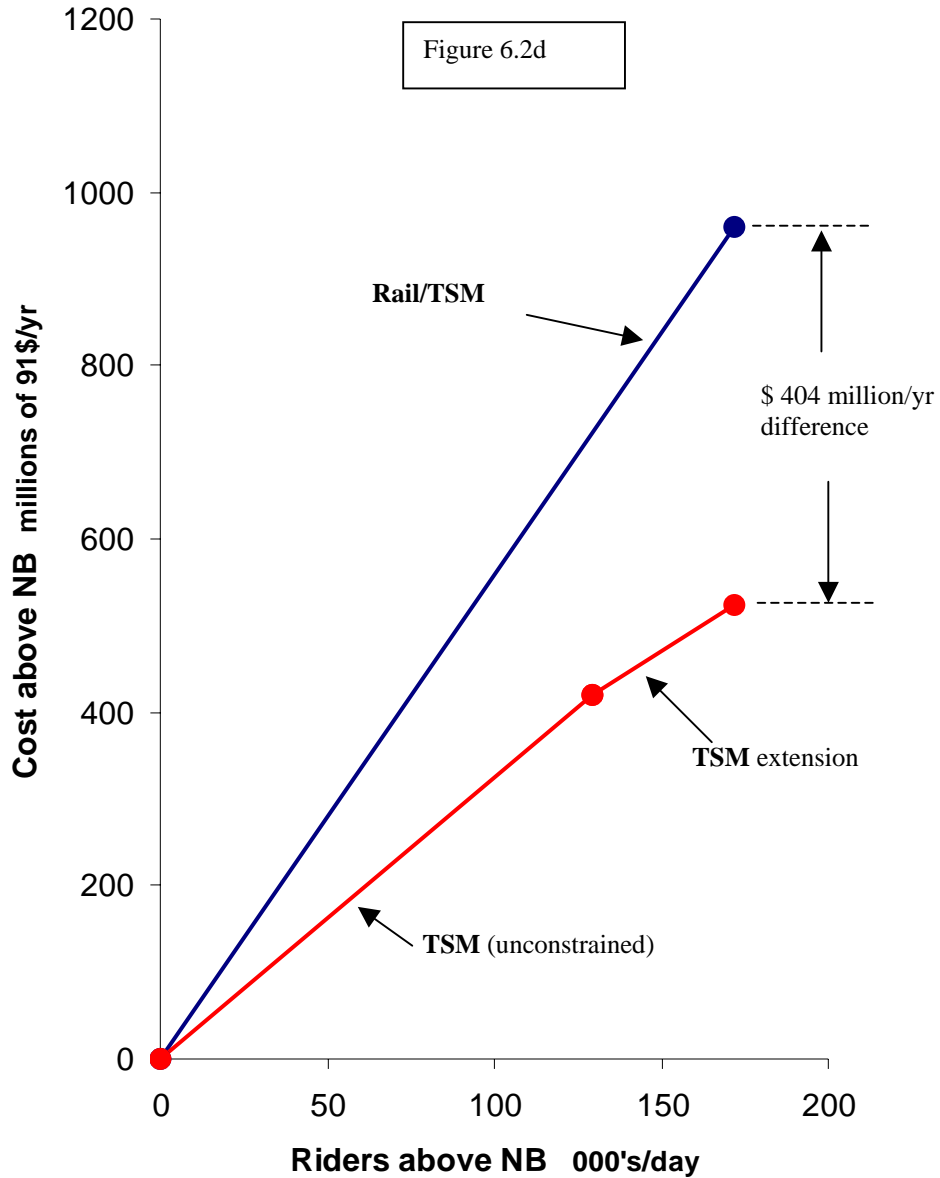


Figure 6.2d, completes the story that the 1993 FEIS should have presented. It shows what it would have cost to extend the TSM alternative until its ridership was the same as the rail alternative. This equal ridership comparison is the type of apples-to-apples comparison needed. It is much more revealing than RTP's 1993 FEIS, where the alternatives were neither equal in cost or in benefit.



The cost of the “TSM extension” in Figure 6.2d was based on the previously cited RTP statement that it would cost \$2.1 billion in capital for 100,000 additional riders. The TSM extension needs only 42,000 to equal rails ridership, and thus would cost \$882 million. After O&M costs are added, the total cost of using TSM to reach rail ridership levels is \$556 million per year. See Tech Notes for details. This analysis shows that

using TSM rather than the Rail/TSM alternative would save taxpayers about \$400 million (in 91\$) per year over the 30-year life of the bonds.

The 1993 FEIS was deficient in not having developed and presented this type of analysis. It's critical for public officials and taxpayers to understand just what they would be paying to expand transit ridership, and to judge whether that cost is reasonable.

6.3 Using the latest information, the difference between the cost of rail and bus is greater than it would have appeared in 1993.

Figure 6.3a brings Figure 6.2d up to date by correcting for known changes since 1993 and converting costs from 1991\$ into 2002\$. Again it shows the relative cost of the TSM versus the Rail/TSM alternatives as they would look today.

Strictly speaking the rail 'curve' in Figure 6.3a is an update of how the rapid rail/TSM alternative in the 1993 FEIS would look today if the cost information were updated but the original ridership predictions were left alone. Nevertheless, Figure 6.3a is a fair and useful indication of the situation facing us here in the fall of 2004 as officials press forward, not with rapid rail but rather with light rail.

In other words, Figure 6.3a is a conservative estimate of the relative costs of pressing ahead with light rail as opposed to switching to an all-bus alternative centered around BRT. It shows that taxpayers could save over \$900 million per year by switching to an all-bus alternative.

The qualifier "conservative" is used because there are some differences between the rapid rail system laid out in the 1993 FEIS and Sound Transit's light rail. First, we know light rail would have fewer riders since it is considerably slower than the rapid rail in the 1993 FEIS. Central Link would have an average speed of 26 MPH whereas the rapid rail in the 1993 FEIS had an average speed of 36 MPH. (Ref 38: p.16 and Ref 1: p.2-58) Any eastside extensions of light rail may or may not operate on streets, but if they do, they would also run slower than rapid rail. Second the capacity of Link's south line might constrain ridership.

When these factors are considered the rapid rail/TSM curve in Figure 6.3a probably presents an overly optimistic view of what we can expect from Sound Transit's light rail strategy in terms of cost versus ridership. For these reasons this Figure is conservative. Most likely the rail curve would be steeper than shown and the cost difference greater. Of course we can't create a more accurate version of this chart without a new and proper alternatives analysis to provide the data.

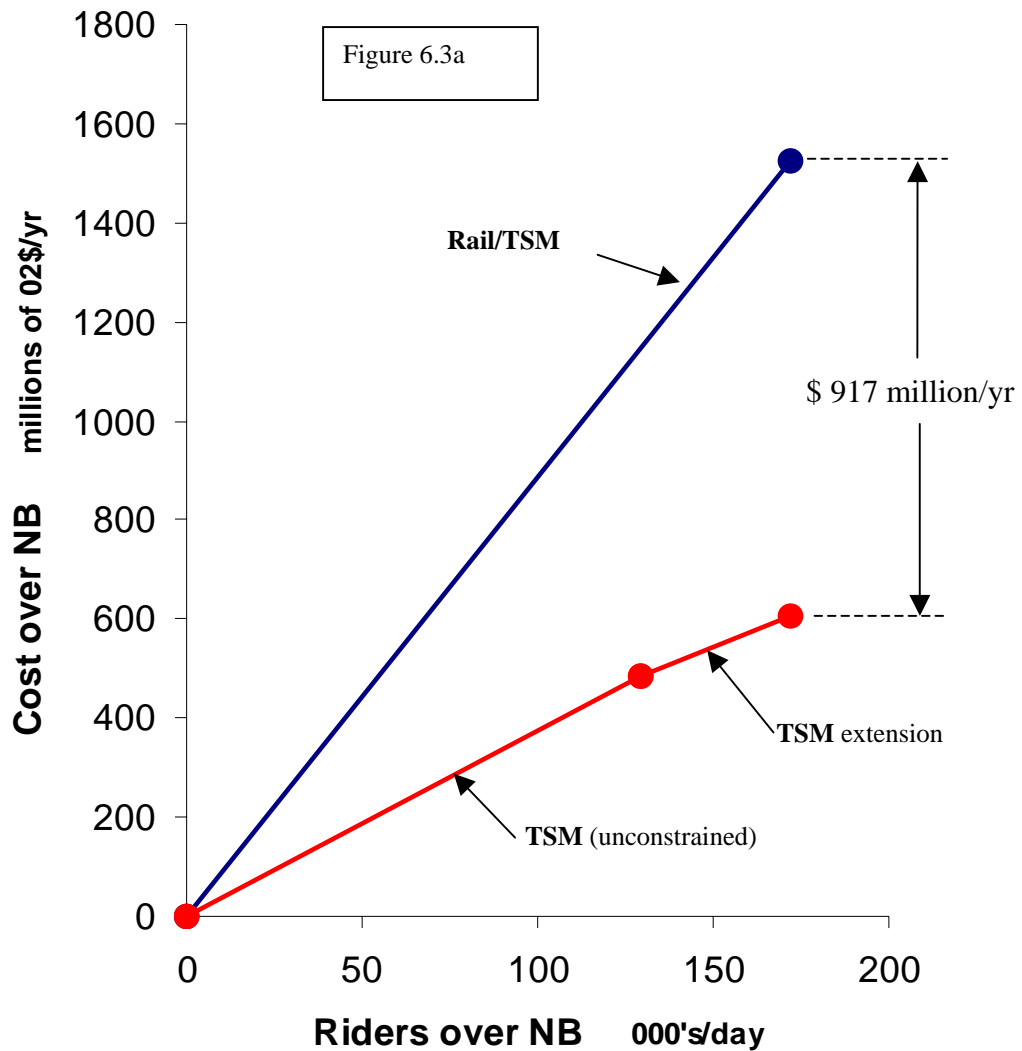
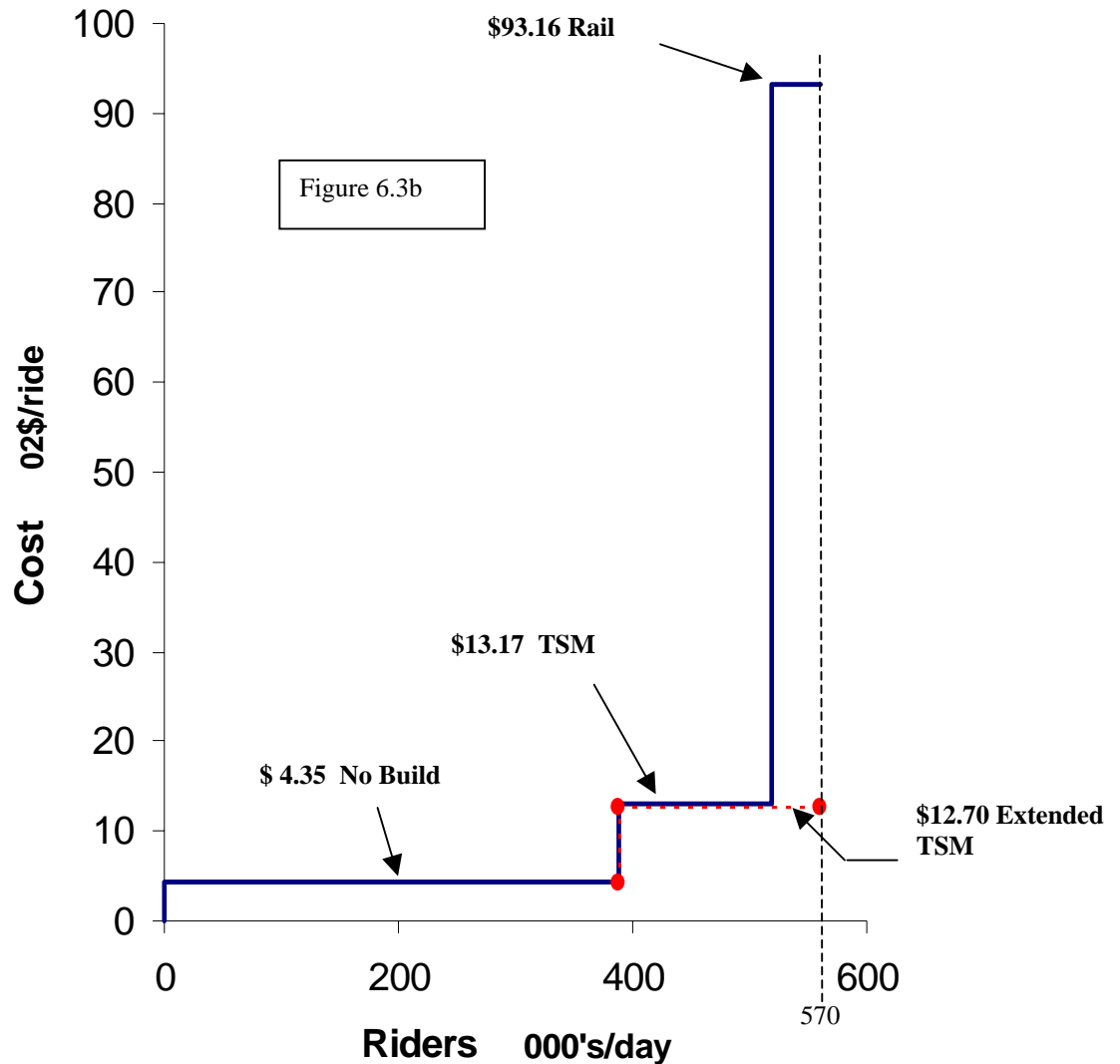


Figure 6.3b is the updated version of Figure 6.2c. It puts the costs in 02\$, and accounts for the fact that rail costs in the 1993 FEIS were underestimated and half the HOV network is now complete. In other words, Figure 6.3b is based on the same capital and operating costs as were used to construct Figure 6.3a.

The solid line in Figure 6.3b represents the costs of the Rail/TSM scenario or strategy. First, it shows the No build riders cost \$4.35 each. Then it shows it would cost \$13 for each rider the TSM component of the Rail/TSM alternative can attract above No Build. And it shows it would cost \$ 93 for each rider (or ride) which rail could attract above and beyond what TSM could attract. Again it raises the question as to whether the last 42,000 riders which rail could attract are worth society spending about \$90 to subsidize each one way ride.

In contrast, the hard to see horizontal dotted line shows how much it would cost if the region decided to scrap the rail strategy and simply extend TSM until TSM reached the same 570,000 ridership level as rail. In that case all the additional riders --above what No Build had already attracted-- would come at an average cost of \$12.70 each.



6.4 Results when VMT is the metric for benefit

The 1993 FEIS uses transit ridership as the main metric for evaluating the cost effectiveness of the different alternatives. Yet, almost no-one actually cares about transit ridership per se. As noted earlier, what people are concerned with is traffic congestion or perhaps some inadequately defined measure of “mobility”. The PSRC uses “travel delay” as their effectiveness metric and of course the RTP and ST should have done

likewise. However, since they didn't the author will use what's available, namely total daily "Vehicle Miles of Travel" or VMT. VMT is a proxy for congestion and delay. The logic is simply that if the demand on the road network (as measured in VMT) is reduced, there will be less congestion and less delay. (Peak period VMT would have been a better proxy for congestion; however, that measure was not reported in the 1993 FEIS so could not be used in Figure 6.4)

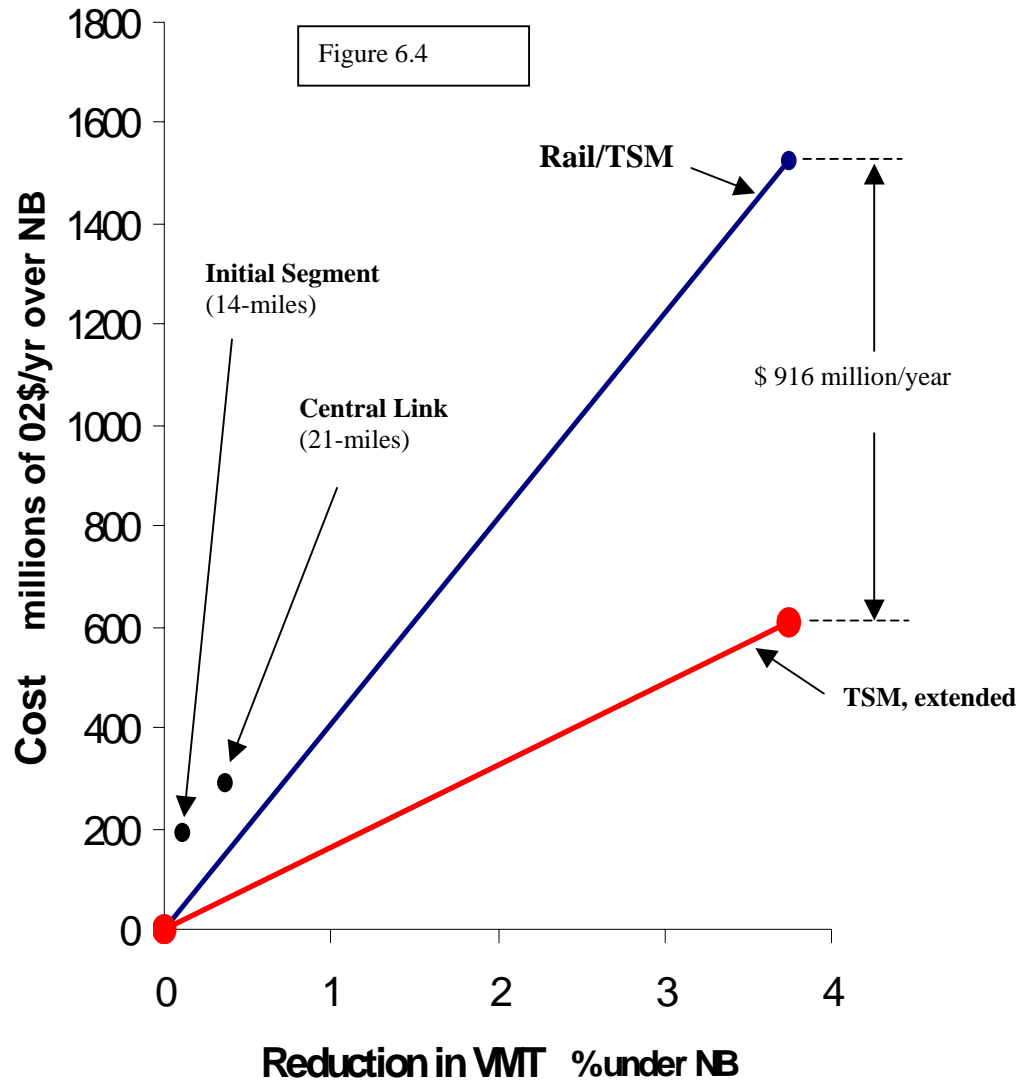
Figure 6.4 is therefore a plot of how well the rail/TSM and TSM alternatives perform in terms of reducing VMT relative to the NoBuild baseline. Figure 6.4 is essentially Figure 6.3a redone with a different variable on the X-axis. The performance of Sound Transit's "Initial Segment" and "Central Link" projects are also included. This is possible because ST did cite the effect of these projects on VMT in their respective EIS and EA. (Ref 18: p.20) (Ref 2: p3-4). The Extended TSM line assumes that if the rail/TSM and extended TSM alternatives have the same ridership --which they do by definition--they will also achieve the same reduction in VMT.

Figure 6.4 is the most important chart in this report because it summarizes the current situation facing the region as it begins implementing a rail intensive strategy as opposed to a bus-only strategy.

Figure 6.4 conveys several messages. First, it reinforces all the prior charts in showing that an all-bus strategy is much more cost-effective than a rail intensive strategy. Second, it shows that Sound Transit's current Initial Segment (of Link light rail) will be even less cost effective than the hybrid rail/bus alternative studied in the 1993 FEIS. When thought about carefully this simply means that the rail element --in any strategy that improves both bus and rail in concert--will be less cost effective than the bus element. Given that information, it again highlights the obvious question: Is the rail element cost justified? Third, the relatively poor cost-effectiveness of Sound Transit's light rail projects is apparent because their plot-points are above the Rail/TSM line. In short, they achieve relatively little reduction in VMT for their cost.

Fourth, the performance of a light rail only strategy (in other words extending the Initial Segment until it reaches 100+ miles, but doing little or nothing for bus) can be implied by constructing a line from the origin through either of the Link plot-points and thence out until light rail achieves the same VMT reduction as Rail/TSM. It is clear that the cost would well exceed even the high cost of the Rail/TSM alternative. This means it would be ruinously cost-ineffective to pursue light rail without at least improving the bus system at the same time, and with sufficient funding.

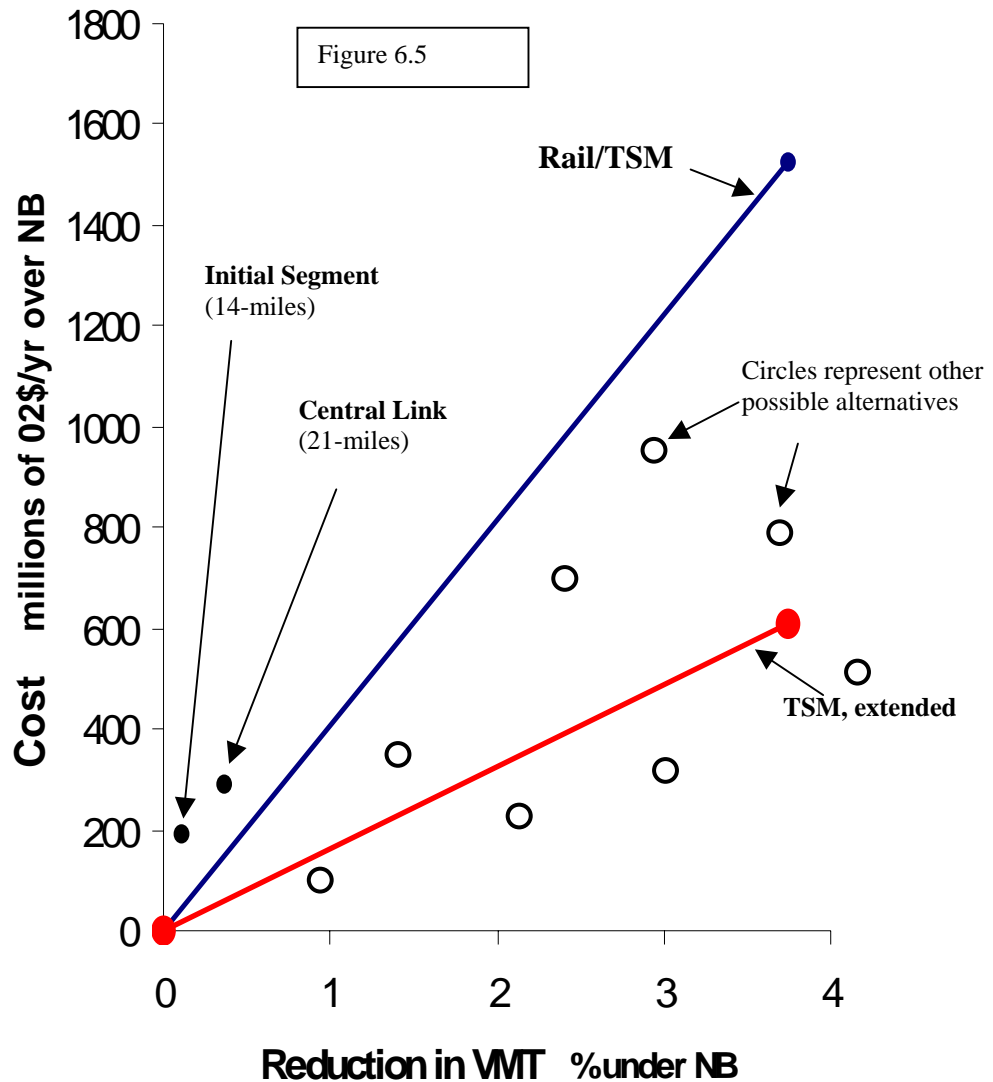
In short, Figure 6.4 teaches that bus-only is the most cost effective strategy, combined rail/bus is a distant next best, and rail-only is worst of all. It shows that an Extended TSM alternative could probably achieve the same reduction in VMT at a far lower cost than would the rail/TSM alternative. At the point where VMT is reduced 3.75% the TSM alternative is \$917 million per year less costly than the rail/TSM alternative.



6.5 The need to consider other alternatives beside bus and rail.

When reducing congestion, reducing delay or improving mobility becomes the objective –as opposed to simply increasing transit ridership—it invites consideration of other alternatives besides just improving mass transit. It suggests adding to the list of alternatives being considered such things as improving roads, increasing car and vanpool use, building bike paths, and a host of “demand management” programs that seek to reduce the need to travel.

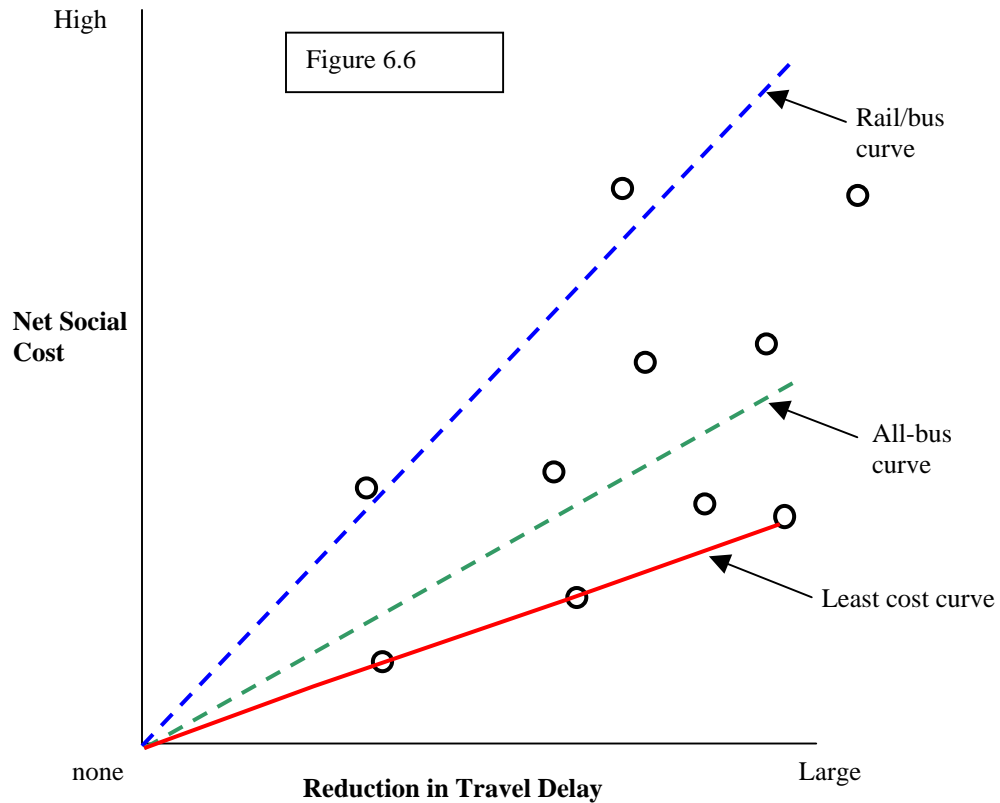
Some of these might actually be more cost-effective in reducing delay than investing in mass transit. Figure 6.5 illustrates this by showing –conceptually, in the form of hollow circles-- a host of other alternatives some of which are likely less expensive than even the TSM alternative.



Clearly, a truly proper alternatives analysis would include and evaluate these other alternatives. FTA and SEPA regulations may not require that of alternatives analyses, but the public interest clearly does.

6.6 Least cost planning: the final refinement.

So far the metric for cost has just included the direct capital and operating costs. However, there are associated environmental, safety and other costs that should be included to get a true measure of 'social cost'. In addition, any ancillary benefits should be subtracted from the cost to arrive at a net social cost. These non-dollar costs can usually be converted to dollar equivalents using standard or semi-standard techniques.



The end result is a long list of alternatives each rated in terms of its cost-effectiveness in achieving the primary objective. The results could be plotted on a chart such as Figure 6.6, which again is conceptual. The Y-axis becomes a measure of net social cost expressed in dollars. The X-axis is the measure of effectiveness or benefit. Alternatives about which we have some data are shown as solid dots. Hypothetical alternatives are shown as hollow circles. A line connecting the least cost alternatives defines the least cost way to achieve any desired level of benefit along the X-axis. This line will undoubtedly bend up according to the law of diminishing returns. Thus, once the easy solutions are exploited and run out of steam, it will get increasingly expensive to make additional progress against the main objective. At some point the added benefit won't be worth the added cost. This point can be determined using classic cost-benefit techniques.

Thus something like Figure 6.6 –if it were filled out with real data—would allow decision makers to determine which projects would achieve the most benefit at the least cost. It is a powerful and logical way to help prioritize projects in the face of limited resources. This technique is sometimes called “Least Cost Planning” or “Integrated Resource Planning”. Least Cost Planning (LCP) is a requirement of Washington State Law which applies to the PSRC. PSRC should have used LCP to evaluate each major project in the Metropolitan Transportation Plan (Destination 2030), including Sound

Transit's light rail plans. (Ref 43) However, PSRC has not yet complied with that law so there is no data available to build a diagram like Figure 6.6 or to know how the various light rail and road projects now being proposed (as part of the RTID package, or the Metropolitan Transportation Plan) actually perform.

The Tech Notes contain some added detail on "Least Cost Planning".

6.7 Concluding comments

The Puget Sound Region has inadequate information upon which to make intelligent decisions about which programs or projects would best solve the region's transportation problems.

The alternatives analysis conducted by the RTP in 1993 is a small and very imperfect part of the homework needed. In future, the primary goal or objective for evaluating all major transportation proposals should be something that people actually care about, such as reduced congestion or delay. In addition, it is necessary to compare a full range of alternatives, and to compare them using net social cost so that environmental and other side effects are taken into account. This story about the 1993 FEIS and events since has shown how far short we are from having good answers.

The analysis in Section 6 shows that a bus-only strategy is probably much more cost effective than a rail or hybrid rail/bus strategy in reducing travel delay; however, it also suggests looking for other alternatives that could be better yet.

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Part 7: Evaluation and recommendations

Parts 1 through 6 of this report have been relatively narrowly focused. First they described the deficiencies of Sound Transit's one and only alternatives analysis, the heart of the planning process. Then they showed that Sound Transit's current light rail strategy would be far more expensive than a comparable all bus alternative. In short they made the point that Link and the present rail-centric strategy, is the failed result of a faulty process.

Part 7 includes several specific actions that should be taken to reassess, and if need be change, the region's current mass transit strategy before additional hundreds of millions of dollars are committed. These are followed by asking, and answering, whether this report is accurate enough to justify taking the actions recommended.

However, before making those recommendations several broader concerns should be examined. One is to take a closer look at why we came to be in this situation. Why did the planning process go astray? Another is the current lack of trust in government's ability to spend transportation tax dollars wisely. That's relevant because recommendations to fix the process must at the same time fix the deficit in public trust. Sound Transit has become the poster child for why people distrust government to spend tax dollars wisely, and that is adversely affecting not just Sound Transit's prospects but the ability to raise funds for other transportation projects as well.

7.1 Genesis of current situation, or why things went wrong.

Because source data is hard to find, every statement in Section 7.1 is not backed up and footnoted in the same scientific manner used elsewhere in this report. Therefore the statements in Section 7.1 could be called opinions. Nevertheless they are based on the author's frequent interactions with the rail planning process over a period of 10+ years, and his struggle to explain why transportation plans and decisions that just don't seem to make sense --from the perspective of someone stuck in traffic, or from a taxpayer's perspective-- happen anyway.

It has become clear that explaining what drives officials and decisions in this arena is not a relatively straightforward engineering or business analysis which starts with a statement of the problem, goes through an objective evaluation of options, and results in some rational conclusion as to which option would best solve the problem. Instead, what has happened is best explained by some complex mix of myth, fact, wishful thinking, uninformed opinion, altruistic and not so altruistic motives, hard-ball politics, ego, psychology, bureaucratic maneuvering, and most of all, money. When all this enters the mix it is not surprising that actually spending taxpayer money wisely so as to make the most progress against traffic congestion falls by the wayside.

How did it come to pass that the planning process was abused in order to promote light rail and that Puget Sound is now embarked on a light rail plan whose implementation

would result in the region wasting billions of dollars relative to an all-bus alternative? Why is it that taxpayers still lack objective information about the alternatives?

To begin with one must acknowledge the superficial appeal of rail transit. Everyone can envision walking aboard a train and being whisked effortlessly from place to place. Rail lovers, like the author, know there is no other form of travel that is quite so soothing and worry free as we relax, watch the world slide by, and need only remember to get off at the right station. Those who have ridden subways in New York, Paris, San Francisco and other cities find them far less hassle than driving in a strange city. Rail just seems neat.

Environmentally minded folk favor rail's electric propulsion, since it moves air polluting generating plants elsewhere. In addition, they feel rail systems encourage high-density development and reduce sprawl. Civic boosters claim Seattle can't be a world-class city without having rail transit. People see the region growing, traffic growing, and, at least some feel the solution just can't be more freeways, especially not through Seattle proper. But if not freeways, what other than mass transit? However for most, rail is probably perceived in some vague way as a solution to our serious traffic congestion problem. If they wouldn't ride it themselves, they hope it will get others off the road thus making driving easier for themselves.

Emotionally, rail is (seemingly) a simple "silver bullet" solution for a complex and intractable problem. People like simple solutions. Elected officials especially like simple solutions. They are easy to explain, easy to sell.

Elected officials have another set of reasons to favor rail. They revolve around power and money. If it proceeds, Link light rail will be among the largest public works projects in Puget Sound history. Billions of dollars will be spent. Officials can feel important making decisions about how billions are spent. They can proudly leave a concrete legacy. They can please certain powerful parties on the receiving end of those billions. They can be seen as providing jobs and stimulating the economy. Perhaps most of all they can be seen as bringing in "free" money from Washington D.C. It has been said that years ago Atlanta got the money that should have gone toward building a rail system here. Now it's time to get our fair share.

Transportation as messy as politics Things sometimes are connected in ways we don't really see, such as the "blanket primary" and the transportation votes.

.... Regard the tyranny presently exerted over public decision making by single issue Tim Eyman/Permanent Offense vigilantes and by the single-interest constellation of law firms, contractors and other vendors who dine at Sound Transit's taxpayer financed light rail trough. The diners reciprocate with a reverse flow of campaign contributions and political support to King County and Sound Transit Chairman Ron Sims and other office holders who fill that trough

With new federal funding still uncertain and funds on hand low, Sims recently has sought back door money from City Light ratepayers and has given King County Metro Transit an ultimatum to commit now to operating the light rail line when it's scheduled to carry its first passengers in 2009.

Seattle Mayor Greg Nickels, Sound Transit's former finance chairman, will ask the City Council to approve next week a fresh \$63 million in scarce city funds to help with cost associated with tossing Rainier Valley people out of their homes and businesses to make way for light rail.

Additionally, as Thomas Shapely pointed out on Tuesday's Post-Intelligencer Editorial Page, Sims and Sound Transit could use another back door device hidden in the regional transportation package on this fall's ballot to generate new billions to keep light rail alive. (Ted Van Dyk, Seattle P-I, April 4, 2002)

A recent Seattle Times article about Senator Patty Murray nicely summarized how this pork barrel game is played:

She never wavered in her support of a controversial third runway at Seattle Tacoma International airport, and she stuck with Sound Transit when the politics looked dicey, helping the agency eventually to score \$500 million to build light rail
(Seattle Times, Oct 25, 2004)

Rail transit has long been favored by at least a significant number of elected officials in the Puget Sound area. This goes back at least to the Forward Thrust effort in the 1960's, which envisioned a BART like rapid rail system for Puget Sound. It continued through several efforts to sell the voters on building a rail system. Voters rejected a \$6.7 billion, 69-mile rail plan in March 1995, but in May 1996 voters finally approved the much smaller 21-mile \$1.8 billion "Central Link" light rail project. However by 2001 Sound Transit found it had grossly underestimated Central Link's cost and, in the wake of much public concern, cut the project back to the 14-mile "Initial Segment". The FTA provided some funding for the Initial Segment, and construction has begun. (See reference 3 for more history)

In trying to zero in on what went wrong, consider first the huge disconnect between the problem (traffic congestion) and the proposed solution (light rail).

The first page of the glossy "Sound Move" brochure, which Sound Transit widely distributed at the time of the 1996 vote begins as follows:

Why regional transit?

There's a old saying that advises "if it ain't broke don't fix it." But if you are one of thousands of people traveling on our region's overburdened and clogged highways each day you can probably relate to a modified version of that proverb- it's broke, let's fix it.

The problem is traffic congestion. Our region rates one of the worst traffic ...

(Ref 15: p.1) (underlining by Harkness)

From this the naïve, gullible voter might have gotten the impression that Link light rail was being put forth by knowledgeable and responsible officials as an answer, or at least a partial answer, to the congestion problem. Certainly Sound Transit intended to convey that message. As anyone who attended the public hearings before the 1996 vote can attest, Sound Transit did everything it could to imply, and lead voters to believe, that

Link was an answer to traffic congestion. However, this was done artfully so as not to leave anything in writing.

Unfortunately, as was documented in Part 3, Link would have virtually no beneficial effect on traffic congestion, something which had been known all along by transportation planners, and something which David Earling, then chair of the Sound Transit board, finally acknowledged publicly on December 26 of 2000:

Light rail: There will never be a better time Richard Harkness got one thing right in a guest column (The Times, Dec 22): Light rail will not ease traffic congestion. Yes, that's a fact. (Seattle Times, Dec 26, 2000)

Of course, ST's first public admission that light rail would not ease traffic congestion, came a bit late since the vote had occurred four years earlier.

And in spite of statements hidden in the EIS and VMT data in the EIS's showing that Link wouldn't have any noticeable impact on congestion, and in spite of Dave Earling's public admission to that Link would have no effect on congestion, key officials continued to mislead the public. The following is taken from a speech King County Executive Ron Sims made to the Sound Transit Board on January 11, 2001.

Mr. Chair, Board Members, I would like to move the adoption of Resolution 2001-01 and speak to the motion....Today, we are voting to take a positive step forward to relive transportation congestion along Interstate 5....We must today move ahead to build a regional transportation system with light rail....I urge a yes vote from all members of this board. (Ref 62) (underlining by Harkness)

That particular speech contains a number of other unfounded assertions that are interesting to read. Later when he was chairman of the Sound Transit Board, Mr. Sims said:

...we cannot bus our way out of congestion along I-5...That is why we are moving forward with light rail.. (Ron Sims, in article entitled "Second Opinion: Light rail coming round the bend, King County Journal, 2/9/03)

In a Sound Transit News Release celebrating FTA's announced intent to fund Link, Senator Patty Murray made the following misleading statement:

This is yet another important milestone in the effort to address the transportation needs of the Puget Sound region. We cannot and will not stand by and watch some of the country's worst congestion choke our state's economy. (Sound Transit news release dated July 11, 2003)

How could the planning process have gone so far astray as to propose spending billions on a non-solution to the region's most pressing transportation problem? And perhaps more sinister: how could the public officials in charge of this process have gone forth to the voters implying that light rail was a solution when they knew, or should have known, it wasn't?

These questions been asked about rail projects in other cities. (See References 21,23, and 24). As a participant in various public hearings going back before 1996, attendee at

Sound Transit Board meetings, and student of this long standing effort to sell rail, the following seems the best explanation of observed behavior.

Key officials have long wanted a rail transit system in Puget Sound, period. In the early 1990's consultants were hired to prepare the necessary paperwork in order to get federal funding and meet state law. Although alternatives analyses are theoretically objective studies, consultants are generally fairly astute at figuring out what the client really wants, and repeat business means delivering it. As a result the 1993 FEIS and alternatives analysis became a pro forma exercise meant to justify a preordained conclusion. The elected officials in charge created the "culture" within which the 1993 FEIS was completed, and almost certainly they did not demand an objective evaluation of alternatives. It must have been a don't ask, don't look, don't tell culture. Officials probably didn't ask why the bus alternative in the 1993 FEIS couldn't be fixed and probably didn't ask probing questions about cost effectiveness of the rail element. Certainly the 1993 FEIS did not address these topics. The technicians doing the actual work no doubt understood they weren't supposed to look for ways to fix the bus capacity problem, present cost data objectively, or to tell management if they had ideas that would have worked against the preordained outcome. Nothing strictly dishonest is needed in this type of culture. It's just a matter of not looking into things where the answer might be unwelcome. If you don't look you don't have to know, and if you don't know you don't have to decide whether or not to tell.

The end result was that the 1993 FEIS is a sham. The document is meant to satisfy State and FTA requirements that call for an alternatives analysis, but is almost totally useless in providing objective information that would help officials or the public make a wise choice between rail and bus technologies.

However, assume for the moment that public officials were motivated solely by what they sincerely believed was best for the region. Is it adequate that they make decisions on the basis of belief alone, no matter how well intended? Certainly the answer is "no".

Transportation is an exceeding complex matter about which the average citizen or elected official has very little understanding. Just as the author, admitting no knowledge of police and fire must entrust public officials to find good solutions, so must the average voter trust public officials to find good solutions for transportation problems. We expect officials to do the necessary homework so that knowledge replaces uninformed belief and naive opinion. Thus taxpayers have given elected officials large staffs and have given Sound Transit a virtually unlimited consulting budget. We expect due diligence. We expect objective homework to be done, and we expect public officials to act on the basis of sound analysis not on the basis of their gut feelings or personal beliefs. To the extent this is not done there is a betrayal of the public trust.

Perhaps the worst abuses to the planning process occurred years ago in preparation of the 1993 FEIS, but the current Sound Transit Board of Directors has inherited the problem by virtue of not having corrected past abuses. In particular the Board continues to lead the region into a multibillion dollar rail-centric strategy with no proof it's the best alternative,

and knowing it doesn't address the congestion problem. They represent to the FTA that a proper alternatives analysis has been done, and they continue to shove the project ahead without making sure the public really understands the key facts about Link's cost effectiveness, or the full implications of embarking on a billion dollar-a-year strategy for extending Link into a regional system.

It would appear that the FTA colludes with Sound Transit in these abuses of the planning process. For instance, the FTA could have rejected Sound Transit's reliance on the 1993 FEIS as the study which legitimized the choice of light rail. The FTA could have seen the obvious faults in that old study as outlined in this report. The FTA could have forced ST to do a proper alternatives analysis comparing what they now propose to build against bus and other alternatives. Unfortunately it appears there is little incentive for the FTA to do so. No bureaucracy wishes to under-spend its budget. So the FTA sets up elaborate requirements, which keep staffs happily employed and cause agencies like ST to spend millions on studies. But at the end of the day the FTA doesn't say no, providing the politics are right.

As a result Link light rail has nothing to do with solving the region's transportation problem, but everything --or almost everything-- to do with money.

Link is quite a clever way to transfer money from the pockets of many to the pockets of a few. Not enough is taken from the pockets of the average taxpayer (in the form of sales tax and auto registration tax) to cause him or her to 'fight city hall', while enough goes to those relative few on the receiving end to ensure their behind-the-scenes pressure to keep the project going. Had it been proposed to fund Link by raising the B&O tax on businesses, the pain would have been focused on those with sufficient muscle to protest; and there is no doubt Sound Transit's plans would have been scrutinized much more closely.

Another reason Sound Transit's a clever mechanism for wealth transfer is that the taxpayers have practically no way to stop it. The State Legislature created Sound Transit as a legal entity, but they forgot to make the Sound Transit Board directly elected for the sole purpose of solving transportation problems, and they forgot to give voters in the Sound Transit taxing district any practical control over Sound Transit via initiative. Instead Sound Transit Board members, such as the recent chair, King County Executive Ron Sims, are elected to other offices wherein transportation is only one of their many concerns. As a result the only way local voters can control Sound Transit is by mounting a state-wide initiative. This self confidence in its own untouchability was probably one reason Sound Transit's attorney had the hubris to say in court that Sound Transit recognized no limits on how much it could spend or how long it could take building light rail.

“Sound Transit says voters set no money limit Facing legal challenge, agency cites brief reference on ballot. Sound Transit argued in court yesterday that it has the power to collect taxes for as many years as necessary, without a spending limit, to complete the entire light rail line voters approved in 1996.” (Mike Lindblom, Seattle Times, Sept. 28, 2002)

It has become increasingly clear that voters don't trust Sound Transit and Sound Transit doesn't trust voters. Voters overwhelmingly voted to rescind Sound Transit's tax on vehicle registration, but ST still fights to overturn that expression of public will in the courts. ST changes the project greatly from what voters approved in 1996 but vigorously fought a lawsuit that would have put the much altered plan back on the ballot for a vote of confidence.

Additionally, ST wants more money. This was foreseen and the legal mechanism already exists. It calls for ST to ask voters for an increase in the sales tax. However, while claiming they have a public mandate and public support for light rail, ST is clearly deathly afraid to go back to the voters.

Thus ST supporters have resorted to political strong-arm tactics to force light rail into a package of regional projects (the RTID), which was originally intended for the specific purpose of reducing congestion.

...King County Councilman Dwight Pelz, D-Seattle, a Sound Transit board member, has lobbied to include \$1 billion for light rail in a possible regional transportation ballot measure." (Mike Lindblom, Seattle Times, March 10, 2003)

As a result the following was placed on the November 2004 ballot:

King County Local Voters Pamphlet
Nov. 2, 2004 General and Special Elections
Advisory Measure No. 1
ADVISORY MEASURE NO. 1
LOCALLY FUNDED TRANSPORTATION PLAN

The King County Council passed Ordinance No. 14995 concerning an advisory measure on a locally funded transportation plan. This advisory measure asks whether the voters in King County support development and placement on the ballot in 2005 of a locally funded transportation plan designed to relieve traffic congestion and increase safety through a mix of road and transit projects in King County in the Interstate 405 and State Route 509, 522, 167 and 99 corridors, including replacing the Evergreen Point Floating Bridge, beginning to replace the Alaskan Way Viaduct, and extending light rail to SeaTac Airport and the University District. Do you want a locally funded transportation plan to relieve congestion and increase safety to be developed and placed on the ballot in 2005?

YES

NO

Source:

<http://www.metrokc.gov/elections/2004nov/pamphlet/measure/kcadvisory1.htm>,
underlining by author

Again, note the contrast between this ballot measure and what David Earling, then chair of the Sound Transit board, acknowledged publicly on December 26 of 2000:

Light rail: There will never be a better time Richard Harkness got one thing right in a guest column (The Times, Dec 22): Light rail will not ease traffic congestion. Yes, that's a fact. (Seattle Times, Dec 26, 2000)

Or the following statement hidden back in the Transportation Technical Report for Central Link:

Therefore, based on traffic forecasts, the Link system will not result in a significant difference in traffic volumes. (Ref 23: p. 95)

The fact that Sound Transit supporters forced light rail into the RTID package knowing it would do virtually nothing to reduce traffic congestion, and that Sound Transit approved the ballot measure's wording implying that light rail will reduce traffic congestion, is a remarkable example of cynical manipulation and deception.

What Sound Transit management understands is the power of the "big lie". If something is said often enough by those in positions of authority many will believe it, whether it's true or not. As voters marked the ballot above, few would have read or now remember Dave Earling's Op ED of December 2000, and far fewer still would have discovered those places in Sound Transit's EIS's which state that light rail will have minimal effect on traffic. In short, Sound Transit will fool most of the people, and for their purposes that's good enough.

There are two reasons why all this background is relevant. First, if we are to fix a broken process we need to understand not only how that process is broken, but why it is broken. That is, we need to understand who the decision makers are and what their motivations might be. Second, before any remedy can be applied successfully we must deal with the issue of trust. It is pointless to assume that a set of players --who have abused the process in the past and who now lack the public's trust-- will simply behave better in future.

One final comment is appropriate even if it seems redundant. It is clear that Sound Transit's board does not place a high priority on finding the lowest cost ways to improve transportation in the Puget Sound Region. In other words achieving the "most bang for the taxpayer buck" is not of great concern to that group. It is, however, one of the public's highest priorities. Thus, there is a fundamental disconnect between what the Sound Transit board, and the PSRC board for that matter, see as their highest priority and what the public wants emphasized.

This is a fairly harsh criticism but it seems justified. If the Sound Transit Board really wanted cost-effective solutions they would have scrutinized the 1993 FEIS in the way the author has done and probably chosen BRT, since it appears BRT would save billions. And after finding that Link's costs had been underestimated and needed to be increased by 44%, they would have revisited their choice of rail, rather than simply looked for additional money. They would have published and agonized over, rather than hidden, the high cost-per-rider data for Sounder and Link. They would have calculated the

approximate cost of fully implementing their current rail centric strategy and compared that against BRT. These are the minimum things a board really concerned with spending tax dollars wisely would have done.

The Puget Sound Governmental Council (PSRC) must also take some blame. If that organization were sincerely concerned with getting the most bang for the taxpayer buck it would have eagerly embraced and practiced Least Cost Planning as State Law requires rather than trying so hard to avoid it. It would have analyzed Sound Transit's light rail plans and ensured they were cost-effective relative to other alternatives before simply downloading them intact into the Metropolitan Transportation Plan. It would be considering van and car pooling as a major alternative to investing billions in mass transit and highways, rather than just as window-dressing attached to the main transit and highway alternatives.

Sound Transit's abuses are apparently not unique. In an excellent article in the Journal of Business and Professional Ethics, Martin Wachs says:

"Forecasts are presented to the public as the results of unbiased scientific procedures yet they are in reality often highly subjective exercises in advocacy. Professionals who must prepare forecast are frequently confused by the mixed signals which they get. According to law, and in the eyes of the public, their forecasts are expected to provide analyses aimed at clarifying choices among courses of action. But their direct superiors and clients expect them to produce forecasts which will become part of the supporting documentation justifying a course of action which had already been chosen for political reasons....

...Public policy rewards this dilemma by requiring through laws and regulation forecasts which are supposedly neutral and objective, while distributing political reward in the form of grants, contracts, promotions, and recognition to those whose forecasts are effective at proving their agencies political position most emphatically.

...Investigation into the bankruptcy of the Washington Public Power Supply System, for example, shows that forecasts which failed to materialize of low nuclear power costs and a growing demand for power were prepared at the behest of corporate managers who insisted that the forecasts be optimistic in order to influence investor and government officials. Technical experts who argued that the forecasts were misleading were told to be silent or leave the project....

Similar experience is now being amassed with respect to urban rail transit systems. ...

I have interviewed public officials, consultants and planners who have been involved in these transit planning cases and I am absolutely convinced that the cost overruns and patronage overestimates were not the result of technical errors, honest mistakes, or inadequate methods. In case after case planners, engineers, and economists have told me that they have had to "revise" their forecasts many times because they failed to satisfy their superiors. The forecasts had to be "cooked" in order to produce numbers which were dramatic enough to gain federal support for the projects whether or not they could be fully justified on technical grounds. One young planner tearfully explained to me that an elected county supervisor had asked her to estimate the patronage of a possible extension of a light rail (streetcar) line to the downtown Amtrack station. When she carefully estimated that the route might carry two to three thousand passengers per day, the supervisor directed her to redo her calculations in order to show that the route would carry twelve to fifteen thousand rider per day because he thought that number necessary to justify a federal grant for system construction. When she refused he asked her superior to remove her from the project and to get someone else to revise" her estimates." (Ref 24)

7.2 The Importance of Trust

The role that trust, or lack thereof, plays in reaching any solution for Puget Sound's transportation problems is hard to overstate. Sound Transit's refusal to conduct a proper alternatives analysis, and give voters objective information about Link and alternatives to Link, is one major factor that contributes to this mistrust. The story about trust is best told through an extended series of quotes, mostly from local newspapers:

On Sept. 6, a group of 88 prominent citizens –including Booth Gardner, Dorothy Bullitt, Matt Griffin, former King County Assessor Norwood Brooks, and a dozen elected municipal and county council members – called for an independent review to get a realistic estimate of the cost of the project. Within hours, their appeal was summarily and rashly rejected by the Sound Transit board. (Emory Bundy, Op Ed, *Seattle Times*, Dec 12, 2000)

Sound Transit: a matter of trust The 10-year plan for increasing transportation system capacity in the Central Puget Sound area was dubbed "Sound Move" by its creators at the regional transportation authority, Sound Transit. ...

...Half of those ten years are now past, and the Sound Move plan has fallen well short of its billing. The most visible culprit of course is the light rail project, which is \$1 billion over budget, three years behind schedule and the subject of a federal audit.

...It's the sort of indecision that makes one wonder, despite the agency's official denial, just how much of the 10-year plan was completed in a vacuum, without input from the very people it is meant to serve. It's the kind of day to day waffling and mismanagement that wastes time, overruns budgets and over time, causes people to lose trust. Some of us in the Legislature have noticed the loss of trust in Sound Transit.

... Why should taxpayers support long term financial commitment to transportation when Sound Transit provides such a convenient example of a commitment gone sour?

...The second offers revote on the grounds that the Sound Transit board's actions have significantly altered the proposition citizens approve in 1996.

...Because of Sound Transit's lackluster performance so far, any taxes directed toward transit and transportation projects from here on out need to be the best spent money in state government.

...At the heart of the public trust, President Abraham Lincoln once wrote, is trusting the public. Government should not be – and cannot afford to be – afraid of letting the people judge how well their money is being spent. Lets. Vote. (Op Ed by 15 members of the State Legislature, *Seattle Times*, Feb. 20, 2001)

Light-rail critics numbers growing ...The Bellevue Downtown Association has piled on the growing ranks of light-rail critics. ... 'Frankly we have no confidence the light rail plan will provide meaningful help to the regional mobility crisis', the association wrote in a letter to Dave Earling, chairman of the Sound Transit board. The letter, released yesterday comes only a few weeks after a similar dispatch sent to Earling by the Downtown Seattle Association. And the Greater Seattle Chamber of Commerce, while not directly opposing light rail, said in January it has 'grave concerns' about the project. In addition, two former governors, Booth Gardner and John Spellman, and a large coalition of elected officials and community leaders oppose light rail. Earling says he's tired of all the griping. (Andrew Garber, *Seattle Times*, Feb. 27, 2001)

Light rail labeled ‘problem’ project Key congressional panel to scrutinize program. ... The agency has come under increasing attack by business groups, community leaders and even its own citizen oversight panel since it revealed in December that the 21-mile rail project is \$1 billion over budget and three years behind schedule. (Andrew Garber, Seattle Times, March 10, 2001)

Despite dying dot.coms, a sagging stock market and a national economy on the verge of recession, Sound Transit is banking on unending good times to pay for its \$3.8 billion light rail project.

A close look at the agency budget show it is counting on a recession-free economy, low interest rates, stable costs, throngs of transit riders and federal largesse that would set a record.

...It clearly a house of cards says Robb McKenna, vice chairman of Sound Transit’s finance committee and a critic of light rail. ‘The assumptions are unrealistic.’

...Richard Steinmann, a top Federal Transit Administration official, says Sound Transit would set a record if it gets all the money it is asking for, and ‘nobody has pulled that off.’ (Andrew Garber, Seattle Times, March 27, 2001)

Sound Transit troubles, Day 2 Sound Transit’s financial woes got \$50 million worse yesterday. The agency learned that amount of money on top of an additional \$75 million in federal funding is being withheld because of concerns raised by the US Inspector General’s Office. The hold ...could delay construction... and ultimately make the \$4.1 billion venture –already the most expensive in the country-- even more costly. ... Metropolitan King Councilman Rob McKenna, vice chairman of the Sound Transit finance committee and a light rail critic, says the agency and its board of directors need to start taking the problems more seriously. ‘There is no introspection here’, he said yesterday. ‘There is just spin control’. (Andrew Garber, Seattle Times, April 6, 2001)

Note to politicians and transit planners: The analogy of “silver buckshot” is an excellent description of how solving regional transportation problems must be addressed. But even silver buckshot won’t work if out incumbent politicians and the Sound Transit Board don’t quit dishing out “silver b.s.” ...

In light of the dynamic growth in King, Pierce and Snohomish counties, how can we trust Sound Transit to produce a practical system ... Can we trust Sound Transit management to have the correct answer? Or do we need a flexible, expandable, affordable transit network? It is not too late to abandon the light rail proposal. (Tobey Wilkins, Soapbox, Seattle Post Intelligencer, June 30, 2001)

Legacy Time: Congestion is the No. 1 Issue Several lawmakers preparing for this weeks triple overtime session in Olympia say if the states daunting transportation problems were so easy to tackle they would already have been solved.

Legislators are letting themselves off easy. For too long they have been afraid to level with the public about transportation.

... Voters do not elect lawmakers to spend entire terms calculating their re-election chances. Between elections they are supposed to do the public’s work. (Editorials The Newspapers View, Seattle Times, July 16, 2001)

A near majority (48 percent) of King County voters now has an unfavorable opinion of Sound Transit, compared to a one-third minority with a favorable opinion. (December 2001 King County Transportation Poll, by Olympic Institute)

Circumstances today present a major opportunity for someone to provide the bold leadership our community so desperately needs. That someone is Ron Sims.

As both king county executive and chairman of the Sound Transit board, Sims is in the strongest position to address the fact that the Link light rail project as promised to voters cannot be done.

He should fully disclose Link Light Rail's current fiscal condition and realistically address its limitations.

Sound Transit's own data, particularly its 2002 financial plan produces no evidence that the agency can fund any extensions of the initial 14-mile segment of light rail either north or south, in the next 20 years. By Sound Transit's own estimates after shelling out \$2.9 billion for this "initial" segment, we'll be left stranded in Rainier Valley completely out of gas. For at least two decades.

... At every turn, Sound Transit has failed at the Link light rail effort. Sure everyone is feeling desperate to "do something" about transportation and congestion but throwing good money after bad is not just "doing something", it's doing something dumb.

... The defeat of referendum 51 shows that the public is seeking smarter transportation solutions that will use public resources prudently.

... We must stop before taking on such an obligation because if the 14 miles south from the state Convention and Trade center is all that will be built, why bother at all? We should, instead, free up those financial resources to make way for a better solution, one that will have an honest, significant impact on reducing traffic congestion. Sims could lead such an effort. (Booth Gardner, former governor, State of Washington, Op Ed, Seattle Times, Nov. 14, 2002)

Sound Transit, an agency in search of credibility, hurt itself anew in the way it picked former Mayor Norm Rice to head an independent review. Rather than consult broadly with critics or even the entire board, a small group at the agency selected Rice, a former board member who is regarded as a defender of Sound Transit's overall direction.

...Huge budget changes and revisions to the plan voters approved in 1996 require an honest reassessment of the fundamental rationale for the light rail program. (Editorials: The Newspaper's View, Seattle Times)

Cranky state reeling from leadership void The Good Ship Washington is leaderless, rudderless, adrift. The one thing voters agree on is we are cranky --cranky at Sound Transit-- , miffed about sweeping transportation proposals, unwilling to buy almost anything our leaders try to sell.... With R-51 down, and I-776 potentially cutting into road and transit funding, the message on transportation is: Don't do much; we don't trust you to do it correctly. (Joni Balter, Seattle Times, Nov. 10, 2002)

That's similar to what happened in Washington State where polls indicated that the main issue for voters opposed to Referendum 51, the transportation package, was their lack of trust in the government. (Susan Gilmore, Seattle Times, Dec. 9, 2002)

State's transportation problems loom large over legislative session Before they can find money to fix roads and build new ones, may political leaders say they have to repair voters' trust. Polls indicate a major reason Ref 51 --which included a 9-cent-a-gallon gas tax-- went down is because voters don't believe government spends their tax dollars wisely. (Seattle Times, Jan. 12, 2003)

Sound Transit's difficulty is not only the management of the project or the Sound Transit Board's reluctance to pursue accountability. The project was flawed from its very inception

The project's history is typical of many public projects where utopian ambitions fail to acknowledge contingent realities of place. Seattle's unique topography and settlement pattern have created technical and fiscal difficulties due to the deep and potentially unsafe tunnels and costly property acquisition necessary for the project. More fundamentally, the revelation that the Sound Transit plan does not expect to relieve traffic congestion raises the question: What, then, is the Sound Transit light-rail plan about? (Folke Nyberg, OpEd, [Seattle Times](#))

State Rep. Glenn Anderson, R-Fall City, accused the agency of stonewalling on cost figures until the legislative session is over. Lawmakers are considering hostile bills to require that Sound Transit board members be publicly elected, or to put light rail to a public revote. 'That's information the public needs to know', he said. 'The impression I've gotten from a number of sources is, they know what it is and they're afraid to tell people'. (Mike Lindblom, [Seattle Times](#), March 10, 2003)

8th District Democrats Gather ... Former radio talk show host Dave Ross, the third Democrat in the field, had a more general goal in mind: to build people's trust in government. 'One of the things I hope to do is not just be your representative but also be your eyes and ears into what's going on, who's making the trades, where the money is going and whether it's being wisely spent,' he said. (Warren Cornwall, [Seattle Times](#), 2004)

Initiative 776 is one particular instance where voters approved a measure Sound Transit didn't like. Rather than accept the will of the people, Sound Transit chose to fight the issue on legal grounds. They may yet prevail on narrow legal grounds, but if so that victory will simply erode public trust further.

What's the plan for light rail now? Sound Transit light rail is in trouble. The overwhelming success of Initiative 776 in Tuesday's election is yet another watershed in the agency's difficult battle to build a regional light rail system. ...Where will the agency and its governing board, chaired by King County Executive Ron Sims, go from here to protect the light rail project? The first step is to challenge the constitutionality of I-776... (P-I Opinion, [Seattle Post-Intelligencer](#), Nov. 10, 2002)

Regarding the passage of Initiative 776, 'the department of transportation told Sound Transit in September that it would continue to assess and collect the tax --even if I-776 passed-- unless a court ordered it to stop'.

Is there any wonder why people have no trust in their elected officials? They have stated explicitly that they don't care what the results of the election were, and would not respect the will of the electorate unless forced by lawsuit. Do the result of an election have no meaning whatsoever?

The hubris of the elected officials in this region is astonishing. How can politicians expect to be perceived as being accountable when they so blatantly demonstrate the exact opposite behavior? (Randy Blaylock, letter to editor, [Seattle Times](#), Nov. 14, 2002)

Why doesn't anything stick anymore? That's what people are asking as the thunder from the election debacle rolls over the state. Anger, palpable and measurable, followed the news that King County government sold some bonds to pay for Sound Transit just ahead of the Nov. 5 vote on that very issue. (James Vesely, *Seattle Times*, Dec 8, 2002)

How many no's will it take? Our local politicians again appear to be clueless when it comes to taxes and the voters 'mixed messages'. To the contrary, our message is loud and crystal clear: "Tell us where the money is going. Assure us every single agency has a performance audit. Move to a zero-based budget and stop trying to hide who gets what". We are simply telling our elected leaders that we don't trust what they are doing with our money. (Scott Carty, letter to editor, *Seattle Times*, Dec 14, 2002)

After Referendum 51 the only choice is a better plan grounded in a higher level of public trust (Doug MacDonald, Secretary, Washington State Department of Transportation In Ref 54)

The state Supreme Court upheld the tax cutting Initiative 776 yesterday but leaders of Sound Transit said they expected to keep collecting its car tab taxes for another quarter-century.

Sound Transit officials say they believe they can keep collection car taxes because yesterday's ruling did not order them to stop

Chief counsel Desmond Brown said Sound Transit will sell more bonds backed by the taxes. (Mike Lindblom, *Seattle Times*, Oct. 31, 2003)

Sound Transit should live with the law Initiative 776 is now the law. The law says Sound Transit's 0.3 percent car-tabs tax is repealed...It cannot mean that Sound Transit can go on collecting the whole tax for the full 25 years, collecting several times the amount needed to cover the bonds, and spending the money on anything it likes. Nor can it mean the Sound Transit can pledge the car-tabs tax to a new group of bonds to keep the game going.

Sound Transit attorney, Desmond Brown, said Thursday that his client could sell a new batch of bonds in just that way.

...The counties of King,....., all of which lost taxes to I-776, have to live with the law. So does Sound Transit. (Editorials: The Newspaper's View, *Seattle Times*)

7.3 Requests that Sound Transit consider alternatives

There have been numerous requests that Sound Transit reconsider its light rail plans, as the following quotes confirm:

The Sound Transit board is struggling with its next move, but is handicapping itself in its eagerness to keep its \$500 million federal grant for Link light rail. It would be better to give that up, take a fresh look, and go back next year with a defensible plan.

...Sound Transit has spent million of dollars over the past five years saying and implying that Link light rail is an answer to congestion, a response to congestion, will fix congestion, zap congestion, provide an alternative to congestion, bypass congestion, and replace the need for 12 lanes of freeway. That's the basis for its public support. But, as admitted recently by Sound Transit's executive director, Link won't solve, or even reduce congestion (*Times*, Oct. 5). It's a waste of money.

...When its board reconvenes Thursday, Sound Transit can plunge ahead into a troubled future, or it can give up on the federal grant for this year, go back to the drawing boards, and put together a better plan. (Emory Bundy, Op Ed, Seattle Times, Dec. 12, 2000)

Halt Sound Transit's Ever More Costly Plans One billion dollars. That's how much Sound Transit's light rail project has gone up in price. Taxpayers from Everett to Tacoma are expected to pay.

...Light rail was supposed to be the backbone of a system that also includes regional buses. That concept is now very much in doubt. Sound Transit's directors need to compare the repriced light rail with an all-bus alternative on a backbone of dedicated road lanes. (Editorials The Newspapers View, Seattle Times, Dec. 14, 2000)

Full speed ahead for light rail In a hasty attempt to secure \$500 million in federal funding before the Clinton administration steps down, Sound Transit will move forward with light rail despite mounting objections about costs, the agency's leaders say.

...But Sound Transit Executive Director Bob White and board Chairman Dave Earling say they already know what the board will decide on that pivotal day: The agency will not explore alternatives to light rail... (Chris McGann, Seattle P-I, Jan. 5, 2001)

Ron Sims' free rideSims is a very strong executive.

...Why does he have so much confidence in Sound Transit's light rail ? As Sound Transit struggles to find the right configuration for its project, when is he going to offer a smarter alternative? (Opinion, Seattle Times, March 25, 2001)

Sound Transit Board: It's time to do your job After the overwhelmingly negative wave of recent events, you would think a board that calls itself "Sound" would stop shelling out our money to move forward on such a monumental undertaking as a \$4.2 billion light rail plan. You would think they would call a timeout not just to patch up the holes that have been revealed, but a timeout to actually rethink whether this flawed vessel, light rail, is going to get us to the vital goal of reducing traffic congestion in central Puget Sound.

Yet I response to the damaging report issued last week by the US Inspector General's office... all we get here at home is more patch-up.

... My response is this: Is there *any* event or combination of facts, any misgivings about cost, funding, ridership, or concerns over the Inspector General's criticisms, *anything* at all that would finally cause the Sound Transit Board to ask, "Is proceeding with light rail still a good idea?" It seems no issue exists that's significant enough to prompt the board's serious review of alternative solutions.

...The board's irresponsibility is found in the decision to remain silent despite their growing awareness of that misinformation, including possession of significant evidence that light rail may not be a cost-effective transit alternative.

Civic groups, critics and other elected officials are calling ever more loudly for a complete review of the project including available alternatives... (Booth Gardner, Op Ed Seattle Times, April 11, 2001)

Sound Transit could use some healthy skepticism ...But Sound Transit was created using misleading projections to win its enabling election. If we may finally treat the immaculate status of the agency with some good, healthy skepticism, let us now see if it might reduce its ongoing expenses by sharply reducing its hordes of consultants, spinmeisters, attorneys (is it necessary to have all the big Puget Sound law firms on retainer?), \$200-per-hour “temporary” big wigs and other recipients of political sinecures.

Then once it’s down to essentials, let it (or better, let some independent investigator) furnish the public with realistic appraisals of the costs and benefits of light rail... Let it look at alternatives.... (Hank Bradley, letter to editor, Seattle Times, April 15, 2001)

The hidden election over Sound TransitWhen challenged, we say we know the 14-mile streetcar is fairly ridiculous, but you have to start somewhere, With other \$2-billion, \$4-billion, \$6-billion wads of money, paid by generous taxpayers somewhere, we shall build a vast system that someday goes where we want to go. “It’s not for us,” we say. “it’s for the children. They will thank us for it.”

They won’t. We will build far less than we promise, because we cannot afford it. Our children will look at our pitiful production and laugh at us: “you expect us to use *this*?”

And we will say, “but we spent billions on it”.

And they will not care.

There is still time to prevent this embarrassment. Light rail may not be listed on the ballot, but if you look for it, it is there. It’s time to till it, and get serious about things that will actually work: buses, van, carpools and --dare we say it--roads. (Bruce Ramsey, Seattle Times, Oct. 24, 2001)

Before tunneling begins, the region expects honest answers about cost, benefits and alternatives. If Plan A is the best approach, it will withstand the scrutiny. If a smarter Plan B exists, give it an airing, and equal scrutiny. (Editorials The Newspapers View, Seattle Times)

Its time to consider alternatives to light rail, which is going nowhere fast Sound Transit has revealed that it cannot fulfill its key promise to voters.... So what now for the deeply flawed Link light rail plan? ...We need a Plan B worthy of the innovative and imaginative people who live here; however, we don’t know what that is yet because Sound Transit refuses to seriously consider alternatives to light rail. ... The elected officials who make up the Sound Transit board pronounce that the voters wanted light rail and that is what they are going to get. In my opinion, what voters want is for you to use your best judgment and improve the traffic situation –whatever it takes. (Booth Gardner, TNT 6/21 newspaper article)

Sound Transit may argue that this is all old news, and that after a number of personnel changes they are now a “reformed agency”. However, their recent attempts to push Link forward using strong-arm tactics and/or deceptive practices (e.g.: RTID ballot, I-90 center lane preemption, and legalistic response to I-776), plus their continued refusal to seriously consider alternatives, all indicate this isn’t true. Sound Transit has still not leveled with the voters, nor have they regained voter trust.

7.4 Key recommendations of this report

The following actions should be taken at this time:

- 1) **The FTA should withhold any additional money for Link until a proper alternatives analysis has been completed, its results fully communicated to the public, and a public vote of confidence confirms voter support for continuation of Sound Transit's light rail strategy. Part 8 of this report outlines key requirements for conducting a proper alternatives analysis.**
- 2) **The Sound Transit Board of Directors should voluntarily undertake the above actions with or without the FTA requiring same. They should do this to confirm they are on the right path and to restore public trust.**
- 3) **Congress should investigate the manner in which mass transit grants are approved to ensure that FTA controlled planning processes are not abused in the ways chronicled throughout this report. They should investigate Sound Transit as one case example of abuse. Congress should insure that the process is redesigned to obtain maximum transportation improvement at the least cost to Federal and local taxpayers.**

The Sound Transit Board has no good reason to balk at taking these actions. If Board members are confident they are on the right path, a proper alternatives analysis can do nothing but confirm it, silence the critics, and help restore public trust. If they are not sure, then they should welcome having the better information that a proper alternatives analysis could provide, welcome the opportunity to reaffirm public support, and welcome the opportunity to best serve the region by changing course if necessary. There is no hurry to build Link since it won't make any difference in traffic congestion, and since the rights-of-way are not disappearing.

Vetting-- Although this report finds Sound Transit's rail centric strategy unjustified, the author does not feel that this report is sufficient in its current state to justify halting construction of Link. Instead the author feels that authorities should immediately cause this report to be reviewed by an objective team of experts to confirm or refute the logic, calculations and conclusions herein. This could be done in about six weeks. If those are upheld by the team of experts then there would exist reasonably credible, but still not conclusive, evidence that an all-bus strategy could achieve much the same benefits as light rail, and do so at a far lower cost. Such vetting would justify temporarily halting construction on Link until the full-fledged alternatives analysis is complete in 12 to 18 months. This may mean paying millions in contract delay or termination fees, but this is small change compared to the billions that would be wasted pursuing the wrong strategy. Finally, Link could be restarted if the full-fledged analysis is favorable, or terminated if it is not.

7.5 How accurate does this report need to be to justify the above recommendations?

The author recognizes the import and controversial nature of the above recommendations. It is appropriate to make a kind of reality check to see if the key findings of this report are accurate enough to justify taking the actions recommended. A first cut at this follows, with hope it will soon be followed by expert team review.

7.5.1 How accurate is the author's finding that an all-bus alternative would have adequate capacity and could attract as many riders as a mature light rail system?

The author did not simply assert that a mature all-bus alternative would be able to attract the same ridership as a mature rail alternative. This conclusion is based on the RTP's own ridership forecasts for the rail and bus alternatives, which the author believes are probably correct, at least one relative to the other. Cheating at this level is not likely, but if there were any it would have been designed to overstate the rail ridership and understate the bus ridership. However, the only way the conclusions of this report would be invalid is if RTP did exactly the opposite by underestimating rail ridership and/or overestimating bus ridership.

The 1993 FEIS found that the all-bus TSM alternative, as it was designed, would attract 518,000 daily riders or 92% of the 560,000 attracted by 125-miles of rapid rail. This is so close that there is little doubt that ridership on the TSM alternative could be bumped up to equal rail ridership just by doing simple things like adding routes or making the buses come more frequently. Additionally, light rail is slower than rapid rail and is unlikely to achieve the same ridership. Thus there is little doubt that a bus alternative can be designed to achieve the same ridership as a light rail system, even a fully mature one. But would it also have sufficient capacity to serve this ridership?

As Part 5 explained in detail, a properly designed bus alternative would have sufficient capacity to carry its full predicted ridership. The only place capacity could become a problem is in the downtown Seattle transit tunnel. However, a range of remedies was identified for that potential problem. If one remedy doesn't solve the problem the next could. First, the tunnel buses should be managed so as to achieve full capacity in the tunnel. If that doesn't solve the problem additional buses could be placed on surface streets according to schemes Metro has already identified. If that isn't enough then a through HOV lane could be constructed on I-5 allowing buses not actually needing to stop downtown to bypass the DSTT. If that doesn't suffice a busway across south Lake Union and along the waterfront could handle some of the load. And if none of that is enough a second bus tunnel could be built. It seems there are remedies in depth. In addition, there is evidence that the absolute level of ridership may be lower than originally expected making the whole capacity issue largely irrelevant.

In short, if one believes the RTP ridership modeling exercises were reasonably accurate, at least in a relative sense, then there seems little doubt that a properly designed bus alternative could attract, and carry, the same number of transit riders as light rail, even a fully mature 100+ mile version of light rail.

7.5.2 How accurate is the author's finding that an all-bus alternative would be much less expensive than a light rail system attracting the same ridership? And how accurate does it need to be?

The key findings in this report ---that light rail is far more expensive than an all-bus alternative attracting the same ridership, and that ST's rail centric strategy would probably cost taxpayers almost a billion dollars per year more than a bus centric strategy—are based directly on cost estimates in the 1993 FEIS and related documents. If the RTP got those numbers wrong then the cost estimates in this report will also be off. But they would need to be very far off to invalidate the author's general conclusions.

Again, the author is inclined to accept the cost estimates in the 1993 FEIS as being honestly arrived at and reasonably accurate given what the engineers knew at the time. And if there was bias, such as inflating the cost of the TSM alternative by including such things as improving the waterfront trolley --which was done--, it probably acted to make the TSM alternative more expensive than it should have been, and/or make the Rail/TSM alternative less expensive than it should have been. In other words the real cost difference between the bus and rail alternatives would --if RTP cheated-- be even greater than shown in this report. This report is therefore safe, if not indeed conservative, in accepting the RTP cost estimates as being accurate for the time. If the reader is willing to accept the RTP's cost estimates, there is only one other place for error. That is in the way the author adjusted those costs to produce an estimate of what a fully mature version of Link might cost, and what an extended version of RTP's original bus alternative might cost. The results all came together in Figure 6.3a.

The author began by assuming a fully built out version of Link would have about the same size network as the 125-mile rapid rail system in the 1993 FEIS, would follow about the same routes, involve about the same amount of tunneling, have about the same station designs, use the same trains and therefore cost about the same as the rapid rail system in the FEIS. The only significant adjustment the author made to RTP's cost estimate was to correct for a probable underestimation of rail construction costs. Thus he escalated the cost of rail by 44% to reflect the difference between what Sound Transit originally said light rail would cost and what contractor bids showed it would actually cost. But just because Sound Transit got their cost estimates wrong it does not automatically mean the RTP cost estimates were too low, however it is a strong indication they were. Still the author may have erred in applying this 44% so a reality check is in order.

Here are two sanity checks: First, the plot-points in Figure 6.3a show that Central Link and Link IS are both costing more than the rail trend line (cost vs. benefit line) in that figure. If a trend line were plotted through either of those plot-points and extended out to show the cost of a fully mature light rail system it would go up at a steeper slope and show a cost differential even greater than \$900 million per year.

The second check is to look at the cost per mile for Central Link and Link IS and see how that compares with the cost per mile of the rail trend line in Figure 6.3a. This is not

perfect either, but it's close enough. Per details in the Tech Notes, Central Link will cost \$ 157 million (02\$) per mile, Link IS will cost \$ 138 million (02\$) per mile, and the rail trend line in Figure 6.3a is based on a cost of \$ 120 million (02\$) per mile. Therefore the rail trend line in Figure 6.3a is probably overly conservative since it assumed a lower per mile cost than Link is actually experiencing.

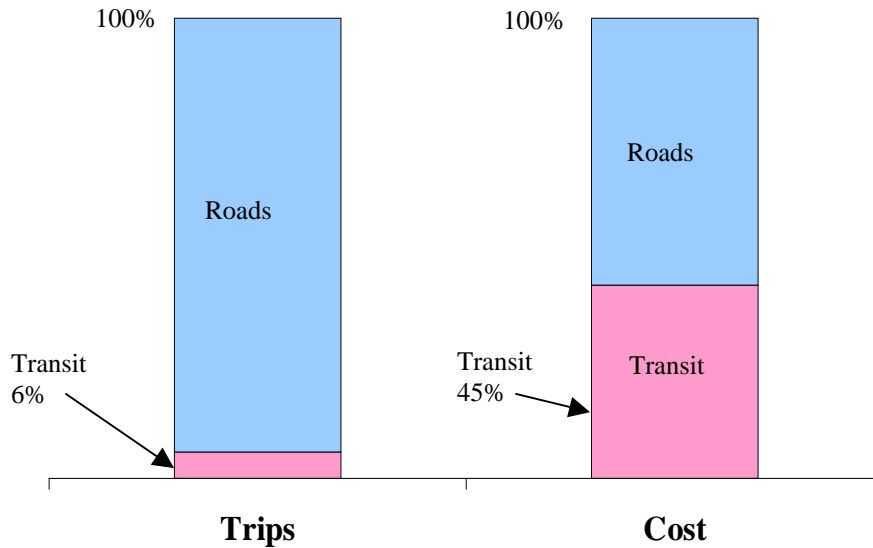
The author also made assumptions in calculating the cost of extending the TSM alternative until it reached rail ridership. This involved making the conservative assumption that the bus capacity issue was real and that nothing short of a second bus tunnel would solve it. So the cost of that tunnel was included in the bus trend line in Figure 6.3a. The cost of that tunnel came directly from an RTP estimate. Likewise the cost of extending TSM to achieve more ridership was an RTP estimate. Finally, the author did reduce the cost of the TSM alternative to account for the fact that about half the HOV lanes were completed in the 1993 to 2004 interim. Since this all relies on RTP data it is not obvious how the author's cost estimate for the TSM trend line in Figure 6.3a could be very far off, unless of course the RTP was wrong.

Finally, one must consider the extreme difference between the cost of the all-bus alternative and the light rail alternative as shown in Figure 6.3a. It would take a massive error in the cost estimates to erase such a big difference. It is pointless therefore to be overly concerned whether the true difference is \$900 million per year, \$1.3 billion, or \$600 million. It is huge in any case. And it strongly suggests Sound Transit is leading us in the wrong direction.

In sum, if one assumes RTP cost estimates were anywhere near accurate, the author's conclusion that light rail is far more expensive than an all-bus alternative is correct. It also safe to say that building a mature version of Link would cost taxpayers hundreds of million of dollars per year more than building a comparable all bus system.

The numbers in Figure 6.3a are large and the message is shocking. There's an emotional urge to say 'it just can't be true'. If you, the reader, are still in denial, please go back through every step and every assumption. If you can't find any errors you may need to accept the conclusions of this report.

7.6 The funding going to transit appears to be out of balance. The PSRC's Metropolitan Transportation Plan calls for about \$ 105 billion to be spent on transportation in this region between now and the year 2030. Of that, \$45 billion is for mass transit: \$19.4 billion for HCT plus \$25.4 billion for local transit. (Ref 61: Table 7) The HCT being 125-miles of light rail. Thus about 45% of total transportation dollars are planned for mass transit. However only 2.8% of trips in 1998 were made on transit and only 5.8% would be in 2020 if all the transit improvements envisioned in the MTP were implemented. (Ref 17: p. xvii) This imbalance is shown graphically in the following chart. A chart by WSDOT Secretary Doug MacDonald makes much the same point. (It's attached as an Addendum)



7.7 Does it matter if the region spends billions more on mass transit than it needs to?

This report concludes that pursuit of Sound Transit’s light rail strategy could end up costing the region roughly a billion dollars a year more than switching to an all-bus alternative capable of achieving the same transit ridership and ridership related benefits.

So what? Does anyone care?

The answers are not obvious. It will be interesting to see if anyone gets concerned enough to actually take action. There are lots of government programs that cost in the billions. The word “billions” appears in the papers on a daily basis. Ordinary people have a hard time relating to something that abstract. Perhaps the best way to make the cost of Sound Transit’s rail plans meaningful is to explain what else could be done with that amount of money, in other words, what we are giving up in order to build light rail.

For some indications consider the following:

Guiding King County’s budget through the health-care crisis Last month, I unveiled a \$3.2 billion budget before the Metropolitan King County Council as a blue print for healthy people, a healthy environment, and healthy communities. ...

... Unless we do something to change the status quo, King County can expect a doubling of its health plan premiums within six years, from \$154 million to more than \$300 million.

.... Two years ago, we made changes to our health-care plans... as a result we saved \$6 million in 2003. (Ron Sims, Op Ed, Seattle Times, Nov. 3, 2004)

Transportation needs require forceful action The Blue Ribbon Commission on Transportation has laid out a blueprint for meeting the goal of moving people and goods efficiently. Building a transportation system on that blueprint will be expensive and will mean more taxes. ...The commission estimates that the gap between what we need to spend on transportation over the next 20 years and what we've budgeted is about \$95 billion –nearly \$5 billion per year. (PI Opinion, Seattle P-I, Dec. 17, 2000)

Council offer 'kinder, gentler' budget Seattle plan raises fees, fines to restore some of mayor's cuts

The Seattle City Council today will unveil a spending plan that softens some of the most controversial budget cuts proposed by Mayor Greg Nickels, restoring money for community health clinics, a Fire Department medic unit and library books.

... the city faces a \$60 million general-fund shortfall between expected tax revenues and the amount needed...

... The revisions include: \$1.6 million in restored funding for community health clinics...Restoring a medic unit at a cost of \$800,000 ... Spending \$1.1 million more on social services, including food banks.... (Jim Brunner and Bob Young, Seattle Times, Nov. 14, 2002)

Wanted: Brave Souls with clear ideas As if the general fund budget shortfall were not headache enough, a separate but essential fund, the Health Services Account, also faces a substantial budget shortage of \$500 million or more... (P-I Opinion, Seattle P-I, Sept. 22, 2002)

School-renovation fund \$11 million short A Seattle School District review shows that its school-renovation programs are running deficits that could mean some projects will be delayed, trimmed or eliminated. (Sanjay Bhatt, Seattle Times, Aug. 4, 2004)

More money for parks endorsed The city (Bellevue) in 2003 identified \$175 million in parks projects over the next decade that it would like to complete. (Warren Cornwall, Seattle Times, Nov. 2, 2004)

Special-ed funding prompts lawsuit Lawmakers accused of neglecting duty Benzel said there is a gap of more than \$100 million between what the state pays for special education services each year and what those services cost districts. (Cara Solomon, Seattle Times, Oct 1, 2004)

\$878 million more sought by Bergeson for schools Terry Bergeson, state superintendent of public instruction, yesterday asked for an additional \$878 million for public schools over the next two years, an amount she says is essential to reach the goals of the states decade old education reform law. (Linda Shaw, Seattle Times, Sept. 23, 2004)

Lack of Money Hampers Superfund site cleanups Facing a record budget shortfall of about \$250 million and about 475 uncompleted sites, the nearly 25-year-old program aimed at protecting Americans from industrial contamination is in crisis. Program managers are scaling back their spending requests and slowing cleanups. (Juliet Eilperin, Seattle Times, CloseUp, Nov. 26, 2004)

Financial news gets worse for Seattle schools Insolvency possible, finance chief says (Seattle Times, Dec. 16, 2004)

Locke eyeing big tax boost Gov. Gary Locke, with only a few weeks left in office, is expected to propose a tax increase of about \$500 million tomorrow as a way to soften the blow of a projected \$1.5 billion budget deficit. (Andrew Garber, Seattle Times, Dec. 15, 2004)

Just weeks ago Washington State voters rejected a ballot measure that would have increased the state sales tax by one percentage point to fund statewide educational improvements. Sound Transit is already collecting a 0.4 percent sales tax, which is barely enough for the Initial Segment. To extend Link to Northgate, much less extend it into a full regional system, would obviously require raising the sales taxes going for light rail to more than the one percentage point sought for education, or raising other taxes instead.

Light rail is obviously competing with education for scarce taxpayer dollars. Underfunding education is one of the “opportunity costs” associated with pursuing light rail.

Sound Transit’s 2004 Financial Plan says that \$2.437 billion will be spent on Link’s Initial Segment between 1997 and 2009. In just 2004 Sound Transit will collect \$271 million in taxes.

The amount of money going to even the Initial Segment of Link light rail would make a big dent in the funding needed to reconstruct the Alaska Way viaduct and rebuild the 520 bridge. But the Initial Segment is just the first step in Sound Transit’s ambitions for light rail. Clearly the \$900 million per year difference between embarking on Sound Transit’s rail-centric vision for mass transit versus switching to an all-bus alternative would be more than enough to pay for both projects.

It would not be surprising if every environmental program proposed for Puget Sound (all the bike paths, all the parks, all the stream clean-ups, etc) could easily be paid for using a small fraction of what Link is costing. Someone should compile a list and find out.

In short, the money that might be wasted on Sound Transit’s rail-centric strategy is not an abstraction, it comes at the expense of opportunities foregone, and of other good ways to spend tax dollars.

Nor is the impact on the Federal budget, of questionable projects all across the country like Link, something to ignore.

Congress lift debt ceiling New borrowing to avert default

Congress last night sent President Bush an \$800 billion boost in the federal borrowing limit, spotlighting how the budget has lurched out of control in recent years and how difficult it will be to afford future initiatives. ... “I want someone to explain to me how it can be moral for a father to stick his kids with his bills,” said Rep. Gene Taylor, D-Miss. (Seattle Times, Nov. 19, 2004)

7.8 Concluding comments on RTA's 1993 FEIS

The 1993 FEIS is an impressive looking document, about an inch thick and perhaps 300 pages in length. The author has been drawing information from it for years, and has studied it intensely over the 4 months it has taken to write this report. The 1993 FEIS is backed by a two or three foot thick stack of technical reports on such things as the cost buildup for the Rail/TSM alternative and ridership modeling results. Some of these are used as references in this report.

Presumably the purpose of these EIS's is to help officials and voters make intelligent decisions regarding massive investments in public transportation. In this sense they are decision aids somewhat akin to the "business cases" used in private industry. They look authoritative and the reader starts with the assumption they are competent and objective. Unfortunately, after trying to dig useful information from the 1993 FEIS the author has come to realize the shortcomings of this report as a decision aid.

Although it is quite a brutal thing to say the author has concluded that the 1993 FEIS is essentially a sham. Yes, it does contain a lot of useful "raw data" kinds of information in the form of cost and ridership estimates and route alignments. However, rather than being dedicated toward thoroughly and objectively informing and educating the reader so he or she can make a wise decision, the 1993 FEIS is apparently dedicated to two different objectives. One is to satisfy FTA and state laws that require projects of this nature to have had completed an alternatives analysis. The other is to sell and justify a preordained conclusion, namely that rail is the better alternative.

The reader not interested in a sales pitch but actually trying to understand the merits of rail verses bus is forced to piece together bits of information from different places in the FEIS and resort frequently to technical backup documents not readily available. Much searching and many calculations are required. The careful reader finds that the FEIS is most interesting not for what it says, but rather for what it hides or ignores. Thus the reader will note that none of the charts appearing in this report –as tools to clarify key findings-- can be found in the 1993 FEIS, nor is the data to plot them found directly in the report.

As an example of what was hidden, the author was long unaware that the RTP actually made two ridership estimates for the TSM or bus alternative. The one featured prominently in the FEIS –and used to estimate all the ridership related benefits of the alternative- was their so called "constrained" estimate, although that label was not used and thus did not signal that there might be another. The indication a higher estimate existed was hidden back in the middle of a paragraph on page 3-93. Discovery of this fact was the Rosetta stone which allowed the author to unravel how the RTP had fatally biased this entire study. It was what enabled him to unravel the capacity story in Part 5 and produce all the cost charts in Part 6. Even then the actual value for "unconstrained" ridership did not appear in the 1993 FEIS. It was finally located in one of the technical backup reports. (Ref 42)

The instances of things not addressed or assertions made without adequate backup are not obvious to the casual reader, and the author missed many of them until actually starting to write this report. It is hard to stress this point enough. It is only when the reader really gets into it, that these problems become evident. But in retrospect they stand out. Some but by no means all are addressed in this report.

The challenge is to find the adjectives that seem most appropriate for describing the 1993 FEIS. The author has tried to apply them fairly and accurately. They include terms like: inadequate, irrelevant, and biased. RTA's creation of a deliberately hobbled bus alternative goes beyond simple bias. Manipulation and deceit are perhaps the proper terms.

The word "sham" is used just once in this report, here in this subsection. Webster's defines "sham" as "an imitation or counterfeit purporting to be genuine". The 1993 FEIS purports to be an objective decision aid containing the information needed to make a wise decision. It isn't. Local officials and the FTA should never have accepted it in the first place. Clearly it does not provide a valid basis for Sound Transit's selection of light rail over a bus alternative. Clearly it is not an acceptable basis for Phase 2 planning.

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Part 8: Guidelines for a proper alternatives analysis

8.1 General guidelines

Clearly state the main goal- What is the primary problem we are trying to solve? How can we measure the extent to which any given alternative might solve it? For instance if the main problem is traffic congestion, then the main goal should be a quantifiable and relevant metric, such as "reduce average travel time" or "reduce travel delay" as measured across the Puget Sound area. Obviously there are secondary goals, and they should be measured as well.

The author recommends that "reduction in travel delay" (measured in hours per average week day for all transit and auto trips) be the metric used. It would be calculated by subtracting total daily travel hours (for all daily transit and auto trips) in the build alternative, from total daily travel hours assuming all trips moved at the posted road speed limits.

Objectivity-- Obviously great pains must be taken to ensure that the overall alternatives analysis process is managed objectively by a party with no vested interest in any particular alternative winning.

Have advocates design the alternatives- Just like in the competition for some new military aircraft, we want each alternative to be as well designed as it can be. We want the alternative analysis "fly-off" to compare the best light rail design against the best all-bus alternative. Thus each alternative should be designed by someone who is skilled and motivated to produce the best possible design. We know Sound Transit favors light rail and would produce the best possible light rail alternative. A different party needs to design the all-bus alternative, and still a different party is needed for any car/van pool, TDM alternatives.

This paper has made it abundantly clear that an agency which has a bias toward one particular alternative can design the other alternatives to fail. The author has seen some of the subtle ways this can be done without attracting much attention. The fact that Sound Transit is designing the bus alternatives for the Phase 2 planning is very dangerous. Even if Sound Transit sincerely plans to be objective, it has an apparent conflict of interest or bias.

Have the alternatives evaluated by a neutral third party- The reasons for this are obvious. It will probably take some effort to find neutral parties due to the cozy nature of relationships between transit agencies and consulting firms. We will need to find a consulting firm that has no close relation with this region. We will need to supplement their work with help from universities and other independent consultants. The role of the evaluator is to estimate the degree to which each alternative would achieve the objective, and to estimate all the direct and indirect costs.

Use constant dollars- It is very hard to compare the cost of plans when they are costed in YOE dollars because the same project can cost different amounts in YOES\$ depending on its construction schedule. The cost of alternatives should be stated in constant dollars such as 02\$ or 04\$. This would make it easy to compare the cost figures in the Central Link FEIS and the 1993 FEIS with those in any new alternatives analysis.

Discount cost and benefits- Both the cost of an alternative, and its primary benefit such as delay reduction should be stated in “Present Value” terms. In support of this, a spreadsheet should be delivered as part of the alternatives analysis final report that shows how much would be spent on the project each year over the next 30 years. That cost stream should be discounted to a single present value or present cost if you will. Likewise the benefits, such as hours-of-delay-reduction per year, should be estimated for each year, tabulated on the spreadsheet, and discounted to a present value. The present value of the benefits compared with the present value of the costs is the best measure of cost effectiveness.

The reason for doing this is obvious. The general notion is that a dollar spent later is worth less than a dollar spent today, and a benefit received later is worth less than a benefit received today. Sound Transit has been collecting taxes for Link for almost ten years but construction has just begun and no actual benefits will occur until the line opens for service in 2009. Thus the bulk of the cost of a rail alternative is incurred years before any benefits accrue. In contrast, a bus alternative can start providing benefits shortly after moneys are spent, and at least part of the investment in a bus alternative can be staged so improvements aren’t made until they are really needed. Thus the cost stream for an all-bus alternative would not be as much front-loaded as the cost stream for a rail alternative.

Estimate ALL the costs- Include not only the dollar cost of the project per se but also costs to the environment, etc. Reduce everything to a dollar equivalent to the extent possible. Any cost that people feel is relevant should be included.

Consider ALL the alternatives- If the primary objective is to reduce travel delay for auto and transit users alike, then there is a long list of potential solutions beside building light rail or BRT. This full range of solutions should ideally be included in the alternatives analysis. If political realities restrict the new and proper alternatives analysis called for in this report to just a rail/bus comparison, then some other organization like the PSRC should be tasked to undertake this broader comparison of alternatives. PSRC is already mandated to do so as part of their legal requirement to implement Least Cost Planning.

To be more specific. For every rail+bus, or all-bus alternative considered, one or more non-transit alternatives should also be considered since they may be more cost-effective in reducing delay than expanding mass transit. Alternatives that should be considered include road improvements, car and van pools incentives, and Transportation Demand Management or TDM. Altogether there are about 50 alternatives that really should be

considered, although that means a more thorough process than officials may be willing to support at this time.

Communicate the results widely- Describe the alternatives, the degree to which they achieve the objective, and all direct and indirect costs to everyone with an interest. Do so with the intent of educating, not selling. This is key to building trust.

Present the cost-effectiveness information in a way that maximizes understanding- The 1993 FEIS presented cost-effectiveness information in a way designed to mask, not illuminate, rail's relatively high cost. Clearly this was not objective and did not foster understanding. A better use of graphics is also suggested.

Never let the alternatives differ in both cost and benefit- This was a major failure of the 1993 FEIS. In theory, use of cost-effectiveness should make it easy to compare alternatives that differ in both cost and benefit; however, in practice it is fraught with chances for confusion, especially in regards to benefits that are not quantified, such as impact on sprawl.

Design alternatives to be equal in cost, or in primary benefit- The alternatives analysis should consist of comparing a series of pairs or sets of alternatives. For instance we should compare the 14-mile Link IS with a bus alternative having the same present cost. Then we should compare the 21-mile Central Link with a bus alternative having the same present cost, and so forth until we compare a fully mature 100+ mile version of link with a bus alternative of equal cost. OR alternately, we should design rail and bus alternatives so they have the same impact on travel delay, then see how their costs differ.

Define the cost baseline carefully- The question of which costs are sunk and therefore should not be included in the cost of the "build" alternatives is important. Sound Transit might argue that multi-year contracts already negotiated or signed constitute sunk costs and therefore should not be included in the cost of the rail alternatives. A more sensible approach would be consider as sunk only costs that could not be recovered under contract termination clauses. The general idea is that rail build costs should include all the costs which could be avoided if we decided not to continue with rail. The same idea with bus.

In theory, we can get the same overall result, that is some picture that resembles Figure 6.3a, either way. It will take careful thought to see whether design-to-equal-cost, or design-to-equal-benefit, is the better approach.

Determine the costs and benefits for different degrees of alternative implementation, not just one arbitrarily sized project- All of RTP's and Sound Transit's FEIS' have just computed costs and benefits for a single point along what is really a continuum of project sizes. In other words the 1993 FEIS looked only at a 125-mile rail system, the Central Link FEIS considered only 21 and 24-mile versions of Link. As explained in Part 6 we need to understand the cost benefit picture for a full range of different size rail and bus systems. There are three primary reasons for this. One is that we are not sure

whether the rail and bus cost-benefit lines cross over at some point. One might be the least expensive way to achieve a modest increase in transit ridership, but not be the least expensive way to achieve a major increase. (I doubt it, but we need to know). Second, because of the law of diminishing returns, we need to understand the maximum degree to which a given alternative might make sense to implement. In other words it might not make sense to build more than 20 miles of light rail, or is it 100? By understanding the entire curve we can identify where the law of diminishing returns takes over and the marginal cost of building more line exceeds the marginal benefit. This theme will be further amplified in Part 8.2

The third reason is that we need to see where we are going. We are currently embarking on a light rail-centric strategy with no clear idea where it is leading. Other than for this report, we have no idea how much it might ultimately cost, and no idea how much it might ultimately be able to reduce traffic congestion. If voters knew where Sound Transit's strategy was leading they might have second thoughts about its affordability and its ability to really make a difference, or they might vote to accelerate it.

Be careful about what is considered a de-facto starting point-

Nothing should be taken as a fait accompli or irrevocable decision unless that's completely true. In particular Sound Transit should not approach the alternative analysis assuming that Link IS is a done deal and can't be stopped. Clearly if society wants it stopped it can be stopped, and no more need be spent on Link than what will already have been spent when the alternatives analysis is complete and the system is placed to a public vote of confidence. This will be contentious.

Sound Transit clearly intends to assume Link IS, indeed all of Central Link, is a done deal. Clearly ST plans to limit any future alternatives analysis to these narrow questions: Should the HCT link across Lake Washington be an extension of Central Link light rail or BRT? Should the extension from South 200th to Tacoma be light rail or BRT? Should the extension north from Northgate be light rail or BRT? This is not adequate. The region needs to determine if even the Initial Segment is justified. This means comparing the Initial Segment, and Central Link against all-bus alternatives.

Provide cost and benefit metrics that can be related to prior studies-- The FEIS' for Central Link and Link IS report costs in YOES\$. These are very difficult (for anyone beside Sound Transit) to convert into constant year dollars so they can be compared with what was said in, for example, the 1993 FEIS. Some of the EIS's give ridership for the entire alternative but not the rail component per se. All the existing EIS' quantify ridership and other impact for the years 2010 and 2020. Phase 2 plans to use 2030 but they must also use 2010 and 2020 or the results will not be comparable with these prior studies. The PSRC uses "delay" as the main dependent variable. Sound Transit should also include estimates for impacts on delay. In short there should be a template of cost and performance metrics, which all studies conducted over the years must fill out in a consistent manner.

8.2 Scenarios and alternatives that should be studied

8.2.1 The concept

Figure 8.2.1 shows what one of the most important outputs of a proper alternatives analysis should look like. It compares the costs and benefits of following a rail-centric strategy versus following an all-bus strategy.

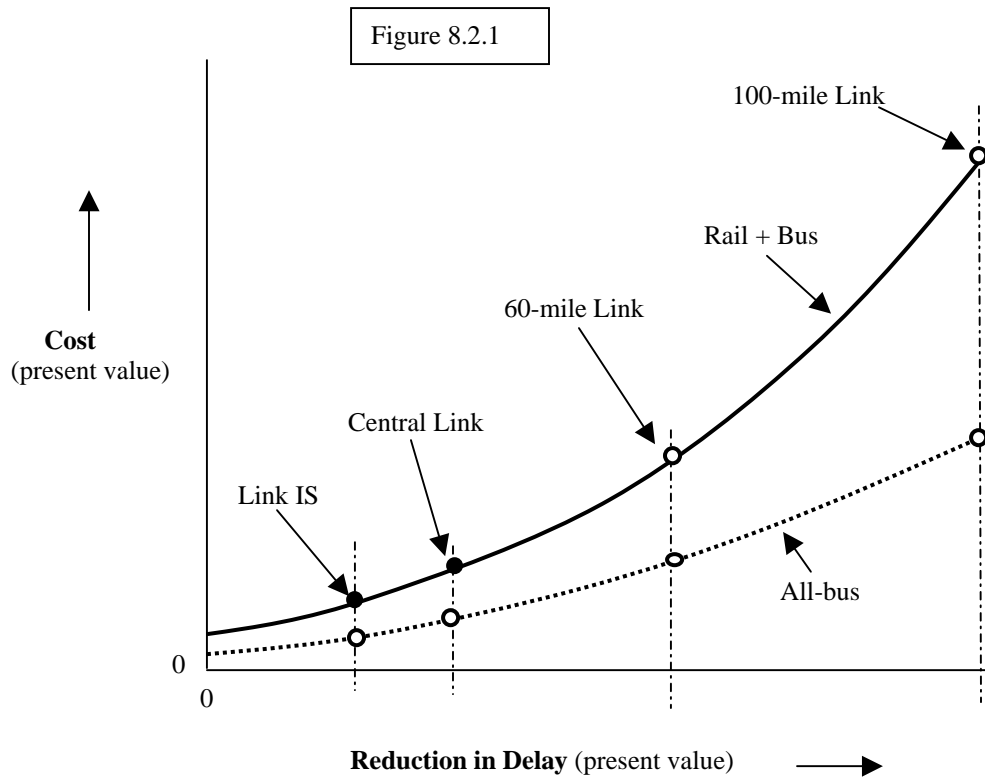


Figure 8.2.1 requires explanation. First, it is a chart relating cost to benefit, where cost is the cost of building and operating a transit system, and benefit is the reduction in travel delay resulting from that system. As noted earlier both metrics should be in terms of “present value”.

The solid line represents a rail+ bus strategy where the first step would be building the 14-mile Link IS along with the needed bus feeder lines. It’s similar to the Rail/TSM alternative in the 1993 FEIS in that rail always needs to be combined with bus. This could be followed by extending light rail to the 21-mile Central Link, then perhaps to a 60-mile system, and eventually to a 100-mile system. Society would probably choose to implement this strategy a step at a time by extending Link in stages, but in theory we could jump directly to any point along the line, such as building a full 100-mile system as one big project. The dotted line is the all-bus strategy.

Each circle represents an “alternative”, scenario, or project that should be evaluated in an alternatives analysis. The size of these projects (in route length, cost, or benefit) is somewhat arbitrary. For instance, Central Link could have been 24 instead of 21 miles in length. It could have been a \$1 billion, \$1.5 billion, or \$2 billion project. The circle at 60-miles is just an arbitrary point picked by the author. The circle labeled 100-miles is meant to represent what Sound Transit is considering for a fully built-out light rail system; namely, light rail from Tacoma to Everett and east to Redmond and Issaquah. The point is to evaluate enough alternatives, scenarios or projects to define the line.

The rail+bus curve in Figure 8.2.1 is shown as always being more costly than the all-bus alternative because that’s what Part 6 of this report indicates will be the case. However, that’s not for certain. Perhaps the curves cross each other at some point. The only way to find out is to compute the costs and benefits for enough points along the curves to make sure we understand their shapes. In other words, the study team needs to design a number of rail alternatives (or scenarios), which differ in terms of length, then compare each with an all-bus alternative designed to have the same delay reduction benefit.

Figure 8.2.1 shows what the results of an “equal benefit” alternatives analysis might look like. The circles line up vertically along the dashed equal benefit lines. In an equal cost study the rail and bus circles would line up horizontally.

Sound Transit already has most of the data to define two of the eight data points in Figure 8.2.1, and that’s why they are shaded black. The EA for Link IS obviously has the cost data. The mode split models have been run for Link IS and from their results Sound Transit should be able to compute the impact on regional travel delay fairly easily. The same is true for Central Link.

What the new and proper alternatives analysis would involve is getting data to plot the hollow circles.

It should be clear then that we need something more than was done in the 1993 alternatives analysis. It just compared one rail alternative against one bus alternative. We need a number of rail alternatives to be compared against a number of equal benefit, or equal cost, bus alternatives.

Again, the first reason we need to see the entire curve is because we need to see where Sound Transits rail-centric strategy is leading. Could we afford to follow it to a full 100-mile system? If we did, would it reduce delay enough to make the whole program worthwhile?

The second reason we need to see the full curves is see if they cross over. It is theoretically possible that a short light rail system in the most heavily traveled part of the network would be the least expensive way to get a modest amount of delay reduction, but that an all-bus network would be less expensive to achieve a large reduction. A crossover seems unlikely, but we need to see the entire curves to be sure.

The third reason we need the entire curve has to do with cost-benefit. It is almost certain that both curves will gradually get steeper per the law of diminishing returns. What that means is that at some point the cost of getting an extra measure of delay reduction will be higher than the value of having that reduction. For example, we could, in theory, extend light rail from Issaquah to North Bend. This might save a few commuters a few minutes, but the cost would probably exceed the benefits. Right now, ignoring the bus alternative entirely, we have absolutely no idea how big a light rail system it might make sense to build. That is, how far out the curve it would make sense to go.

8.2.2 Specific alternatives that should be included in a proper alternatives analysis

The light rail alternatives:

There are at least five light rail+bus alternatives or scenarios that should be evaluated. Each alternative is comprised of a HCT sub-network embedded into a much larger (in route miles) local bus network. The HCT sub-network in each scenario would be comprised of light rail and BRT. The non-HCT part of the transit network would be essentially the existing bus system, except some routes would no longer run into downtown, rather they would terminate at light rail stations. The scenarios are:

- 1) **Link IS+BRT, except with Link terminated south of the DSTT** - The only part of the high capacity transit (HCT) network that would be light rail in this scenario would be light rail from South 154th to somewhere just south of the bus tunnel. The rationale for this scenario is mainly political. Rail fans could still have light rail, but it would stop short of the DSTT so as not to interfere with BRT operations.
- 2) **Link IS+BRT--** This scenario would build Link IS as currently planned, but that 14 miles would be the full extent of light rail. The remainder of the HCT network would be BRT.
- 3) **Central Link+BRT--** This scenario would build a 24-mile version of Link from South 200th to Northgate. The remainder of the HCT network would be BRT.
- 4) **60-mile Link+BRT-** This scenario would build 60-miles of light rail and complete the rest of the HCT network using BRT. The idea here is to have a data point between a 24-mile system and a 100-mile system. The figure of 60-miles is just suggestive. The light rail system that ST plans to study for Phase 2 might be a good candidate. The author thinks it might be about 60 miles long.
- 5) **Fully mature version of Link+BRT--** This scenario would have light rail going anywhere and everywhere that it might conceivably make sense to go in the next 20 years. Then BRT would be used for the remainder of the HCT network. This fully mature version of Link might have 100 or so miles of light rail.

The All-Bus Alternatives—

There would be five all-bus alternatives. Each all-bus alternative would be designed to be equal in cost, or in benefit (e.g.: delay reduction) to one of the rail alternatives.

The HCT parts of the network would use BRT. The non-HCT parts of the transit network would essentially comprise the existing bus system. In other words, the bus alternatives would be similar to the TSM alternative in the 1993 FEIS, except they would be updated to include the latest improvements in BRT, such as off-bus fare collection.

It is anticipated that existing and planned HOV lanes or express lanes would suffice as “guideways” for BRT. It is not envisioned that any lanes would be converted into exclusive busways. Thus BRT buses would intermix with car and van pools on those HOV lanes.

The HOV lanes would be managed so as to achieve a good speed differential relative to the GP lanes. If and when it looked like the HOV lanes might slow down from over use, the requirement for car pool occupancy would be increased from 2 to 3, or 3 to 4.

The cost of the All-bus alternatives would include the cost of completing any HOV lanes, HOV to HOV interchanges, or HOV center access ramps that would be needed to optimize the alternative.

The all-bus alternatives would include the most cost effective fix to the downtown Seattle capacity problem discussed in Part 5, if such a fix were needed.

The other alternatives— As pointed out elsewhere in this report, the truly proper way to approach this problem of reducing congestion or delay is to consider additional alternatives beyond just improving mass transit in the form of BRT or light rail. Car and van pools are particularly cost effective.

“During the past two decades, vanpooling has proven to be one of the regions most successful TDM products. There are now more than 1200 public vanpools operating in our four county regions, carrying more than 5.5 million passenger trips every year.” (Ref 47: p.7)

Thus, ideally, there should be entire alternatives where all funds are devoted to car and van pool incentives. There should be other alternatives where car and van pool incentives are combined with other Transportation Demand Management (TDM) concepts. And there should be alternatives wherein part of the money goes for BRT and the remainder goes for car and van pools.

If for some political or procedural reason these other alternatives can not be included in the “new and proper” alternatives analysis recommended in this report, then they should be done in parallel by the Puget Sound Regional Council in a way that would allow the results to be directly compared against the bus and rail alternatives. (e.g.: equal in cost or in benefit to the rail and bus alternatives)

8.3 Roles and responsibilities

8.3.1 Sound Transit cannot be trusted to conduct an objective alternatives analysis. Therefore Sound Transit's role should be limited to two things:

- 1) Sound Transit should pay for the entire analysis including funding the tasks in 8.3.2 or 8.3.3 below.
- 2) Sound Transit should design the light rail alternative and estimate its costs. Much of this work has already been done for Central Link and Link IS; however, ST will need to design the mature 100+ mile version of Link as well as one or two intermediate steps toward it. Also ST should prepare cost estimates for the various light rail alternatives.

Neither Sound Transit nor the Sound Transit Board should have any management responsibility over the tasks in 8.3.2 or 8.3.3.

8.3.2 The all-bus alternatives should be designed and cost estimated by some organization that has the skill and motivation to design the best possible bus alternatives. METRO should be considered for this role.

8.3.3 A third organization should run the mode-split models and produce ridership estimates, estimates of impact on travel delay, and most if not all the estimates of environmental impacts. This organization might also provide guidelines for doing the cost estimates so they are done in consistent manner. This same organization should probably author the alternatives analysis report. The PSRC should be considered for this role, assuming they make a formal commitment to be objective.

8.3.4 Several expert panels should be formed to monitor the above mentioned players, and ensure an objective and thorough job. They should have sufficient power to force correction of any problems. Members of these expert panels should have no conflicts-of-interest. These expert panels should include known critics of Sound Transit's light rail plans. There should be at least one expert panel knowledgeable about mode-split models, and another expert in economic analysis.

8.3.5 Ideally, there should be still another organization that can design and cost one or more alternatives that rely mostly on car pools, van pools, and various forms of TDM.

8.4 Early indicators as to whether or not Sound Transit plans to continuing abusing the planning process for Phase 2.

The author does not expect Sound Transit's Board to conduct a new and proper alternatives analysis as described in Sections 8.1 and 8.2 unless there is outside pressure forcing them to do so. How would we know until it's too late? As Sound Transit begins

Phase 2 planning there are several litmus tests that will give early warning as to whether or not Sound Transit plans to continue abusing the planning process. These tests are:

- 1) Sound Transit designs the all-bus alternative by itself rather than lets outside bus experts and advocates do so. (It would be easy for Sound Transit to design the all-bus alternative so it's deliberately inferior to the light rail alternative. There are a host of ways to cheat. One way is to inflate costs by including expensive things like freeway HOV to HOV interconnects until and unless it is proven each of them is cost effective.)
- 2) Sound Transit refuses to include alternatives suggested by its critics. In specific, Sound Transit refuses to include alternatives that do not have any light rail, or that truncate Link IS south of the DSTT. In other words, all its alternatives take Link IS or Central Link, and Link in the DSTT, as givens.
- 3) Sound Transit refuses to give its critics meaningful roles in the design and evaluation of alternatives. Taking "input" at public hearings is not a suitable substitute.
- 4) Sound Transit does not structure the alternatives analysis so all the alternatives are either equal in cost or equal in benefit.
- 5) Sound Transit does not commit publicly and officially to use reduction-in-travel-delay or reduction-in-congestion as the main metric for evaluating the alternatives. Instead ST uses something like transit ridership.
- 6) Sound Transit does not commit publicly and officially to discount the cost and benefit streams when arriving at a summary measure of cost-effectiveness.
- 7) Sound Transit appears to be in a hurry with Phase 2. (Since Link will do virtually nothing to relieve Puget Sound's pressing traffic congestion there is no apparent reason to hurry commitments to extend it, like a used car salesman coercing customers into hasty decisions. Additionally, it would be foolish to lock in any plans to extend Link across Lake Washington until Link IS is successfully operating and until funding to extend Link to Northgate is assured.)

Part 9: Conclusions

Main conclusions of this report:

- 1) The existing planning process is not producing the kind of information needed by officials and the public to make intelligent decisions about major mass transit projects. Important information is missing or obscured. Promising alternatives are ignored. Reports seem intended more to sell than to inform.
- 2) Sound Transit and its predecessor agency the RTA have abused the planning process in order to promote light rail. They biased key studies by making inappropriate assumptions and masking key information. They compared a robust rail alternative against a deliberately hobbled bus alternative. They disseminated misleading information to the public.
- 3) ST justifies its choice of light rail on the one and only rail vs. bus alternatives analysis conducted here since the 1980s. However, that study was deliberately biased to favor rail. When that bias is removed the underlying data shows that an all-bus solution could probably achieve the same level of benefit at far lower cost.
- 4) ST and RTP dismissed bus alternatives largely on false claims that buses lacked adequate capacity. Their analysis was deliberately manipulated to support these claims. BRT has more than adequate capacity to meet the region's long-term needs. Light rail has less capacity than BRT and is therefore less strategic.
- 5) As construction begins on Link there is still no study which compares the benefits of spending \$X billions on light rail plan versus spending the same amount on bus rapid transit.
- 6) If the money now intended for light rail were instead redirected toward other projects such as BRT, car and vanpool enhancement, and other transportation projects the region could probably make considerably more progress in solving our transportation problems, because these other alternatives are more cost-effective.
- 7) By objective measures Link does not seem like something worth pursuing. Among other faults it would have almost no effect on traffic congestion and is not cost-effective as an alternative to driving.
- 8) BRT is a viable alternative to light rail in the Puget Sound Region. It could achieve the same benefits at a much lower cost and has more than adequate capacity to handle long term growth.
- 9) Link is the failed result of a faulty planning process. The process can and has been manipulated to favor preordained outcomes. It is not objective. It does not produce the type of information needed to make intelligent decisions. It fosters distrust. It is a process that needs to be fixed. This would take local and Federal action.

- 10) The region is embarking on a rail-centric mass transit strategy, which could result in over 125 miles of light rail. If fully implemented, that strategy will probably cost the region about a billion dollars per year more than an all-bus (BRT) strategy having the same level of transit ridership and related benefits. Meanwhile Link IS and Central Link are probably costing over twice what comparable all-bus alternatives would cost.
- 11) Link light rail is an example of the “waste, and abuse” that is driving up the Federal budget deficit, because it was sold on the basis of misleading information and because there are more cost-effective alternatives.
- 12) There has been insufficient public discussion about the merits or consequences of committing the region to this multi-billion dollar rail-centric strategy, and there is no solid analysis demonstrating it’s the best strategy.
- 13) Transportation planning in the Puget Sound region has not placed a high priority on spending taxpayer money efficiently or in finding the lowest cost solutions.
- 14) Link should be put on hold and further Federal funding withheld until and unless a new and honest alternatives analysis is completed, and that analysis demonstrates that light rail is superior to BRT and other options. On the basis of available evidence, such a conclusion seems unlikely.
- 15) The FTA should review, and if appropriate withdraw, its prior acceptance of the 1993 FEIS as meeting FTA requirements for a proper alternatives analysis, since that particular analysis is faulty in so many respects and contains no apples-to-apples comparison between Sound Transit’s light rail plans and all-bus alternatives. By the same token FTA should not allow Sound Transit to proceed with any Phase 2 planning until a new and proper alternatives analysis has been completed.
- 16) Sound Transit’s planning process for Phase 2 will not provide the information needed for this region to make intelligent decisions about massive investments in mass transit unless the recommendations listed in Part 8 of this report are adopted.
- 17) The PSRC should be forced to obey the State Law that requires Least Cost Planning because imposition of that planning technique is the single most important thing that can be done to help ensure that scarce transportation tax dollars are spent wisely.
- 18) Sound Transit’s latest Long-Range Plan should not be approved because it’s very foundation, the 1993 FEIS, is obsolete and corrupt.

Brief Introduction to Least Cost Planning

Least cost planning is a planning methodology to identify the least cost way to achieve a stated objective. An example of a stated objective would be a 10% reduction in traffic delay in the Puget Sound region.

Within Washington Administrative Code (WAC 468-86-030 and WAC 468-86-080) least-cost planning is defined as “a process of **comparing** direct and indirect **cost of demand and supply options** to meet transportation goals and/or policies where **the intent** of the process **is to identify the most cost/effective mix of options.**”

Washington State Law requires that regional planning agencies, such as the Puget Sound Regional Council, use Least Cost Planning as the basis for their regional transportation plans.

No single remedy will suffice-- The methodology recognizes that no single remedy, such as synchronizing traffic lights, adding HOV lanes on I-5, or building 20 miles of light rail is likely to comprise the entire solution. Instead the least cost solution will probably be a carefully designed mix of remedies, for instance spending: \$200 million on remedy A + \$500 million on remedy B + \$400 million on remedy C, and so forth. In short, the least cost solution is probably a “package” of different projects.

Include all the costs-- Least cost planning also recognizes that finding the least cost solution in pure dollar costs is not sufficient. In other words it is not sufficient to consider only the construction and operating costs of some option like light rail. The side effects, that is the social, safety and environmental costs are also important. Thus LCP considers these kinds of costs and converts them into dollar equivalents. For example a ton of air pollution may be assigned a dollar equivalent cost of \$10,000, or a serious injury may be assigned a cost of \$50,000. Economists and insurance adjusters have well established ways to derive these dollar equivalents.

Besides having negative side effects that are considered as costs, most projects have positive side effects that are in addition to helping achieve the stated objective. An example might be a roadway improvement not only helps reduce delay but also reduces accidents. Positive side effects are also converted into dollar equivalents. The objective is to estimate what I would call the “net social cost” of each alternative. The net social cost would be the capital and operating cost of the alternative, plus the dollar equivalent of the negative side effects, minus the dollar equivalent of the positive side effects.

For the purposes of LCP a remedy is any project or policy that might help achieve the stated objective. A remedy can also be considered as an alternative or an option, because during the LCP planning process the different remedies, alternatives, or options will essentially be competing with each other to see which survive and become part of the least cost package.

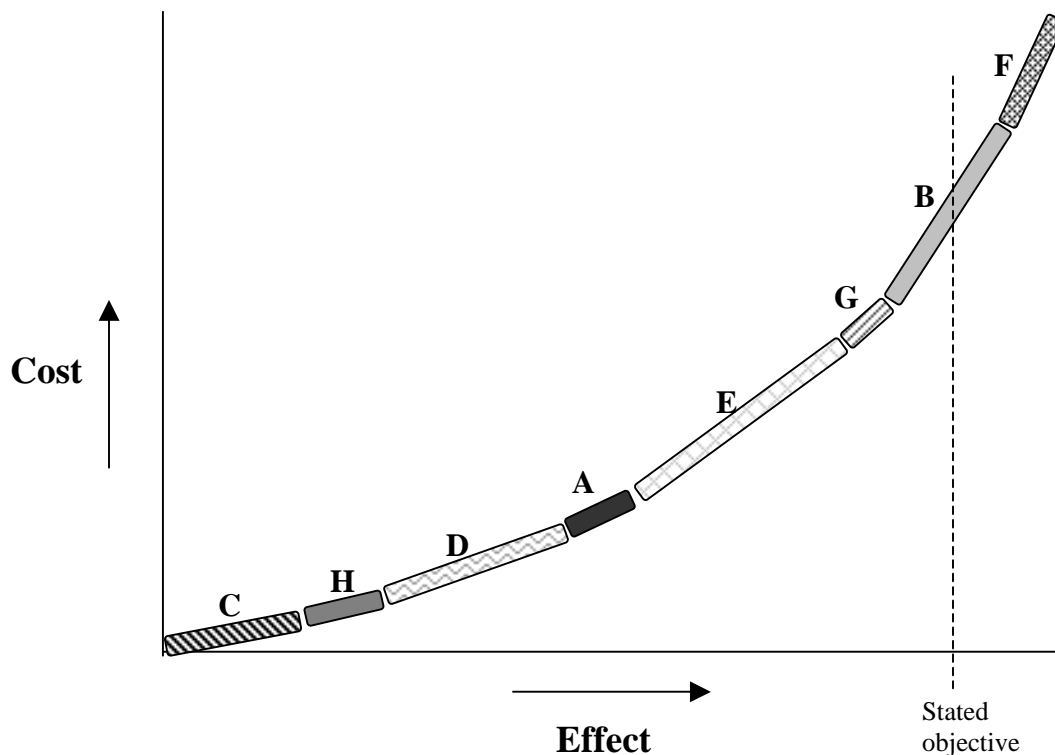
Consider all the alternatives-- A key aspect of LCP is to consider any and all alternatives that might help achieve the objective. If the objective is to reduce travel delay this means not only considering different ways to increase the supply of transportation (such as building new roads and transit routes) but also ways to reduce demand (such as telecommuting, and shifting traffic to off-peak hours). And it includes ways to increase the efficiency of existing transportation investments (such as ramp metering, and van pooling).

Each alternative is a specific project-- Least cost planning can not deal with open ended alternatives such as “build more roads”. Instead LCP deals with specific projects whose cost and benefit can be quantified. Thus LCP needs alternatives stated in terms like this: build 20 miles of light rail from SeaTac to Northgate, replace the 520 bridge, or institute a \$20 million car pool incentive program.

Compute the cost-effectiveness of each project-- The essential task in LCP is to compute the net social cost and benefit (effectiveness) of each project. Again, the benefit is the degree to which the project helps achieve the stated objective. For instance the 520 bridge replacement project might have a net social cost of \$500 million and reduce regional travel delay by 1.2%. The cost-effectiveness of this project would be \$417 million per 1% delay reduction.

Create a prioritized list of projects-- One of the main outputs from LCP is a list of all the alternatives that were considered rank ordered in terms of their cost effectiveness.

What is the least cost solution?-- The least cost solution is found by selecting the most cost effective project first, the second most cost effective next, and so forth until enough have been accumulated to reach the stated objective in terms of beneficial effect. Implementing this market basket of projects would be the least cost way to achieve the stated objective. This idea is illustrated in the diagram below, which arranges a number of projects (labeled A through H) in order of decreasing cost-effectiveness. In other words Project C is the most cost effective while F is the least cost effective. The projects can all be of different sizes. In this particular example a scaled down version of Project B might be needed whereas project F is simply not cost-effective enough to survive.



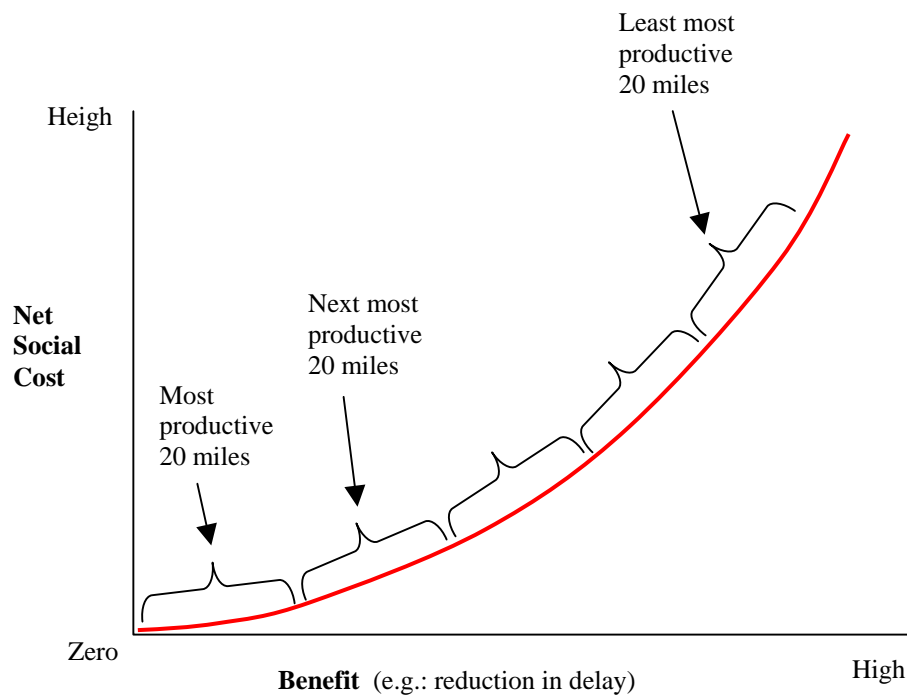
Least cost planning does not dictate the solution—The “least cost solution” identified by LCP is essentially a suggestion. Decision makers will always have the ability to accept, modify or reject it. Hopefully, provides objective information that helps society make more rational decisions.

Disagreements over valuation-- Not everyone may agree with the dollar value assigned by the planning team to things like a ton of air pollution, or a life lost to accident. Some might feel strongly that a higher or lower value is more appropriate. This difference in values can not be resolved analytically and in that respect LCP is not a perfect exercise. However, what can be done is to run sensitivity analyses to see if assigning a different value would alter the final results. For example if an environmental organization felt a ton of air pollution was worth \$80,000 rather than \$10,000 it would be very easy to put that value into the spreadsheet and see if the order of the alternatives on the priority list changed. If not, perhaps the issue would die out. If it did change the order of the projects, the dispute over which projects to implement would need to be settled by other means.

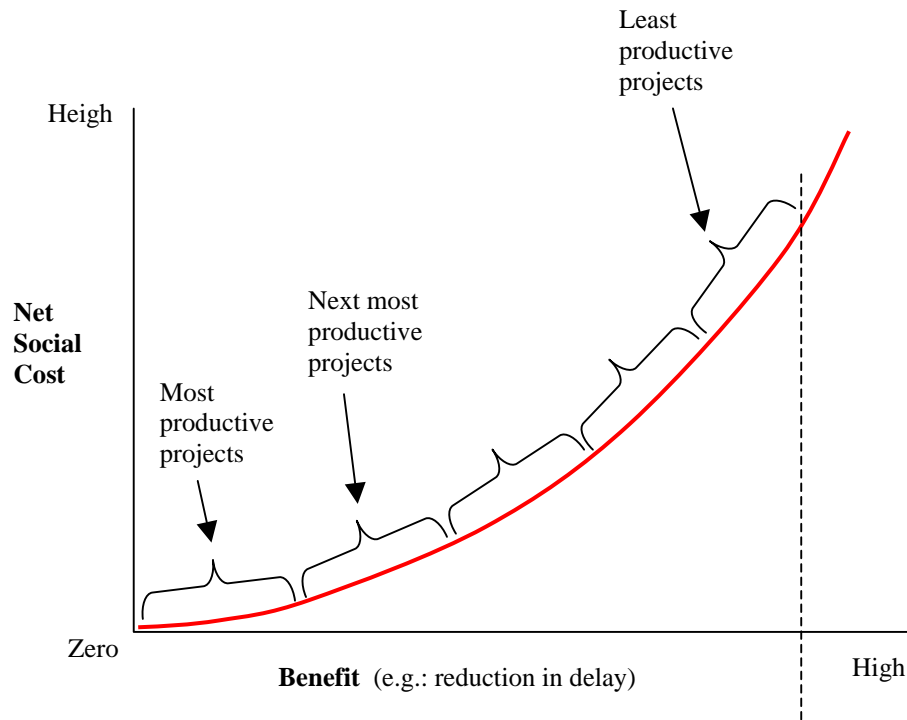
The law of diminishing returns-- Every type of remedy such as widening roads, building light rail, coordinating traffic lights, or incentivizing people to carpool follows the law of diminishing returns. The first dollars spent on any of these remedies will probably be spent where “bang for the buck” is highest. For instance the first 24 miles of light rail from SeaTac to Northgate would certainly attract more transit riders than 24 miles between say Northgate and Marysville.

Thus each type of remedy, such as Sound Transit’s current rail-centric strategy, will follow a curve like that below. The most productive 20 miles of light rail would achieve relatively high benefits per dollar spent, whereas the least productive 20 miles would achieve relatively low benefits per dollar spent.

The only way to actually construct a light curve representing Sound Transit’s light rail strategy would be to hypothesize a number of different light rail projects, evaluate each in terms of cost and benefit and plot the results. A line between those plot-points would define the light rail curve. The same logic applies to all the other remedies, and reinforces the idea that least cost planning must evaluate a whole range of specific projects, as opposed to a type or class of projects.



The same law of diminishing returns applies to the market basket of remedies that constitutes the least cost way to achieve the stated objective as illustrated below.



It is important to understand the concept behind these curves because there are practical implications. For one thing just because the first 20 miles of light rail might be fairly productive it does not follow that it would make sense to add another 20 miles. That next 20 miles might be far less cost effective than switching over and doing something different with the next \$X billion. So perhaps after building 20 miles of light rail we should next implement 100 more miles of HOV lanes. Perhaps the next 20 miles of light rail would make sense, or then again maybe the next best project would be some road widening.

The next major implication of the curves is that at some point the curve gets so steep that going further makes no sense. That point occurs when the cost of gaining another increment of benefit exceeds the value of that benefit. A cost-benefit analysis can determine that point. This point may or may not be reached before achieving the originally stated objective. In other words if the original stated objective were to reduce travel delay 10% we might find it too expensive to go that far. We may find anything over 8% does not make sense. This means we would just implement enough projects on the prioritized list to achieve that 8%.

Tech Notes

Vehicles Removed From Peak Period Traffic in 2020:

Central Link- Central Link will reduce regional PM Peak period VMT by 63,185 in the year 2020. The source data (16,996,434 – 16,933,249) is found on page 3-4 in the FEIS. (Ref 2: Table 3.1-4) Per PSRC staff, the average one-way work trip length is about 10 miles. Dividing the reduction in VMT by the average trip length indicates that Central Link would remove about 6320 cars from peak period traffic in 2020.

Using the change in VMT to estimate the number of cars removed is the honest way to get that number because the intent is to provide some indication of how much rail would reduce traffic congestion that is easier to visualize than something called “VMT”. However, Sound Transit has chosen to use a different approach, which gives a larger, albeit misleading, number.

“Link Light rail will remove 16,000 vehicles from the daily commute-“ (Ref 27: Appendix B, page 1-8)

This 16,000 number is not cited in the FEIS for Central Link and the author has not found its derivation. Sometimes a “new transit rider” is said to equate to one less car trip. However that is misleading for two reasons. First, Central Link trips are shorter (5.3 miles) than the average auto trip. Second, if someone drove 20 miles to reach a light rail station then took Link the last two miles that would count as a new transit trip, and thus one less auto trip.

Link IS- Data in the EA shows the Initial Segment will reduce peak period VMT by 18,899 VMT, which is equivalent to removing 1890 cars from peak period traffic. (Ref 18: Table 3.1-1)

Figures 6.2a: Source of all data: Ref 1: Table 4. Capital costs converted to annualized value by assuming 30-year 6% bond. Thus annual cost = $.072 \times$ capital cost. Annualized capital cost added to O&M cost to get total annual cost used on Y-axis. All costs in 91\$. Total annual cost of No Build (NB)= \$360 M; TSM= \$737 M; Rail/TSM= \$1320 M. Chart plots costs and ridership above and beyond or over the cost of the No Build alternative so \$360 M is subtracted from the TSM and Rail/TSM totals to get the values plotted. (\$377 M/yr for TSM; \$960 M/yr for Rail/TSM) Ridership metric plotted is total daily transit trips minus the 388,500 attracted by No Build.

Figure 6.2b: Rail line is same as in Figure 6.2a. TSM plot point (the end of the line) is moved right to the higher “unconstrained ridership” of 518,000 daily trips or 129,500 over NB. (Ref 42: Table 3.2) It is also moved vertically to account for the cost of adding \$600 M for a second bus tunnel. \$600 M is from Ref 26 page 8. Thus total cap cost of TSM with the second tunnel was \$5.3 B. The value plotted is it’s total annual cost of \$420M/yr over NB

Figure 6.2 d: This is the same as Figure 6.2b except for the extension of the TSM line. The cost of the extension had a capital and O&M component. The RTP had estimated it would cost \$2.1 billion to expand the TSM alternative enough to attract another 100,000 daily riders. (Ref 45: p. 46) This cost was prorated to account for the fact only 42,000 added riders would be needed to increase unconstrained TSM ridership to where it equaled that of rail (i.e. 560,000). This brought cap cost of a TSM alternative able to equal rails ridership up to \$6.193 B. I assumed the O&M cost for this extension was the same, on a per rider basis, as that used to plot the TSM line in Figure 6.2b. The total annual cost plotted for extended TSM was \$515M/yr over NB.

Figure 6.3a: This is an updated version of Figure 6.2d meant to indicate what the Rail/TSM and TSM alternatives would cost today. The capital cost of the rail component in the \$11.5 billion Rail/TSM alternative costs \$7.9 billion. This was multiplied by 1.44 to account for ST’s finding that light rail was

costing 1.44 times more than previously expected. Also the HOV lanes are now half completed. The Rail/TSM and TSM alternatives both contained \$1.5 billion for HOV lanes, so \$750 M was subtracted from each alternative. Finally all costs were multiplied by 1.32 to inflate them from 91\$ into 02\$. The capital costs in 02\$ were: Rail/TSM= \$18.778 B; extended TSM=\$7.184 B; NB=\$1.584 B. Total annual costs were Rail/TSM=\$2001 M/yr; extended TSM=\$1084 M/yr; NB=\$476 M/yr. The costs above NB were plotted. The \$917 M/yr difference is \$2001 M-\$1084 M.

Strictly speaking this is an updated cost comparison between the rapid rail/TSM alternative and the TSM alternative in the 1993 FEIS. However it gives a good indication of the difference between the light rail/bus alternative that Sound Transit is planning and an all-bus or BRT alternative. That is true because from a capital cost viewpoint the cost of the rapid rail system in the 1993 FEIS would not be much different than the capital cost of a light rail system following similar routes and having similar stations, which seems to be the intent. What differences we know about, such as at-grade rather than tunnel along Rainier Ave, would save a \$100 M or so, but that's not enough to noticeably alter these results. As to ridership, the light rail is slower and would probably attract fewer riders, but saying this chart gives a good indication of the performance of light rail is a conservative approach since if light rail attracts fewer riders than indicated in this figure the rail line would get steeper and the difference between rail and bus grow wider. In other words the \$917 M/yr difference is probably too low.

Figure 6.4: This is simply figure 6.3a with a different X-axis. It would have been preferable to plot the effect of the alternatives on Peak Period VMT since that is the best proxy for impact on traffic congestion that can be obtained from the data provided in the EIS's. However, the 1993 FEIS did not report on Peak Period VMT so the reduction in Total Daily VMT relative to No Build –which all the EIS's did report-- was used to dimension the X-axis. The performance of Central Link and Link IS is also shown.

Figures 6.1, 6.2c, and 6.3b: These charts all show the incremental cost of adding incremental riders. The first plateau is the total annual cost of the No Build alternative (i.e. the current bus system with incremental expansion as population grows) divided by the number of annual riders it carries. The annual costs are calculated as described above. For instance the No Build alternative costs \$360M/yr (91\$) and carries 109M riders per year. In the transit industry a “rider” means one person taking a one-way trip by transit. Thus riders= rides. Thus the cost per ride under the No Build alternative is \$3.29. But the No Build alternative only attracts 389,000 daily riders. If we want more we could implement the TSM alternative. That would cost another \$ 377M /yr above the \$360 million we are already paying for NoBuild. However, it would add 85,500 additional daily riders or rides, which is equivalent to 24.4 million additional annual riders. Dividing the added cost by the added rides shows it will cost \$15.40 for each additional ride. But this still does not get to the 560,000 ridership level of the Rail/TSM alternative. Adding rail on top of the TSM would cost an additional \$583M/yr. The cost for each additional rider it attracts comes to \$24.70 per ride. If the benefit of attracting each of these added riders does not exceed that amount then rail is not worth building. Put another way, at some point the law of diminishing returns takes over. It is simply not worth the cost of attracting still more transit riders.

Figures 6.2c and 6.3b are constructed using the same approach. When, in Figure 6.2c, the TSM capacity restraint is removed with a second tunnel its ridership increases so there is not much left that implementing rail could add. This causes the cost per ride for each ride provided by rail to rise dramatically to \$47.50. Figure 6.3b is based on the updated costs used to construct Figure 6.3a. The marginal cost of the rail riders now exceeds \$90 per one-way ride.

Cost and ridership for Link and Rapid rail:

NOTE: The unit costs used in the 1993 FEIS and those used in the EIS's for Central Link and Link IS appear to be identical except for adjustments for inflation between 1991 and 1995. In other words the cost for a given station or for a given segment of track appear to be identical in constant dollars whether for the rapid rail in the 1993 or the Central Link system costs as presented to the voters in 1996. Evidence for this is found in a 1996 RTA memo from Bob White, then head of the RTA.

“...the ERP concluded that RTA’s capital cost estimates were appropriate and concluded that “the capital cost methodology used for the JRPC system plan (i.e.: the 125-mile rapid rail system in the 1993 FEIS) was appropriately updated to reflect 1995 construction costs and was then applied to the new options ...” We are continuing to use these same tunnel cost estimates.” (Ref 63)

...First, as I have discussed, to remind you that the RTA numbers still provide a sound basis for upcoming decisions. (Ref 63)

What this means is that the author is probably correct in assuming that the cost of a 125-mile rapid rail system as reported in the 1993 FEIS would, after increasing it by 44% to account for known errors, provide a good estimate of what a 125-mile version of Link light rail would cost. Of course that estimate is not perfect since a few miles along Rainier Ave are now at grade whereas before they were in tunnel, and no doubt there are other details that have changed. However, this approach is the best available way to estimate the cost of a fully mature version of Link, and the capital cost estimate would need to be off by literally billions of dollars to invalidate the main finding of this report; namely that a fully mature (100+ mile) version of link light rail would be hundreds of millions of dollars more expensive than a BRT system having the same ridership.

Central Link- SOURCE DATA: Cap cost = \$2.599 billion in 95\$ as of Jan 11, 2001 (Ref 27: Section 13) O&M cost = \$42 million 95\$ per year. (Ref 2: p.5-11)

Year 2020 daily rail riders= 133,000, of which 55,000 (or 0.414) are new transit riders. (Ref 2: p.3-21 and 7-11) Ratio of new riders to total riders was slightly lower (0.373) in New Starts Report. (Ref 40: p.10) Another ST document says: “Almost one third of the 100,000 plus daily light rail riders will be former automobile commuters.” (Ref 27: Appendix B, p.2-8)

No build=72883000 total daily VMT; with IS VMT=72802000; with central link VMT= 72612000. (Ref 18:p.20)(Ref 2: p.3-4) ESTIMATES: total annual cost = .072*2600 million + 42= \$229 million/yr in 95\$. 02\$/95\$= 1.27. Thus Central Link costs \$291 million/yr in 02\$. Reduction in total daily VMT= 0.37%. NET: \$291m/yr for 0.37% reduction in VMT.

Initial Segment- SOURCE DATA: Cap cost=\$2.1B in YOES (Ref 18: p.45) O&M cost = \$52 million Year\$ assume 01\$ (Ref 18:p.47) \$3602 in YOES = \$2600 in 95\$ (Ref 27: Section 13, p.1-8) Year 2020 daily boardings= 42,500 (Ref 18: p.20) New transit rider data not located. VMT data per Ref 18: p.20. ESTIMATES: \$2.1 B in YOES = \$1.52 in 95\$. Cap cost of Initial Segment =.072*1520 million = \$109 million/yr in 95\$, or \$139 million per year in 02\$. Total including O&M= \$191 million per year in 02\$. Based on Central Link’s ratio of total to new transit riders: 55/133* 42,500= 17,575 new transit riders on IS. Reduction in total daily VMT= 0.11%. NET: \$202m/yr for 0.11% reduction in VMT.

Rapid Rail in 1993 FEIS- Cap cost for alternative =\$11.5 billion. Cap cost for just rail =\$7.9 B in 91\$. (Ref 45: p.44 and Ref 45: p.40) O&M cost= \$399 million/yr in 91\$. (Ref 1: p.xxxiii) Ratio 02\$/91\$ = 1.32. Total daily 2020 rail boardings = 330,000. (Ref 42: p.3-26) New 2020 transit riders due to Rail/TSM alternative= 172,000 per day. Year 2020 total daily VMT for NB= 84,189,000, VMT for rail= 81,030,000.(Ref 1: p.3-95) ESTIMATES: Total annual cost for alternative=.072*11500 million +399= \$1227 million/yr in 91\$, or \$1619 million/yr in 02\$. New transit riders on rail= 55/133*330000= 136,500 per day. VMT percentage reduction for entire alternative= 3.75%. NET: \$1619 million/yr for 3.75% reduction in total dailyVMT.

Estimate peak loading on Link if it were extended north, south and east: The approach used was to start with RTP’s forecast of 15,000 pph --as the one-way peak load on the 125-mile rapid rail system-- and then estimate how much that would decline if the system were truncated to Central Links 24-mile route. If the result comes close to the 5415 predicted for Central Link then the two forecasts are consistent.

Step one was to see how much effect removing the east-side route from the 125-mile system would have. According to the Travel Forecasting Results report there were 88,600 daily trips to the north corridor from the south and east corridors plus the Seattle CBD. This volume translated into a peak load of 15,000 just north of the DSTT. (Ref 42: Table 3.8) Of that, 12,300 came from the east corridor. Per Ref 42, Figure 3.3 some east to north riders use the I-405 corridor but I assume all went via the CBD. Eliminating all riders from the east would leave 76,300 trips to the north corridor via the DSTT.

Step 2 removes some of those riders to the north corridor who come from the south corridor. Of the 88,600 total, 23,000 came from the south corridor. Per Table 3.15, of the 21,300 persons who depart south corridor stations in the PM peak period 7900 use stations south of SeaTac. I assume half of those 7900 would not use rail at all if it ended at South 200th, but the other half would transfer to bus. Thus the south line would lose 4000 PM departures, which can be assumed to comprise 19% of its riders. 19% of 23,000 is 4400 riders. 76,300 less 4400 leaves 71,900 riders going into the north zone assuming it extends to Everett.

Step 3 is to remove half of all those that would be destined to stations north of Northgate. Again the remainder are assumed to transfer from rail to bus, or simply park at the Northgate station. Per Table 3.15 18,700 of the 43,300 PM departures from north corridor stations occur north of Northgate. Assume half the 18,700 or 9400 would no longer use rail if it ended at Northgate. 9400 is 21% of the 43,300 which means that the north line would lose 21% of its 71,900 remaining riders. The end effect of eliminating the east line and truncating the north and south lines is that daily ridership into the North Corridor would drop from 88,600 to 56,800 riders. This would cause loading at the peak load point to drop proportionally, from 15,000 to 9600. This is admittedly a very crude approximation.

In short, this exercise establishes the approximate ratio of peak load point volumes between a full 100+ mile rail system and 24-mile South 200th to Northgate rail system. That ratio is 15,000 divided by 9600 or 1.56 to 1. This ratio was determined from examination of RTP's rapid rail system but the same ratio should apply to a light rail system, since any difference in speed between rapid rail and Link should not affect the ratio.

There now exist two forecasts and one statement. First, we have RTP's forecast that peak loading on the 124-mile rapid rail system would be 15,000pph. in 2020. (Ref 1: p.2-58). Next we have ST's statement saying the long range ridership projections estimate Central Link would have a peak load of 15,000. (Ref 18: Appendix L, p.23). One can only assume they meant that for a fully built out 100+ mile version of Central Link. Finally, we have ST's forecast that peak loading on a 24-mile version of Central Link will be 5415 pph in 2020.

Thus if ST was right in saying a fully built out version of Link would have a peak load point volume of 15,000, then the peak load on the 24-mile version should be roughly 9600. However this conflicts with ST's forecast showing the peak load on the 24-mile system would only be 5415. Since 9600 is much different from 5415 there appears to be a conflict between these two forecasts. Either the 15,000 figure is correct, or the 5415 figure is correct.

The author suspects that the 5415 number is the correct one because it was a direct forecast made for Central Link, whereas the 15,000 attributed to Central link was probably just taken blindly from RTP's old 1993 FEIS for rapid rail. However, since the author can't be certain it is interesting to consider the implications of each being right.

If 5415 is the correct peak load for the 24-mile version of Link then a fully built out version of Link would probably have a peak load of only about 8500, not the 15,000 claimed. This comes from applying the 1.56 to 1 ratio to 5415.

If the 15,000 figure is correct then Link would not have enough capacity on the south line by 2020 and not enough on the north line to handle growth much beyond 2020.

Cost per mile sanity check: Central Link: SOURCE DATA: Cap cost = \$2.599 billion in 95\$ as of Jan 11, 2001 (Ref 27: Section 13) $02\$/95\$ = 1.27$. Length = 21 miles. Calculation: $2600 \times 1.27 / 21 = \157 million (02\$) per mile. Link IS: SOURCE DATA: Cap cost=\$2.1B in YOES (Ref 18: p.45) \$2.1 B in YOES = \$1.52 in 95\$. $02\$/95\$ = 1.27$. Length= 14 miles. Calculation: $\$1520 \times 1.27 / 14 = \138 million per mile. Per mile cost of rail trend line in Figure 6.3a: 125-mile rapid rail in 1993 FEIS cost \$7.9 billion in 91\$. Ratio $02\$/91\$ = 1.32$. Cost per mile in 02\$= $7,900 \times 1.32 / 125 = \83.4 million/mile. Correction factor is 1.44. Thus cost per mile of the trend line in Figure 6.3a is $\$83.4 \times 1.44 = \120 million per mile. In sum, the rail line in Figure 6.3a, and the finding that a full build out of light rail would cost about \$900 million a year more than a comparable BRT system, are conservative because they are based on light rail costing \$120 million per mile, whereas Link IS is costing \$138 million per mile and Central Link was expected to cost \$157 million per mile.

Capital cost of Sound Transits Rail centric strategy versus an all-bus alternative: The capital cost of the rail centric strategy (which is essentially the Rail/TSM strategy but with 125-miles of light rail rather than 125-miles of rapid rail totals \$18.8 billion in 02\$. Derivation was: Take original cost of \$11.5 billion in FEIS. Subtract one half of the \$1.5 billion that was for HOV lanes. Multiply the \$7.9 billion that was for rapid rail by 1.44 to correct for underestimates. Then multiply by 1.32 to convert from 91\$ to 02\$. Capital cost of the all bus alternative in Figure 6.3a (which is identical with the TSM alternative in the FEIS) is \$6.8 billion in 02\$. Derivation: Take original cost of \$4.7 billion and subtract one half of the \$1.5 billion that was for HOV lanes since these have now been built. Add \$600 million for a second bus tunnel. Multiply total by 1.32 to convert into 02\$.

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Abbreviations:

PB/KE = Parsons Brinckerhoff/Kaiser Engineers
RTP = Regional Transit Project
RTA = Regional Transit Authority (predecessor to Sound Transit)
PSRC = Puget Sound Regional Council

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End of Report