Washington State Transportation Commission

Statewide Rail Capacity and System Needs Study

Task 8 – Policy and Investment Options

technical memorandum

prepared for

Washington State Transportation Commission

prepared by

Cambridge Systematics, Inc.

with

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

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555 12th Street, Suite 1600
Oakland, California 94607

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Table of Contents

List of Tables

List of Figures

Task 8 – Policy and Investment Options

■ Summary

This Technical Memorandum (TM) presents policy and investment options to improve rail system capacity and operations in Washington State. It also provides illustrative examples of how the benefit evaluation and decision analysis framework presented in TM 7 can be used to evaluate investment options consistent with the policies presented in this TM (TM 8).

The policy recommendations discussed in this TM focus on the following policy questions:

- Should the State continue to participate in the preservation and improvement of both the freight and passenger rail transportation system and how can the public benefits of this participation be determined?
- How can the State use a systematic assessment and comparison of benefits and costs of rail action (as outlined in TM 7) to make decisions about strategic investments and actions?
- What principles should the State use in addition to consideration of public costs and benefits to guide its actions in the rail transportation system?

Ultimately, the Washington Statewide Rail Capacity and System Needs Study will consider other policy recommendations related to rail governance in the State and asset management needs. However, these issues are discussed in subsequent TMs (TM 10.3 and TM 9, respectively).

This TM argues that the answer to the first question is, "Yes. The State should continue to participate in the rail system provided there are documented public benefits." This is based on analysis contained in previous TMs that show that rail is critical to a number of economic sectors in the State and that it has the potential to provide mobility benefits to passengers in certain corridors. The economic vitality of Washington State requires a robust rail system capable of providing its businesses, ports, and farms with competitive access to North American and overseas international markets. For example:

- Manufacturers, lumber and wood products producers, and central and eastern Washington agriculture and food products businesses rely on rail transportation to move heavy, bulky products to market cost effectively. These businesses generate 14 percent of the State's gross state product and 15.5 percent of its employment. If rail service deteriorates, these businesses may shift their freight to trucks, but this will increase their transportation costs and may increase the cost to state and local governments of maintaining roads. In some cases, the loss of rail service could drive businesses to relocate or close.

- The State's ports and international trade industry depend on rail to export grain and other agricultural products and to import intermodal containers of consumer goods. The ports generate more than 200,000 jobs directly and indirectly, and over $500 million in state and local tax revenues. If the rail system cannot deliver high-quality transportation services, especially for intermodal cargo that is not destined for Washington State, shippers will quickly shift to other ports. This could result in lower growth at Washington ports and a loss of port-related jobs. In addition, export trade plays a major role in the Washington economy, ranking it first among states in export value per capita. Without good rail connections to support both import and export trade, the Washington ports will become less attractive to ocean carriers, and ultimately, the State will become a less attractive location for export businesses.

- A high-quality intercity passenger rail service offers an alternative to automobile and air travel that can help reduce congestion, energy use, and environmental impacts of highways. If the rail system cannot accommodate frequent and reliable intercity passenger rail service, the State risks losing the benefits of passenger rail as an alternative to highway and air travel.

The earlier TMs also indicate that rail capacity in the State is at or nearing capacity in many corridors, that the rail industry is expanding capacity and changing its operating practices to improve velocity, but these approaches are unlikely to meet the most pressing needs from the public perspective. Faced with this future, Washington State has two distinct policy options: 1) it can opt for a market-driven rail system, with little state participation, and hope that the system continues to support its critical industries; or 2) it can push for a policy-driven expansion of capacity that allows the State to participate in actions that have been carefully targeted to either protect the State's critical industries or otherwise provide public benefit.

If the State chooses the second option, it will need to strategically target its actions and investments towards projects and programs that address the most pressing capacity and operational constraints in the system. These have been identified in TMs 3 and 4 and this TM identifies the types of actions that have potential for addressing these needs. These are presented based on the needs of each of four key rail user groups that generate benefits for the State: 1) industrial carload shippers; 2) ports and international trade industry; 3) agriculture and food processing industry; and 4) passenger rail users.

The strategies and investment options that are identified in this TM may or may not achieve sufficient public benefit at acceptable public cost to warrant public participation. Alternatively, they may provide substantial benefits to carriers, shippers, communities, and the national economy such that the State's role should be more limited as compared to these other parties. The benefit evaluation methodology and decision-making framework presented in TM 7 provides an approach for making this determination. In this TM, several illustrative examples are provided to show how this methodology can be applied to evaluate decisions about state participation in strategic packages of projects. These strategic packages address four of the more pressing rail issues identified in the earlier TMs:

- Projects to provide consolidation facilities to preserve agricultural shipping options;
- Projects to expand east-west rail capacity to accommodate growth in intermodal and international trade traffic while still providing capacity for local shippers;
- Projects to rationalize industrial carload networks and improve service options for these shippers; and
- Projects to allow for improvement of passenger rail services while addressing needs of the freight rail system in the I-5 corridor.

■ Objective

The objective of TM 8 is to present policy recommendations to guide Washington State to strategically participate in the state rail system. In addition, TM 8 presents examples of the types of strategic projects that fulfill the policy recommendations for each of the four primary rail user groups. TM 8 will then present illustrative examples of how the benefits evaluation methods developed in TM 7 can be applied to strategic packages of projects that address key needs of the rail system. The illustrative examples test the evaluation methodology and provide comments on the strengths and weaknesses of particular analytical methods to assist future users of the methodology. Finally, the illustrative examples provide observations about the types of projects where a state role may be justified and the limits to state participation depending on the nature of the project benefits.

Both the policy statements and the evaluation methodology grew from the data collection, analysis, and research performed during this Washington State Rail Capacity and Needs Study. They also were informed by work sessions with members of the Washington State Transportation Commission, and by members of the Technical Resource Panel (TRP) assembled for this project.

■ Policies to Guide Washington State Involvement in the Rail Sector

A key question asked by the Legislature for this study was: "Should the State continue to participate in the freight and passenger rail system, and if so, how can it most effectively achieve public benefits." Our analysis of rail issues in Washington State led to the first policy recommendation of this study.

Policy Recommendation #1: Washington State should continue to participate in the preservation and improvement of the rail transportation system where there are public benefits to Washington State, its businesses, and its communities.

As noted in the introduction and documented in Interim Report #1, the freight rail system in Washington State provides critical transportation for major manufacturing and resource industries and rail links to the State's international trade ports. As documented in TM 3, key segments of the rail system already are operating at or near their practical capacity. Given the current investment priorities and new operating strategies of the Class I railroads, it is likely that capacity will continue to be constrained, that shippers within Washington State (particularly those in traditional industrial and agricultural carload markets) will see declines in service or price increases, that growth at the ports could be slowed, and that there will continue to be conflicts between passenger and freight trains. Without state action, the businesses and citizens of the State will not realize the full potential benefits that rail transportation could provide.

Working with the railroads, rail users, and communities, Washington State should develop a description of the rail transportation system needed for the 21st Century as a framework for policy and investment. The description of the rail system and its evolution should address the rail transportation of the major rail user groups in Washington State (as described in Interim Report #1), and should be focused on the priority problems identified in this study (in Interim Report #1, TM 3 and TM 4). The specific types of actions that could be supported will vary by user group. In the next section of this report we present examples of the types of strategies that would be most effective in meeting these needs and examples of the types of projects that could be undertaken to implement these strategies. This is followed by a list of project packages that address the highest priority capacity constraints and choke points in the system.

State participation in the rail system is complicated by a number of factors:

- Because of the limited competition in the rail industry in any given part of the county, railroads are subject to some economic regulation but this responsibility rests largely with the Federal government (the Surface Transportation Board). The Staggers Act of 1980 provided for substantial deregulation of the railroad industry and gives the railroads much greater latitude in setting rates and abandoning unprofitable service than the industry had prior to deregulation. Thus, the regulatory leverage that the State has over private railroad decisions is fairly limited. Class I carriers also have large capital intensive systems to manage. Even if an investment in Washington State might provide a positive return on investment (ROI) to the railroad, there are many reasons why it could be a lower priority for the railroads (in comparison to other investments elsewhere in the system) than it would be for the State. Influencing railroad investment priorities will need to be a goal of state actions and project evaluations need to consider this reality.

- There are many projects that could be undertaken in the State that would address critical needs of key user groups but that also bring significant economic benefits to these user groups. In these cases, the state role needs to be more limited. One option for participation in private rail projects that warrants serious consideration by the State is the use of innovative financing approaches that make use of tax exempt financing alternatives. These approaches can significantly reduce the costs of a project for private participants without requiring the State to be a major contributor to direct project investment. There are several ways that tax exempt financing can be applied, some of which make use of new provisions in the recent Federal transportation legislation (SAFETEA-LU), like private activity bonds. In addition to providing debt financing to private partners, the State also may be able to actually issue the bonds to pay for a project, charge user fees to rail carriers or shippers (for example, through container fees), and use the fees to repay the bonds. This has the added advantage of allowing the private sector to obtain financing for projects of importance to them without showing the debt on their balance sheet. This type of financial support to projects should be the primary type of state involvement in projects with significant private benefits.

- There are a number of critical rail needs in Washington State that have clear benefits to rail users outside of the State. As will be illustrated in the case studies presented later in this TM, this is often the case with major mainline capacity improvements that benefit long-haul intermodal corridors. As one of the major Pacific Rim gateways in a period of time when trade with Asia is growing for the entire U.S. economy and when all West Coast ports in North America are experiencing capacity strains, it is in the national interest to examine the public benefits of multiple projects in support of the West Coast trade system. There are clearly projects in the East-West rail corridors in Washington State that should be proposed as such "projects of national significance."

Policy Recommendation #2: The State should base its decisions to participate in projects, programs, and other rail initiatives on a systematic assessment and comparison of benefits and costs across users and across modes.

The State cannot and should not participate in all project opportunities that address critical rail system needs. Some method is needed to ensure that there are sufficient public benefits, that takes into account the costs relative to benefits, that identifies the degree to which other beneficiaries should participate in the project, and that can be used to compare alternatives and set priorities. The assessment should:

- Assess the benefits and costs of projects, programs, and other rail initiatives for each of four affected groups: the State; rail users, including shippers and passengers; carriers and transportation service providers, including railroads, ports, and truckers; and affected communities (including rail labor);

- Consider qualitative and nonmonetary benefits and costs as well as quantifiable benefits and costs;

- Compare the benefits and costs for the project to the benefits and costs of taking no action;

- Where appropriate, also compare the benefits and costs of the project to investment in other transportation modes and service that might achieve the same goals; and

- Use the assessment of benefits and cost to determine who the State should partner with and how the partnership should be structured so that project costs are allocated in accordance with benefits.

The proposed framework for conducting this assessment was provided in TM 7. Illustrations of how this framework can be applied to strategic decision-making are provided by the case studies provided at the end of this TM.

Policy Recommendation #3: Where the State determines there are sufficient public benefits to justify public participation in the preservation and improvement of the rail transportation system, these actions should be governed by the following general principles:

- **Emphasize operations and nonfinancial participation in projects before capital investment –** The State should give priority to preserving and improving rail transportation through leadership, planning, permitting, maintenance, and operations that leverage existing rail infrastructure and services then through capital investment.

- **Preserve and encourage competition –** Investment in one railroad's infrastructure can change competitive balance among railroads to the detriment of the overall system. Before making an investment that directly benefits only one rail company, the State should conduct a comprehensive analysis of competitive impacts on other rail carriers and users.

- **Target actions to encourage private investment that advances Washington State economic development goals –** State actions should influence railroad investment decisions so that rail improvements generate greater benefits to Washington State than could be achieved if the State did not invest.

- **Leverage state participation by allocating cost responsibility among beneficiaries –** The State should not invest in the private rail system unless the railroads and other beneficiaries participate in proportion to their benefits and risks.

- **Require projects to have viable business plans** – Funding from the State should be contingent upon demonstrating that the project proponent has rail service and/or customer agreements in place in order to make the project financially viable.

■ Strategic Project Recommendations

This section will include a set of strategic project recommendations for the State's rail system. The section starts by listing the major strategies that should be considered to address the needs of each of the major rail user groups. For each strategy, examples are provided of the types of possible projects/actions that could be undertaken. These strategies are presented in Table 1. Based on this list of potential strategies, Table 2 presents a list of strategic projects that address many of the highest priority choke points and capacity constraints in the State (see TM 3 for more detail on these problem areas). The projects listed in Table 2 are user-group specific and offer a mix of infrastructure and operational improvements that will assist the State in gaining the maximum public benefit of the rail system. Projects here are illustrative of the type that the State may choose to participate in after adopting the Policy Statements introduced in the first part of this report. The projects were not fully evaluated using the evaluation framework presented in TM 7 although several were included in the illustrative examples. A detailed evaluation of these projects, particularly those that involve major mainline capacity upgrades, would warrant detailed rail capacity and operations modeling accompanied by economic impact modeling, which was beyond the scope of this study. Each of these projects may individually provide public benefits, but as will be seen in the case studies, they also can be bundled into packages to provide greater benefits.

Table 1. 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.

Table 1. Examples of Projects Addressing the Rail Service Needs of Washington State Rail Users (continued)

Possible Strategies	Possible Projects/Actions
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.
• 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.

Table 1. Examples of Projects Addressing the Rail Service Needs of Washington State Rail Users (continued)

Possible Strategies	Possible Projects/Actions
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 where 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.

Table 2. Rail System Strategic Projects[a]

Project	Project Details
Port Access Projects	
Duwamish Corridor and Second Lead Improvements – Port of Seattle	• Improves access to Seattle International Gateway, T5, and T18 • Improves UP's Argo Intermodal Operations
Tacoma Tideflats Access Improvements[a] (including North Wye Connection to BNSF, Puyallup River Crossing, and Two 8,000-foot A&D Tracks at Fife Yard) – Port of Tacoma (POT)	• Improves mainline access to/from POT • Provides arrival place for 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

Table 2. Rail System Strategic Projects[a] (continued)

Project	Project Details
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 Puget Sound & Pacific Railroad (PSAP) by building siding in Elma • Abandons Tacoma Rail (TR) 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 third 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
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 (including Lind-Ellensburg connection, new 4.1-mile tunnel with < 1.6% eastbound ruling grade, Centralized Traffic Control (CTC), 8,000-foot 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 Washington agricultural producers • Supports Ports intermodal growth projections

Table 2. Rail System Strategic Projects[a] (continued)

Project	Project Details
East-West Corridor Projects (continued)	
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 • Allows track to hold 8,000-foot 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
Potential South Sound Carload Network Restructuring Strategy	• Provides new railcar switching yard 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 relocation facility for mainline industries • Improves rail service for timber products and other railcar dependent industries • Complements other I-5 Corridor projects between Tacoma and Vancouver

[a] This table assumes that intermodal equipment will be standardized and intermodal trains will grow to 8,000 feet in length.

Case Studies

Four case studies are presented here in order to illustrate the use of a public benefit evaluation methodology. The case studies each highlight one of the four major users of the State's rail system, including:

1. **Agriculture –** An agricultural consolidation program;
2. **Ports and International Trade –** An east-west capacity expansion program;
3. **Industrial Users –** A South Sound carload restructuring strategy; and
4. **Passenger –** Continue Amtrak system build-out until "Timetable C" (the halfway build-out) is reached.

It should be noted that these case studies generally use simplifying assumptions and available data in order to illustrate the general approach and are not meant to justify any particular decision with respect to the specific project packages that are analyzed. In many cases, benefits and impacts that could be quantified are missed in the analysis because they could only be captured with much more intensive modeling of rail and economic impacts. In cases where the project investments are tens of millions of dollars (or more) this may very well be justified. At the conclusion of each case study, we have provided a brief set of comments on the nuances of the case that are not captured in the case study as well as observations on lessons learned from the case study.

Case Study 1: An Agricultural Consolidation Program (Railex)

Case Study 1: Background

The Class I railroads are increasingly focusing their business on the high-density, long-haul freight movements where large volumes enable economies of scale in operation and keep service profitable. This has meant giving priority to intermodal container movements from the West Coast Ports and unit coal trains from the Powder River Basin, at the expense of the short-haul, more traditional carload traffic. In a survey of shippers performed for this study, 74 percent believe that the railroads have shifted their focus during the past 2 years and now give certain types of trains (intermodal, coal) priority.

This problem is negatively affecting the agricultural industry of the State, an industry that is economically very beneficial to the both the state and essential to many local economies. Washington's agricultural industry is the 11th largest in the country, producing crops and livestock valued at $5.3 billion in 2002. It also is the fourth largest producer of wheat in the United States, mostly coming from the productive regions of eastern Washington State. Pricing is market-driven and Washington farmers must be cost-competitive to secure orders and maintain profitability. Rail plays a critical role in controlling costs by providing an inexpensive option to transport Washington's agricultural products to West Coast seaports and eastern U.S. markets.

One strategy to enhance the attractiveness of this business to the railroads is development of agricultural consolidation centers where individual farmers can bring their products, thus creating a high-volume origination point. The combined shipments of many farmers create sufficient volume for the railroads to operate a dedicated unit train. This contributes to greater rail system velocity by reducing the amount of loading/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 locations.

Case Study 1: Description of Solution

Produce distributor Ampco Distribution Services of Riverhead, New York wanted to obtain West Coast produce for distribution to East Coast grocery stores. Trucks could make the cross-country trip in 5 days, but the logistics costs made it difficult for Washington State produce to compete in East Coast markets. Traditional rail service offered competitive logistics costs, but it took anywhere from 10 to 25 days to go from

Washington State to New York. This was not a viable option for the perishable apples, potatoes, asparagus, and other produce.[1]

Ampco Distribution Services approached the Union Pacific Railroad and CSX Transportation about dedicating a single train full 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: the train runs at least once a week, so the railroads could dedicate cars and locomotives to the service; and, Ampco handled the loading and unloading of the produce. There also was initial resistance from the growers, who had seen their produce spoil on previous slow train service. Working together, the distributor, the growers, and the railroads became convinced this was a viable service.

The total project cost was $58 million, with approximately $50 million covered by Ampco Distribution (the Railex Founders), and the Union Pacific railroad. The State, the Port of Walla Walla, the Federal government, and Walla Walla County contributed the remainder. The cost went toward construction of two identical refrigerated 212,000-square-foot refrigerated warehouses, one in Wallula, Washington and the other in Rotterdam, New York, and to the necessary track to support the operation. The facility in Wallula serves several dozen small agribusinesses by allowing them to aggregate their shipments and deliver them to the Union Pacific Railroad for movement east. UP interchanges with CSX Transportation, who then delivers the produce five days later to the distribution center in Rotterdam. Once delivered to a refrigerated warehouse in Rotterdam, the produce is sent by trucks north into New England and eastern Canada, and south as far as North Carolina. Railex customers include Wal-Mart, Ahold, and Sysco.

The train only stops to change crews and receive fuel – there is no waiting in railyards and the produce is not subjected to the damage caused by multiple coupling/decoupling during switching of cars. 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, though within three years, that number could double according to the owners.[2]

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[1] Adapted from "Join the Cold Train" by Jonathan Fahey, Forbes.com, November 3, 2006, retrieved from: http://www.railexusa.com/pressroom.php?id=58.

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

Figure 1. Train Entering the Railex Facility in Walulla, Washington

Source: http://www.railexusa.com/about.php.

Case Study 1: Decision Analysis

The Revised Code of Washington (RCW) states that Washington State funding for rail service, rail preservation, and corridor preservation projects must benefit the State's interests. One way to do this is by increasing domestic and international trade and creating jobs. A consolidation facility does both, by supporting low-cost transportation to the State's agricultural businesses and providing new jobs at the consolidation center.

Since the Railex facility already has been constructed and is operating, this case study will use actual job and traffic volume information to perform a post-decision analysis on the benefits of the project. There are two alternative scenarios to consider:

1. **Do Nothing –** Assumes that the Railex facility had not been constructed.

2. **Alternative: Construction of Railex –** A $58 million investment is made to construct two distribution centers (one in Walulla, Washington and one in Rotterdam Junction, New York) and the necessary rail infrastructure to begin operations of a weekly, dedicated unit train of produce. The distributor and railroads contribute $50 million, while the State, the Port of Walla Walla, the Federal government, and Walla Walla County contribute the remainder.

Since Washington State requires a benefit/cost greater than or equal to one for investment in freight rail projects, a benefit/cost analysis was performed using Cambridge Systematics Freight Rail Investment Calculator (FRIC). This tool uses the standard Federal Railroad Administration (FRA) 10-year planning horizon and determines the benefit/cost in current year dollars. The relevant input values are listed in Table 3 and the results of the benefit/cost analysis are contained in Table 4. The jobs and truck to rail diversion estimates were obtained from Railex press releases available on their web site. Multipliers to convert measures into dollars of public benefit were obtained from the CS FRIC. For these multipliers, the original source is listed in the Table 3. Professional judgment and information from comparable projects were used when data were not readily available.

Table 3. Decision Analysis Input Values for Agricultural Consolidation Project

Item	Value	Source
Net new Jobs to Washington State	100	"Railex takes local produce to East Coast," November 2, 2006. It is assumed these jobs will start in Year 1
Truck to Rail Diversions	200/week, 10,400/year	"Railex takes local produce to East Coast," November 2, 2006. It is assumed these diversions will start in Year 1
Average Wages	$43,896	Bureau of Labor Statistics average 2005 annual wages in Washington State for Transportation and Warehousing (NAICS 48-49) was $42,617. Inflated by 1.03 to 2006 value using the Consumer Price Index (CPI)
Length of Haul (Total)	2,750 mile	Cambridge Systematics and Global Insight
Length of Haul (Washington)	6.1 mile	CS/GI
Percent of Traffic Originating in Washington State	100%	CS
Average Rail Rate Washington to New York	$0.035/ton-mile	CS/GI/HDR rail rate for 2,750-mile trip and truck drayage in Washington and New York
Average Truck Rate Washington to New York	$0.128/ton-mile	CS/GI/HDR
Highway Maintenance Costs	$0.127/VMT	Addendum to the 1997 Federal Highway Cost Allocation Study Final Report U.S. DOT, FHWA, May 2000. Pavement rate for 80 kip 5-axle trucks on rural interstates. Inflated to 2006 values using the CPI
Roadway Safety	$0.091/VMT	National Highway Safety Traffic Administration, 2004 National Statistics. Inflated to 2006 values using the CPI
Difference between Truck and Train Emissions	$0.00953/VMT	EPA Mobile 6 and "Monetary Values of Air Pollution Emissions in Various U.S. Cities," Wang and Santini, Transportation Research Board Paper No. 951046, 1995. Inflated to 2006 values using the CPI
Average Truck Weight	17 tons	CS/GI
Time Value of Money	7.5%	CS
Annual Inflation Rate	3.0%	CS
Planning Horizon	10 years	Federal Railroad Administration

Table 4. Benefit/Cost Analysis for Agricultural Consolidation Project

Item	Value (in Millions)
Jobs	$36.3
Highway Maintenance	$0.1
Emissions	$0.0
Highway Safety	$0.0
Logistics Cost Savings	$373.9
Total Benefits	$410.3
Cost	$58.0
B/C	7.1

This analysis yields a favorable benefit/cost ratio of 7.1 for the Railex project. The 100 new jobs contribute a public benefit of $36 million over the 10-year planning horizon, but the real benefits are the logistics cost savings to the growers of $374 million over the planning horizon. These logistics savings are primarily a private benefit and thus justify the high-cost contribution of the private sector relative to the public sector.[3] In a more sophisticated economic impact analysis, these logistics cost savings may generate public benefits or beneficial regional economic impacts that are not captured in this simplified analysis. This issue is discussed further in the comments on this case study. It also should be noted that in actuality, the growers would most likely not truck the produce cross-country, but would either sell it in lower profit markets or reduce production. Finally, the highway savings from reduced maintenance and emissions, and improved safety, are negligible due to the short length of haul in Washington State (6 miles of the 2,750-mile trip).

This benefit/cost analysis provides one important component of the overall decision analysis. Table 5 examines a broader range of criteria, broken out by user group. A low, medium, or high category is assigned to each scenario for each user group. This information is summarized in Table 6.

[3] Logistics costs savings typically benefit the shipper originating the traffic. For this analysis, it was assumed that 100 percent of the traffic was originated by Washington State shippers.

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.	100 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 million)
	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
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 Washington 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

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

	Measures	No Action	Construction of Railex Consolidation/ Distribution Center and Loop Track
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

Table 6. Summary of Decision Analysis by User Group for Agricultural Consolidation Project

User Group	No Action	Construction of Railex Consolidation/Distribution Center and Loop Track
State	Low	Medium
Shippers	Low	High
Passengers	Low	Low
Railroads	Low	Medium
Ports	Low	Low
Communities	Low	Medium
National	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 U.S. due to the lower logistics costs of the rail service. Medium beneficiaries include the State, the railroads, and the communities. The State and community 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 impact from this service.

Case Study 1: Comments

The benefit/cost methodology used in the simplified analysis misses an important impact of the project which is only hinted at in the calculation of the shipper logistics cost savings but which could be captured in a more extensive economic impact analysis model. In this case, 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. As the case study notes, 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 market 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 also could reduce GRP and would likely depress wages. If additional investigation of local market conditions was conducted, including determining prices and yields per acre for different crop alternatives, it would be possible to provide inputs to a regional econometric model such.[4] This would calculate impacts on GRP, personal income, and jobs in the region. If the project was in a region with especially limited economic development opportunities, this approach would highlight impacts that would be important in justifying the project. However, it is important to recognize that this type of economic impact analysis is not benefit/cost analysis and treating the GRP impacts as benefits in a benefit/cost analysis is an incorrect way of using benefit/cost analysis. Changes in GRP are simply a different metric for evaluating the impacts of the project.

Another issue that is raised by this example is the question of how truck to rail diversion is treated. In this case, a benefit of reduced highway maintenance is calculated based on the assumption that the produce would be trucked out of the State. A more careful analysis of the alternative market conditions as described above, might have determined that the likely alternative for comparison of maintenance costs should be one in which rather than being shipped to the East Coast, the produce was shipped to a closer market that could be reached economically by truck and still priced competitively. Further, the calculation of highway maintenance savings can be accomplished with a much higher degree of accuracy

[4] Information about alternative economic impact modeling tools is presented in a recent U.S. DOT publication, *Guide to Quantifying the Economic Impacts of Federal Investments in Large-Scale Freight Transportation Projects*, prepared by Cambridge Systematics, Inc., Economic Development Research Group, and Boston Logistics, August 2006.

if the actual routes by truck are known and maintenance costs are a function of the class of facility that would be affected rather than using a generic highway maintenance cost estimate. This more detailed analytical approach to highway maintenance costs was used by WSDOT in a recent analysis of the PCC short-line railroad purchase.

A final issue is the way that the value of jobs was calculated in the benefit-cost analysis. In the simplified example, a statewide average wage rate for transportation services was used in the calculation. Wage rates in Wallula might be different than this average and this could be taken into account in a more rigorous analysis.

Case Study 2: An East-West Capacity Improvement Program

Case Study 2: Background

East-west capacity is crucial to Washington State and the nation, both to supply throughput capacity to international cargo arriving at the ports, and to provide an outlet for Washington State exports. The trade and distribution industry is a critical contributor to the Washington State economy. The ports are a major contributor to this industry. For example, in 2004 a Port of Tacoma study found that 113,000 jobs were connected to the Port, and that the Port generated $91 million in state tax revenue.

Investment in east-west capacity will allow the State to take full advantage of the projected tremendous increase in local and international trade. Maintaining sufficient east-west capacity and rail service are crucial steps for maintaining or improving the competitiveness of Washington's ports.

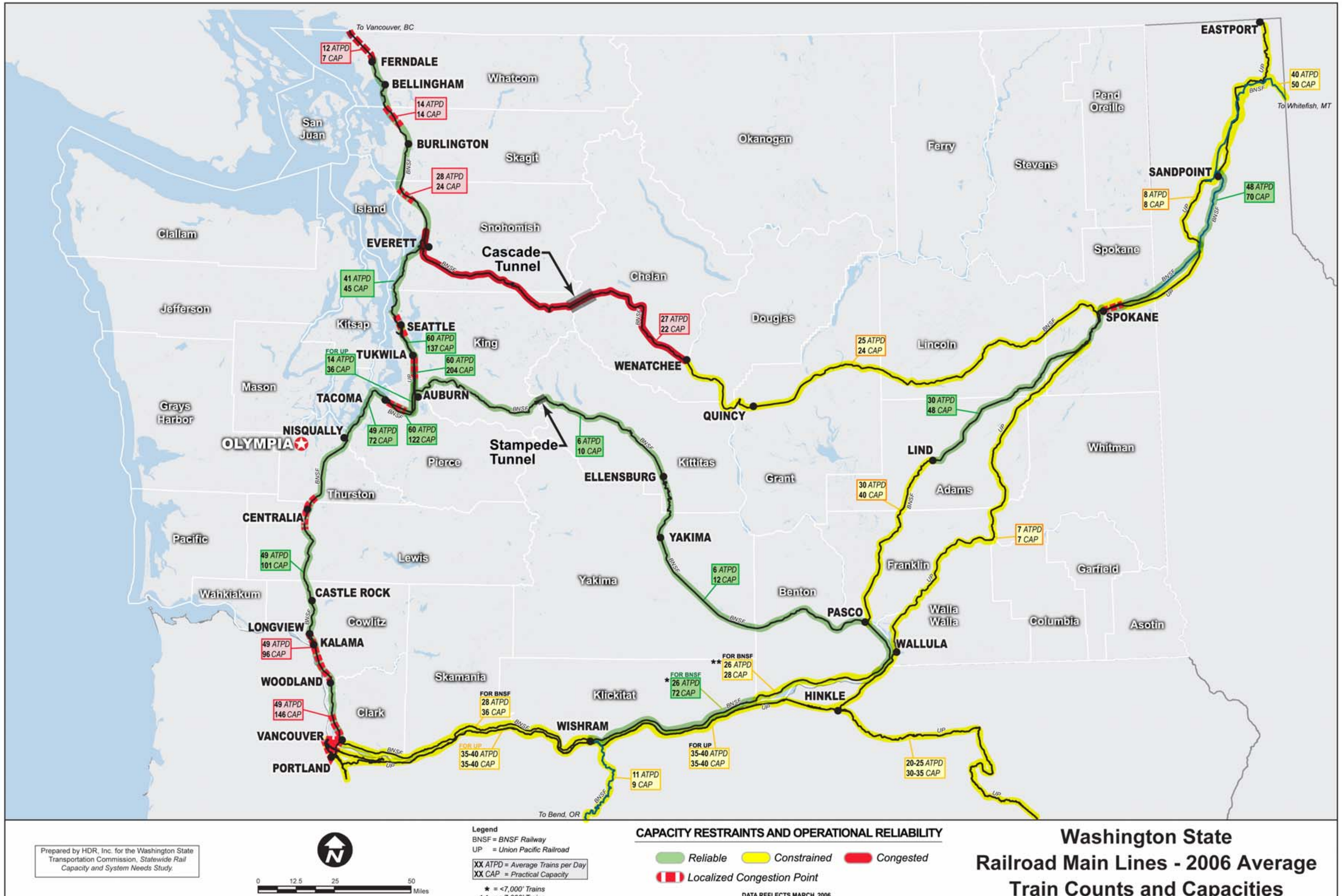
Case Study 2: Description of Solution

Already, the major east-west routes in the State are at or near capacity. Specifically, the Stevens Pass tunnel is congested: with a daily practical capacity of 22 trains per day there are 27 trains per day trying to access the tunnel. In addition, the mainline from Stampede Pass, through Spokane and into Sandpoint, Idaho is severely constrained. With a practical capacity of 24 trains per day, there currently are 25 trains per day trying to use the mainline infrastructure. Figure 2 shows the existing capacity constraints on the Washington Rail System. The lack of excess capacity in the dominant east-west corridor is evident by the heavy red and yellow lines (red = congested, yellow = constrained, and green = reliable). While Stampede Pass is shown as reliable it only has capacity for an additional 4 to 6 trains per day before it becomes constrained.

Several different east-west capacity building projects are presented to the State as alternative packages. The projects include improving Stampede pass to allow for double-stack containers, restoring the Old Milwaukee line from Ellensburg to Lind, and incorporating "Bridging the Valley" improvements for the Spokane to Sandpoint, Idaho section. The State must decide if it should participate in east-west rail capacity expansion, and if so, at what level. There are three alternatives for Washington State to consider:

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.

Figure 2. Capacity Constraints on the Dominant East-West Corridor



2. **Alternative A** – East-West Capacity Expansion Project – 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: These train volumes include the UP Columbia River route capacity.]

3. **Alternative B –** East-West High Velocity Rail Corridor Project – 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 7.

Table 7. East-West Capacity Expansion: Summary of Alternatives A and B

Project	Alternative A	Alternative B
Reduce eastbound grade over Stampede Pass from 2.2% to 1.6% by constructing a new 4-mile Stampede Pass Tunnel.		●
Crown cut Stampede pass.	●	
Construct Lind, Washington to Ellensburg, Washington connection.	●	●
Install 8,000-foot siding tracks to provide 20-minute headways between Auburn, Washington and Ellensburg, Washington and between Lind, Washington and Spokane, Washington.	●	●
Install CTC train control system overlaid with ETMS.	●	●
Implement bidirectional 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 affected communities.		●
Construct the triple-track segment as well as other improvements suggested in "Bridging the Valley."		●
Grade separate the corridor from Spokane, Washington to Athol, Idaho as suggested in "Bridging the Valley."	●	●
Create a shared use agreement for railroads operating on track segment between Athol, Idaho and Sandpoint, Idaho.		●

Case Study 2: Decision Analysis

Participating in these actions satisfies the goal of the State to address the rail transportation needs of the major rail user groups. The State should participate in improvements to the rail system that address mainline capacity constraints and bottlenecks, port access needs, and intermodal terminal capacity constraints to maintain port competitiveness and support job growth. Therefore, it would seem likely that the State should participate in a manner which is commensurate with public benefit received, but only if other beneficiaries (ports, railroads, etc.) also participate.

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. As will be described in the Comments section of this case study, 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 in the Comments, 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 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, though a more practical number is 50 trains per day due to other limitations. For the Alternative B analysis, 50 additional trains were used even though this may represent an impractical growth rate during the 10-year planning horizon.

Since Washington State requires a benefit/cost greater than or equal to one for investment in freight rail projects, a benefit/cost analysis was performed using Cambridge Systematics' Freight Rail Investment Calculator (FRIC). This tool uses the standard Federal Railroad Administration 10-year planning horizon and determines the benefit/cost in current year dollars. The relevant input values are listed in Table 8 and the results of the benefit/cost analysis are contained in Table 9. The jobs estimates were developed by Global Insight using their econometric model. The general approach that Global Insight uses to develop estimates of the economic impacts of an investment in the rail system is to estimate the change in traffic patterns by mode of transport or rail route (if the traffic is staying on rail mode but using a different route) and to then determine the change in average costs to the industries that generate the traffic from this shift in traffic. This change in business costs is then fed into an economic impact model to determine the affect that the change in costs has on the output and consequently employment of the industries that shift traffic patterns as well as the indirect impacts on industries that provide supplies and services to the primary shipping industries. In the case of improved east-west capacity, the assumption is made that without this capacity, the traffic would shift to another port and this would reduce the level of economic activity associated with the port sector in the economic models. In other case studies analyzed in this technical memorandum (see Case #3), it is assumed that the investments in rail allow industries to realize cost savings by use of rail as compared to trucking and this is the business cost savings that drives the economic models.

Table 8. Input Values for East-West Capacity Improvement Analysis

Scenario	Item	Value	Source
A	Jobs – Direct and Indirect	500	Global Insight. It is assumed these jobs will be phased in over the planning horizon.
B	Jobs – Direct and Indirect	2,100	Global Insight. It is assumed these jobs will be phased in over the planning horizon.
A	Additional Trains/Day	12	HDR (5*52*12*200 = 624,000 containers/year)
B	Additional Trains	50	HDR (5*52*50*200 = 2.6 mil containers/year)
A and B	Wages	$43,896	Bureau of Labor Statistics average 2005 annual wages in Washington State for Transportation and Warehousing (NAICS 48-49) was $42,617. Inflated by 1.03 to 2006 value using the Consumer Price Index.
A and B	Average Container Weight (factoring in locomotives and cars)	32.4 tons	CS & GI. Assumes 6,480 tons and 200 containers per train. This value factors in the weight of the locomotives and railcars.
A and B	Average Distance in Washington	300 miles	CS
A and B	Truck to Rail Diversion	0	This traffic would use other ports if rail capacity is not expanded. Therefore, there is no truck to rail diversions.
A and B	Train Emissions	$0.056 ton/mile	EPA Mobile 6 and “Monetary Values of Air Pollution Emissions in Various U.S. Cities,” Wang and Santini, Transportation Research Board Paper No. 951046, 1995. Inflated to 2006 values using the CPI. Inflated by 1.03 to 2006 value using the CPI.
A and B	Time Value of Money	7.5%	CS
A and B	Annual Inflation Rate	3.0%	CS

Table 9. Benefit/Cost Analysis for East-West Capacity Improvement

Item	Scenario A	Scenario B
Net New Jobs in Washington State	$93.2 million	$391.6 million
Highway Maintenance	$0.0	$0.0
Emissions	-$29.7 million	-$123.7 million
Highway Safety	$0.0	$0.0
Logistics Cost Savings	$0.0	$0.0
Total Benefits	$63.5 million	$267.3 million
Cost	$350 million	$1,500 million
B/C	0.181	0.178
Percent Cost for Washington State B/C = 1	18.1%	17.8%

Multipliers to convert measures into dollars of public benefit were obtained from the CS FRIC. For these multipliers, the original source is listed. Professional judgment and information from comparable projects were used when data were not readily available.

This analysis does not yield a favorable benefit/cost ratio, with a value of 0.181 for Alternative A and 0.178 for Alternative B. Both projects benefit the ports, improving their competitiveness for attracting international traffic. 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. The final row in Table 10 indicates that the State should not consider funding more than 18 percent of either alternative (if it wishes to see a positive public benefit to cost ratio).

Table 10. Decision Analysis Matrix for East-West 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
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
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 $6,000 car	75 trains x 100 cars/train x $6,000 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

Table 10. Decision Analysis Matrix for East-West Capacity Improvement (continued)

	Measures	No Action	Alternative A: East-West Capacity Expansion Project	Alternative B: East-West High Velocity Rail Corridor Project
Ports	Throughput	Current Capacity	Additional 12 trains/day = 2,400 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	Negative: emissions from YY trains x mileage x 12,000 tons/train	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

This benefit/cost analysis provides one important component of the overall decision analysis. Table 11 examines a broader range of criteria, broken out by user group. A low, medium, or high category is assigned to each scenario for each user group. This information is summarized in Table 11.

Table 11. Summary of Decision Analysis by User Group for East-West Capacity Improvement

	No Action	Alternative A. East-West Capacity Expansion Project	Alternative B. East-West High Velocity Rail Corridor Project
State	Low	Medium	Low
Shippers	Low	Medium	High
Passengers	Low	Low	Medium
Railroads	Low	Medium	High
Ports	Low	High	High
Communities	Low	Medium	Medium
National	Low	Medium	High

The primary beneficiaries of the east-west capacity enhancements are the ports and the railroads (in this case, primarily, BNSF). For the ports, the benefits are driven by increased imports and exports attracted by the improved transportation system. The railroads increase revenue from the additional trains and reduce 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 potentially could make this project a candidate for national funding under a program such as Projects of Regional and National Significance.

In this illustrative analysis, the State has relatively low benefits from east-west rail capacity expansion, as reflected in the low B/C ratio. The principal benefits are job creation, which are low for an investment of this size. As illustrated in Table 10, this analysis shows that the State may wish to limit its contribution to a project of this type based on the share of total benefits that accrue to the State (in this case roughly 18 percent of the costs of the project would yield public benefits equal to public costs). As noted earlier, actual benefits to the State are likely to be higher than what is illustrated in this simplified analysis and thus, a higher state contribution may be justified.

Case Study 2: Comments

As noted in the discussion of the analysis results, 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 also are impacts that need to be mitigated that can substantially offset much of these 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 small state role in these very costly projects. A key question that would need to 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. An alternative approach to state participation in the project might involve using tax exempt financing alternatives. 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.

Another issue with the analysis is the degree to which the economic benefits from the port activity are fully captured in the analysis. 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 could 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.

The last issue that is not dealt with in the analysis is the policy principle which calls on the State not to upset competitive balance among railroads. In this case most of the investment that is proposed is on BNSF track. While it could be argued that this would move growth that would otherwise be forced into the I-5 corridor where UPRR has trackage rights on the BNSF system and the investment would therefore benefit both railroads, this might be hard to demonstrate in fact.

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. Class I railroads are experiencing capacity limitations at their yards, increased switching costs serving scattered industries, and reduced mainline velocities resulting from serving existing carload businesses off their mainlines. Shortline 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 all of these issues, a set of solutions has been bundled into a $185 million dollar project collectively referred to as the South Sound Carload Restructuring Strategy. This strategy is aimed at improving rail carload movements in a corridor parallel to I-5 in Washington State. A key component of this strategy is development of a 740-acre South Sound Logistics Center in Maytown, Washington. It should be noted that this strategy is intended to handle rail carload traffic, not increasing intermodal traffic. It should be further noted that the proposed uses of such a facility as described in this case study are to some degree, hypothetical. While there are a number of proposed uses of the Maytown project that have been discussed, there is no actual set of uses that has been agreed to.

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-foot A&D tracks, intermodal yard, and transload facility. Establish SSLC as car load rail consolidation point for local Union Pacific Railroad (UP), 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 UP. 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 – 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 III track.

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

Case Study 3: Decision Analysis

The Revised Code of Washington (RCW) states that Washington State funding for rail service, rail preservation, and corridor preservation projects must benefit the State's interests. One way to do this is by increasing domestic and international trade and creating jobs. The South Sound Carload Restructuring Strategy would create jobs at the logistics center, and improve north-south mobility enhancing trade. The increased capacity also would benefit passenger rail services in this corridor.

Under the South Sound Carload Restructuring Strategy there are two alternative scenarios to consider:

1. **Do Nothing –** Assumes that any investment in this corridor is made by the private sector. For this purposes of this analysis, no improvements are included.

2. **Alternative: Implementation of the Four South Sound Carload Restructuring Strategies –** The full $185 million investment is made to build the South Sound Logistics Center, construct the Centralia – Chehalis Rail Corridor Consolidation Project, upgrade the PSAP and TRMW track, and implementing operational changes.

Since Washington State requires a benefit/cost greater than or equal to one for investment in freight rail projects, a benefit/cost analysis was performed using Cambridge Systematics Freight Rail Investment Calculator (FRIC). This tool uses the standard Federal Railroad Administration 10-year planning horizon and determines the benefit/cost in current year dollars. The relevant input values are listed in Table 12 and the results of the benefit/cost analysis are contained in Table 13. The jobs estimates were developed by Global Insight using their econometric model. Truck to rail diversions were estimated by Global Insight from analysis of the TRANSEARCH data and based on the size of the logistics center. Multipliers to convert measures into dollars of public benefit were obtained from the CS FRIC. For these multipliers, the original source is listed. Professional judgment and information from comparable projects were used when data were not readily available.

Table 12. Decision Analysis Input Values for South Sound Carload Restructuring Strategies

Item	Value	Source
Net New Jobs to Washington State	3,100	Global Insight. It is assumed these jobs will be phased in over the planning horizon.
Truck to Rail Diversions	39,638/year	Global Insight. It is assumed these diversions will be phased in over the planning horizon.
Average Wages	$43,896	Bureau of Labor Statistics average 2005 annual wages in Washington State for Transportation and Warehousing (NAICS 48-49) was $42,617. Inflated by 1.03 to 2006 value using the Consumer Price Index (CPI).
Length of Haul (Total)	1,440 mi	Global Insight
Length of Haul (Washington)	245 mi	Global Insight
Percent of Traffic Originating in Washington State	50%	CS
Average Rail Rate Washington to New York	$0.063/ton-mile	CS/GI/HDR rail rate for 1,440-mile trip and truck drayage at both ends.
Average Truck Rate Washington to New York	$0.123/ton-mile	CS/GI/HDR
Highway Maintenance Costs	$0.216/VMT	Addendum to the 1997 Federal Highway Cost Allocation Study Final Report U.S. DOT, FHWA, May 2000. Weighted average of pavement rate for 80 kip 5-axle trucks on rural and on urban interstates. Inflated to 2006 values using the CPI.
Roadway Safety	$0.091/VMT	National Highway Safety Traffic Administration, 2004 National Statistics. Inflated to 2006 values using the CPI.
Difference between Truck and Train Emissions	$0.00953/VMT	EPA Mobile 6 and "Monetary Values of Air Pollution Emissions in Various U.S. Cities," Wang and Santini, Transportation Research Board Paper No. 951046, 1995. Inflated to 2006 values using the CPI.
Average Truck Weight	17 tons	CS/GI
Time Value of Money	7.5%	CS
Annual Inflation Rate	3.0%	CS
Planning Horizon	10 years	Federal Railroad Administration

Table 13. Benefit/Cost Analysis for South Sound Carload Restructuring Strategies

Item	Value (in Millions)
Net New Jobs in Washington State	$578.1
Highway Maintenance	$8.9
Emissions	$0.3
Highway Safety	$3.8
Logistics Cost Savings	$123.7
Total Benefits	$782.8
Cost	$185.0
B/C	3.9

This analysis produces a favorable benefit/cost ratio of 3.9 for this collection of projects. The largest category of public benefits is generated by the 3,100 new 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 contributes to the overall public benefits total.

This benefit/cost analysis provides one important component of the overall decision analysis. Table 14 examines a broader range of criteria, broken out by user group. A low, medium, or high category is assigned to each scenario for each user group. This information is summarized in Table 15.

Table 14. 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 million)
	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	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.

Table 14. Decision Analysis Matrix for South Sound Carload Restructuring Strategies (continued)

	Measures	No Action	Full Implementation of South Sound Carload Restructuring Strategies
	Summary Railroad Benefits	LOW	HIGH
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	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

Table 15. Summary of Decision Analysis by User Group for South Sound Carload Restructuring Strategies

User Group	No Action	Full Implementation of South Sound Carload Restructuring Strategies
State	Low	High
Shippers	Low	Medium
Passengers	Low	Medium
Railroads	Low	High
Ports	Low	Medium
Communities	Low	High
National	Low	Medium

The South Sound Carload Restructuring Strategies have high positive impacts on the State, the railroads, and the communities. The State and communities benefit from increased jobs and the diversion of long-haul trucks from the roadway. Shippers, passenger rail, and the ports should be medium beneficiaries. The shippers and ports will benefit from lower logistics costs and better reliability from improved carload rail service. Passenger rail will benefit from additional time slots available for increasing service. There are not large national benefits from this project, but there are regional benefits, especially from reduced truck traffic along I-5 through Oregon and California.

Case Study 4: Passenger Rail Improvements Up to Timetable C

Case Study 4: Background

The Amtrak *Cascades* passenger rail service stretches 466 miles from Vancouver, BC to Eugene, OR. It provides service in Washington to Bellingham, Mount Vernon/Burlington, Everett, Edmonds, Seattle, Tukwila, Tacoma, Olympia/Lacey, Centralia, Kelso/Longview, Vancouver, and in Oregon to Portland, Oregon City, Salem, Albany, and Eugene. Four trains per day run on the Cascades service between Portland and Seattle, and two trains between Seattle and Bellingham with one continuing on to Vancouver, BC. Amtrak also operates two long distance trains over the line: the Coast Starlight travels between Seattle and Los Angeles and the Empire Builder which connects Seattle/Portland with Chicago via Spokane.[5]

This service was initiated by a 1993 directive from the Washington State Legislature to improve intercity passenger rail service along the I-5 corridor. In 1994, the Washington State Department of Transportation (WSDOT) teamed with Amtrak, the State of Oregon, and the Burlington Northern Railroad (now the Burlington Northern Santa Fe) to develop the service. Since the State has started investing in this service, ridership has steadily increased from 180,000 riders in 1994 to 590,000 riders in 2003.[6]

When the Legislature directed WSDOT to initiate the Amtrak *Cascades* service, it did so in the belief that alternative travel options would be needed in the corridor due to highway congestion, high cost of air travel for certain city pairs, and limited alternative modal options for travelers who cannot or do not have access to an automobile. The potential benefits to the State were expected to include absorption of some of the growth in highway congestion, transportation system redundancy, improved safety, and reduced air pollutant emissions. The Legislature recognized that in order to achieve these benefits, the service would need to be able to provide frequent, high speed, and reliable service that meets the needs of business and recreational travelers alike. WSDOT developed a phased program

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[5] *Draft Short-Range Plan for Amtrak Cascades*, Washington State Department of Transportation, February 2006.

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

of improvements that would allow the *Cascades* to continue adding more trains, reducing travel times, and improving on-time performance. It was hoped that as service improved, new riders would be attracted and at the ultimate buildout of the system, ridership would be high enough to fully support operations and maintenance costs from farebox revenues.

The *Cascades* service runs primarily on track owned by the BNSF. As more passenger trains are added and as freight traffic grows, investments are needed to ensure that all users do not experience a degradation of service. This requires addition of new capacity and supporting infrastructure to resolve choke points.

The objective of this case study is to look at a strategic package of investments that move the *Cascades* service to a critical level of service where it can realize substantial growth in ridership and revenue and begin to tap into passenger markets that are important to its long term success. The package is also designed to address other critical freight rail infrastructure needs to the maximum extent possible in order to provide a complete systems level solution.

Case Study 4: Description of Solution

The draft long range plan for the Amtrak *Cascades* is comprised of 52 capital projects totaling $6.5 billion. The 52 projects have been bundled into 6 packages, known as Timetables A, B, C, D, E, and F, with an overall completion target date of 2023. Each timetable introduces new increments of service improvements in terms of increases in frequency of trains and/or reductions in travel time. Timetables A, B, and C are collectively referred to as the Mid-Point, and a number of these improvements have either already been made or are underway. The capital costs through the Mid-Point are between $2.3 billion and $2.9 billion. Completion of the entire portfolio of 52 projects will increase capacity on the rail network. Supporters argue that this will bring benefits to both the passenger and freight railroad operators, the rail passengers and shippers, and the State and local communities.

The goals for the Cascade 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 by the WSDOT passenger rail program to reach 1.4 million passengers. Farebox recovery (the amount of operating costs recovered by ridership revenue) was 45 percent in 2002. If ridership goals are realized, the projected farebox recovery is 71 percent at the Mid-Point.[7]

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

The complete list of projects for all six timetables is contained in Table 16.

Table 16. Timetable C Projects
All Values in Millions of U.S. 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 & 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 & Main Track Relocation ($40.4)		*Marysville to Mt. Vernon High-Speed Track ($322.5)*
Sound Transit: Seattle to Lakewood Improvements ($304.0)	Tenino Crossover ($3.4)	Centralia Steam Plant Coal Track & 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)*			

Table 16. Timetable C Projects (continued)
All Values in Millions of U.S. Dollars

Timetable A	Timetable B	Timetable C	Timetable D	Timetable E	Timetable F
	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.

Note: Standard font indicates projects between Seattle, WA and Portland, OR. *Italicized font* indicates projects between Seattle, WA and Vancouver, BC.

Case Study 4: Decision Analysis

As input to the draft long-range plan for the Amtrak *Cascades*, a cross-modal analysis was performed to compare the cost effectiveness of intercity travel by automobile, air, and passenger rail through the year 2023.[8] 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. For this case study, this cost effectiveness metric (the cost to deliver a particular level of mobility in passenger miles) is used as a substitute for a benefit-cost analysis.

The focus of the cross-modal analysis was passenger travel, and therefore emphasized public sector issues rather than private sector issues. To gain a better understanding of the operational issues related to freight rail service, a railroad simulation analysis was

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

performed.[9] The simulation provided information on freight train delays both on the road (i.e., rail lines) and at the origins (i.e., rail yards).

This section first summarizes the results of both the cross-modal analysis and the railroad simulation analysis, and then uses that information to complete a decision analysis matrix. For each mode, a description of the direct operating, travel time, external, and capital costs are provided. Each modal discussion only presents only a brief summary of the analysis. The full *Amtrak Cascades Cross Modal Analysis Technical Report* should be consulted for additional detail.

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 for the purposes of this case study.

Cost-Effectiveness Analysis

Automobiles. Automobile costs per passenger mile by year are contained in Table 17. Direct operating costs are defined as the expenses necessary to cover both the variable costs of travel and regular maintenance. For automobiles, this includes the following:

- The expenses associated with maintaining existing facilities (paid by the public sector);
- The costs of vehicle ownership and operation (paid primarily by users); and
- The cost of parking (paid by users).

Travel time costs are bracketed by a low and a high range. The low range is based on 50 percent of the wages of the traveler, while the high range uses 100 percent of wages. This takes into account the fact that business travelers may value their time at closer to what they could be earning while traveling while recreational travelers may have a lower value of time. For automobiles it is assumed that the traveler cannot conduct business during the trip, therefore no discount is applied for consideration of work done while traveling. Current highway speeds, broken into urban and rural, were used for automobile travel time. These speeds were reduced 1 percent per year to account for growing congestion.

[9] The rail simulation study was done as part of a prior effort and only summarized in this document. The information was provided by Tom White, Transit Safety Management, in an e-mail received November 17, 2006.

Table 17. 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.

Externalities, or external costs, describe all unintended consequences created by an action. For transportation projects the externalities typically include environmental, safety, and more recently, security concerns. For the analysis in the Amtrak *Cascades* long range plan, externalities that were considered include air, noise, and water pollution; waste disposal; and accidents. Air pollution considered costs associated with emission levels, health impacts, and global warming. Waste disposal for automobiles included the disposal costs of used oil, worn tires, and dead batteries.

The final cost category is capital costs. Although capital costs are incurred at specific points in time, for the cross-modal analysis the costs were annualized over the life of the project. Therefore, a project with a 30-year life will not consider the full capital costs over the 20-year horizon of this analysis. The cost of existing facilities was considered to be sunk costs, and not included as a capital cost in the cross-modal analysis. For highways, the planned capital expenditures included projects on I-5, I-405, I-205, SR 167, and SR 512. The total over 20 years was $6.1 billion in 2003 dollars. This has a relatively small impact on cost per passenger mile as it is spread over a large number of passenger miles.

Air Travel. Air travel costs per passenger mile are contained in Table 18. Direct operating costs for air travel includes the following:

- The cost of operations and maintenance at the airport facilities, which included Sea-Tac International Airport, Vancouver International Airport, Portland International Airport, and Bellingham International Airport (some of this is covered by fares and some by government subsidy).

- The cost of providing air service between Seattle, WA and Vancouver, BC; Seattle and Portland, OR; Seattle and Bellingham, WA; and Vancouver and Portland. This cost was estimated from average business and leisure travel fares between these city pairs (thus, this cost is borne primarily by passengers).

The same approach of considering a range of travel time values as was conducted for automobile travel was used for air travel. For air travel part of the business trip is considered to be productive, therefore an opportunity cost equal to 70 percent of that associated with automobiles is assumed for business trips. Travel time is based on terminal time and air transit time. The time spent traveling to and from the airport was considered, but ultimately not used due to various concerns. The travel time is assumed constant over the planning horizon for air travel.

The same set of externalities was considered for air travel as was used in the analysis of automobile travel except that waste disposal for airlines was considered an internal cost and not directly included in the analysis.

The final cost category is capital costs. For air travel, the planned capital expenditures total nearly $100 million per year at Sea-Tac and are expected to increase to $300 million per year by 2023. Vancouver International Airport currently spends $52 million (U.S.) per year, and this could grow to $210 million by 2023. Portland International Airport allocates approximately $70 million per year for capital costs. Bellingham International Airport identified a total of $36 million in capital improvements through 2015.

Table 18. 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.

Passenger Rail. Passenger rail travel costs per passenger mile are contained in Table 19. Direct operating costs for rail travel includes (only partial recovery of costs from rail users) the following:

- The costs of operations and maintenance for passenger rail facilities and stations; and
- The cost of providing rail service in the corridor.

The same approach of considering a range of travel time values as was conducted for automobile travel was used for air travel. For passenger rail travel part of the trip is considered to be productive, therefore an opportunity cost equal to 70 percent of that associated with automobiles is assumed for business trips. Travel time is based on station time and transit time. The time spent traveling to and from the rail station was considered, but ultimately not used due to various concerns. The travel time is assumed to improve based on the analysis in the *Amtrak Cascades Operating and Infrastructure Plan Technical Report*.

Table 19. 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.

The same set of externalities was considered for passenger rail travel as was used in the analysis of automobile and air travel, except that waste disposal for passenger rail was considered an internal cost and not directly included in the analysis.

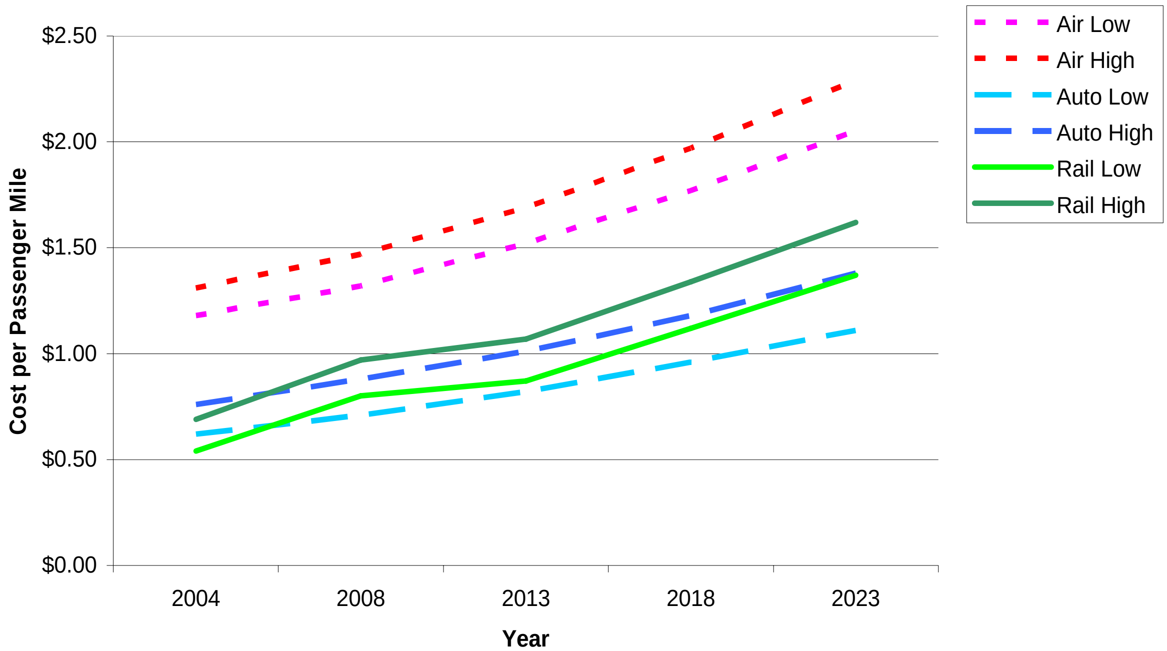
The final cost category is capital costs. For passenger rail, the capital cost estimates were obtained from the *Amtrak Cascades Capital Costs Technical Report*. The costs include new trains, improving stations, acquiring land, and upgrading track. The capital costs ranged from $2.3 billion to $2.9 billion at the Mid-point and from $6.1 billion to $6.6 billion in 2023.

Review of the appendices in the Amtrak *Cascades* Cross Modal Technical Report shows how the six project packages (Timetables A through F) were used in allocating the costs to years. Worksheet 29 in the Technical Report uses the following years:

- Timetable A – 2005;
- Timetable B – 2007;
- Timetable C – 2009;
- Timetable D – 2015;
- Timetable E – 2017; and
- Timetable F – 2023.

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 relatively cost competitive on a passenger mile basis for the study area, especially through the build up to implementation of Timetable C improvements. However, it should be noted that ramp up in ridership during this period also leads to higher costs per passenger mile being covered by state subsidies. 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.

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



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

Passenger Rail Costs and Freight Rail Simulation Analysis. The discussion thus far has focused on the cost effectiveness of passenger rail compared to automobile and air travel. Much of the benefit to the passenger rail system comes from increased ridership, increased revenues, and decreased expenses per passenger. A full analysis of the projected operating costs is detailed in the *Amtrak Cascades Operating Costs Technical Report*.[10] Also, if the investments are made through Timetable C, the private sector railroads and shippers will realize benefits through increased capacity and reduced delays. To better understand the value to the freight railroads, specifically BNSF, a simulation analysis was performed using the Rail Traffic Controller (RTC) software.[11]

Table 20 contains a summary of the key passenger rail results from the operating costs analysis. The base year was 2002 and the Mid-Point (completion of Timetables A, B, and C projects) was estimated for the year 2008. Base year ridership was 326,000 (though current ridership is now over 600,000) and projected to grow by 432 percent by the Mid-Point. This analysis projected revenues to increase more than operating costs, leading to large reductions in the losses for both revenue per passenger mile and revenue per passenger.

[10] *Amtrak Cascades Operating Costs Technical Report, Volume 4*, Washington State Department of Transportation, June 2004.

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

Table 20. Summary of Cost Per Passenger Mile for Passenger Rail Travel

Item	Base (2002)	Through Timetable C	Change
Ridership	326,201	1,410,100	432%
Farebox revenue	$9,232,065	$36,452,805	395%
Operating cost	$20,329,279	$51,532,452	253%
Net revenue per passenger mile	-$0.13	-$0.07	46%
Net revenue per passenger	-$34.02	-$10.69	69%

Source: *Amtrak Cascades Cross Modal Analysis Technical Report, Volume 6*, Washington State Department of Transportation, June 2004.

Ideally, the RTC simulation analysis would have looked at delays to freight rail with and without 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 model was first run assuming the entire capital plan was implemented. This was necessary to eliminate the case were later projects make earlier projects obsolete. From this full analysis, projects were backed out until simulation results for all six Timetables were available. The simulation used 2002 as the base year for freight rail operations. The Timetable 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.[12] For Timetable C, the simulation also assumed a third passenger trip to Vancouver, BC. In interpreting these numbers, it is important to note that a large amount of infrastructure improvement between Portland, OR and Vancouver, WA is needed and not represented in the simulation.[13]

The impacts on BNSF operations are summarized in Table 21. Without improvements to the rail infrastructure, the Simulation Base 2004 represents the 2004 operations with normal freight growth. The results show that without the Kelso Martin's Bluff and Vancouver 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.

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[12] 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.

[13] This description, while technically correct, tends to oversimplify the process. The simulation was run using multiple software packages and various assumptions over an extended period of time.

Table 21. 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 Vancouver projects. Results for the entire package of Timetable C projects were not available.

WSDOT Decision Analysis Framework. Table 22 presents the decision analysis matrix for passenger rail improvements, similar to the matrices developed for the other illustrative examples.

Completion of the rail improvement projects through Timetable C has high positive impacts on passenger railroads and riders, the freight railroads, and the communities. Impacts on the State are viewed as medium primarily because of the high fraction of costs of passenger rail service (capital and operating) that are borne by the State in comparison to costs of providing the automobile alternative. However, the analysis does show that the increased use of passenger rail does reduce external costs (health and safety) to the State and provides a number of non-quantifiable benefits in terms of system redundancy. The analysis does not do an effective job of capturing the potential economic gains for shippers in the I-5 corridor and the impact that has on job creation. 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 Midpoint. The freight railroads primarily gain through 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. This is summarized in Table 23.

Table 22. 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	5 additional trains per day (equivalent to 1,000 trucks removed from roads).	8 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%).	Substantial fraction of the $2.3 billion to $2.9 billion in capital costs and 29% of the operating costs to be borne by the State. The total cost to the State per passenger mile taking these subsidies into account is higher than for automobile although the total cost per passenger mile is comparable.
	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
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

Table 22. Decision Analysis Matrix for Passenger Rail Improvements Up to Timetable C (continued)

	Measures	No Action	Build Out Through Timetable C
Passengers	Service Frequency	No room for additional passenger trains	Simulation assumes 2 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.
	Increased Modal Choice/Access	No change or possible reductions if service on passenger rail degrades to make it not viable for certain travelers currently using rail.	Substantial potential increase with doubling of service frequency in the Seattle to Portland corridor. Potential to begin offering an alternative for business travelers.
	Summary Passenger Benefits	LOW	HIGH
Railroads (Passenger)	Rail Capacity for Passenger Trains	No room for additional capacity.	Simulation assumes 2 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
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

Table 22. Decision Analysis Matrix for Passenger Rail Improvements Up to Timetable C (continued)

	Measures	No Action	Build Out Through Timetable C
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

Table 23. Summary of Decision Analysis by User Group for Passenger Rail Improvements Up to Timetable C

User Group	No Action	Build Out Through Timetable C
State	Low	Medium
Shippers	Low	Medium
Passengers	Low	High
Railroads (Freight)	Low	High
Railroads (Passenger)	Low	High
Ports	Low	Low
Communities	Low	High
National	Low	Low

Case Study 4: Comments

While the simplified analysis of the Timetable C investments provides an example of how the decision analysis framework can be applied to passenger rail, it leaves out some critical elements that should be included in a more detailed analysis. The cost effectiveness metric used as a surrogate for a benefit-cost ratio is appropriate for analysis of passenger rail but it needs to distinguish costs to the State from cost to the users as an additional metric. In the example provided above, there are clear health and safety benefits of rail as compared to automobile as well as travel time savings (effectively congestion relief for those travelers who use rail). But these benefits are relatively small on a passenger-mile basis. And if cost to the State per passenger mile is considered, passenger rail is not likely to look like a good investment. However, it should be noted that the operating cost (which also takes into account energy savings benefits, which some would consider a public benefit), travel time cost, and external cost benefits of passenger rail as compared to automobile travel grow in relative terms quite substantially over time. Even though it was not a part of this analysis, it is likely that this would be the case even if no further improvement were made to the *Cascades* service beyond Timetable C because the operating and travel time costs of automobile use are growing at a much faster rate than are passenger rail costs. A critical question then becomes, at what point do future benefits justify high capital investment today?

The analysis also does not do a very good job of taking into account the potential benefits to the State of improved freight rail performance. If shippers are able to reduce their logistics costs through reductions in delay, they may be able to expand their businesses and create jobs. A full economic impact analysis of the type suggested in the Railex case study could provide some insight into this potential benefit. The simulation analysis that was used to make the case for freight rail benefits cannot, however, be considered definitive proof of the benefits of these projects to the Class I railroads as it does not consider alternative means by which similar performance improvements might be achieved at lower cost and sustained over a longer timeframe.