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Rail Freight Assistance Program Benefit Cost Analysis

FINAL REPORT
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Submitted by

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In cooperation with

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INTRODUCTION

As authorized by the *New Jersey Administrative Code, Title 16, Chapter 53C*, New Jersey Department of Transportation (NJDOT) administers the Rail Freight Assistance Program (RFAP) to provide assistance to freight railroads throughout the State for the purpose of supporting an "efficient and effective rail freight system." Assistance may be applied to rail facility construction, rail line rehabilitation or reconstruction, or demonstration projects that contribute to the purpose. RFAP applicants may receive up to 90 % of the project cost in assistance (95 % in the case of demonstration projects), while supplying a minimum 10 % match (5 % in the case of demonstration projects). NJDOT has established a match requirement scale to correspond with the size and resources of each class of railroad. The scale requires a 10 % match from Class III, or short line, railroads, 30 % match from Class II railroads, and a 50 % match from Class I railroads such as CSX and Norfolk Southern. Since 1978, RFAP has been receiving applications annually and publishing awards in the annual updates to the State Rail Plan.

Currently the RFAP is being rolled into a multimodal grants management program in the State Government known as the System for Administering Grants Electronically (SAGE). NJDOT is one of several State agencies participating in SAGE. The Division of Multimodal Services is a new branch of NJDOT, which has the responsibility of managing assistance programs for rail, aeronautics, and maritime projects. The reorganization of NJDOT assistance programs provides an opportunity to evaluate the RFAP, and the potential to develop the capabilities of the RFAP application process to address a broader range of benefit and cost considerations to more completely ensure that the program's purpose to support efficiency and effectiveness are being achieved.

This report documents the process by which Cambridge Systematics (CS) conducted a review of NJDOT's Rail Freight Assistance Program (RFAP) application and analysis tool to identify opportunities to enhance the program's capabilities and provides a series of recommendations developed to enhance the analysis tool's capabilities to account for a more comprehensive range of benefits and costs associated with candidate projects. The report consists of three sections.

- **Approach and Methodology** provides a list of documents reviewed by Cambridge Systematics;

- **Conclusions** summarizes, based upon review of a series of documents supplied by NJDOT and discussions with NJDOT staff, the team's understanding of the procedures and methods currently used to analyze candidate rail projects, their compliance to State statutes and rules, and opportunities to improve the accounting for several of the required considerations in the benefit-cost calculations.

- **Recommendations** provides recommended implementation approaches that NJDOT may pursue to advance the application methodology, including pursuit of one of three potential Benefit-Cost Analysis (BCA) model development approaches that would enhance the analytical capabilities of RFAP, some of the components of which could be applied to the other modal programs under SAGE.

APPROACH AND METHODOLOGY

CS completed a review of the RFAP to determine whether or not the program meets all requirements of the New Jersey Administrative Code and New Jersey Statutes, and to identify where the potential to improve the capabilities of the analysis methods exist. The review was completed with an understanding that NJDOT desires a process that is transparent, data-driven, and subject to minimal human error. Those goals can be achieved with an analysis tool that calculates benefit-cost ratios automatically, based upon a calculation of credible economic factors and verifiable project data from program applicants. Identifying ways in which the tool NJDOT currently uses meets those specifications, and ways in which the process may be improved to that end, are presented as the conclusions and recommendations sections of this memorandum.

To assist the effort, NJDOT supplied a series of documents supporting RFAP, including copies of:

- FY 2011 State Rail Plan Update Grant Application.
- A summary spreadsheet listing FY 2011 State Rail Plan Applications.
- Two completed representative sample applications.
- Explanation of Cost Benefit Model.xls.
- New Jersey State Rail Plan Updates, 2008-2011.
- N.J.S.A 27 1A-5.1, which establishes NJDOT's authority to participate in the development and maintenance of the State's rail freight system.
- N.J.A.C. 16:53C, which establishes requirements for the Rail Freight Assistance Program.

To identify opportunities to enhance the RFAP application process and the BCA model, CS relied upon knowledge of BCA modeling tools currently in use in other states, including Florida, Virginia, Maryland and Pennsylvania.

CONCLUSIONS

The review of the FY 2011 application form and BCA model spreadsheet found that the process currently used by NJDOT to review candidate projects meets the minimum requirements set forth in N.J.A.C. 16:53C. The Code directs NJDOT to develop an application form that requires, at minimum:

- The full name and principal business address of the applicant.
- The name, title, address and phone number of the persons to whom correspondence regarding the application should be addressed.
- A project description and benefits.

- Data for benefit/cost analysis.
- Photographs of the project area.
- Scope of work and current project cost estimate.
- Financial and match assurances.
- Certification of permission to submit an application.
- Certification agreeing to allow the State to issue a lien against the property if required.

The Code does not, however, specify criteria for thresholds of specificity or methodologies for collecting data from the applicants. Guidance on precisely what sorts of benefits and how they should be measured (public versus private, economic development versus transportation performance benefits, etc.) is not specified.

The RFAP BCA process is fairly limited in its capabilities to quantify benefits among an array of stakeholders in the public and private sector, and among various categories of benefits related to transportation system performance, economic development, or environmental and sustainability impacts. The application form and BCA model allow for the quantification of some benefit categories, such as direct permanent employment, new carloadings and associated wage impacts. RFAP allows ample space for narrative, qualitative descriptions of other benefits, such as environmental and system efficiency benefits. Based on observations of other peer states, New Jersey could potentially improve the selection process by more fully quantifying certain benefits as part of the benefit-cost estimate, including:

Truck VMT Estimation

The greatest single change to the evaluation methodology could be to account for the benefit of reducing or maintaining (mitigating growth) truck vehicle miles traveled (VMT) on the New Jersey highway system. By estimating truck VMT reduction (or in the case of projects that preserve rail traffic, the number of avoided truck miles that *would* have transferred to the highways *if* the project were not conducted), the selection process would have a basis for estimating and monetizing savings in several categories that are mentioned under “16:53C-5.4 Project selection.”

Energy and Environmental Factors

Rail transportation is typically 3.5 to 4 times more fuel efficient than truck transport on a tons/mile basis. Using the estimated avoided or reduced truck VMT, factors could be developed from other models and research studies to quantify and monetize fuel savings. Similarly, factors could quantify and monetize emissions (based on ton-miles factors or unit-miles for intermodal).

Efficient and Responsive Freight Distribution

Rail transportation typically is less expensive than truck transport and yet more expensive than waterborne freight. If the model could capture the per-mile or ton-mile savings using the truck VMT estimates then the evaluation could consider the effect of shipper cost savings. Because rail is typically slower than trucking, it is unlikely that the rail projects would offer positive logistics costs savings, such as lower inventory or carrying costs, therefore, these have not typically been estimated for rail projects. The main focus could be on the shipper cost savings, which often constitute the single largest savings factor in some rail project analyses. However, because the savings are not directly accruing to the state or the public (obviously some cost savings are passed onto consumers), this may be a benefit that is quantified but left outside the cost-benefit formula.

Other Benefits

In addition to these the aforementioned selection factors cited in 16:53C-5.4, VMT estimates could also provide a basis for estimating highway maintenance savings (e.g. pavement savings) and safety savings (e.g. reduced crash potential and associated costs). These two benefit categories (highway maintenance and safety) are not explicitly mentioned in the legislation, but would help the selection process account for the State Rail Plan goals of "Sustainable Investment" (to cultivate and protect freight initiatives which provide lasting returns on public investment) and "Safety and Security" (to protect people, cargo, and infrastructure), respectively.

In order to develop truck VMT savings estimates, the application would need to be changed to collect information on origins, destinations or mileage shifted from truck to rail in the state. Peer states employ different methods—each with strengths and weaknesses—to collect and estimate the VMT. New Jersey could examine the way that Virginia, Pennsylvania, and Washington State, for example, collect and estimate the change in truck VMT to help guide the way New Jersey would add this to the selection process.

Highway Congestion Mitigation

Other states with well established rail evaluation methodologies (e.g. Pennsylvania) do not quantify highway congestion benefits as part of their project selection process. The reason many states do not estimate congestion savings (even though they could ostensibly use the trucks VMT estimates to develop passenger car equivalent congestion reduction factors using HERS-ST) is that truck travel patterns are varied and often occur on rural highways, making the ability to measure and monetize congestion very difficult. New Jersey could potentially measure congestion effects using the truck VMT estimates for projects that would remove concentrated numbers of trucks from specific corridors, especially urban corridors, but the prospect of doing this work for each application in a way that would remain consistent from project to project could be difficult and would deserve more thought on the best approach to develop a methodology.

Treatment of Preserved Versus New Carloads

The enabling legislation allows NJDOT to provide funding for rail capital and rehabilitation projects, the latter of which do not provide "new" carloads but instead act to preserve both

jobs and carloads. The current application asks for "maintained jobs" but not "maintained carloads". The state might consider whether it would like to include "preserved carloads" as part of the benefit calculation, including avoided costs that would be incurred if the rail project failed to preserve the rail traffic. To illustrate this point, the Commonwealth of Pennsylvania has been grappling with this issue in their rail project evaluation methodology and for now, PennDOT has resolved to consider both new and preserved carloads although the preserved carloads might receive lower weighting in the scoring of projects.

Economic Impacts

The current process does not fully account for the economic impacts of spending and employment. Other states are embedding factors from input-output models such as MIG, Inc.'s Impact Model for Planning (IMPLAN) or Regional Economic Models, Inc. (REMI) into their rail benefit-cost models to account for the changes in employment. While the current NJDOT process considers the impacts of direct jobs, it does not utilize multipliers or other features to account for indirect or induced jobs supported by the direct jobs in the broader economy. By adding some features to account for changes on jobs and even state gross domestic product, the process could more fully measure the degree to which projects are fulfilling the economic development / job creation goals of the State Rail Plan.

Tax Impacts

Rail projects can increase employment taxes, corporate tax revenue, and can influence (potentially decrease) net diesel tax revenues. To more fully account for the "Sustainable Investment" goal of the State Rail Plan, the NJDOT process could use available models (including IMPLAN or REMI) to provide rough estimates of the effects of projects on Federal, State, and local tax revenues. Simple factors can be embedded into spreadsheet models to also account for diesel tax revenue shifts.

Accounting for New Jersey State Rail Plan Prioritization Criteria

The State Rail Plan lists a number of criteria—many of which are qualitative—used to prioritize projects. It may be helpful to NJDOT to include a qualitative scoring sheet that allows the state to develop composite scores within an improved rail benefit cost model. PennDOT has developed a similar model that encompasses many state planning goals and other criteria and assigns a composite numerical score based on state-assigned weightings for many categories (e.g. does the project catalyze redevelopment as part of the states smart growth initiatives).

RECOMMENDATIONS

In order to address the issues revealed in the review of the RFAP BCA, NJDOT may wish to develop a new BCA model which is capable of accounting for many of the required considerations that are currently evaluated qualitatively. A broader range of benefit and cost elements would expand NJDOT's understanding of the benefits and costs each candidate project accrues among a wide range of stakeholders, and help the Department make selections based upon that more comprehensive account.

Three model development approaches are proposed for implementation—Basic, Enhanced, and Comprehensive. Their names correspond to the level of model sophistication, reliance on user inputs versus model calculations, and level of investment required to develop each. A fourth option, which calls for the acquisition of the recently-developed BCA model that the Pennsylvania DOT (PennDOT) currently uses for its rail assistance program and adapting the model's input categories background multipliers to represent New Jersey's economic and freight activity, is also presented later in this report. This report presents a discussion of each approach and identifies a preferred approach based upon an evaluation of the capabilities and cost in balance with NJDOT's desires. The decision regarding which, if any, model approach will be developed will ultimately be made by NJDOT.

Table 1. Proposed Benefit Cost Model Development Approaches

Category	Model	Basic	Enhanced	Comprehensive
Basic Information	Cost	$50k	$75k	$100k
	Excel based model with macros	X	X	X
	Multiplier Impacts (I-O Model)			
	Existing multipliers (MAROPs)	*X*		
	Multipliers from IMPLAN Statewide Model		*X*	
	Multipliers from IMPLAN County Level Model			*X*
Construction Impacts	Construction Impacts (I-O Model)			
	Direct	*X*	*X*	*X*
	Indirect/Induced		*X*	*X*
	Tax impacts		X	X
Operational Impacts	Operational Job Impacts			
	Direct	*X*	*X*	*X*
	Indirect/Induced		*X*	*X*
	Estimate truck VMT reduction along with corresponding economic impacts			
	Based on rail equipment type	*X*	*X*	*X*
	Based on commodity classification			*X*
	Diesel Tax Impact	X	X	X
	Shipper savings			
	User entered distances	*X*		
	Shortest Path (GIS Model)		*X*	
	Distances estimated from State Freight Model			*X*
	Grade Crossings Impact			X
	Account for preserved carloads	X	X	X
	Tax impacts		X	X
Project Evaluation	Qualitative data			
	Current criteria	*X*	*X*	*X*
	Scoring for 15 qualitative items + project ranking			*X*

Each of the three models will be prepared in Excel, according to the preference of AGATE Software, the consultant developing the web interface for the SAGE program, with Visual Basic macros. The models will allow the user to enter, save, view and edit data for individual projects as well as provide construction and operational impacts that will be used to evaluate each project. The Comprehensive Model will also combine user entered qualitative data to produce a ranking for all of the projects entered in the system. The features for each of the three model approaches are discussed in the following paragraphs.

Comprehensive Model Approach

The Comprehensive Model will utilize county-level data obtained from IMPLAN to estimate direct construction impacts, tax impacts for the construction and operation phase, as well as multipliers for indirect (business expenditure) and induced (employee expenditure) impacts from both phases. With county-level data, the user will have the option to select the county or counties in which the project will be taking place and to track direct, indirect, and induced job creation throughout New Jersey by county. For example, the model will summarize employment impacts by the county or counties where the investment takes place *and* other New Jersey counties. CS will obtain the IMPLAN model and data necessary to perform this analysis. The outputs of the Comprehensive Model include a score for the projects' performance among several qualitative criteria first. If the project achieves an acceptable score against the qualitative criteria, it will be advanced to a quantitative analysis that will generate a benefit-cost ratio based upon monetized costs and benefits resulting from job, wage, tax and GDP impacts by county, and state costs and revenues or savings. The inputs, processing steps and outputs of the Comprehensive Model approach are summarized in Table 2.

The model will have the capacity to account for a variety of qualitative factors that demonstrate whether or not a project qualifies for assistance. These criteria generally cannot be monetized. Examples of such factors include whether or not a project is aligned with State goals, is supported by local officials and communities, or is considered to be "shovel ready." The model will include input of information regarding these factors and a weighted scoring. Projects that score well on these criteria will advance to benefit-cost analysis.

Truck VMT reduction (from the shift to rail) is the primary source of quantified public benefits including decreased expenditure in highway maintenance, accidents, pollution, and highway congestion. Projects that either maintain rail mode share (keep trucks off the highways) or divert new truck trips to rail produce public benefits in the proposed model. In addition to these VMT-based public benefits, transporting by rail instead of truck also results in significant savings for freight shippers in the state, attracting or keeping more business in the region. Given the magnitude of these impacts it is important to obtain an accurate estimate of total truck VMT reduction as well as the portion of the reduction that takes place within the State of New Jersey.

To estimate truck VMT reduction and shipper savings, the Comprehensive Model will use either rail equipment type or commodity data (2-digit SCTG) to estimate number of trucks generated. Instead of relying on user input or GIS data for total and NJ-only distances this model will utilize a trip table of average county-to-county centroid distances for truck travel, which CS will be developing using NJDOT's freight model or GIS software. This model will allow the user to select an origin and destination from drop-down menus and automatically retrieve the desired distances from a lookup table. This will diminish user error as well as provide a consistent source for all projects. The distance matrix will include counties within NJ, as well as counties in the State's surrounding which will allow for more accurate representation of trip length and route. Beyond the surrounding counties, regions will be aggregated at the state level. The change in distance traveled within New Jersey alone will be used to estimate factors that affect its residents such as pavement deterioration,

accidents, pollution, congestion, and diesel tax impacts. The total distance will be used to produce an estimate of shipper savings.

Rail crossing delay impacts will be calculated based upon the change in number, length and speed of trains passing through the crossings in the project area and resulting changes to grade crossing delays, multiplied by the monetized value of time for New Jersey drivers. The value of time estimation will include IMPLAN value of time data by trip purpose, NJDOT's trip purpose ratios, and NJDOT and National Household Transportation Survey (NHTS) vehicle occupancy data by trip purpose.

To validate the change in volume of freight moved that the applicants will submit, the Comprehensive Model will perform a calculation to estimate the maximum throughput capacity for a given facility. The applicant will be asked to submit the terminal and customer facility acreage (existing and expanded if applicable). Using the NJDOT Rail GIS, rail line and yard characteristics (number of main line tracks, signal systems, number and length of sidings, number and length of working tracks, operating constraints, etc.) will be referenced, and a maximum carload and intermodal container throughput capacity threshold established. If the applicant submits an anticipated future volume that exceeds the estimated capacity threshold for the project area, the model will produce a "red flag." This will indicate to NJDOT that the anticipated growth in traffic appears implausible and should be examined more closely.

The cost to develop, calibrate and prepare summary documentation for the Comprehensive Model is estimated to be approximately $100,000. Of that sum, approximately $2,200 would be applied to the purchase of a county-level IMPLAN data package. The cost of developing the model architecture and calculation functions would be about $58,800, and testing and calibration of the model would cost approximately $30,000. About $9,000 would be applied to final documentation and a workshop to demonstrate and train NJDOT staff on how to operate, interpret, and maintain the model. The $2,200 data purchase will provide NJDOT with current (2011) IMPLAN data and multipliers. Periodically, to ensure that costs and benefits are properly discounted, NJDOT should make additional data purchases to update the factors to current year standards. The cost of county-level IMPLAN data packages may vary year-to-year.

Table 2. Comprehensive Model Approach

Input Type	Input	Processing	Process Output	Result
Qualitative	Project aligned with State goals. Supported by local leaders/communities. Adopted within local plans. Adequate funding. Shovel readiness.	Scoring of qualitative criteria.	Automated recommendation based on qualitative score. If approved, proceed to quantitative calculations.	Qualitative and quantitative measurement of projects' impacts. Qualitative: - Recommendation. Quantitative: - ROI. - Jobs by county. - Wages by county. - Taxes by county. - GDP by county. - Total State costs. - Total state revenues/savings.
Construction	Construction Cost. NJDOT % Share of Costs. Construction start/duration.	County-level IMPLAN model: - Direct, indirect, induced impacts. - Base wages by job type and county.	Economic impact from construction: jobs, taxes, GDP, output summarized by county.	
Operations	VMT Reduction Estimation: OD Pairs (Top 3). Years 1-5 Traffic by commodity and cargo type.	Cube Model: Distance traveled. Payload factors: Tons/ton-miles estimated using commodity info and distance. Rail: Increased unit-miles, ton-miles. Truck: Increased truck-miles, ton-miles. TIGER: Parameters to calculate output.	Reduction in highway maintenance, Reduction in crash costs, Air quality impacts, Diesel tax revenue, Shipper savings.	
	Rail Crossing: AADT, trains per day.	Delay calculation by crossing. IMPLAN: Value of time information. NJDOT: Trip purpose data. NJDOT/NHTS: Vehicle occupancy factor.	Total time savings monetized.	
	New/maintained operations jobs.	County-level IMPLAN model: - Direct, indirect, induced impacts. - Base wages by job type and county.	Economic impact from operations jobs, taxes, GDP, output summarized by county.	
Validation	Current land acreage. Expansion acreage. Rail line characteristics. Current traffic throughput.	Measure of maximum capacity expected for a particular land area and rail line.	Red flag if data submitted is beyond maximum capacity threshold estimated for the project.	

Enhanced Model Approach

The Enhanced Model approach represents a “medium level” investment. Like the Comprehensive Model, the Enhanced Model produces a benefit-cost ratio based upon monetized economic impacts of construction and operations phases, truck VMT reduction impacts, grade crossing delay impacts. The Enhanced Model will also use the same validation methodology as the Comprehensive Model. The primary differences between the Comprehensive and Enhanced models are the level of specificity in the econometric model, source of distance traveled information used in the VMT reduction calculation, and the approach to evaluating qualitative information. The Enhanced Model approach is summarized in Table 3. The differences between the Enhanced and Comprehensive approaches are highlighted using bold, italic typeface.

Qualitative information, such as a project’s alignment with local and state planning processes and goals, will be recorded, but no weighted score will be calculated. A list of check-marks will be recorded as appropriate, and may be used by NJDOT for review. If a project meets the criteria in the qualitative review, it may be advanced to the quantitative benefit-cost analysis.

The Enhanced Model approach relies on a 2009 statewide IMPLAN for New Jersey which allows estimation of direct construction impacts, tax impacts (for the construction and operation phase), as well as multipliers for indirect (business expenditure) and induced (employee expenditure) impacts from both phases. The Enhanced approach is based upon statewide averages, instead of county-specific wages. The economic impact of construction and operations jobs will be summarized at the statewide level. The ability to determine which counties may see positive job impacts and which may see negative job impacts will not be present.

To estimate truck VMT reduction and resulting shipper savings, the Enhanced Model will make use of distance traveled information based upon an estimation of the distance of the shortest path between regions using GIS software. The zones will include counties within NJ and statewide regions outside of NJ. Distances will be estimated from centroid to centroid. Payload factors will be estimated using the equipment type (i.e. tanker, hopper, container) and the average number of trucks that would be required to handle each carload, instead of the commodity-specific factors used in the Comprehensive Model.

The cost to develop, calibrate and provide summary documentation supporting the Enhanced Model is estimated to be about $75,000. This estimation includes approximately $500 for data purchase, $44,000 for model development, $22,800 for testing and calibration, and $7,500 for final documentation and a workshop to train NJDOT staff on how to operate, interpret, and maintain the model. The $500 data purchase will provide NJDOT with current (2011) IMPLAN state-level data and multipliers. Periodically, to ensure that costs and benefits are properly discounted, NJDOT should make additional data purchases to update the factors to current year standards. The cost of the state-level IMPLAN data package may vary year-to-year.

Table 3. Enhanced Model Approach*

Input Type	Input	Processing	Process Output	Result
Qualitative	Project aligned with State goals. Supported by local leaders/communities. Adopted within local plans. Adequate funding. Shovel readiness.	***No scoring of qualitative criteria, check marks used for each.***	***NJDOT to review qualitative input to decide on project approval before quantitative evaluation.***	Qualitative and quantitative measurement of projects' impacts. Qualitative: - Recommendation. Quantitative: - ROI. - Jobs ***statewide.*** - Wages ***statewide.*** - Taxes ***statewide.*** - GDP ***statewide.*** - Total State costs. - Total state revenues/savings.
Construction	Construction Cost. NJDOT % Share of Costs. Construction start/duration.	***State-level*** IMPLAN model: - Direct, indirect, induced impacts. - Base wages by job type ***at State level.***	Economic impact from construction: jobs, taxes, GDP, output ***summarized at State level.***	
Operations	VMT Reduction Estimation: OD Pairs (Top 3). ***Years 1-5 Traffic by Type.*** ***Average distance traveled by OD Pair.***	***User-entered*****:** Distance traveled. Payload factors: ***Tons/ton-miles estimated using traffic type and distance.*** Rail: Increased unit-miles, ton-miles. Truck: Increased truck-miles, ton-miles. TIGER: Parameters to calculate output.	Reduction in highway maintenance, Reduction in crash costs, Air quality impacts, Diesel tax revenue, Shipper savings.	
	Rail Crossing: AADT, trains per day.	Delay calculation by crossing. Value of time information from IMPLAN. Trip purpose data from NJDOT. Vehicle occupancy factor NJDOT/NHTS.	Total time savings monetized.	
	New/maintained operations jobs.	***State-level*** IMPLAN model: - Direct, indirect, induced impacts. - Base wages by job type and county.	Economic impact from operations jobs, taxes, GDP, output summarized ***at State level.***	
Validation	Current land acreage. Expansion acreage. Rail line characteristics. Current traffic throughput.	Measure of maximum capacity expected for a particular land area and rail line.	Red flag if data submitted is beyond maximum capacity threshold estimated for the project.	

*Differences between the Enhanced and Comprehensive Models are shown in ***bold italics***.

Basic Model Approach

The Basic Model approach is similar to the Enhanced Model approach in its evaluation of qualitative criteria and in its use of the State-level IMPLAN model to estimate direct and induced employment and wage impacts during the construction and operations phases of a project. Two key differences between the Basic and Enhanced approaches are the elimination of the calculation of rail crossing delay monetized impacts (and hence, the removal of grade crossing impacts from the benefit-cost calculation) and the removal of the procedure to validate applicants' estimated change in traffic volume resulting from the project. The Basic Model approach is summarized in Table 4. The differences between the Basic and Enhanced approaches are highlighted in bold, italic typeface.

The cost to develop, calibrate and document the Basic Model is estimated to be approximately $50,000. Of this sum, about $29,000 would be applied to the development of the model and $16,000 would be used for testing and calibration of the model. All of the data and factors used for the development of the Basic Model are assumed to be available to NJDOT free of charge.

Additional Factors

- Preserved Carloads. All three models will allow the user to define the % of affected carloads that are being preserved versus generated given that they will have different economic impacts. CS will work with NJDOT staff to determine the appropriate "discount factor" for preserved traffic if applicable or deemed necessary.

- Consideration of Varying Wage Rates by County. One distinction between the Enhanced and Comprehensive models is the use of statewide versus county-level multipliers from IMPLAN. NJDOT has expressed interest in understanding the impacts of varying wage rates, within industry classification groups that represent rail customers, based upon geography. The salaries shown in Table 5 illustrate the differences in compensation among New Jersey's 21 counties within each of four industrial classification groups. Wholesale trade workers in Somerset County, for example, earn $85,178 in annual wages on average, while workers who are employed in the same industry in Camden County earn $39,367. The advantage to using county-level wage information is to develop a wage impact using a factor based upon data from businesses located in the project's host county(ies). As a statewide policy, however, such ranges in wage impacts county-to-county may lead the model to favor a greater number of projects in high-wage locales than it would if wages within each industry group were assumed to be equal statewide. CS will continue to discuss this issue with NJDOT, though the preferred approach will ultimately be determined by NJDOT.

Project Evaluation

CS will estimate Benefit/Cost ratios for each project under all three model options, while identifying public and private benefits and costs. The basic and enhanced options will include qualitative criteria that are currently included in NJDOT's project submittal form. These factors will not be accounted for in the model's evaluation process, however NJDOT can address them outside of the models. For the comprehensive model, CS will work with

NJDOT to develop and score up to fifteen qualitative criteria that, when combined with the benefit cost ratio, will be used to produce a ranking of all of the projects entered in the system.

Table 4. Basic Model Approach*

Input Type	Input	Processing	Process Output	Result
Qualitative	Project aligned with State goals. Supported by local leaders/communities. Adopted within local plans. Adequate funding. Shovel readiness.	No scoring of qualitative criteria, check marks used for each.	NJDOT to review qualitative input to decide on project approval before quantitative evaluation.	Qualitative and quantitative measurement of projects' impacts. Qualitative: - Recommendation. Quantitative: - ROI. - Jobs statewide. - Wages statewide. - Taxes statewide. - GDP statewide. - Total State costs. - Total state revenues/savings.
Construction	Construction Cost. NJDOT % Share of Costs. Construction start/duration.	State-level IMPLAN model: - Direct, indirect, induced impacts. - Base wages by job type at State level.	Economic impact from construction: jobs, taxes, GDP, output summarized at State level.	
Operations	VMT Reduction Estimation: OD Pairs (Top 3). Years 1-5 Traffic by Type. Average distance traveled by OD Pair.	User-entered: Distance traveled. Payload factors: Tons/ton-miles estimated using traffic type and distance. Rail: Increased unit-miles, ton-miles. Truck: Increased truck-miles, ton-miles. TIGER: Parameters to calculate output.	Reduction in highway maintenance, Reduction in crash costs, Air quality impacts, Diesel tax revenue, Shipper savings.	
	No calculation of rail crossing delay.			
	New/maintained operations jobs.	State-level IMPLAN model - Direct, indirect, induced impacts - Base wages by job type and county.	Economic impact from operations jobs, taxes, GDP, output summarized at State level.	
Validation	***No validation of input data***			

*Differences between the Basic and Enhanced Models are shown in ***bold italics***.

Table 5. Salaries by County Among Four Industry Groups

County	Wholesale Trade	Transportation and Warehousing	Construction	Manufacturing
Atlantic	$44,966	$32,794	$54,924	$37,380
Bergen	$69,637	$44,466	$55,068	$56,206
Burlington	$58,404	$44,694	$51,377	$58,808
Camden	$52,565	$34,685	$54,208	$51,148
Cape May	$47,149	$39,358	$38,806	$35,125
Cumberland	$39,367	$36,827	$54,982	$39,926
Essex	$74,637	$41,804	$58,383	$58,031
Gloucester	$50,965	$37,006	$59,160	$57,983
Hudson	$52,246	$42,667	$56,631	$41,486
Hunterdon	$52,291	$46,361	$49,872	$51,585
Mercer	$82,748	$32,424	$56,183	$46,074
Middlesex	$71,338	$40,542	$61,122	$56,495
Monmouth	$62,864	$31,639	$68,313	$52,748
Morris	$80,564	$47,759	$58,455	$57,853
Ocean	$43,685	$31,901	$44,052	$43,513
Passaic	$56,680	$28,208	$57,434	$49,450
Salem	$42,928	$31,789	$56,630	$65,259
Somerset	$85,178	$41,730	$58,080	72,580
Sussex	$54,010	$25,582	$48,151	44,220
Union	$63,895	$49,756	$65,282	71,221
Warren	$58,368	$33,642	$47,625	51,787
Average	**$66,979**	**$41,393**	**$57,314**	**56,107**

Source: U.S. Bureau of Labor Statistics, 2008.

"Pennsylvania Model" Alternative

The Pennsylvania DOT completed the development of a rail benefit-cost analysis model in 2011, referred to hereafter as the "Pennsylvania model." Like the three proposed approaches for New Jersey, the Pennsylvania model is an Excel-based spreadsheet tool that calculates a benefit-cost ratio based upon construction and operations costs to the State and economic impacts resulting from job creation during the construction and operations phases. Like the Comprehensive Model approach, the Pennsylvania model provides a calculated scoring of qualitative criteria relative to weighted factors and it uses Pennsylvania DOT's statewide truck model to estimate distances between origin and destination pairs. The Pennsylvania model contains two sets of aggregated data that are similar to the inputs to the Enhanced Model approach presented earlier in this document: aggregation of historic and future traffic to equipment type (rather than by commodity as in the Comprehensive approach); and the use of statewide IMPLAN data and outputs. The

Pennsylvania model therefore represents a “hybrid” between the Comprehensive and Enhanced model approaches.

In addition to the three approaches (Comprehensive, Enhanced and Basic) proposed for developing a new model “from scratch,” NJDOT could develop a model that makes use of Pennsylvania DOT’s recently developed model architecture as an alternative. Assuming NJDOT can acquire Pennsylvania DOT’s spreadsheet model for NJDOT use, several hours of a technician’s time spent building spreadsheets and linking worksheets and formulae can be saved. Developing a New Jersey model from the Pennsylvania model architecture will not come without significant effort, however. IMPLAN data for New Jersey (including wage rates by industry and value of time) must be purchased and built into the model. Distance matrices between points within and beyond New Jersey must be calculated using the State truck model and populated in the BCA model. New Jersey trip purpose and vehicle occupancy data will be acquired from NJDOT and/or Federal sources and built into the model. In addition, if NJDOT requests any changes to the qualitative scoring weights or wishes to substitute qualitative criteria, New Jersey-specific scoring weights must be developed. Furthermore, the Pennsylvania model does not have a built-in “validation” feature to identify potentially false information submitted by applicants, and such a feature would have to be added for NJDOT’s benefit. The effort expected to transition the Pennsylvania model into an appropriate New Jersey model is approximately $75,000 to $85,000.

Recommended Next Steps

The determining factor in NJDOT’s decision on a model development approach will be development cost. The Comprehensive Model approach has the greatest cost, but its consideration of county-by-county employment and wage impacts, commodity-specific VMT estimation, and scoring of qualitative criteria make it the most granular and complete accounting of benefits and costs that can be performed for multiple candidate projects within a reasonable level of effort and time. The Enhanced Model approach costs significantly less to develop, while surrendering the county-level economic impacts and commodity-specific VMT estimation. Acquiring the Pennsylvania model will allow NJDOT to save a relatively small amount of effort in developing the spreadsheet architecture, and therefore will cost slightly more to prepare than a “from scratch” development of the Enhanced Model. The savings could be lost if the process of acquiring the Pennsylvania model spreadsheet requires any substantial level of effort. The concluding recommendation of this report advises NJDOT to acquire Pennsylvania DOT’s model spreadsheet. If Pennsylvania DOT complies with the request, and if NJDOT is satisfied that the Pennsylvania model meets NJDOT’s needs, the Pennsylvania model’s architecture should be copied to establish the foundation for a new NJDOT model. Should Pennsylvania DOT be unwilling or unable to provide their model spreadsheet, NJDOT should proceed to develop a new model using the Enhanced Model approach or the Comprehensive Model approach, depending upon the resources available to complete the project.