Washington State Transportation Commission

Statewide Rail Capacity and System Needs Study

Task 10.2 – Washington State Rail Investment Plan

Technical Memorandum

prepared for

Washington State Transportation Commission

prepared by

Cambridge Systematics, Inc.

with

Global Insight, Inc.
HDR, Inc.
Transit Safety Management

December 2006

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technical memorandum

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Summary

This Technical Memorandum uses information on rail system constraints and issues and user needs to lay out potential investment strategies that would benefit the State. It describes the features of programs that could be used to implement these strategies and draws on the analysis in Technical Memorandum 8 to illustrate the evaluation of four strategic action packages that are illustrative of the types of investment strategies recommended more broadly.

Objective

The goal of this Technical Memorandum 10.2 is to identify the types of projects that should be the focus of future rail investment plans for Washington State and to illustrate how the decision-making framework presented in Technical Memorandum 7 can be used to prioritize these investments. Consistent with direction provided to the consultant team by the Washington Transportation Commission, this plan does not recommend a specific set of prioritized projects as this would be beyond the scope of the study. The objective of this Tech Memo is to help guide the Legislature and WSDOT towards that types of investments that will have strategic value to the State by addressing critical problems faced by users of the rail system and to lay out a process for prioritizing these investments based on available funding.

The technical memorandum will accomplish these objectives through the following steps:

- Review the major capacity constraints and choke points in the Washington rail system;
- Review other changes in the rail system/business environment that affect Washington State rail users and that might be addressed with State investment;
- Based on a review of how the major system constraints and changes in rail business environment affect major user segments, identify types of investments that would provide benefit to these user segments;
- Using the analysis of capacity constraints and choke points and looking at system needs across user segments, identify a set of high priority projects that could

potentially deliver the greatest benefits to the State from an improved freight and passenger rail system; and

- Provide examples of how the benefit/impact methodology introduced in Technical Memorandum 7 could be used to evaluate some of the priority projects and determine their benefits to the State and the appropriate role for the State in these investments.

Rail System Capacity Constraints and Choke Points

Many segments of the rail mainlines in the Washington rail system are at or near capacity. As reported in Technical Memorandum 3, mainline capacity was determined in a two-step process that first estimated theoretical capacity (that is the maximum density of trains that can operate over a given section of track at the highest speeds authorized), then adjusted the estimates to practical capacity (that is, the fraction of theoretical capacity at which the system can be operated reliably without significant delays). The results of this analysis are illustrated in Figure 1. The most significant current capacity constraints that were identified include:

- Current train volumes exceed practical capacity on the BNSF lines between Everett and Wenatchee (over Stevens Pass), and between Ferndale and the U.S.-Canada border.
- Current train volumes are nearing capacity on the BNSF lines on segments between Everett and Bellingham; Wenatchee and Spokane; Pasco and Lind; and along the Columbia River Gorge between Vancouver and Wishram.
- Current train volumes are nearing capacity on the UPRR lines along the Columbia River Gorge between Portland and Hinkle; between Hinkle and Spokane; and between Spokane and Sandpoint.

As shown in Table 1, the number of line segments that are expected to exceed capacity is expected to grow dramatically if current unconstrained demand is realized. This would occur even taking into account changes in operations by the Class I railroads aimed at improving throughput in the system.

Figure 1. Washington State Rail System: Mainline Capacities, 2006

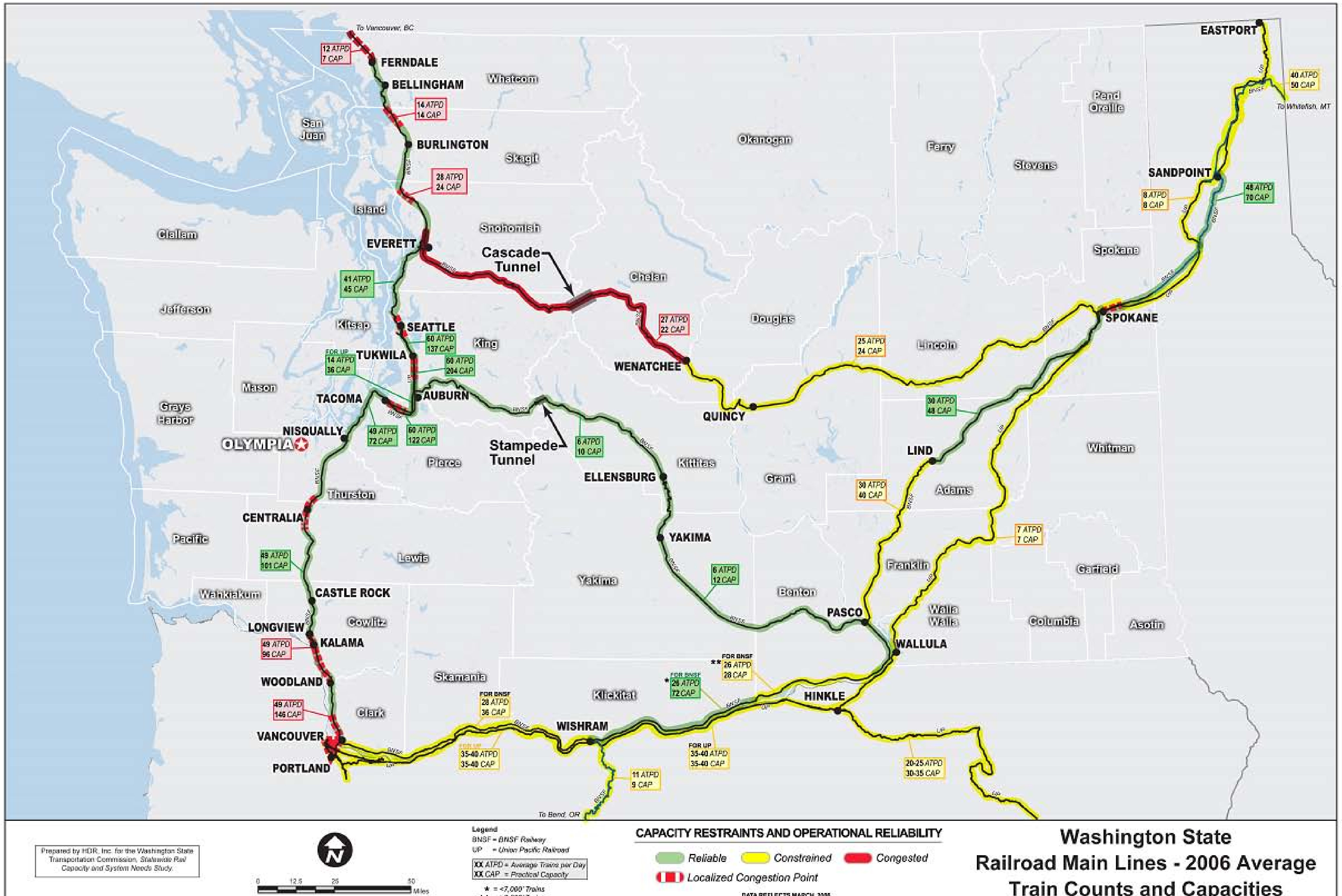


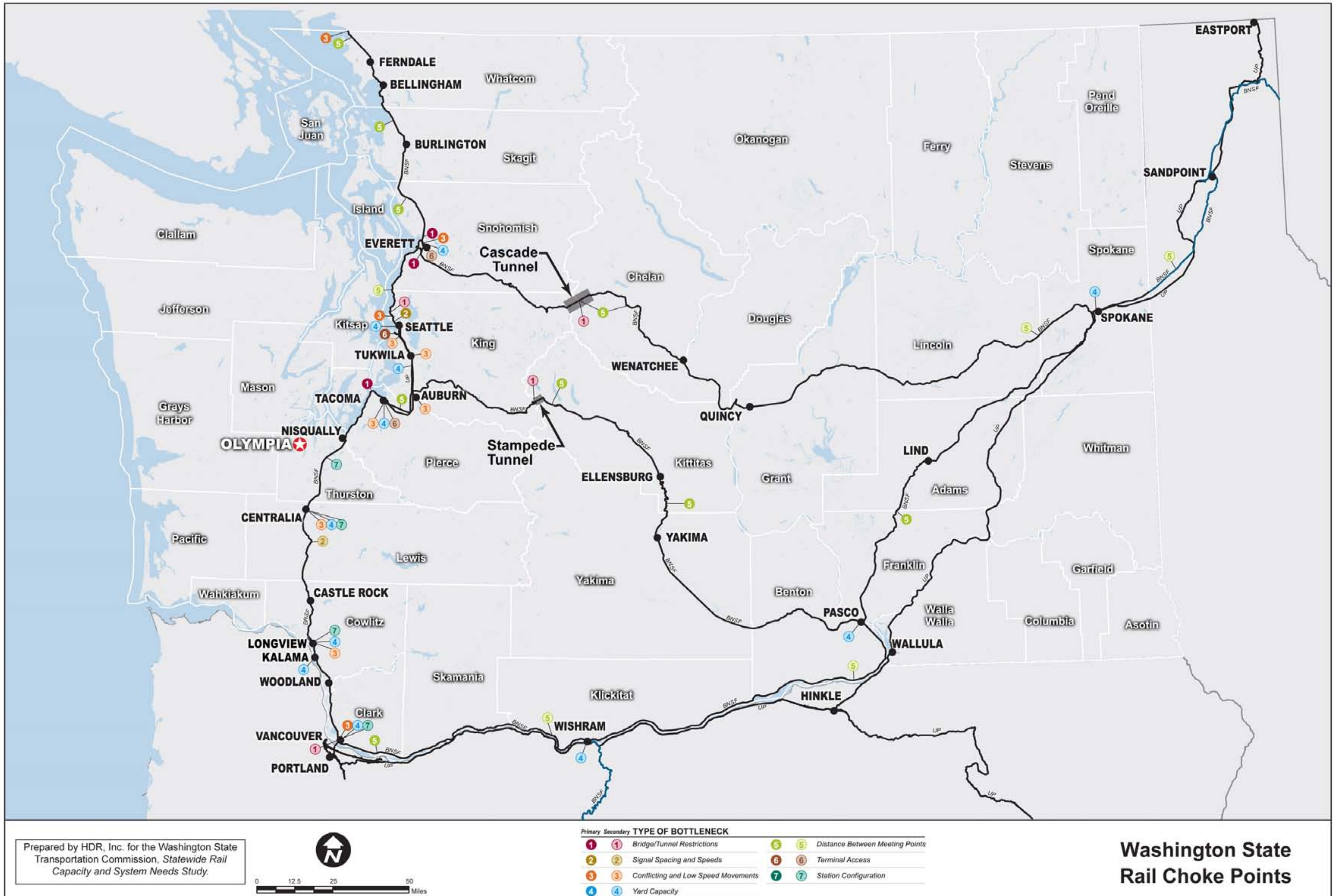
Table 1. Rail Lines in Washington State Exceeding Practical Capacity
2015 and 2025

2015	2025
Everett-Burlington	Everett-Burlington
Burlington-Ferndale	Burlington-Ferndale
Ferndale-New Westminster	Ferndale-New Westminster
Everett-Spokane, Washington (BNSF)	Everett-Spokane, Washington (BNSF)
Vancouver-Wishram	Vancouver-Wishram
Wishram-Roosevelt	Wishram-Roosevelt
Roosevelt-Pasco	Roosevelt-Pasco
	Pasco-Spokane, Washington (BNSF)
Pasco (Wallula)-Spokane, Washington (UP)	Pasco (Wallula)-Spokane, Washington (UP)
Spokane, Washington-Sandpoint, Idaho (UP)	Spokane, Washington-Sandpoint, Idaho (UP)
Auburn-Yakima	Auburn-Yakima
Yakima-Pasco	Yakima-Pasco

Note: Based on peak-day train volumes and assuming operation of 8,000-foot trains.

Technical Memoranda 3 and 4 also determined that there are significant choke points throughout the system. These choke points are presented in Figure 2. With the Everett-Spokane line nearing capacity, the BNSF has been routing more intermodal trains south along the I-5 corridor to Vancouver, Washington, and then east. This has added considerable volume to the Vancouver-Pasco line along the Columbia River Gorge, and made the scheduling of train moves through the Gorge and along the I-5 rail corridor more complex. While there would appear to be sufficient capacity to handle this growth in traffic in the north-south corridor, it is subject to frequent stoppages when trains tie up the mainline to enter and exit the many ports, terminals, and industrial yards along the corridor. Some half-dozen sections are chronic choke points. The on-time performance of the Amtrak *Cascades* service has dropped, and delays for both BNSF and UPRR freight trains have increased, although recent changes in freight operating practices have improved performance somewhat. The problem is particularly acute in the Portland/Vancouver area, where the railroads' north-south and east-west routes intersect. Rail simulation studies of grain trains bound for the ports, intermodal trains running through, industrial carload trains serving local industries, and intercity passenger trains shuttling up and down the I-5 corridor show that the delay hours per train moving through the Portland/Vancouver area are greater than the delay hours for trains in the Chicago area, one of the nation's

Figure 2. Washington State Rail System: Rail Choke Points, 2006



most congested rail hubs.[1] Other notable choke points shown in the figure include the tunnel over Stampede Pass, which has insufficient clearance for double-stack trains, and bottlenecks moving through Spokane.

The railroads are investing to expand rail line capacity and add new equipment, nationally and in the Pacific Northwest. However, both the BNSF and the UPRR have indicated a preference for addressing capacity problems through operational strategies instead of capital expenditures. The railroads argue that they are at their best as a cost-effective transportation mode when they focus on wholesale "hook-and-haul" services. By handling large volumes over longer distances they can realize economies of scale that keep the cost of individual shipments low. They prefer this approach because it represents less financial risk than expanding mainline infrastructure. Once in place, rail mainline infrastructure must be maintained for decades and cannot be reduced or redeployed to other markets.

The railroads are pursuing a number operational strategies to increase freight "velocity," that is, to increase the volume of freight moved through the system using existing infrastructure. These strategies will have significant impacts on the Washington State rail system. The strategies include:

- Operation of longer trains and higher slot utilization on intermodal trains (e.g., maximizing the number of containers on intermodal flat cars);
- Marketing and operation of single-destination unit trains for carload traffic;
- Consolidation of traffic at central terminals by third parties;
- Elimination of mainline switching wherever possible (i.e., picking up and putting out of individual cars or sets of cars for a specific shippers and receivers while the train is "parked" on the mainline); and
- Transfer of responsibility for branch line switching from the Class I railroads to local short lines wherever possible.

These operating strategies will increase velocity and reduce car cycle times (generating more effective capacity) if certain infrastructure improvements are undertaken. However, they have major implications for Washington State:

- The benefits of longer trains cannot be realized without significant investment in supporting infrastructure. This includes lengthening sidings, building more and longer storage tracks for assembling trains in terminals and yards, and adjusting operations

[1] "Freight, Intercity Passenger and Commuter Rail," PowerPoint presentation to the Portland-Vancouver I-5 Transportation and Trade Partnership on May 21, 2002; and "Final Strategic Plan: June 2002," prepared by Willard F Keeney and HDR, Inc. for the Portland-Vancouver I-5 Transportation and Trade Partnership.

to account for the time it takes longer trains to clear grade crossings and entry and egress locations at terminals. In addition, the use of longer and heavier trains will mean more, and more frequent, track maintenance.

- Significant improvements must be made at yards and at access points from the Ports of Seattle and Tacoma. While many of the terminal capacity and access issues that these ports are experiencing are independent of railroad operations (that is, the chokepoints will exist without the shift to longer trains), they will be exacerbated by the shift to longer trains, at least as currently contemplated. For example, assembling an 8,000-foot train as opposed to a 6,000-foot train will require longer lead tracks; longer storage tracks; more switching time on the lead tracks to assemble the train; more time to inspect and air-test the readied train; more time to set-out a bad-order car if one is discovered prior to departure; and more time for the train to depart once a signal to enter the mainline is received. Long slow-moving trains may also block at-grade road crossings located near the yard for an inordinate amount of time.

- The inability to use the Stampede Pass corridor for intermodal trains and the growth in container trade through the ports will put increasing pressure on the north-south I-5 rail corridor. This is and will continue to degrade the performance of passenger trains in the corridor as well as UP's ability to serve its intermodal traffic over track shared with the BNSF. Ultimately, this will affect the availability of competitive rail service from the ports and their potential attractiveness to certain ocean carriers.

- Carload shippers who generate small volumes of cargo and who ship small numbers of carloads to many different destinations will find it harder to get service, will find the service increasingly costly, and will see their service receiving the lowest priority of all the cargo that is being moved. This change in priorities has already been felt by Washington's industrial carload shippers and Eastern Washington's agricultural shippers.

- Many shippers of carload traffic, even those generating high volumes, will need to reorganize their rail facilities and operations to bring them more in line with the operating models of the Class I railroad. Many customers are finding that they must change storage track configurations, change the way they build trains, and change how trains are set for pickup and drop off. In the future, shippers on industrial leads may need to identify opportunities for third-party switching in order to maintain their service.

- Short-line traffic that does not fit the "hook-and-haul" operating strategy of the Class I railroads will find it increasingly difficult to get cars, get timely service, and get low rates, especially for small shipments. It will take more time and cost more for short lines to service their customers. This may affect the long-term financial viability of some of the short lines. In the past, short lines have often compensated by deferring expensive infrastructure maintenance, particularly on low-density lines. This usually compounds the problem by forcing slower train speed and less reliable services – services that cannot compete effectively against trucking, especially for short-haul shipments. Additional financial pressure on short-line railroads may affect the market share and profitability of agricultural product storage businesses. In the worst cases, the financial pressures might force businesses to relocate or close with a loss of jobs and revenue for the local communities.

- Longer, more frequent trains will create growing conflicts in at-grade crossings throughout the state. Given current traffic patterns, this is expected to be a significant problem along the I-5 corridor. If BNSF crown cuts the Stampede Tunnel, enabling it to route more double-stack intermodal trains over this line, the high traffic flows will be felt in communities from Wenatchee to Yakima through to Kennewick, where there is increasing development.

- Third-party operators are interested in providing short-haul services that connect Washington exporters with the ports or other domestic markets. These services would benefit the State by decreasing truck traffic; however, given the current capacity constraints in the system, the availability of train time slots for short-haul services is expected to be extremely limited.

- Railroads are using pricing to turn aside lower-profit carload freight in favor of intermodal and coal traffic, which can be handled more cost-effectively and profitably in bulk unit trains. In some markets and corridors, international intermodal traffic is squeezing out industrial-carload traffic. Shippers, who are used to being price setters, are now price takers. This is painful change for all shippers, especially captive shippers, who are being forced to rethink their supply chains and markets. This shift is having a noticeable effect in Washington State and the PNW. The Ports of Seattle and Tacoma are major gateways for intermodal traffic moving to and from the Pacific Rim. The strong growth in intermodal traffic is slowly eroding the railroads' capacity to serve local Washington State and Oregon industrial and agricultural carload traffic.

■ Impact of Rail System Issues on Rail Users

Port and International Trade

We focus here on international container trade. Bulk cargo exports face their own issues moving through the Ports of Vancouver, Kalama, and Longview as well as through Seattle and Tacoma. Those issues are discussed in a later section focus on freight rail and the agricultural sector.

In the near-term, the throughput capacity of the ports could be affected by a number of rail issues including rail-terminal capacity constraints and choke points accessing the mainlines from the port terminals. The key problems are:

- Intermodal capacity constraints at the Port of Seattle caused by short stub-ended intermodal tracks; short arrival and departure tracks; short switching leads crossing busy streets at-grade; low-speed train movements; short staging tracks; limited ability to move cars between intermodal and staging yards; and dense urban development surrounding their facilities.

- Duwamish corridor access constraints to the Port of Seattle.

- Terminal access problems at the Port of Tacoma through the Tideflats, most notably the current configuration of Bullfrog and Chilcote Junctions, as well as the lack of direct northbound access to the BNSF's mainline at Reservation Junction.

- Capacity choke points on the mainlines between Everett and Tacoma, especially the choke point associated with the double-track Seattle Tunnel, which is located just north of King Street Station in downtown Seattle.

In the longer term, the lack of intermodal capacity in the east-west mainline corridors is likely to be the most significant constraint to growth facing the port and international trade sector. The current routing options are limited by capacity over Stevens Pass. Running times between sidings between Skyhomish and Leavenworth over Stevens Pass will continue to limit capacity on this line even if the ventilation is improved in the tunnel. As intermodal traffic demand grows, the railroads will divert more traffic into the north-south I-5 corridor to get to the Columbia River Gorge. Sidings along the Gorge routes do not have sufficient length at a sufficient number of locations to accommodate 8,000-foot trains. Opening up Stampede Pass to intermodal traffic and implementing directional running by pairing the Stevens Pass and Stampede Pass lines may be effective strategies to address the needs of the ports to move intermodal traffic.

Agriculture and Food Products

The three major components of this market sector are: 1) Midwest grain exporters; 2) Washington agricultural shippers using the Columbia River and Puget Sound ports to export products to international and domestic U.S. markets; and 3) the food products industry, especially the growing wine industry of the Columbia Valley. Rail traffic in this market sector is dominated by unit trains serving Midwest grain exporters using the Columbia River and Puget Sound ports. The Class I railroads have also been encouraging Washington State grain and other bulk agricultural shippers to consolidate shipping points so that the railroads can operate more unit trains. Notable examples of this trend are the Ritzville loading facility and the new Rail Ex service. Both of these examples involve third parties, which assemble shipments from a number of business, then assemble them at a central location before handing them over to the Class I railroads for the long-haul move.

Specific problems on the primary agricultural products routes through the State that affect all shippers that use these lines include:

- Short sidings that cannot accommodate longer trains and inadequate siding spacings or sidings that require trains to slow down when entering them on the BNSF Columbia River Gorge route. These capacity constraints create operational problems downstream by causing westbound trains to miss schedule windows when they move through the Portland/Vancouver Triangle and into the I-5 rail corridor. There is also limited capacity on the UPRR line between Wallula and Sandpoint, Idaho caused by inadequate siding lengths and spacing along the line.

- Low-speed trains moving through Portland/Vancouver area block Portland-Seattle trains, including passenger rail trains, for long periods. Likewise, trains stopping on the mainline outside Vancouver to change crews block the mainline tracks and significantly reduce effective throughput capacity of the I-5 corridor. The problems are compounded track configuration problems through Vancouver and Portland area that cause trains to block mainline movements and reduce effective capacity.

- Limited access to the grain elevators, lack of long industrial tracks adjacent to the mainline, and limited yard and unloading track capacity at Kalama and Longview require trains to stop on the main tracks for extended periods.

- At Centralia, BNSF currently interchanges trains (changes crews) with the Puget Sound & Pacific Railroad on the BNSF mainline. Movement to and from the mainline is restricted to 10 mph, blocking one of the two main tracks and many at-grade road crossings within Centralia for significant periods.

- Short lead tracks at the Port of Seattle's Cargill grain elevator require trains to block a main track when arriving or departing the grain elevator.

There are also problems that within-state agricultural shippers face that are unique to their situation. Historically, many Washington agricultural shippers, particularly grain shippers, have moved their products to elevators and storage facilities that were built adjacent to rural branch lines, most of which are today operated by short lines. The storage facilities and the short lines have developed relationships that rely on the financial health of both entities. Many of these short lines have not generated enough revenue to maintain their tracks. As track is downgraded, safe operating speeds decline, and the service that shippers receive no longer meets their needs. Those who can, shift to truck, transferring their product to another storage location where they receive better rail service. Over time, this has undermined the financial viability of the storage facilities on low-density short lines as well as the short lines themselves. The problem has been exacerbated by the changing business model of the Class I's, which favors unit train operations, and the growth in other more profitable intermodal traffic that uses the available mainline capacity. In the long run, shippers need viable transportation options to stay competitive and stay in business. This may include rail, but in some cases it may involve shifts to truck or barge. In considering cases where preservation of rail service is desirable, the State may wish to consider actions that help rationalize the short-line system, improving overall operations and velocity, keeping costs down, and minimizing the amount of additional truck traffic.

Industrial Carload Shippers

The industrial carload market segment was the mainstay of the rail business until the development of intermodal service and bulk unit-train services. It is still a large market for the railroads nationally and in the PNW, especially for the UPRR. In Washington State, there are businesses throughout the state that are located along the mainlines and along industrial leads and spurs that rely on traditional carload rail service because of the nature of the commodities they ship and the markets they are trying to reach. Many of these are low-volume shippers, but high-volume shippers are experiencing some of the same service issues and problems as low-volume shippers. Even when shippers generate high volumes of traffic, destination management is an issue. Moving dozens of carloads out of Washington State to a single Midwest or East Coast destination for a high-volume shipper is cost-effective and profitable for a Class I railroad; but moving dozens of carloads out of Washington State to a many Midwest or East Coast destinations may be less cost-effective and profitable.

In general, the industrial carload market in Washington will experience healthy growth in the next decades. Interviews with shippers conducted during the first phase of the study indicate that most shippers expect their businesses and volume of freight shipments to grow, and freight forecasts prepared for this study show growth in this market. However, many of these shippers report that they are paying higher prices, are getting lower quality service, and are often having business turned away. These shippers substitute truck for rail when they can, but for shippers of bulky semifinished products or primary materials, trucking may not be feasible or cost-effective. In the longer term, there is a risk that Washington State will lose some of these businesses to relocation or closure.

If industrial carload shippers want to continue to use rail, they may need to reorganize their rail facilities or make arrangements to consolidate their shipments with those of other rail shippers. Many shippers, even those with high traffic volumes, have track configurations at their plants and warehouses that are not compatible with the Class I railroads preferred, high-volume, hook-and-haul operations. For example, their storage track configurations may not allow for efficient switching of cars to and from the mainline. The Class I railroads are pushing shippers, wherever possible, to reorganize and upgrade their tracks and track layout to improve switching efficiency.

Where track configurations cannot be changed or upgrades are not cost-effective, a second option may be for the shipper to arrange with a third-part switching railroad to move cars from the shipper's location to the nearest rail consolidation terminal.

A third option is to move industrial shippers into new or existing rail-served industrial parks where carload lots from a number of businesses can be combined into a wholesale-sized consist. Rebuilding track and relocating businesses is costly, and many Washington State industries will require outside financial assistance to make these changes.

A fourth option is to use transload centers. This works well for shippers who send and receive freight in less-than-carload quantities and can ferry their commodities between a railyard and their plant by truck. Lumber, plastic pellets, feed, and some chemical products can be handled cost-effectively through transload centers. However, both consolidation and transload centers must be located and designed with sufficient storage and siding track so that pick-up and put-out operations do not block the mainline. Again, the costs of these facilities is high, they need a strong business plan to ensure that they can generate sufficient revenues, and none are feasible if the railroads cannot keep pace with economic growth and handle the freight across the PNW and the U.S.

A related problem facing the industrial carload market is yard capacity. As the railroads move to longer trains, cars spend more time in the yard because there are less frequent trains to haul them out. This creates yard congestion, increases shipping time, may dramatically increase car-hire costs, and can decrease pick-up and delivery reliability. Yards with short switching leads and inadequate arrival/departure track lengths – like individual industry sidings – will contribute to congestion on the mainline because the longer trains must occupy the mainline track for more time.

Passenger Rail

The passenger rail sector covers both intercity rail and commuter rail. While serving different markets with different service requirements, both intercity and commuter rail require:

- Frequency of service and service at appropriate times of day. The trains need to run when people want to travel and they need to run often when people want to travel.
- High-speed services. Both intercity and commuter rail need to be able to transport passengers at speeds that produce overall travel times that are at least competitive with auto travel. Intercity rail travel times should compete with the local air city-pair service.
- Reliability at an appropriate cost. The trains need to run on-time and at a cost, including out-of-pocket cost and the cost of transfer and waiting time, that is commensurate with the frequency, times, speed, and reliability of the service.

Both Sound Transit and the Amtrak services that are provided in the State have developed service and operating plans with these goals in mind. In addition, both have experienced growth in ridership as they have added trains. However, achieving these performance goals when the passenger trains share track with freight trains is difficult.

The choke points and operational problems in the north-south I-5 rail corridor have been well documented. These bottlenecks must be eliminated for the Amtrak *Cascades* to achieve its service objectives. It is generally agreed by the passenger and freight rail operators that these improvements must be made in the short- to medium-term and that the additional capacity will benefit all users of the I-5 rail corridor – passenger and freight. But as the Amtrak service moves towards a truly high-speed and reliable service (beyond Timetable C), the improvements will increasingly be for the benefit of the passenger system only. And the demand for passenger service is likely to grow in the short-term, as a result of rising fuel costs and freeway congestion. In examining the potential benefits to the State of supporting passenger rail programs, it will be important to take into account the environmental benefits, the congestion benefits, and the investments already made in the rail system and the highways.

■ Investment Strategies that Can Address Rail System Needs

Table 2 presents recommended investment strategies that would address the needs of each of the Washington State rail user groups as outlined in the previous section. This is followed by a list of high-priority investments that resolve major system capacity constraints. System capacity constraints and choke points in key corridors affect all users of the rail system, especially to the extent that they cause the Class I railroads to "ration" capacity and provide priority service to the most profitable customer segments. It is important to note, however, that additional capacity alone will not resolve the issues facing many Washington State rail shippers in traditional, low volume carload markets. Class I railroads are likely to continue to move in the direction of the business models they are currently pursuing even if capacity constraints are relieved. However, additional capacity in the system, especially if it is purchased with significant contributions by the State, may be linked to opening the network for new third party services. These services can provide new revenue sources for the Class I railroads that could be attractive if capacity is not constrained.

The types of strategies that are described in Table 2 can be grouped into the following categories:

- Assistance to shippers or community-based economic development entities to construct rail improvements or consolidation facilities off of the mainline rail system;
- Assistance to develop new intermodal terminal facilities that may or may not be owned and operated by a single rail carrier;
- Investments in mainline capacity;
- Investments to resolve choke points and access problems; and
- Community impact mitigation.

There are a number of program ideas that are contained in the descriptions of the investment strategies:

- When assistance is provided to shippers, short lines, third party service providers, or community-based economic development entities, it is recommended that this be done through a formal call for projects with clear eligibility criteria and a designated managing entity for the project. These entities will need to provide a significant share of the funding for the project. If there is not a private entity proposing the project, it is recommended that the managing entity by a Rail Improvement District or a Public Port Authority. The managing entity should present a business plan for the project that demonstrates service agreements from a rail carrier and commitments from shippers to use the service.

Table 2. Examples of Projects Addressing the Rail Service Needs of Washington State Rail Users

Possible Strategies	Possible Projects/Actions
Industrial Manufacturers	
• Offer financial assistance and technical assistance to shippers for site improvements. Assistance can be in the form of tax-exempt bond financing repaid with user fees, industrial development tax credits, or CERB assistance. • Provide assistance for development of industrial carload transload/consolidation facilities, including financial assistance programs (similar programs to those described for site improvements), site identification; investments in supporting infrastructure (both through CERB and state DOT programs), and expedited permitting processes. • Develop rail improvement districts for service preservation on low density lines. This could include expansion of the existing Local Rail Assistance program or new financing programs targeted to these districts.	• New on-site storage track. • Site access improvements off mainline. • New loop tracks on-site. • Proposed carload consolidation facilities in the South Sound area – possibly a rail-served industrial park for carload consolidation to rationalize a dispersed, low-density system of carload shippers near Tacoma and provide more efficient rail service for these customers.
Ports and International Trade	
• Develop a comprehensive strategy to increase State's east-west rail capacity in partnership with Class I railroads, ports, and Federal government.	• Investments that resolve high-priority east-west bottlenecks, such as crown cutting the Stampede Pass Tunnel to allow double-stack trains and providing supporting infrastructure and grade separations to allow for increased usage of this line. • Advocate for Federal funding of high-priority east-west bottlenecks and designation as Corridors of National Significance. An example would be the development of a high-capacity corridor over Stampede Pass with a new tunnel, lengthened sidings, construction of new track from Lind to Ellensburg, and other downstream capacity improvements. • Investments that resolve high-priority north-south bottlenecks, such as completing the Vancouver Rail Project that provides access to east-west corridors for trade traffic. • Advocating to railroads and ports beneficial operating strategies such as directional running (e.g., running directionally on Stevens Pass line and Stampede Pass line after crown cutting Stampede Pass) and scheduling alternatives. • Expedited permitting processes for projects that eliminate high-priority bottlenecks.
• Increase domestic and international intermodal terminal capacity through financial assistance, identification of and local advocacy for sites, and development of expedited permitting processes.	• Work with Port of Seattle and Port of Tacoma to investigate potentially feasible sites for new near-dock/off-dock intermodal terminals.

Table 2. Examples of Projects Addressing the Rail Service Needs of Washington State Rail Users (continued)

Possible Strategies	Possible Projects/Actions
Ports and International Trade (continued)	
• Partner with ports, Class I railroads, and third-party switchers to resolve critical port access bottlenecks.	• Port of Vancouver Rail Extension Project (providing direct access to the Port from the Columbia River Corridor eliminating mainline diamond crossings on the I-5 Rail Corridor). • Advocating to railroads and ports beneficial operating strategies. • Expedited permitting processes for projects that eliminate high-priority bottlenecks.
• Partner in community impact mitigation to allow for higher rail traffic associated with international trade.	• Rail crossing grade separations along the Stampede Pass line to accommodate increased traffic associated with crown cutting the tunnel.
Agriculture and Food Products Businesses	
• Encourage formation of Railroad Transportation Improvement Districts (under existing or expanded TID authorities) to assist rail carriers and shippers in low density agricultural and industrial carload corridors. Districts should receive financial assistance through the Local Rail Assistance program.	• Track upgrades to meet specified service objectives; • Maintenance of rights-of-way and track owned by the State or district; and • Development of consolidation facilities, including collaborative work with multiple interested parties (such as the Railex project).
Passenger Rail Users	
• Continue to support incremental development of high-quality intercity passenger rail programs where documented demand exists and high levels of farebox recovery of operating and maintenance costs can be achieved.	• Partner with Class I railroads in mainline infrastructure improvements that provide positive benefit-cost tradeoffs. • Identify traffic thresholds and key track segments were separating passenger rail and freight rail on their own track is cost-beneficial. • Advocate alternative operating strategies to the Class I railroads that will increase combined operating efficiencies for passenger and freight rail. • Give priority to projects that provide benefits to freight and passenger rail service.

Source: Cambridge Systematics, Inc.; and HDR, Inc., 2006.

- When funding is provided to shippers, short lines, third party service providers, or community-based economic development entities alternatives to direct investment should be considered. Under new provisions of the Federal surface transportation legislation it may be possible to create tax exempt financing opportunities using private activity bonds and have the bonds repaid with revenues from the project. Other types of financial assistance, such as investment tax credits, or loan guarantees should be investigated prior to direct investment.
- In most cases, it will be difficult to justify the State being a major investor in mainline capacity that will be owned by private businesses. There are constitutional limitations and the evaluation framework recommended in this study will generally show that

only a modest role for the State will be justified for these types of projects. Therefore, the State must use these types of investments strategically. State investments in mainline capacity can involve trading "value for value"; that is, they can be investments in projects in which the overall benefit evaluation from the State's perspective would suggest a small role in the project but the State might consider a larger role in exchange for Class I concessions on other projects or services in the State. Wherever possible, the State should investigate innovative financing options as a way to leverage its participation in major mainline capacity projects. An example of this approach would be to finance the project using a mix of tax exempt debt instruments available to the State or private activity bonds and charging the railroads a "user fee" to generate the revenues to repay the bonds. This can significantly reduce the cost of financing for a project as compared to private financing and also keeps the debt off the books of the railroad users.

Table 3 lists some of the worst choke points in the Washington State rail system, which affect many rail users, and projects that could help relieve these strategic choke points. Table 4 provides a more complete description of these projects and their potential benefits.

Table 3. Major Choke Points in the Rail System and Potential Projects to Increase Capacity

Choke Points	Potential Projects
Port of Seattle Access and Argo Yard Operations	Duwamish Corridor and Second Lead Improvements
Mainline access to Port of Tacoma	Tacoma Tideflats Improvements: North Wye Connection, Puyallup River Crossing
Port of Vancouver access	Port of Vancouver Rail Extension Project
I-5 Corridor and access to Ports of Kalama and Longview	Kelso to Martins Bluff Third mainline
I-5 Corridor Centralia-Chehalis Segment	Centralia-Chehalis Rail Corridor Consolidation Project (Blakeslee Junction)
I-5 Corridor-Everett and Delta Yard Segments	Everett Passenger Rail Speed Improvements and Delta Yard Expansion
I-5 Corridor-Bellingham segment	Bellingham Mainline Track realignment
East-West Corridor: Stampede Pass	Stampede Pass High-Capacity Rail Improvement Project (including Lind-Ellensburg connection)
East-West Corridor: Spokane Improvements and Spokane to Sandpoint Corridor	Bridging the Valley Projects, including improving mainline capacity, 72 grade crossings, additional trackage, etc.
Lack of yard capacity in South Sound Region	Proposed carload consolidation facilities in the South Sound area
Congestion at Vancouver (WA) Yard, including safety concerns	Vancouver Rail Project
Seattle to Portland Freight/Passenger Train conflicts	WSDOT Point Defiance Bypass Phase 1 Project

Table 4. Project Details for Addressing High-Priority Choke Points

Project	Project Details
Port Access Projects	
Duwamish Corridor and Second Lead Improvements – Port of Seattle	• Improves access to SIG, T5, and T18 • Improves UP's Argo Intermodal Operations
Tacoma Tideflats Access Improvements (incl. North Wye Connection to BNSF, Puyallup River Crossing, and Two 8,000-ft. A&D Tracks at Fife Yard) – Port of Tacoma (POT)	• Improves mainline access to/from POT. • Provides place to arrive long trains near port. • Eliminates need to run around trains. • TR now provides switching service to both railroads • Alternative to North Wye Connection is new UP/BNSF connection at Sumner.
Port of Vancouver Rail Extension Project- Port of Vancouver	• Provides direct access to the Port from the Columbia River Corridor eliminating mainline crossing diamonds on the I-5 Rail Corridor. • Eliminates conflict with Amtrak Cascades service. • Improves BNSF yard operations. • Works in conjunction with WSDOT's Vancouver Bypass Project.
I-5 Corridor Projects	
Kelso to Martins Bluff Third Main Line-WSDOT Passenger Program	• Phase 1 funded for $60 million of $300 million project. • Improves access to Ports of Kalama and Longview. • Provides dedicated passenger track. • Increases capacity by eliminating unit grain trains blocking main line tracks waiting to access grain terminals. • Allows unit grain trains to enter mainline at speed.
Centralia-Chehalis Rail Corridor Consolidation Project (Blakeslee Junction) – WSDOT Rail Passenger program	• Phase 1 funded for $7 million of $30 million project. • Improves track capacity from Centralia and Port of Grays Harbor on PSAP by building siding in Elma. • Abandons Tacoma Rail Line from Blakeslee Junction to Centralia eliminating grade crossing. • Increases BNSF mainline capacity through signaling improvements and upgrading PSAP Blakeslee Junction connection to mainline. • Improves Amtrak passenger operations by building new 3rd main and additional station platform at Centralia. • Provides direct northbound connection from PSAP to TR and the Port's of Olympia and Tacoma's proposed South Sound Logistics Center at Grand Mound. • Could free existing TR right-of-way for I-5/Grand Mound freeway project.

Table 4. Project Details for Addressing High-Priority Choke Points (continued)

Project	Project Details
Everett Passenger Rail Speed Improvements and Delta yard Expansion-BNSF and WSDOT Passenger Rail Program	• Improves Amtrak passenger speeds from PA Junction to Delta Junction • Expands BNSF's Delta Yard's switching capacity • Improves passenger and freight reliability
East-West Corridor Projects	
Stampede Pass High-Capacity Rail Improvement Project (incl. Lind-Ellensburg connection, new 4.1 mile tunnel with < 1.6% eastbound ruling grade, CTC, 8,000-ft sidings, and directional running on Stevens Pass and Stampede Pass lines) – Ports, State, and BNSF	• Provides significant increase in east-west capacity beyond current 20-year projections. • Reduces 2.2% ruling grade to less than 1.6% for eastbound intermodal trains. • Detours trains from fast growing Yakima Valley and Tri-Cities area. • Provides access to mainline for Eastern WA agricultural producers. • Supports ports intermodal growth projections.
Bridging the Valley Project- (includes stakeholders SRTC, WSDOT, IDT, UPRR and BNSF)	• Provides mainline capacity by double tracking Spokane River Bridge. • Improves mainline capacity between Hauser, ID and Spokane, WA. • Provides trackage to hold 8,000-ft trains in Spokane. • Improves rail safety and vehicle travel times by constructing 20 grade separations and eliminating 72 grade crossings. • Consolidates UP rail operations onto BNSF right-of-way freeing abandoned corridor for public uses including transit and trails.
Proposed carload consolidation facilities in the South Sound Area	• Provides new railcar switching with greater capacity than Vancouver Yard for rapidly growing South Sound Region. • Consolidates railcar load operations at single location accessible by UP, BNSF, TR, and PSAP railroads. • Improves mainline velocity for both freight and passenger trains by providing attractive facility for mainline industries to relocate to. • Improves rail service for timber products and other railcar dependent industries. • Complements other I-5 Corridor projects between Tacoma and Vancouver.

■ Examples of Strategic Project Package Evaluation

Technical Memorandum 8 provided four case studies to illustrate how the benefit evaluation methodology developed for the Washington Statewide Rail Capacity and System Needs Study could be applied to evaluating state action's in the rail system. These four case studies are also good examples of high priority strategic investment packages consistent with the user-focused investment strategies described earlier in this technical memorandum. A summary of each of these case studies is provided in this technical memorandum to illustrate several key features of the investment approach described earlier. Readers are referred to Technical Memorandum 8 for a more complete discussion of each of these case studies.

Case Study 1: An Agricultural Rail Shipping Point Consolidation Program (Railex)

Case Study 1: Background

One of the strategies described above to address needs of agricultural shippers in the State is development of agricultural rail shipping consolidation centers. This contributes to greater rail system velocity by reducing the number of loading and unloading points along a route. This strategy also reduces railroad costs by eliminating crew and equipment expenses associated with the collection of farm products from multiple, often widespread locations.

Case Study 1: Description of Solution

The Railex service was developed as a project of a private produce distributor. By reducing logistics costs as compared to trucking and improving delivery time as compared to traditional carload services, the project creates an expanded market opportunity for Washington growers increasing their profitability and bringing associated economic benefits to rural communities in the State. The distributor, Ampco Distribution Services, approached the Union Pacific Railroad and CSX Transportation about dedicating a single train of refrigerated cars that could travel from the West Coast to the East Coast and be time competitive with trucks. The railroads were interested and would guarantee delivery in five days provided that the train runs at least once a week, so the railroads could dedicate cars and locomotives to the service, and that Ampco handled the loading and unloading of the produce.

The total project cost was $58 million, with approximately $50 million covered by the Railex founders, Ampco Distribution, and the Union Pacific railroad. The State, the Port of Walla Walla, the Federal government, and Walla Walla County contributed the remainder of the funding. The funds went toward construction of two, identical, 212,000-square-foot refrigerated warehouses, one in Walulla, WA and the other in Rotterdam, NY, and to construction of the track to support the operation. Each weekly 55-car train hauls the equivalent of 200 truckloads of onions, potatoes, and apples to the East Coast (a weekly total of 8 million pounds of produce). The Railex facility employees about 100 people, although within three years, that number could double according to the owners.[2]

[2] "Railex takes local produce to East Coast," November 2, 2006, retrieved from http://www.railexusa.com/pressroom.php?id=57.

Case Study 1 – Decision Analysis

Table 5 presents the results of a simplified application of the decision analysis for the Railex project. A detailed explanation of how these values were calculated is presented in Technical Memorandum 8.

Table 5. Decision Analysis Matrix for Agricultural Consolidation Project

	Measures	No Action	Construction of Railex Consolidation/Distribution Center and Loop Track
State	Jobs	Negligible loss in agriculture due to loss of rail service	One hundred new jobs at Railex facility
	Tax Benefits	Negligible loss in agriculture due to loss of rail service	Negligible increase from consolidation center and trucking, loss in short line railroads
	Truck to Rail Diversion	Loss of rail service. Must find alternative mode	One 55 car train/week. Approximately 200 trucks/week for 52 weeks/year
	Environmental Benefits	Increase in long-haul trucks	Reduction in long-haul trucks, but increase in local trucks. Increase in locomotives. An EIS is needed to fully understand the impacts
	Partner Funding	Shippers cover expense through higher logistics costs	Most of cost ($50 of $58 million) covered by private sector
	Benefit/Cost	n/a (Cost = $0)	B/C = 7.1 (Cost = $58 mil)
	Summary State Benefits	LOW	MEDIUM
Shippers	Business-Cost Impacts	Increases loss of services. Forces use of more expensive modes	Retains lower-cost rail service for shippers. For shipments to Albany, NY, prices estimates are $0.128 per truck ton-mile and $0.035 per rail ton-mile
	Access to Service	Class I railroads disinvest from selected rail markets	Retains rail service for shippers
	Service Reliability	Poor, with 10 to 25 transit times cross country	Good, with 5-day expedited unit trains
	Summary Shipper Benefits	LOW	HIGH
Passengers	Rail Capacity for Passenger Trains	No impact on passenger rail	No impact on passenger rail
	Summary Passenger Benefits	LOW	LOW

Table 5. Decision Analysis Matrix for Agricultural Consolidation Project (continued)

	Measures	No Action	Construction of Railex Consolidation/Distribution Center and Loop Track
Railroads	System Velocity Improvements	Delays as trains load and unload. Trains often must wait on main line, blocking through trains	Reduction in main line delays since trains are loaded on loop track
	Hours of Train Delay	Requires simulation analysis	Requires simulation analysis
	Yard Dwell Time	Not applicable	Not applicable
	Increased Revenue Traffic	Continued disinvestment of Class I railroads from selected rail markets	Continuation of business on Class I. Loss of business on short lines as trucks haul produce to consolidation center
	Equipment Utilization	Used in other regions as WA eastern grain markets are disinvested	Can dedicate equipment to this operation. Reduction in car cycle time from 5-day expedited service
	Summary Railroad Benefits	LOW	MEDIUM
Ports	Throughput	No change	No change
	Market Share	No change	No change
	Summary Port Benefits	LOW	LOW
Communities	Environmental Benefits	Increase in long-haul trucks	Reduction in long-haul trucks, but increase in local trucks. Increase in trains and locomotive emissions
	Safety Benefits	Increase due to more trucks on roadways	Decrease from less long-haul trucks, offset by increase due to more local trucks serving consolidation center
	Reduced Roadway Delays	Increase due to more trucks on roadways	Decrease from less long-haul trucks, offset by increase due to more local trucks serving consolidation center
	Local Jobs	Negligible loss in agriculture due to loss of rail service	100 new jobs at Railex facility
	Summary Community Benefits	LOW	MEDIUM
National	National significance	None	None
	Other States Benefiting	None	NY, East Coast recipients of produce
	Summary National Benefits	LOW	LOW

The primary beneficiaries of the Railex facility are the shippers, which includes both Ampco Distribution Services and the local agricultural industry. These benefits are due to the ability to expand the market into the Northeastern United States because of the lower logistics costs of the rail service. Medium beneficiaries include the State, the railroads, and the communities. The State and communities benefit through the retention of businesses and creation of new jobs in eastern Washington. The community does have a reduction in long-haul truck activity, but this is offset by increases in trains and short-haul trucks serving Railex. Passenger rail, the ports, and the nation have minimal benefits from this service.

A more sophisticated application of the decision analysis framework would show greater benefits to the State associated with the expanded economic activity among agricultural producers served by Railex. A major impact of the project is the degree to which it expands markets for Washington State agricultural shippers by providing access to markets at much lower transportation cost than the trucking alternative. The cost of transporting to the East Coast by truck would most likely make the cost of the produce noncompetitive (or would eliminate profits for the producers). The alternative is likely to be that producers would have to sell their produce in a more limited market area. This could reduce potential demand. The measure of this reduced demand would be a reduction in Gross Regional Product (GRP). Alternatively, the producers might be forced to shift to other, less profitable crops in order to compete in accessible markets. This could also reduce GRP and would likely depress wages. This reduction in GRP could also lead to a reduction in jobs in the agricultural sector and indirect jobs associated with spending by this industry. When a project such as this is in a region with especially limited economic development opportunities, these economic impacts should be taken into account as they provide an important justification for the project.

Case Study 2: An East-West Intermodal Rail Capacity Improvement Program

Case Study 2: Background

As noted earlier in this Technical Memorandum, there is a growing east-west capacity constraint in the Washington State rail system. This is a particularly critical issue in the medium to long term for the state's port and international trade sector, although the lack of east-west capacity also makes it difficult for third party providers to access the system for shorter haul services.

Case Study 2: Description of Solution

Two different approaches were investigated to address east-west capacity constraints in the state's rail system. While other combinations of packages could be developed, these two approaches are representative of the range of options that may be available. The projects include improving Stampede pass to allow for double-stack containers, restoring the Old Milwaukee line from Ellensburg to Lind, and incorporating the "Bridging the Valley" improvements for the Spokane to Sandpoint, Idaho section. There were three alternatives analyzed:

1. **Do Nothing** – Under this scenario, the State does not invest public funding to improve east-west capacity. Any investment is done by the railroads.

2. **Alternative A – East-West Capacity Expansion Project –** Assumes a $350 million investment, shared between the State and the railroads, for selective capacity improvements. This will add capacity for approximately 25 percent more capacity

(from 100 to 108 trains per day to 124 to 132 trains per day). (Note that these train volumes include the UPRR's Columbia River route capacity.)

3. **Alternative B – East-West High Velocity Rail Corridor Project –** Assumes a $1.5 billion to $2.0 billion investment, shared between the State and the railroads, for comprehensive capacity improvements. This will increase the east-west capacity by approximately 60 to 70 trains per day and lower operating costs.

A summary of the improvements for Alternatives A and B are contained in Table 6.

Table 6. East-West Capacity Expansion – Summary of Alternatives A and B

Project	Alternative A	Alternative B
Reduce eastbound grade over Stampede Pass from 2.2 percent to 1.6 percent by constructing a new 4-mile Stampede Pass Tunnel		●
Crown cut Stampede pass	●	
Construct Lind, WA to Ellensburg, WA connection	●	●
Install 8,000-ft siding tracks to provide 20-minute headways between Auburn, WA and Ellensburg, WA and between Lind, WA and Spokane, WA	●	●
Install CTC train control system overlaid with ETMS	●	●
Implement bi-directional running on Stevens and Stampede Pass lines		●
Install improved signaling and ventilation system in Cascade tunnel to allow two trains in the tunnel at the same time		●
Mitigate for increased train traffic through effected communities		●
Construct the triple-track segment as well as other improvements suggested in "Bridging the Valley"		●
Grade separated the corridor from Spokane, WA to Athol, ID as suggested in "Bridging the Valley"	●	●
Create a shared use agreement for railroads operating on track segment between Athol, ID and Sandpoint, ID		●

Case Study 2: Decision Analysis

The East-West Capacity Projects expand the capacity on the BNSF routes through the State. Alternative A costs $350 million and will add capacity for 24 additional trains per day. For analysis purposes, it was assumed that traffic growth would be sufficient to generate an additional 12 trains per day during the planning horizon. Alternative B costs $1.5 billion to $2.0 billion and will add capacity for 75 trains per day, although a more practical number is 50 trains per day due to operational limitations. For the Alternative B analysis, 50 additional trains were used even though this may represent an impractically high growth rate during the 10-year planning horizon. The analysis assumes that without this capacity, cargo will divert to other ports where rail capacity is available for discretionary cargo movements.

The application of the decision-analysis methodology described below illustrates in a simplified manner how the benefits of this type of project package could be evaluated. However, mainline capacity improvements such as those illustrated in this case study are expensive and high profile. This would justify a much more detailed and rigorous analysis of the benefits/impacts prior to decision-making. Readers are cautioned that the analysis contained in this case does not provide this detailed analysis and should not be used for decision-making purposes. There are a number of gaps in available data and easily applied analytical tools with which this case study could be accomplished within the resources of this study. This limits the ability to analyze some key aspects of this package of projects. For example, while the primary benefit of the projects is providing more intermodal capacity for international trade cargo, there are benefits to eastbound domestic cargoes that might be displaced if there were insufficient capacity in the east-west corridors. If this traffic were diverted to highways, this might have cost consequences for the State that are not taken into account in this analysis. Further, as noted below, if limited east-west capacity impedes growth at the ports, this may affect the availability of ocean carrier services, and this in turn could impact Washington State shippers whether or not they use the rail system to access the port. Finally, the case study mentions, but does not quantify the national benefits of the project. In an actual application of the decision analysis framework, these impacts must be considered. Nonetheless, the case study analysis provided below is instructive as an illustration of the issues associated with evaluating this type of project.

The primary public benefit is increased jobs at the port, with projections of 500 and 2,100 new jobs by the end of the 10-year planning horizon for Alternatives A and B, respectively. In Alternative A, the $93 million in benefits from the jobs is partially offset by a $30 million cost from increased emissions from the additional 12 trains per day. For Alternative B, the $392 million in jobs benefits are partially offset by the $124 million in costs from the emission of 50 more trains per day. There are no benefits from logistics costs savings, highway maintenance reductions, or highway safety improvements. The assumption is that without the east-west capacity expansion, this international traffic would divert to other ports and would not appear on Washington State roadways. Table 7 presents a summary of the results of a simplified decision analysis. A more detailed description of the calculations and data depicted in this summary can be found in Technical Memorandum 8.

Table 7. Decision Analysis Matrix for East-West Intermodal Rail Capacity Improvement

	Measures	No Action	Alternative A: East-West Capacity Expansion Project	Alternative B: East-West High Velocity Rail Corridor Project
State	Jobs	Net New Jobs = 0	Net New Jobs = 120 direct and indirect	Net New Jobs = 500 direct and indirect
	Tax/Fee Benefits	None	None	None
	System Efficiency	Congested	Reliable	Reliable
	Environmental Benefits	n/a	Negative: emissions from 12 trains x 300 mi x 6,480 tons	Negative: emissions from 50 trains x 300 mi x 6,480
	Partner Funding	BNSF & UP make improvements	Expect railroad participation	Expect railroad participation
	Benefit/Cost	n/a (Cost = $0)	B/C = Negative Benefits	B/C = Negative Benefits
	Summary State	LOW	MEDIUM	LOW
	Measures	No Action	Alternative A: East-West Capacity Expansion Project	Alternative B: East-West High Velocity Rail Corridor Project
Shippers	Business-Cost Impacts	Increases due to increased rail cost, loss of service, and deteriorating reliability	Improvements to international intermodal traffic; little benefit to WA shippers	Reliable service
	Access to Service	Railroads disinvest from selected rail markets	Improved access for international shippers	Greater rail access due to increased rail service
	Service Reliability	Poor	Reliable in short term	Reliable in long term
	Summary Shippers	LOW	MEDIUM	HIGH
Passengers	Rail Capacity for Passenger Trains	Limited to current services	Potential 1 or 2 train expansion	Can satisfy rapid demand growth
	Summary Passengers	LOW	LOW	MEDIUM

Table 7. Decision Analysis Matrix for East-West Intermodal Rail Capacity Improvement (continued)

	Measures	No Action	Alternative A: East-West Capacity Expansion Project	Alternative B: East-West High Velocity Rail Corridor Project
Railroads	System Velocity Improvements	Further delays due to capacity issues	Crown cutting Stevens Pass, installing CTC, and eliminating grade crossings will increase velocity	Grade reduction over Stampede Pass and other improvements increases velocity; Lind-Ellensburg cutoff shortens distance by approximately 60 miles
	Hours of Train Delay	Requires simulation analysis	Requires simulation analysis	Requires simulation analysis
	Yard Dwell Time	Requires simulation analysis	Requires simulation analysis	Requires simulation analysis
	Increased Revenue Traffic	Yes	12 trains x 100 cars/train x $6000 car	75 trains x 100 cars/train x $6000 car
	Equipment Utilization	Little change	Reduction in car cycle time; requires simulation analysis to quantify	Reduction in car cycle time; requires simulation analysis to quantify
	Summary Railroads	LOW	MEDIUM	HIGH
Ports	Measures	No Action	Alternative A: East-West Capacity Expansion Project	Alternative B: East-West High Velocity Rail Corridor Project
	Throughput	Current Capacity = XX	Additional 12 trains/day = 2400 containers per day	Additional 75 trains/day; but other factors limit to 50 trains/day
	Market Share	Decline	Requires complete analysis of West Coast Ports	Requires complete analysis of West Coast Ports
	Summary Ports	LOW	HIGH	HIGH
Communities	Environmental Benefits	None	Negative: emissions from 12 trains x 300 miles x 6,480 tons/train	Negative: emissions from 50 trains x 300 miles x 6,480 tons/train
	Safety Benefits	More potential train incidents and grade crossing accidents due to increased trains	More potential train incidents; safety improvements from elimination of 20 grade crossing	More potential train incidents; safety improvements from elimination of 20 grade crossing
	Reduced Roadway Delays	No change	Elimination of 20 grade crossings	Elimination of 20 grade crossings
	Local Jobs	Mostly at the port; some increase in train crews	Mostly at the port; some increase in train crews	Mostly at the port; some increase in train crews
	Summary Communities	LOW	MEDIUM	MEDIUM
National	Pct Benefits in WA State	Requires detailed economic analysis	Requires detailed economic analysis	Requires detailed economic analysis
	Other States Benefiting	ID, IN, IL, MT, MN, NE, NJ, OH, PA, NY	ID, IN, IL, MT, MN, NE, NJ, OH, PA, NY	ID, IN, IL, MT, MN, NE, NJ, OH, PA, NY
	Summary National	LOW	MEDIUM	HIGH

The primary beneficiaries of the east-west capacity enhancements are the ports and the railroads. For the ports, the benefits are driven by increased imports and exports attracted by the improved transportation system. The railroad increases revenue from the additional trains and reduced costs from less delays on the currently congested routes. The local communities have medium benefits from the additional jobs, but there will be additional roadway delays from increased port activity. Communities impacted by "Bridging the Valley" will receive public benefits of reduced roadway delay and improved safety from elimination of 20 grade crossings. Since most of this traffic is serving locations outside of Washington State, there are national benefits accruing from expanding east-west rail capacity. This could make this project a candidate for national funding under a Federal transportation funding program such as the Projects of Regional and National Significance Program authorized in SAFETEA-LU.

Projects that develop capacity primarily to serve port traffic pose a difficult tradeoff for the State. While there are benefits in terms of jobs, there are also impacts that need to be mitigated that can substantially offset much of the benefits. Further, the largest benefit of these projects may be to the railroads and national shippers. But there are sufficient public benefits to justify a modest State role in these very costly projects. A key question that must be explored if the State were to proceed with such a project is whether the relatively small contribution would be sufficient to influence the Class I carriers' investment decisions. If the State invests, would the carriers be more inclined to invest in the Pacific Northwest rather than in the highly competitive rail markets of the Pacific Southwest? An alternative approach to State participation in the project might involve using tax exempt financing. The idea of the State holding the debt and repaying it with user fees charged to the railroads might more highly leverage the State's participation in the project in this case.

It should be noted that the simplified decision analysis contained in this case study probably underestimates the full extent of economic benefits to the State from growth at the ports. The analysis assumes that if the capacity is unavailable, the demand will shift to another port. Over the longer term, this might cause reductions in ocean carrier services at the Puget Sound ports and a less competitive port complex, which would in turn affect the growth opportunities for businesses that may not be rail users but who benefit from growth in services at the port. There are no good modeling tools in general use that can capture this aspect of the analysis. A more detailed analysis would require one-on-one interviews with shippers and others who rely indirectly on the volume of business moving through the ports.

Case Study 3: A South Sound Carload Restructuring Strategy

Case Study 3: Background

Carload shippers in the South Sound Region are increasingly experiencing shipping delays, car shortages, increasing rail rates, and restrictions that prevent them from expanding their businesses. The Class I railroads are experiencing capacity limitations at their yards, increased switching costs for serving scattered industries, and reduced mainline velocities resulting from serving existing carload businesses off their mainlines. Short line rail operators are experiencing increased delays interchanging cars with Class I railroads, increased operating costs from low speed operations.

Case Study 3: Description of Solution

To address these issues, several projects and actions have been bundled into a $185 million project referred to as the South Sound Carload Restructuring Strategy. This strategy is aimed at improving rail carload movements in the I-5 rail corridor. A key component of this strategy is development of a 740-acre South Sound Logistics Center in Maytown, WA. This strategy is intended to handle rail carload traffic, not increase intermodal traffic. The proposed uses of such a facility, as described in this case study, are still hypothetical. A number of uses have been proposed for the Maytown project, but there is as yet no agreement among interested parties on uses and participation.

The specific projects included in the South Sound Carload Restructuring Strategy are:

1. Construct new 740-acre South Sound Logistics Center (SSLC), including new railcar switching yard, 8,000-ft A&D tracks, intermodal yard, and transload facility. Establish SSLC as car load rail consolidation point for local Union Pacific Railroad (UPRR), Burlington Northern Santa Fe Railway (BNSF), Puget Sound and Pacific Railroad (PSAP), and Tacoma Rail Mountain Division (TRMW) traffic. Establish scheduled train service from BNSF and UPRR Provide industrial development sites that will allow industries currently located on the mainlines to relocate to SSLC or other sites off of the PSAP and TRMW lines.

2. Construct Centralia to Chehalis Rail Corridor Consolidation Project (Blakeslee Junction) to relieve mainline congestion and provide direct access to the SLLC from PSAP via a new connection at Grand Mound.

3. Upgrade PSAP and TRMW to Class 3 track.

4. Implement operational changes such as restructuring switching zone agreements center on SSLC, granting mainline trackage rights to short line operators delivering to SSLC, and establishing car hire zones/car availability pools.

Case Study 3: Decision Analysis

The South Sound Carload Restructuring Strategy would create jobs at the logistics center, and improve north-south mobility enhancing trade. The increased capacity would also benefit passenger rail services in this corridor. The largest category of public benefits are generated by the 3,100 new and retained direct and indirect jobs, which contributes a benefit of $578 million over the 10-year planning horizon. The logistics cost savings to the shippers from using rail instead of truck is estimated at $124 million over the planning horizon. The highway savings from reduced maintenance ($8.9 million) and emissions ($0.3 million), and improved safety ($3.8 million), each contribute to the overall public benefits total. A summary of the simplified decision analysis is presented in Table 8.

Table 8. Decision Analysis Matrix for South Sound Carload Restructuring Strategies

	Measures	No Action	Full Implementation of South Sound Carload Restructuring Strategies
State	Jobs	Change through normal growth	3,100 direct and indirect jobs, mostly associated with the logistics center
	Tax Benefits	Increase through normal growth	Will increase through taxes collected from logistics center
	Truck to Rail Diversion	Likely rail to truck diversions as congestion causes continued deterioration of service	Estimated at approximately 40,000 trucks per year
	Environmental Benefits	Increase in long-haul trucks	Reduction in long-haul trucks, but increase in local trucks to/from logistics center. Increase in locomotives. Overall positive benefit, though an EIS is needed to fully understand the impacts
	Partner Funding	Shippers cover expense through higher logistics costs from trucking	Shippers and railroad will benefit and should contribute
	Benefit/Cost	n/a (Cost = $0)	B/C = 3.9 (Cost = $185 mil)
	Summary State Benefits	LOW	HIGH
Shippers	Business-Cost Impacts	Possible loss of rail services as congestion becomes worse. Forces use of more expensive modes	Allows carload shippers to divert some traffic to lower cost rail service. Truck costs estimated at $0.123/ton-mile and rail rates (plus drayage) estimated at $0.063/ton-mile
	Access to Service	Should remain constant	Will increase through SSLC
	Service Reliability	Will become worse without investment	Improved access, increased capacity, improved track, and improved operating strategies will improve reliability
	Summary Shipper Benefits	LOW	MEDIUM
Passengers	Measures	No Action	Full Implementation of South Sound Carload Restructuring Strategies
	Rail Capacity for Passenger Trains	No change	Increased capacity should free additional slots for passenger trains
	Summary Passenger Benefits	LOW	MEDIUM
Railroads	System Velocity Improvements	Current congestion and problems will only increase without improvements	Should increase velocity, and reduce costs, through capacity expansion, improved track, and improved operating strategies
	Hours of Train Delay	Requires simulation analysis	Requires simulation analysis
	Yard Dwell Time	Requires simulation analysis	Requires simulation analysis
	Increased Revenue Traffic	Continued disinvestment by Class I railroads of selected rail markets	Increased rail traffic, primarily due to the SSLC
	Equipment Utilization	Continued congestion and increased delays will reduce equipment utilization	Increased velocity and increased volumes will improve equipment utilization
	Summary Railroad Benefits	LOW	HIGH

Table 8. Decision Analysis Matrix for South Sound Carload Restructuring Strategies (continued)

	Measures	No Action	Full Implementation of South Sound Carload Restructuring Strategies
Ports	Throughput	No change	Will benefit import/export of bulk goods. Will have minimal impact on intermodal traffic
	Market Share	No change	Possible increase in share of bulk traffic due to improved rail service
	Summary Port Benefits	LOW	MEDIUM
Communities	Measures	No Action	Full Implementation of South Sound Carload Restructuring Strategies
	Environmental Benefits	Likely increase in long-haul trucks as rail lines become more congested	Reduction in long-haul trucks, but increase in local trucks. Increase in trains. Will require an EIS to understand full impacts
	Safety Benefits	Increase due to more trucks on roadways as traffic grows	Decrease from less long-haul trucks, offset by increase due to more local trucks serving logistics center
	Reduced Roadway Delays	Increase due to more trucks on roadways as traffic grows	Decrease from less long-haul trucks, offset by increase due to more local trucks serving logistics center
	Local Jobs	Normal increase from constrained growth	3,100 direct and indirect, mostly due to SLLC
	Summary Community Benefits	LOW	HIGH
National	National significance	None	Will have positive impacts on other regions, especially California and the southwestern U.S.
	Other States Benefiting	None	CA, OR, also Canada
	Summary National Benefits	LOW	MEDIUM

Case Study 4: Passenger Rail Improvements Up to Timetable C

Case Study 4: Background

The Amtrak *Cascades* service has developed a long-range plan to make incremental improvements in the service while building a "rail culture" in the State. This is consistent with the direction for the program as originally authorized by the State legislature. Each increment of service corresponds to increases in frequency of service and potential improvements in service reliability. The design of the projects in each increment is to seek integrated system solutions wherever possible and share costs among all users of the north-south rail corridor to the extent that multiple parties benefit from the improvements. Timetable C is considered the Mid-point in service improvements and many analysts believe that the improvements through this increment have wide ranging benefits beyond those realized by the Amtrak service.

Case Study 4: Description of Solution

The full buildout of the *Cascades* long-range plan includes 52 capital projects totaling $6.5 billion. The 52 projects have been bundled into six packages, known as Timetables A, B, C, D, E, and F, with an overall completion date of 2023. Timetables A, B, and C are collectively referred to as the Mid-point. The capital costs through the Mid-point are between $2.3 and $2.9 billion. Completion of the entire portfolio of 52 projects will increase capacity on the rail network, benefiting both the passenger and freight railroad operators, the rail passengers and shippers, and the states and local communities.

The goals for the *Cascades* service are to increase ridership and lower operating costs, with an ultimate goal of eliminating operating subsidies. The proposed projects will increase network capacity, allowing for more trains. It will also lower transit times making the service more attractive and lowering operating costs. For example, between Portland and Seattle, there was one daily train in 1994, 3 in 2003, and a target of 8 for the Mid-point. Transit time in this corridor has gone from 3:55 hours in 1994 to 3:30 in 2003, and a goal of 3:00 at the Mid-point. Ridership at the Mid-point is projected at 1.4 million. Farebox recovery (the amount of operating costs recovered by ridership revenue) was 45 percent in 2002. The projected farebox recovery is 71 percent at the Mid-point.[3]

The complete list of projects for all six Timetables is contained in Table 9.

Table 9. Timetable C Projects
Values in Millions of United States Dollars

Timetable A	Timetable B	Timetable C	Timetable D	Timetable E	Timetable F
Felida Crossover ($2.2)	Vancouver Rail Project ($86.6)	King St. Station Track ($92)	Winlock to Chehalis 3rd Main Track ($149.9)	Chehalis to Hannaford 3rd Main Track ($66.6)	Felida to MP 114 3rd Main Track ($173.1)
Woodland Crossover ($2.8)	Kelso to Martin's Bluff ($464.3)	Seattle Maint. Facility ($109)	Chehalis Jct Crossover ($3.5)	Ostrander to Winlock 3rd and 4th Main Track ($283.1)	Hannaford to Nisqually 3rd Main Track ($512.5)
Titlow Crossover ($4.0)	Centennial Crossovers ($3.4)	Point Defiance Bypass ($412)	Chehalis Siding ($11.3)		Columbia River Bridge ($575.0)
Ruston Crossover ($3.6)	Winlock Crossover ($3.4)	Reservation to Stewart 3rd Main ($48.3)	East St. Johns Siding and Main Track Relocation ($40.4)		*Marysville to Mt. Vernon High-Speed Track ($322.5)*

[3] *Draft Long-Range Plan for Amtrak Cascades Service*, Washington State Department of Transportation, February 2006.

Table 9. Timetable C Projects (continued)

Values in Millions of United States Dollars

Timetable A	Timetable B	Timetable C	Timetable D	Timetable E	Timetable F
Sound Transit: Seattle to Lakewood Improvements ($304.0)	Tenino Crossover ($3.4)	Centralia Steam Plant Coal Track and Power Switches ($6.1)	Lake Yard North Leads ($26.0)		*Burlington to Bellingham High-Speed Track ($408.5)*
Mount Vernon Siding ($8.4)	Ketron Crossover ($3.4)	Wodland Siding ($15.3)	Portland Union Station ($7.6)		*Bellingham to Blaine High-peed Track ($197.7)*
	North Portland Jct to Kenton ($58.7)	Newaukum Siding ($3.4)	Advanced Signal System – 110 mph ($308.0)		*Everett Jct to Everett 2nd Main Track ($22.9)*
	Swift Customs Facility ($13.8)	China Creek Crossover ($1.7)			*Advanced Signal System -110 mph ($228.0)*
	Stanwood Siding ($9.9)	Auburn South 3rd Main ($23.9)			*White Rock Bypass ($312.7)*
	PA Jct/Delta Jct Improv. ($25.2)	Sound Transit: Seattle to Lakewood ($160.0)			*Colebrook to Brownsville High-Speed Track ($91.8)*
	Bellingham GP Improv. ($2.3)	*Sound Transit: Seattle to Everett Improv. ($207.0)*			
	Colebrook Siding ($11.4)	*Bow to Samish Siding Ext. ($50.5)*			
		Bellingham Siding Extension ($102.6)			
		Ballard Bridge Speed ($11.5)			
		Vancouver, BC Project Improv. ($86.3-651.0)			
$325.0	$685.8	$1,329.6-1,894.3	$546.7	$349.7	$2,844.7
		$2,340 – 2,905			$6,082 – 6,646

Source: "Draft Long-Range Plan for Amtrak Cascades," Washington Department of Transportation, February 2006.

Note: Gray shaded projects have been identified by WSDOT as needed improvements that will be funded by other jurisdictions or agencies, but are necessary to achieve WSDOT's goals for the Amtrak Cascades service. Standard font indicates projects between Seattle, Washington and Portland, Oregon. *Italicized font indicates projects between Seattle, Washington and Vancouver, BC.*

Case Study 4: Decision Analysis

During development of the Amtrak *Cascades* Draft Long-Range Plan, a cross modal analysis was performed to compare the cost effectiveness of intercity travel by automobile, air, and passenger rail through the year 2023.[4] This analysis considered the operating costs, capital costs, travel-time costs, and external costs (environmental, safety, noise, etc.) of each mode. Each of these costs was monetized and reported using the common measure of passenger miles. The costs were developed for the years 2004, 2008, 2013, 2018, and 2023. Thus, the cost per passenger mile becomes a measure of the cost-effectiveness of the mobility provided by each mode and substitutes for the benefit-cost analysis in the case of passenger rail.

It should be noted that Cambridge Systematics has reviewed the cross modal analysis and found the methodology to be reasonable and comprehensive. Cambridge Systematics has not done a thorough review of the projected ridership and cost estimates and is accepting the values as stated in the report.

A more detailed presentation of the results of the cost-effectiveness analysis of passenger rail as compared to intercity automobile and air travel in the corridor is provided in Technical Memorandum 8. A summary of the results is presented in the tables and figures below.

Table 10. Summary of Cost per Passenger Mile for Automobile Travel

Year	2004	2008	2013	2018	2023
Operating	$0.43	$0.49	$0.57	$0.66	$0.76
Travel Time	$0.12 – 0.24	$0.14 – 0.28	$0.16 – 0.32	$0.19 – 0.38	$0.23 – 0.45
External	$0.07 – 0.09	$0.08 – 0.11	$0.09 – 0.12	$0.11 – 0.14	$0.12 – 0.17
Capital	$0.002	$0.001	$0.001	$0.001	$0.001
Total	$0.62 – 0.76	$0.71 – 0.88	$0.82 – 1.01	$0.96 – 1.18	$1.11 – 1.38

Source: *Amtrak Cascades Cross Modal Analysis Technical Report*, Volume 6, WSDOT, June 2004.

[4] *Amtrak Cascades Cross Modal Analysis Technical Report*, Volume 6, Washington State Department of Transportation, June 2004.

Table 11. Summary of Cost Per Passenger Mile for Air Travel

Year	2004	2008	2013	2018	2023
Operating	$1.00	$1.12	$1.30	$1.52	$1.77
Travel Time	$0.12 – 0.23	$0.13 – 0.26	$0.15 – 0.30	$0.18 – 0.35	$0.21 – 0.41
External	$0.01 – 0.03	$0.01 – 0.03	$0.01 – 0.03	$0.01 – 0.04	$0.01 – 0.05
Capital	$0.05	$0.06	$0.06	$0.06	$0.06
Total	**$1.18 – 1.31**	**$1.32 – 1.47**	**$1.52 – 1.69**	**$1.77 – 1.97**	**$2.05 – 2.29**

Source: *Amtrak Cascades Cross Modal Analysis Technical Report*, Volume 6, WSDOT, June 2004.

Table 12. Summary of Cost Per Passenger Mile for Passenger Rail Travel

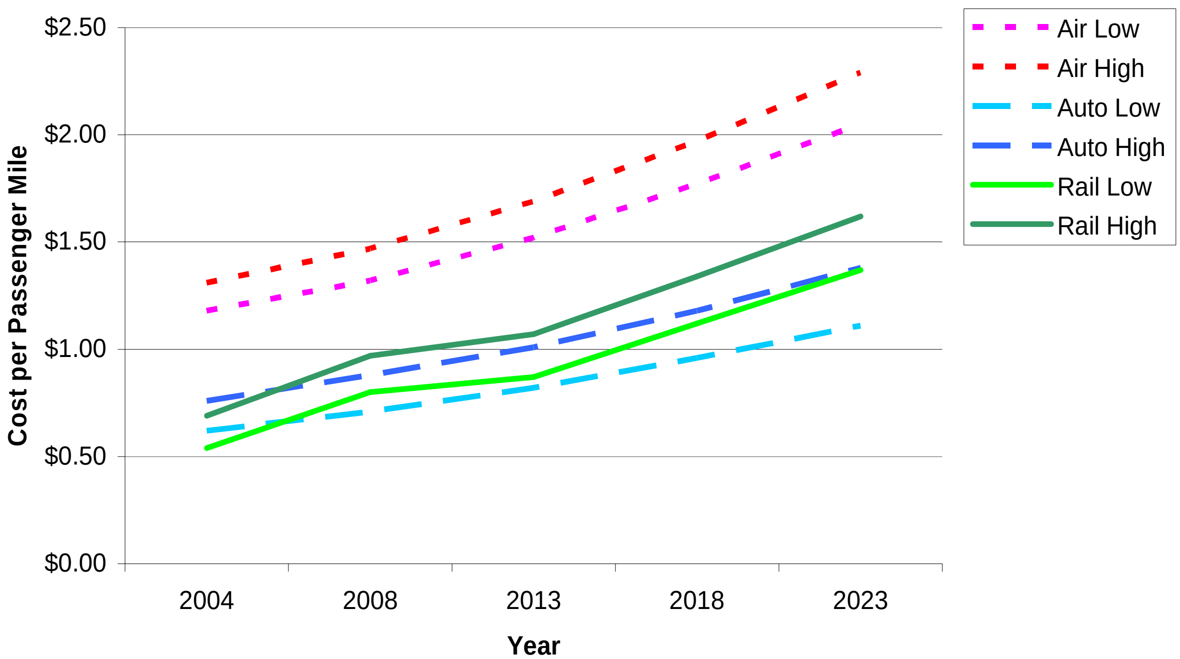
Year	2004	2008	2013	2018	2023
Operating	$0.31	$0.29	$0.31	$0.34	$0.34
Travel Time	$0.10 – 0.20	$0.11 – 0.22	$0.13 – 0.26	$0.15 – 0.29	$0.15 – 0.30
External	$0.02 – 0.07	$0.02 – 0.08	$0.03 – 0.10	$0.03 – 0.11	$0.03 – 0.13
Capital	$0.11	$0.38	$0.40	$0.60	$0.85
Total	**$0.54 – 0.69**	**$0.80 –°0.97**	**$0.87 – 1.07**	**$1.12 – 1.34**	**$1.37 – 1.62**

Source: *Amtrak Cascades Cross Modal Analysis Technical Report*, Volume 6, WSDOT, June 2004.

Review of the appendices in the Amtrak Cascades Cross Model Technical Report indicates that the six project packages (Timetables A through f) are used in allocating the costs to years. Full implementation of Timetable C is assumed to correspond to 2009.

Figure 3 summarizes the total cost per passenger mile by mode. Air travel has, and is projected to continue having, the highest cost per passenger mile. This is driven by the large cost per passenger mile to operate the planes. This helps explain the low demand for passenger air service in the Sea-Tac to Bellingham market. As can be seen in Figure 3, passenger rail and automobiles are cost competitive on a passenger-mile basis for the study area. Automobiles have a high operating cost, but a low capital cost due to the large number of passenger miles. Passenger rail has lower operating costs, but higher capital costs due to several expensive projects and a low number of passenger miles compared to the highways. It should be noted that this comparison reflects total costs per passenger mile and not costs to the State. It should be noted that the relatively high operating- and travel-time costs associated with automobiles are paid primarily by users whereas capital costs are borne almost exclusively by the State.

Figure 3. Summary of Total Cost Per Passenger Mile by Mode



Source: *Amtrak Cascades Cross Modal Analysis Technical Report*, Volume 6, WSDOT, June 2004.

Rail Simulation Analysis. If the investments are made through Timetable C, the private sector railroads and shippers will also realize benefits through increased capacity and reduced delays. To better understand the value to the railroads, specifically BNSF, a simulation analysis was performed using the Rail Traffic Controller (RTC) software.[5]

Ideally, the RTC simulation analysis would have looked at delays to freight rail in the absence of the Timetable C improvements with normal freight growth and without any growth in passenger rail. The actual simulation was somewhat different but still provides insight into the benefits of the Timetable C improvements on freight operations. The simulation used 2000 as the base year for freight rail operations. The Timtable C simulation results assume implementation of the final design of the Kelso Martin's Bluff and Vancouver projects, plus it assumes normal freight growth and 2 additional *Cascades* train round trips.[6] The simulation projects operations out to 2004 for comparative purposes, looking at how the system might have performed in that year with and without

[5] The Rail Traffic Controller is a product of Berkeley Simulation Software. For more information visit http://www.berkeleysimulation.com/.

[6] The Kelso Martin's Bluff and Vancouver projects represent a significant portion, but not all, of the Timetable C projects. Simulation results for the entire package of Timetable C projects were not available.

the Timetable C improvements. A complete description of the simulation analysis and a review of the results are presented in Technical Memorandum 8.

The impacts on BNSF operations are summarized in Table 13. The base year data is 2000. Without improvements to the rail infrastructure, the Simulation Base 2004 represents the 2004 operations with normal freight growth and without the Timetable C (Kelso Martin's Bluff and Vancouver) improvements. The results show that without the improvements, the delay on the road (i.e., rail lines) will increase 134 percent and the delay at the origin (i.e., rail yard) will increase 525 percent. With the improvements the delay on the road will decrease 1 percent and the delay at the origin will decrease 4 percent, despite an increase in passenger and freight rail trains.

Table 13. Summary of Freight Rail Improvements With Timetable C*

Item	Base 2000	Simulation Base 2004	Simulation Base 2004 Over Base 2000	Through Timetable C*	Timetable C* Change Over Base 2000
Trains	134	139	4%	142	6%
Delay on road (min)	4,479	10,460	134%	4,431	-1%
Delay at origin (min)	667	4,234	525%	650	-4%

Source: RTC simulation of rail operations provided by Tom White, Transit Safety Management.

* The simulation assumed the final design of the Kelso Martin's bluff and the Vancouver projects. Results for the entire package of Timetable C projects was not available.

Table 14 presents a summary of the simplified decision analysis.

Completion of the rail improvement projects through Timetable C has high positive impacts on the passenger railroads and riders, the freight railroads, and the communities. Washington State gains through some increase in jobs, less traffic on the roadways, and from significantly lower passenger rail operating subsidies. The greatest impact on the passenger railroads is increased ridership and reduced losses per passenger, leading to lower subsidies per passenger. The passengers gain from increased service options (additional trains) and reduced transit times of 30 minutes between Portland and Seattle by the Mid-point. The freight railroads primarily gain through slight capacity increases and large reductions in both line and yard delays. Communities benefit through more frequent and more reliable passenger rail service, and from less automobiles on the roadways, less air pollution, and improved roadway safety. Shippers have medium benefits, derived mostly from improved reliability in the rail system. The projects through Timetable C are not directed at improving service at the ports, or improving nationwide mobility.

Table 14. Decision Analysis Matrix for Passenger Rail Improvements Up to Timetable C

	Measures	No Action	Build Out Through Timetable C
State	Jobs	Change through normal growth	Increase in Amtrak and freight rail jobs from increased rail activity
	Tax Benefits	Increase through normal growth	Increase in Amtrak and freight rail jobs from increased rail activity
	Additional Freight Rail Traffic	Five additional trains per day (equivalent to 1000 trucks removed from roads)	Eight additional trains per day (equivalent to 1600 trucks removed from roads)
	Additional Passenger Rail Traffic	Growth to existing capacity	Two additional daily trains would represent 1700 less autos (if assume 120 person capacity, 10 cars per train, and current auto occupancy of 1.4)
	Passenger Rail Subsidies	Operating-cost subsidized at 55% in 2002 (farebox recovery was 45%)	Operating-cost subsidized at 29% at Mid-point (farebox recovery estimated at 71%)
	Externalities (air pollution, noise, safety)	Increase through normal growth	Estimates per passenger-mile range from $0.09-0.12 for autos, $0.03-0.10 for rail, and $0.01-0.03 for air. Fewer automobiles lead to lower external costs
	Partner Funding	Railroads and shippers incur higher costs through increased delays	Contributions should come from the freight railroads, Amtrak, the Federal Transit Administration, the State, and communities similar to prior investments in the network
	Summary State Benefits	LOW	MEDIUM
	Measures	No Action	Build out through Timetable C
Shippers	Business-Cost Impacts	Increased costs due to longer transit times and late shipments. Less capacity on rail lines forces increased truck use	Retention of current rail transit times and reliability. Slight increase in capacity allowing some diversion of truck to lower-cost rail service
	Access to Service	Should remain constant	Should remain constant
	Service Reliability	Simulation shows freight delay increases of 134% on rail lines and 525% in rail yards	Simulation shows freight delay reduction of 1% on rail lines and 4% in rail yards
	Summary Shipper Benefits	LOW	MEDIUM
Passengers	Service Frequency	No room for additional passenger trains	Simulation assumes two additional daily passenger trains, creates additional service options
	Transit-Time	No change, or possible additional delays	Reduction from 3:30 hours in 2003 to 3:00 by Mid-point for Seattle-Portland passenger trains
	Summary Passenger Benefits	LOW	HIGH

Table 14. Decision Analysis Matrix for Passenger Rail Improvements Up to Timetable C (continued)

	Measures	No Action	Build Out Through Timetable C
Railroads (Passenger)	Rail Capacity for Passenger Trains	No room for additional capacity	Simulation assumes two additional daily passenger trains
	Ridership	Currently at 600,000. Growth restricted by capacity	Growth to 1.4 million (432%) by Mid-point
	Farebox Revenue	$9.2 million	$36.5 million (+395%)
	Operating Cost	$20.3 million	$51.5 million (+253%)
	Revenue per passenger mile	-$0.13	-$0.07 (+46%)
	Revenue per passenger	-$34.02	-$10.69 (+69%)
	Farebox Recovery	Was 45% in 2002	Estimate of 71% at Mid-point
	Summary Passenger Railroad Benefits	LOW	HIGH
	Measures	No Action	Build out through Timetable C
Railroads (Freight)	System Velocity Improvements	Simulation shows freight delay increases of 134% on rail lines and 525% in rail yards. Will reduce average velocity	Simulation shows freight delay reduction of 1% on rail lines and 4% in rail yards. Will allow velocity to remain steady as number of trains increases
	Road (Rail Line) Delay	Increase of 134%	Decrease of 1%
	Origin (Yard) Delay	Increase of 525%	Decrease of 4%
	Increased Revenue Traffic	Normal growth of 5 additional trains	Growth of 8 additional trains
	Equipment Utilization	Road and yard delay will reduce equipment utilization	Maintaining current delay levels while increasing capacity will allow retention or slight improvement of current equipment utilization
	Summary Freight Railroad Benefits	LOW	HIGH
Ports	Throughput	No change	Slightly more rail capacity, but little change
	Market Share	No change	No change
	Summary Port Benefits	LOW	LOW
Communities	Externalities (air pollution, noise, safety)	Increase through normal growth.	Estimates per passenger-mile range from $0.09-0.12 for autos, $0.03-0.10 for rail, and $0.01-0.03 for air. Fewer automobiles lead to lower external costs
	Travel-Time Costs	Increases with roadway congestion	Delay costs per passenger-mile range from $0.16-0.32 for autos, $0.13-0.26 for rail, and $0.15-0.30 for air
	Local Jobs	Change through normal growth	Increase in Amtrak and freight rail jobs from increased rail service
	Summary Community Benefits	LOW	HIGH
National	National significance	None	Very little
	Other States Benefiting	None	Oregon
	Summary National Benefits	LOW	LOW