



Washington State Department of Transportation

**State Rail and Marine Office
Rail Benefit/Impact Evaluation Methodology**

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Definitions

Application – A form completed by the proposer of a project. It asks for information on project description, status, funding, operations, partners, scope, schedule, and budget.

Benefit Cost Analysis – The process involving the analysis of project benefits and costs to determine the benefits as compared to the costs.

Benefit/Cost Ratio – The ratio of benefits to cost for a project.

Decision maker – A person that has authority to take action on the guidance given in this document to the level indicated.

Evaluator – Individual assigned to evaluate project proposal.

Present Value (PV) – is the value on a given date of a future benefit or series of future benefits, discounted to reflect the time value of money and other factors such as investment risk.

Net Present Value (NPV) – Calculates the net present value of a project by using a discount rate and a series of future expenses (negative values) and benefits (positive values). NPV is an indicator of how much benefit a project will provide.

Project Management – The discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives.

Rail Benefit/Impact Evaluation Methodology – A document that conveys the methodology used by WSDOT to evaluate and recommend rail projects.

Rail Benefit/Impact Evaluation Workbook – An Excel workbook that contains tools to aid in the evaluation and recommendation of a rail project. The tools include the Legislative Priority Benefit Matrix, User Benefit Level Matrix, and Benefit Cost Analysis Calculator.

Shipper – A company or individual that ships a product or products to customers.

User Group – An identified group that may use or is connected to rail as a transportation mode.

Rail Benefit/Impact Evaluation Methodology

Introduction

The Washington State Legislature requested the *Statewide Rail Capacity and System Needs Study*, which was approved by the Washington State Transportation Commission on December 12, 2006. The study recommended policies, procedures, and approaches to govern and manage the state's rail programs and assets.

The key question asked by the legislature for the 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?" It was concluded that the state should continue to participate in the freight and passenger rail systems. The Washington State Transportation Commission recommended six policies as a result of the study.

Under ESHB 1094, the Washington State Legislature has required Washington State Department of Transportation (WSDOT) to develop and implement the benefit/impact evaluation methodology recommended in the *Statewide Rail Capacity and System Needs Study* finalized in December 2006. The benefit/impact evaluation method is to be developed using the following priorities, in order of relative importance:

- i. Economic, safety, or environmental advantages of freight movement by rail compared to alternative modes;
- ii. Self-sustaining economic development that creates family-wage jobs;
- iii. Preservation of transportation corridors that would otherwise be lost;
- iv. Increased access to efficient and cost-effective transport to market for Washington's agricultural and industrial products;
- v. Better integration and cooperation within the regional, national, and international systems of freight distribution; and
- vi. Mitigation of impacts of increased rail traffic on communities.

Guiding Principles

Guiding Principle 1: Provide a benefit/impact evaluation methodology and supporting tools as recommended in the *Statewide Rail Capacity and System Needs Study* (2006).

Guiding Principle 2: Develop a benefit/impact evaluation methodology that includes the priorities set forth in ESHB 1094.

Guiding Principle 3: Develop a benefit/impact evaluation methodology that includes measurable public benefits.

Guiding Principle 5: The *Statewide Rail Capacity and System Needs Study* (2006) recommends using only a few good measures including applying qualitative analysis techniques.

Guiding Principle 6: This document is dynamic and proposed alternative evaluation methods should be reviewed for incorporation or used as supplements.

Guiding Principle 7: Decision makers will take into account the public interest and good, going beyond analysis of single stakeholder interests.

Rail Benefit/Impact Evaluation Methodology Components

The Rail Benefit/Impact Evaluation Methodology is comprised of the following components:

- Rail Benefit/Impact Evaluation Methodology (Guidance Document)
- Proposal Application
- Rail Benefit/Impact Evaluation Workbook
 - Legislative Priority Matrix
 - Project Management Analysis
 - User Benefit Levels Matrix
 - Benefit/Cost Analysis Calculator
 - Benefit/Cost Analysis Summary Sheet
 - Benefit/Impact Evaluation Summary Sheet

The components of the methodology are intended to assist the decision maker in the evaluation and recommendation process. The level of rigor applied to the use of any tool should recognize the type, size, and complexity of project and expectations of results.

Using the Rail Benefit/Impact Evaluation Methodology Overview

The methodology contains guidance on how to review proposed projects and apply the tools of the workbook. A main focus when applying the methodology should be the end result of the process, not simply using the tools. A decision maker should be able to summarize a project's review, results, and recommendation.

In determining the appropriate actions to take for investing in rail projects, a rail system benefit/impact evaluation of alternatives is required. An evaluation should only be undertaken if the proposed project is determined to be consistent with state policy.

The benefit/impact evaluation methodology and supporting tools have been developed considering the following:

- The priorities detailed in ESHB 1094.

- Public benefits that are quantitative as well as additional qualitative criteria (this helps determine if state action is warranted at all).
- Benefit levels for each identified user group that can be assessed using measures, percentage of benefit, and justification for amount (state, ports, shippers, railroads, and communities).
- Comparison of the benefits across the identified user group to initiate and foster negotiation of the appropriate level of State involvement and the level of support that could be expected from other users.
- Incorporating qualitative analysis. There will be benefits and impacts that cannot be associated with a number. Those need to be considered, and if accepted, justification provided.
- Recommendations in the Statewide Rail Capacity and Needs Study finalized in December 2006.

The process will generally be initiated when a project proposal application is submitted. Projects may also be initiated by other means, but the same evaluation process will be employed. The steps to evaluating and summarizing recommendations will be outlined later. The submitted application should be reviewed to ensure all information needed to complete the evaluation has been supplied. If all of the information is not supplied, a follow up with the proposer will need to be done. Once all of the information has been gathered, it will need to be verified. Verification occurs by confirming that the information in the application reflects existing field conditions and aligns with project requirements. In addition, shippers, railroads, business owners, and other parties related to the project must concur that the information in the application conveys their business needs and commitments.

Once all information in the application has been verified, the next step is to do an initial benefit/cost analysis. Information in the verified application will be the driver for the benefit/cost analysis. An additional benefit/cost analysis will be done if project parameters change during the evaluation process.

At the same time, evaluating the project for benefits and impacts will take place. The Legislative Priority Matrix and Project Management Analysis workbook sheet will need to be completed to determine how the project fits into the priorities and how scope, schedule, and budget expectations will be met.

Another tool in the workbook, the User Benefit Levels Matrix worksheet, will also be completed. This worksheet has been developed to help the decision maker determine what users are receiving benefits and at what approximate level.

After the project has been reviewed using the Rail Benefit/Impact Evaluation Methodology tools and standard project management methodologies, a summary of

the results will be developed. The summary should include how the project was reviewed, tools applied, reasoning, and recommendations.

Application Process

The application for a rail grant or loan is the document that gathers the initial information that will be evaluated for possible selection. The application needs to collect enough information to effectively start the evaluation and selection process. It also needs to contain information for follow up calls to users and applicants.

Since calls for projects may be driven by a variety of factors and limitations there needs to be clear communication the application document to ensure the right information is gathered. A standard application may not fit all calls for projects; **therefore the application may need to be modified to gather the appropriate information.**

At other times, a project may simply be assigned without an application process through legislation. Such a project still requires that a benefit/impact evaluation be conducted and the results and recommendations shared with the appropriate parties to validate the project or show the level of impacts and alternatives.

Benefit/Cost Analysis

The Benefit/Cost Analysis is a major component of the Rail Benefit/Impact Evaluation Methodology that will be used when evaluating rail projects. The calculation (benefit/cost ratio) produced will also be supplemented with an assessment of other benefit categories. That supplemental information will be generated by the requested project information in the application form. The major categories for Benefit/Cost Analysis are:

- Transportation and economic benefits.
- Economic impacts.
- External impacts.

A benefit/cost ratio greater than 1.0 shows the benefits of a project outweigh the costs. A ratio of less than 1.0 shows that the costs outweigh the benefits and it is very likely that the project should not be funded.

Benefit/Cost Analysis Calculator

The Benefit/Cost Analysis Calculator was created based on the recommendations provided in the *Statewide Rail Capacity and System Needs Study* finalized in December 2006.

This Benefit/Cost spreadsheet is used to calculate cost-effectiveness of rail projects based on the initial construction cost of the project and anticipated yearly savings and maintenance costs. Enter benefits starting in the year they will start to be realized.

	2008	2009	2010	2011	2012	2013	2014	2015
Measures (see measures sheet for explanations)								
Transportation and Economic Benefits								
Reduced Road Maintenance Costs					\$4,147	\$5,076	\$6,048	\$7,020
Shipper Savings					\$49,075	\$60,066	\$71,568	\$83,070
Reduction in auto delays at grade crossing								
Economic Impacts								
New or retained jobs								
Tax from industrial development								
External Impacts								
Safety Improvements					\$48,425	\$59,271	\$70,620	\$82,070
Environmental benefits					\$45,824	\$56,087	\$66,827	\$77,568
Total Maint Costs Yearly maintenance and other recurring costs								
	\$65,933	\$0	\$0	\$0	\$0	\$6,500	\$7,000	\$7,500
Maint Present Value	\$0	\$0	\$0	\$0	\$5,343	\$5,532	\$5,699	\$5,866
Project Cost Net Yearly Benefits								
	\$1,291,354	\$0	\$0	\$0	\$0	\$147,471	\$180,500	\$215,063
Benefit Present Value	\$0	\$0	\$0	\$0	\$121,210	\$142,652	\$163,430	\$184,208
Factor	Value		Definition					
15 -Yr. Benefits	\$3,034,694		Total Benefits					
Payback*	10.23 years		Time for payback					
Discount Rate	4.00%		Rate used to calculate time value of money					
NPV	\$654,244		Net Present Value of all costs and benefits					
B/C Ratio	1.48		The ratio of the Net Present Value of all benefits to Net Present Value of all costs					
B/C Pass	yes		B/C ratio greater than or equal to 1.00?					

Screen shot of Benefit/Cost Analysis Calculator used on a Rail Bank Project Application

The Benefit/Cost Analysis Calculator is a spreadsheet with areas of benefit, equations for calculations, and benefit parameters to calculate the benefit/cost ratio for a given project or action on a project.

The defined equations and input areas in the calculator are based on documented standards, research, and common practice. These equations will be periodically reviewed and updated with changes in industry practices, price indexes, and new accepted standards. **The input values must be verified based on actual data and**

verifiable field information in consideration of expected project results, freight logistics, user logistics, local economic influences, current costs, impacts to industries, and historical data. For example, putting a company's product on a train does not mean that a one-to-one impact would occur; the trucks that traditionally hauled the product are now completely removed from service. Verification of actual circumstances and logistics must be accomplished.

There may be times that additional benefit areas will need to be included in the benefit/cost analysis. When appropriate, they can be added and included in the calculation. However, there needs to be documentation to justify the calculated benefit. For example, a project for installing idle reduction technology may require the examination of benefits based on product, specifications, and operations.

When project work is a maintenance type project, the benefits may be the result of preventing a failure instead of improving functions or quality. These types of projects should look at impacts based on probability of occurrence and the actual number of benefits that will be affected. There is a tendency to forecast an "all or nothing" scenario showing a loss of all benefits starting immediately. This will normally produce a very large benefit/cost ratio that many times cannot be justified.

Default Values Used and Adjustments

The Benefit/Cost Analysis Calculator uses default values that are included in the equations contained in the Benefit/Cost Instruction sheet. They are used to calculate a dollar value for benefits. These default values are based on generally accepted practices and some may need to be adjusted for project specific goals and objectives. **For more detailed information on the application of values to specific project objectives and goals, a review of *NCHRP Report 586* should be done.**

A validation of the default values must be done for each project with the following in mind:

- Reduction in shipper costs evaluates the cost difference between truck and rail. The default value uses the general assumption that rail is cheaper than truck. This in an overall sense is true. However, for light-density lines rail will not be cheaper and rail will not be more fuel-efficient for very short trains and cumbersome switching moves.
- Trucks can provide superior service for most movements. Trucks can be more flexible for many movements and may prove to be more efficient when logistic costs are considered.
- Railroads on the whole, are more fuel efficient than trucks because of the inherent efficiency of the steel wheel on the steel rail and the use of gentle grades on rail routes. However, fuel use varies greatly with the commodity and car type, and public agencies need to validate the actual difference in fuel costs.

- A benefit calculation should not make the assumption that trucks are completely removed from roadways when a product is placed on rail. Application of elasticity modeling based on *NCHRP Report 586* with a qualitative analysis may be necessary to provide the proper perspective and values.

Benefit/Cost Analysis Measures (Defaults)

Measures identified in the *Statewide Rail Capacity and System Needs Study* finalized in December 2006, are used in the Benefit/Cost Analysis Calculator.

Transportation and Economic Benefits

Reduced maintenance costs	If the project preserves rail service, the no-action alternative may put more freight traffic on highways. 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 are from lower logistic costs to the shippers, which ultimately can lead to lower consumer prices. This can include the ability to use different modes that provide competitive alternatives for shippers.
Reduction in automobile delays at grade crossings	Benefits that would be realized by reducing automobile delays at grade crossings.

Economic Impacts

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 production.
Tax increases from industrial development	A rail action/project may foster industrial development that

results ultimately in increased industrial property taxes to the state.

External Impacts

Safety improvements

By diverting truck freight to rail, savings on highway safety improvements may occur as well as adding fencing, removing a crossing, etc.

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. This includes air and water quality as well as reduction of the use of petroleum, consistent with the Governor's policies.

Yearly Maintenance Costs

Track maintenance

Costs for maintaining a track or section of track that is part of a project.

Equipment maintenance

Equipment maintenance costs for equipment that is purchased as part of the project.

Benefit/Impact Evaluation Workbook Tools

The tools of the workbook are intended to help the decision maker assess a project and provide recommendations. Workbook users should review the tools and be familiar with the tools prior to evaluating a project.

Legislative Priority Matrix

Benefit Matrix Ranking for Legislative Priorities and Project Management							
	4: Highly likely/probable (76% - 100%)	3: Likely (51% - 75%)	2: Somewhat likely (26% - 50%)	1: Unlikely/improbable (0% - 25%)	-1: Has a negative impact on benefit	Totals	Comments
Legislative Priorities and Measures							
i) Economic, safety, or environmental advantages of freight movement by rail compared to alternative modes							
Yellow boxes are calculated automatically							
Economic	4						
Safety		3					
Environmental			2				
						54	
ii) Self-sustaining economic development that creates family wage jobs							
New Jobs				1			
Retained Jobs			2				
Business		3					
						30	
iii) Preservation of transportation corridors that would be otherwise lost							
Rail preservation				1			
Intermodal			2				
Access			2				
						20	
iv) Increased access to efficient and cost-effective transport to							

Screen shot of the Legislative Priority Matrix worksheet

The Legislative Priority Matrix worksheet is intended to help the evaluator determine how a project aligns with the priorities. The priorities were provided in a relative order of importance. Each priority area is weighted based on that order.

Users of the Legislative Priority Matrix worksheet select the score (4 through negative 1) that pertain to the measure and place it in the box that aligns with both. Information on how a score was selected should be provided in the comment box. Scores are compiled to help determine how a project meets the legislative priorities.

The benefit measures that have been identified for each priority are to be used as a baseline of measures. There may need to be other or different measures considered for a project. As new measures and their parameters are identified and proven, they should be included for use on future projects. The tools used to aid benefit/impact determinations should be supplemented as a decision maker uses expert and value judgments to determine of a project's public value.

Project Management Assessment

Benefit Matrix Ranking for Project Management Assessment									
Measure	Score	Comments							
Project Readiness									
Partner Funding									
Project Scope									
Project Resources									
Project Budget									
Project Schedule									
Project Equipment Needs									
Project Management Score	0								

Screen shot of the Project Management Assessment Matrix

The Project Management Assessment Matrix is intended to help determine the current status of the project and how likely it can successfully be delivered within the constraints of scope, schedule, and budget. The scores are compiled to determine a project management score. Information on how a score was selected should be provided in the comment box.

User Benefit Levels Matrix

User Benefit Levels									
Enter the percentage of benefit for the measure that will be realized for each user of the result of the project. The total value must equal 100%. Provide reasoning information for the conclusion of amounts in the comment section.									
Measure ↓	User →	State	Ports	Trucking	Shippers	Railroads	Communities	Totals	Comments
New Jobs		75%						25%	100%
Cost Reductions					80%			20%	100%
System Velocity Improvements		25%			25%	50%			100%
Hours of Train Delay		25%	25%			50%			100%
Yard Dwell Time		30%				70%			100%
Increased Traffic Revenue			25%			75%			100%
Reliability		50%				50%			100%
Throughput/Capacity		14%	12%	74%					100%
Market Share		25%				75%			100%
Competitive Advantages							100%		100%
Shipping Advantages		25%	25%			50%			100%
Region Economy							100%		100%
State Economy		100%							100%
International Trade Flow		75%				25%			100%

Screen shot of the User Benefit Levels Matrix

The User Benefit Levels Matrix is intended to help determine who is benefiting from the project and at what level. The matrix is to be completed giving a percentage that represents the amount of benefit for each user for each measure. The percentage of benefits are then added for each user and divided by the number of measures used providing an overall project benefit for each user.

User Benefit Levels										
Enter the percentage of benefit for the measure that will be realized for each user of the result of the project. The total value must equal 100%. Provide reasoning information for the conclusion of amounts in the comment section.										
Measure ↓	User →	State	Ports	Trucking	Shippers	Railroads	Communities	Totals	Comments	
State Economy		100%						100%		
International Trade Flow		75%				25%		100%		
Network			50%		25%	25%		100%		
Market Access		25%	25%		25%	25%		100%		
Bottleneck Relief			100%					100%		
Benefit Levels		28%	15%	4%		29%	14%			
Results					Comments					
This Test		28%	15%	4%	0%	29%	14%	State should participate, but only if other beneficiaries contribute an appropriate share	Direct investment and supporting institutional mechanisms	The results show the highest levels of benefit are for two of the users. The state and
Example		55%	0%	0%	10%	15%	20%	State should participate and be prepared to contribute more than the other groups if not all funds.	Direct investment at a higher level and supporting institutional mechanisms.	Community are the highest benefactors and as such most of the fund would be by them. Depending on the

User Benefit Levels Matrix result section

Evaluation Process

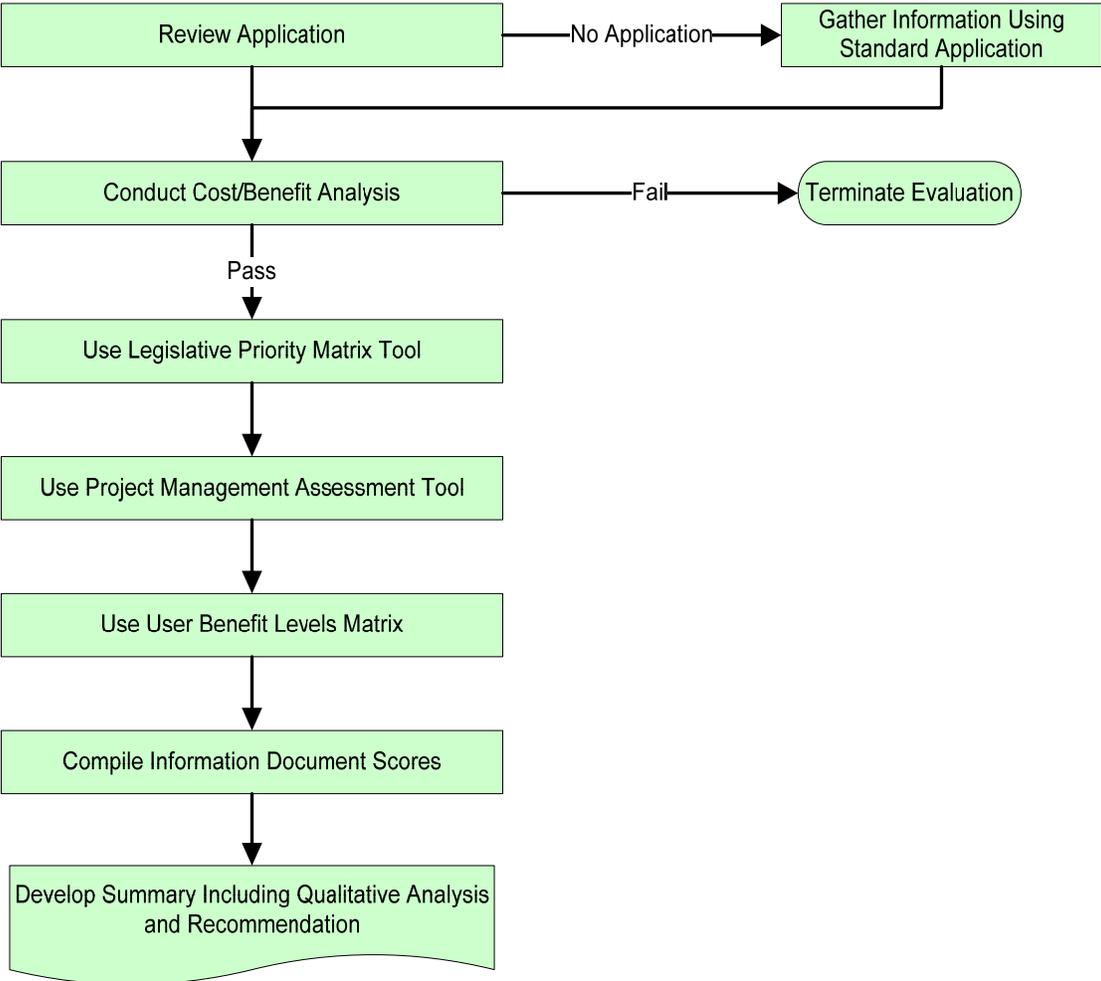
This section outlines the general process that should be followed for evaluating and selecting projects. The methodology and tools will be used by evaluators to develop recommendations.

Project Evaluations

A project evaluation may begin with a proposal application or by legislation. Both will require evaluation steps to be completed as indicated below:

1. Review application or obtain information to conduct evaluation. If there is no application, use the current general project application, eliminating superfluous questions, as a tool to identify what information is needed from the project stakeholders.
2. This step will be completed by the WSDOT State Rail and Marine Economist. Compile data for a benefit/cost analysis and use the Benefit/Cost Analysis Calculator. Include any additional data or information necessary to analyze the true benefits and costs. This may require a qualitative analysis and summary.
3. If Benefit/Cost Analysis Calculator indicates a ratio greater than one, then the Legislative Priority Matrix should be used. The evaluator should use the tool as indicated in its guidance for each priority measure. Once complete, justification for selections and a score will become part of the project documentation.
4. The evaluator will use the Project Management Assessment Matrix. If the evaluator has questions on any of the project management assessment areas, they should contact one of the State Rail and Marine Office Project Managers. This will ensure consistent interpretation with adopted standard operating procedures.
5. The final tool to be used is the User Benefit Levels Matrix. This tool with help determine what users are receiving a benefit and at what level.
6. Once a project has been through the steps above, the evaluator needs to compile all of the information to generate a score and to develop a recommendation. Depending on the project, a qualitative summary may need to be included to convey benefits that are not easily quantifiable.
7. If there are multiple recommendations, a report should be done to incorporate all recommendations for easy review.

Evaluation Process Flowchart



Additional Evaluation Considerations

This evaluation methodology is intended to lay out an overall consistent process that can be used for evaluating the economic benefits and costs for rail projects. However, benefit measures and decision support tools need to be selected and used in a manner that considers the underlying project driving goals for specific projects that may not be specifically addressed. Additional research may be required to acquire data. This may also require adjustments to the evaluation process tools.

Project driving goals may include:

- Reduce congestion to improve air quality.
- Enhance safety to improve quality of life.
- Economic stimulus.
- Support of overall state economic goals.

Incorporation of Value Judgments

While there are many quantitative ways to determine the value for a given project, there may be a need for including value judgments. If the number of evaluation measures is kept to “a few good measures,” the decision maker can review the full scope of the evaluation and weigh each measure according to their political and technical judgment. Value judgments are incorporated by the decision maker when determining the level of benefit for areas that are not quantitative and may have outside drivers that will provide a benefit for outside programs or operations. The decision maker must document their decision providing justification for the level of benefit ranking.

Decision Documentation (When Incorporating Value Judgments)

While the workbook spreadsheets used provide documentation and justification for decisions made, there may be additional documentation requirements. Documentation on value judgments that are qualitative rather than quantitative will need to have supporting information about the decision. When required, the decision documentation package should include:

1. Summary of spreadsheet determinations including alternatives.
2. Additional social or economical values considered.
3. Justification for value judgment determinations.
 - a. Benefits and impacts reviewed.
 - b. How the reviewed benefits and impacts apply.
 - c. Determination considerations.
 - d. Justification documentation.

Lessons Learned

An essential part of the evaluation process is documenting and using lessons learned. As the evaluation methodology is applied to the project lessons learned should be used for improvement of the methodology. Each lesson recommendation should be reviewed for consistency with state policies and regulations. Recommendations should be appropriately reviewed for benefit and application prior to incorporating into the methodology.

Future Development

The Rail Benefit/Impact Evaluation Methodology and tools have been developed with the foresight of expanding in future versions. One such addition will be inclusion of the Statewide Freight Data and Analytic Program information as part of all project evaluations once it is complete. Incorporation of this data into project evaluations will generate recommendation results consistent with statewide freight strategic goals.

In addition, as changes in the economy and state goals occur, the methodology will need to be updated to ensure the correct benefits and measures are being used. The methodology addresses the need to use lessons learned for improvement as well as being dynamic enough to stay current. A technical work group will be put in place to periodically review baseline evaluation results and the latest evaluation results to ensure that the correct measures and benefits for the current freight conditions are being used.