



Washington State Transportation  
Commission

**Statewide Rail Capacity and System Needs Study**  
*Task 10.1 – Washington State Rail Analytical Plan*

technical

**memorandum**

*prepared for*

**Washington State Transportation Commission**

*prepared by*

**Cambridge Systematics, Inc.**

---

*technical memorandum*

# **Statewide Rail Capacity and System Needs Study**

## *Task 10.1 – Washington State Rail Analytical Plan*

*prepared for*

Washington State Transportation Commission

*prepared by*

Cambridge Systematics, Inc.

*date*

December 2006

---

# Table of Contents

<b>Summary</b> .....	<b>1</b>
<b>Objective</b> .....	<b>1</b>
<b>Framework to Examine Public Benefit</b> .....	<b>2</b>
What Metrics to Measure Public Benefit Should Be Used in Washington State? ...	3
How Can Public Benefit Be Measured/Quantified? .....	5
<b>Summary and Conclusion</b> .....	<b>8</b>

# List of Tables

Table 1. Washington State Measurement of Benefit .....	4
Table 2. Variables to Include in The State Benefit-Cost Analysis .....	5
Table 3. Possible Methodology by Which to Measure Public Benefit in Washington State.....	6
Table 4. Cross-User Group Benefit/Impact Methodology .....	8

# Task 10.1 – Washington State Rail Investment Analytical Plan

## ■ Summary

The *Washington Rail Capacity and System Needs Study* was initiated by the Washington State Legislature to answer the question: “Should the State continue to participate in the freight and passenger rail system, and if so, how can it most effectively achieve public benefits?” In order to answer this question a major focus of the study was to develop an approach for defining and measuring public benefits. Specifically, the study scope of work called for an analytical plan setting out a methodology for determining when public sector investment in the rail system is appropriate and defensible. Task 7 of the study developed a methodology making this determination based on a systematic assessment and comparison of benefits and costs across users and across modes. The methodology identifies groups that are likely to be impacted by state rail investments and actions, including the State (acting on behalf of all citizens and resident businesses); rail users (shippers and passengers); carriers; the ports; labor; and affected communities. The methodology defines several key metrics for measuring impacts (both positive benefits and negative impacts) for each of these groups and a process for assessing the overall net impact on each group. By looking at net impacts on the State, the methodology can be used to assess the level of public benefit. By looking at net impacts on other groups, the methodology can be used to help determine the level of involvement the State should have relative to other potential project or program beneficiaries. Finally, by looking at the relative impacts of different alternative sets of projects aimed at addressing the same issues, the methodology can be used to prioritize projects. The approach is meant to be transparent to decision-makers and the public, not overly complex, and to consider both quantitative and qualitative measures. This methodology constitutes the analytical plan.

## ■ Objective

The goal of this Technical Memorandum 10.1 is to present an analytical plan to guide Washington State’s future investments in the rail system. This analytical plan describes a methodology with which to measure the public benefit received from a rail improvement project. Doing so will allow for a determination of whether or not public sector involvement in the rail system is appropriate and defensible. The methodology will also guide the State in determining the suitable level of state involvement, as well as what types of partnerships with other interested entities should be sought.

The technical memorandum will accomplish this in the following steps:

- Suggesting the best set of metrics to define public benefit (i.e., what constitutes public benefit);
- Suggested variables to use for Washington State benefit/impact methodology; and
- A possible framework/methodology by which public benefit can be measured for any proposed rail action.

This benefit/impact framework is introduced in Technical Memorandum 7 of this rail study. Technical Memorandum 7 also includes justification for the benefit/impact framework, drawing on historical examples of the State's participation, direction offered by the State's Revised Code of Washington, (RCW), and the benefit/impact methodologies used by other states and organizations. Technical Memorandum 8 contains case studies of several packages of projects as an illustration of how the framework can be used for state-level decision-making.

## ■ Framework to Examine Public Benefit

This section of the technical memorandum will illustrate how the previous work in this study can be used to develop a framework for making project and program decisions regarding public involvement in the rail system using the concept of public benefits evaluation. An outline of the framework is described below.

- Measures that best represent public benefit are determined for each user group. Technical Memorandum 7 reviewed the metrics by which other states and organizations choose to characterize and measure the public benefit of a rail action. This review, along with discussions with members of the Technical Resource Panel (TRP), significantly influenced the selection of metrics by which to measure public benefit in Washington State.
- Benefits/impacts of individual projects/actions or packages of projects are evaluated for each of four groups of affected parties: 1) the State; 2) users (shippers and passengers); 3) carriers (railroads and ports); and 4) communities (affected by rail service to or through the community). The idea of the framework is to determine whether the impacts of the project/package on each group is positive or negative, and if the impact is high, medium, or low relative to the needs of that group. The results of this evaluation tell whether other parties should be involved in the project/package and what type of partnership arrangement is most appropriate. The evaluation of a project/package as having high, medium, or low benefits/impacts is always based on a comparison with some other action – at least a no-action scenario, but preferably at least one other option that may or may not involve providing the transportation service by another mode.

- Benefits/impacts of the project/package are estimated using a few measures for each affected group. These measures are intended to reflect the impact or benefit categories that are likely to be most important to that group in determining whether the project is beneficial from that group's perspective. While most of the measures could be evaluated quantitatively, it is recognized that in many cases (particularly for private parties) these evaluations may need to be qualitative. In the case of the State, all of the benefit measures can be evaluated quantitatively.
- One of the benefit measures for the State is the benefit/cost (B/C) ratio. This is intended to be applied to all projects, passenger, and freight. The B/C ratio is introduced to enable state decision-makers to evaluate cost-benefit tradeoffs and not focus solely on benefits. The precise calculation methodology for the B/C ratio is left to the state DOT to finalize and may vary depending on the project type and the level of investment. However, the framework does provide recommended benefit variables and general calculation approaches as a starting point.
- The B/C ratio is only one of the measures used to evaluate benefits/impacts to the State. Some of the other measures are also included within the benefit-cost calculation, but they are also broken out separately so that decision-makers can weight these more heavily when making decisions than they would be in a true B/C ratio. The framework does not recommend a specific weighting procedure, but leaves this decision to the Legislature or the Commission.

### ***What Metrics to Measure Public Benefit Should Be Used in Washington State?***

The first step in developing a framework to measure public benefit is to determine what metrics best represent public benefit. Selecting the appropriate metrics by which to measure public benefit for Washington State rail user groups was a fairly extensive process. It used several sources of information to determine the variables by which to measure public benefit, including the following:

- Best practices review of rail benefit/cost methodologies used by other states and organizations (summarized in Technical Memorandum 7);
- Consultation with area experts, including shippers, community association representatives, ports, railroads, and others who are members of the Washington State Rail Study Technical Resource Panel; and
- Metrics derived from established state policy as captured in the RCW and in previous case studies of state participation in the rail system (summarized in Technical Memorandum 7).

Selected metrics are meant to reflect those aspects of system performance that are most critical to each rail user group. The benefits to each user group were represented with a few quantitative measures, as well as with a set of accompanying qualitative questions. The quantitative variables are provided so that public benefit can be evaluated in a simple manner. The qualitative questions are meant, in some cases, as a "fatal flaw" analysis – a

review to ensure that the proposed project is practical and congruent with the goals of the State.

The metrics that were determined to best measure the potential benefits and impacts to each group are presented in Table 1 below.

**Table 1. Washington State Measurement of Benefit**

Rail User	Benefit and Cost Measures
State	<ul style="list-style-type: none"> <li>• Jobs created/retained(private sector, public sector, and impact on rail-related union jobs)</li> <li>• Tax benefits (through new or retained businesses)</li> <li>• Contribution to transportation system efficiency/balance (measured in terms of reduced travel delays, improved system reliability, or system redundancy as appropriate)</li> <li>• Environmental benefits (air pollution and water quality impacts)</li> <li>• Safety benefits (reduced property damage, injuries, and fatalities)</li> <li>• Availability of partner funding</li> <li>• Cost to State</li> <li>• Benefit/cost (B/C) ratio (using recommended benefit/cost analysis methodology)</li> </ul>
Shippers	<ul style="list-style-type: none"> <li>• Business cost impact (through impact on cost of service)</li> <li>• Access to service (does project increase rail/transportation service options)</li> <li>• Service reliability (on-time performance)</li> <li>• Transit time</li> </ul>
Passengers	<ul style="list-style-type: none"> <li>• Rail capacity for passenger trains</li> <li>• Travel costs</li> <li>• Travel time</li> <li>• Increased modal choice/ access</li> </ul>
Railroads	<ul style="list-style-type: none"> <li>• System velocity improvements</li> <li>• Hours of train delay</li> <li>• Yard dwell time</li> <li>• Increased revenue traffic</li> <li>• Equipment availability</li> </ul>
Ports	<ul style="list-style-type: none"> <li>• Throughput</li> <li>• Market share</li> </ul>
Communities (similar to State)	<ul style="list-style-type: none"> <li>• Environmental benefits</li> <li>• Safety benefits</li> <li>• Reduced roadway delays and truck/auto delay at grade crossings</li> <li>• Local jobs created or retained</li> </ul>



### ***How Can Public Benefit Be Measured/Quantified?***

There are many different methods by which these variables can be evaluated. The methods can range from a very simple approximation of values (which may be suitable for very small projects) to a very complex, mathematical model-based method to arrive at values (which may be suitable for a large, capital-intensive project). In the case of the state benefits-impacts, the starting point is a benefit-cost analysis that includes, at minimum, the variables included in Table 2 below. Many different methods can be used to calculate the B/C ratio for a proposed action. This study does not promote a particular method because it will vary according to the complexity and costs of the proposed action. However, this study does promote the use of these variables to calculate a B/C ratio that is then folded back into the public benefit evaluation process in Table 3.

**Table 2. Variables to Include in The State Benefit-Cost Analysis**

Variable Description	Explanation
<b>Transportation and Economic Benefits</b>	
Avoided maintenance costs	If the project preserves rail service, the no-action alternative may put more trucks on the highway. This may produce a net positive or negative benefit, to be evaluated based on the type of road affected and the cost of maintaining the rail line.
Reduction in shipper costs (for shipments originating in State) – freight only	Benefits derived from lower logistic costs to the shippers, which ultimately can lead to lower consumer prices.
Reduction in automobile delays at grade crossings	Benefits resulting from improving grade crossing and decreasing automobile delays.
<b>Economic Impacts</b>	
New or retained jobs	Jobs that a particular project/action may keep from moving out of the State (e.g., by construction of a rail spur serving a factory or warehouse, etc.), or new jobs that are created within the State. Also to be considered are changes in job quality and pay levels (e.g., adding, losing, or changing union jobs). This measure accounts for both retained and new jobs.
Tax increases from industrial development	A rail action/project may foster industrial development that results ultimately in increased industrial property taxes to the State.
<b>External Impacts</b>	
Safety Improvements	By diverting truck freight to rail, savings on highway safety improvements can occur.
Environmental Benefits	Railroads are on average three or more times more fuel efficient than trucks. The State can benefit from savings due to environmental improvements.

**Table 3. Possible Methodology by Which to Measure Public Benefit in Washington State**

	Measures	No Action	Alternative A	Alternative B
State	Jobs			
	Tax/Fee Benefits			
	System Efficiency			
	Environmental Benefits			
	Safety Benefits			
	Partner Funding			
	Cost to State			
	Benefit/Cost			
	Transit Time			
<i>Summary State</i>				
Shippers	Business Cost Impacts			
	Access to Service			
	Service Reliability			
<i>Summary Shippers</i>				
Passengers	Rail Capacity for Passenger Trains			
	Travel Costs			
	Travel Time			
	Increased Modal Choice/ Access			
<i>Summary Passengers</i>				
Railroads	System Velocity Improvements			
	Hours of Train Delay			
	Yard Dwell Time			
	Increased Revenue Traffic			
	Equipment Utilization			
<i>Summary Railroads</i>				
Ports	Throughput			
	Market Share			
<i>Summary Ports</i>				
Communities	Environmental Benefits			
	Safety Benefits			
	Reduced Roadway Delays			
	Local Jobs			
<i>Summary Communities</i>				
National	Pct Benefits in WA State			
	Other States Benefiting			
<i>Summary National</i>				

The results of the full assessment of benefits/impacts for all the affected groups will be summarized in a decision matrix. The decision matrices will allow for direct comparisons among alternative rail project packages or comparisons between rail project packages and alternative modes with respect to the decision measures. Table 3 provides an example of a blank matrix. Illustrative examples of how to use this matrix will be provided in Technical Memorandum 8. Where measures can be quantified (as will be the case with all the measures suggested for the State), it will be relatively straightforward to compare and rank each project with respect to each individual measure. Where the measures cannot be quantified, the analyst will need to exercise professional judgment and rate the project as having “high, medium, or low” benefits/impacts with respect to the measure in question.

As noted above, for private parties and for relatively small investments, some of these measures may need to be evaluated qualitatively through discussions with the affected parties. However, for large investments, efforts should be made to develop independent estimates using tools, such as rail simulation models and economic impact models.<sup>1</sup>

Finally, each of the affected groups can be assigned a relative “received benefit” rating of “high, medium, or low. The purpose of comparing the relative benefits received by all four groups is to summarize the benefits/impacts received by each group; and to use this information to draw conclusions about which groups are benefiting the most from any proposed action. Doing so gives a good estimation of which groups should be held responsible to support and implement a proposed action. It also can be used by the State to determine the State’s reaction and level of participation.

The cross group benefit methodology is a qualitative comparison that draws the individual user group’s relative rating of benefits (high, medium, or low) out of the benefits/impacts matrix (Table 3) and compares them against each other. A separate comparison should be done for each proposed action. As shown in Table 4 below, there are many possible combinations of user group “relative ratings.” Each combination will lead to a different conclusion as to the appropriate State role or action.

---

<sup>1</sup> *Guide to Quantifying Economic Impacts of Large Scale Freight Investments*, prepared for the U.S. Department of Transportation by Cambridge Systematics, Inc., Economic Development Research Group, and Boston Logistics (available at <http://www.dot.gov/freight/guide061018/guide.pdf>) provides a good compendium description of both transportation and economic modeling tools that can be used to generate estimates of the variables listed as user benefits impacts in the proposed methodology if a more rigorous calculation procedure is justified.

**Table 4. Cross-User Group Benefit/Impact Methodology**

Proposed Action	WA State	Shippers	Passengers	Railroads	Community	Likely Recommendation	Level of Action	Example
A	H	H	H	H	H	State should participate, but only if other beneficiaries contribute appropriate share	Consider direct investment and supporting legal and institutional mechanisms	Consider sources such as additional dedicated state freight rail funds, Federal funding sources through SAFETEA-LU, other state matching sources
B	H	L	L	L	H	State should participate and be prepared to contribute more than other groups	Consider direct investment and supporting legal and institutional mechanisms	Consider sources such as additional dedicated state freight rail funds, Federal funding sources through SAFETEA-LU, other state matching sources
C	M	M	M	M	M	State should participate with caution and only if costs to do so are low	Consider tax exempt financing loans or other methods that have limited costs to State, but benefit private industry	Consider public-private partnerships, tax credits, and other non-financing incentives
D	L	H	H	H	L	State should probably not participate	State should probably not participate with financial, institutional, or legal mechanisms	No state role is anticipated
E	L	L	L	L	L	State should probably not participate	State should probably not participate with financial, institutional, or legal mechanisms	No state role is anticipated

## ■ Summary and Conclusion

Effective implementation of this analytical plan should assist the State in making decision about strategic investments and other forms of participation in the rail system. This can be best accomplished by using the methodology in two distinct ways:

1. Develop strategic project packages that address the most pressing needs of the key user segments and that result in the greatest level of public benefits. In this application, the methodology could be used to evaluate total benefits of different alternative packages and develop strategic priorities.

2. Evaluate projects within a specific call for projects procedure. The revised application procedures for the Freight Rail Assistance Program are an example of this type of use.

The development of strategic project packages would involve a process; whereby, the Washington State DOT would identify potential projects/actions that are consistent with the types of projects recommended in Technical Memorandum 8, and that address priority choke points, capacity constraints, or operational issues. These would then be grouped into complementary packages subject to a funding constraint. The strategic packages could then be compared to each other in an iterative process in order to refine the package, such that it maximizes benefits to the State. Ideally, this process would involve the identification of non-rail alternatives to ensure that the strategic package evaluation is mode neutral.

The project evaluation use of the analytical plan assumes that there are certain issues/problems that should be solved using a bottoms up, rather than a top down approach. Short line assistance, development of third-party consolidation facilities, or financial assistance programs to improve shipper sites are all examples of cases where the DOT is more likely to establish a program that calls for eligible participants to submit project applications, and to have the projects compared and ranked against criteria such as those suggested in this evaluation approach. In fact, the application procedures for the Freight Rail Assistance Program were recently revised to incorporate many of the same measures and criteria suggested in this Technical Memorandum, and a process was crafted to award points to participants based on the degree to which they meet the different evaluation measures/criteria.

In all cases, the analytical plan would be implemented as part of structured process with established timeframes for decision-making. This would move the decision-making process away from consideration of project needs on a case-by-case basis. This would allow the decisions about the rail program to become more strategic in nature.