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Impact of the Rail Grants Program

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16. Abstract

The New Jersey Rail Freight Assistance Program awards approximately $10 million annually in grants to freight rail operators for construction and improvement projects. The purpose of the rail investments is to promote and sustain economic development and maintain a balanced transportation system where rail is more economically viable than other transportation systems. However, the New Jersey Rail Freight Assistance Program (hereinafter the "rail grants program") does not currently evaluate the impact of the grants after they have been awarded. No study has been conducted to evaluate the long-term impact of the program on the state's transportation goals. New Jersey Department of Transportation (NJDOT) is now studying the past performance of the program to learn its effects on the NJ economy and transportation system to potentially modify the rail grants program.

The research team recommends improvements to the NJDOT's program and selection methodology based on the findings of the research presented this report. This report compiles information from the literature, similar rail grant programs of other departments of transportation (DOTs), and other sources to comprehensively analyze and report on the economic,, traffic, and external impacts of the rail grants program. Several methodologies are reviewed and discussed throughout this analysis. Finally, the research team provides recommendations for improvements to NJDOT's program and application selection methodology.

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EXECUTIVE SUMMARY

This project report is comprised of a review of studies of various grant programs of different departments of transportation (DOT) and the New Jersey Rail Grant Program. The research team compiled information from the literature, similar grant programs of other DOTs, and other sources to develop a comprehensive review of New Jersey's program. A second component of the report is the estimation and analysis of impact of the awards in terms of economy and traffic. Economic impacts are quantified in terms of jobs created while traffic impacts are quantified in terms of direct and indirect costs that are based on cost functions estimated as part of other NJDOT funded projects conducted in the past using NJ specific data.

The literature review confirms the private and social benefits of maintaining short line railroads, but the cost of doing so is often prohibitive for short line operators. Thus, several assistance programs have been established—most of which are operated by State DOTs for rail lines within their states. Because there is no single methodology universally used to administer the programs, several state DOT programs are reviewed. The review showed that many states utilize loans to further extend limited funding, and negotiate loan terms and matching requirements based on the ability of the applicant or funding situation. Clawback provisions are used by many programs, several of which are in conjunction with mandatory post-evaluation. Post-evaluation requires data collection for several years following construction completion to ensure projected carloads, job creation/preservation, and the critical components of cost-benefit analysis are not unrealistically inflated. The projections must be realized (usually to a certain minimum level) or some or all of the grant money must be returned. While a cost-benefit analysis is required by all states, the details for each analysis vary, with some states (Oregon and Virginia) outsourcing their economic analysis to third parties.

Next, the previous as well as the current New Jersey Rail Grant Programs are reviewed and summarized in detail, along with an overview of the application requirements, and compared with other state DOT programs.

In the NJDOT Application Evaluation chapter, the application scoring method and its analysis are discussed. The sample scorecard and explanation of each category is defined for its significance in terms of project selection. All available scorecards from the previous funded and non-funded applications are studied, and noticeable discrepancies are highlighted. A systematic scoring technique is suggested for implementation for the purpose of avoiding possible discrepancies. The cost-benefit analysis of recent NJDOT applications is done using a sample Microsoft Excel™ sheet. This spreadsheet tool is also reviewed, where each entry in the sheet is described using an example project.

Next, targeted interviews and surveys are conducted as part of the data collection task. Several DOT managers, New Jersey railroad managers, and railroad industry experts participated in the interview and/or survey process. These interviews and surveys are summarized in the report.

The following chapter of the report includes the economic impact analysis conducted by the research team. Economic impacts are the effects of investments on the level of economic activity in a given geographical area. They can be observed by various parameters such as the output in terms of the total value of industry production, value added, wealth, wages or jobs. Before making an investment similar to the ones funded by the "NJDOT's Rail Grant" program, it is important to complete a standard economic impact analysis to assess all the feasible alternatives with respect to their projected economic impacts. The literature review of the report describes the measures of the economic impacts, their types, and also the economic impact of America's freight railroads to provide necessary background information to demonstrate the need for an objective economic impact analysis to assess evaluate different applications to the "NJDOT's Rail Grant" program.

Based on the literature review, it was also determined that IMPLAN is a commonly used tool to conduct the economic analysis of investments similar to the ones found in the applications to the rail grant program. Therefore, a chapter of this research report is devoted to a detailed review of IMPLAN. The use of IMPLAN by several other agencies is reviewed to support its use for the analysis of the economic impacts of railroad projects. Then, IMPLAN is used to quantify economic benefits of projects proposed in previous years under New Jersey's Rail Grant Program. Features such as multiple region scenarios of IMPLAN are used to determine the effects of investment in the railroad industry on the primary county as well as neighboring counties. The number of new jobs predicted by the applications and IMPLAN as a result of investments using the funds obtained from the program came out to be relatively different. Moreover, IMPLAN predicted mainly indirect jobs while the applications to the program predicted direct jobs. As a result of these findings, it is suggested that, like many other states, New Jersey can use a combination of IMPLAN and benefit-cost analysis to score the projects.

In the Traffic and Other Impacts chapter, traffic impacts of the projects are calculated by running the NJRTM-E travel demand model as the base network and evaluating the output in the ASSIST-ME tool previously developed by the research team as part of other NJDOT funded projects dealing with the quantification of highway transportation costs in New Jersey. ASSIST-ME is used to calculate the average costs for trucks making a trip on the highway network in lieu of rail. Estimations of savings in terms of dollars per unit that could have been experienced if the traffic is moved to roads were determined for various short rail lines.

Based on the results of this study, a number of recommendations to improve the existing "New Jersey Rail Grant" program are provided. It was concluded that NJDOT could consider finding a way to incorporate financial analysis into its management of this program as well as using it to redefine the program's purpose. Among some of the recommended improvements are the introduction of a more objective and standard method for the prediction of the economic and traffic impacts of the proposed projects and a well-defined process for post project monitoring and reporting. There is also an opportunity for a more rigorous monetization of emissions, safety, road maintenance and congestion costs in the benefit-cost calculation. In the application form there is

some double counting between the sub-criteria used for the BC analysis and other criteria in the NJDOT scorecard. The weights assigned to each criterion in the scorecard could also be revised to make sure they can be used to differentiate between feasible (realistic) and infeasible applications, and also to reflect the priorities of the NJDOT.

As the NJDOT approaches this self-imposed responsibility to redefine the rail freight assistance program, it is highly recommended that it considers strategic rail freight investments benefiting any worthy carrier that possess a reasonable chance of retaining or attracting industry in competition with other states, or re-mold the program to function as something that accomplishes both or some of both of those objectives.

INTRODUCTION

The New Jersey Rail Freight Assistance Program awards approximately $10 million annually in grants to freight rail operators for construction and improvement projects. The purpose of the rail investments is to promote and sustain economic development, as well as to maintain a balanced transportation system where rail is used in lieu of trucks when economically viable. However, the New Jersey Rail Freight Assistance Program, henceforth referred to as rail grants program, does not currently evaluate the impact of the grants after they've been awarded. More specifically, a study has not been conducted to evaluate the long-term impact of the program on the state's transportation goals. To that end, the New Jersey Department of Transportation (NJDOT) has begun studying the past performance of the program to learn the effects it has had on the NJ economy and transportation system, with the aim of potentially modifying the rail grants program based on their findings.

With scarce resources available, a proper evaluation of the rail grants program is critical to ensure that the program meets the needs of NJDOT and the traveling public. Likewise, it is important that the program contributes to the state's economy. To achieve these goals, Rutgers Intelligent Transportation Systems (RITS) Lab, Bloustein Center for Survey Research (BCSR), and railroad industry experts, Martin Robins and Dr. W. Bruce Allen, have formed a research team to evaluate the rail grants program.

Project Goal and Objectives

The research team has compiled information from the literature, similar grant programs of other departments of transportation (DOTs), and other sources to develop a comprehensive review of NJ's rail grants program. A second component of the report is the analysis of the economic impacts, traffic, and impact of the awards on various externalities. Several methodologies are reviewed and discussed throughout this analysis. Finally, based on the information collected and analyses conducted, the research team provides recommendations for improvements to NJDOT's program and application selection methodology. This report is divided into the following 7 chapters:

1. Literature review of rail grant programs, and program provisions of similar programs run by DOTs of several states
2. Summary of Freight Rail in New Jersey and NJDOT's Rail Grants Program
3. Summary of Interviews and Surveys with key informants
4. Economic analyses of rail grants
5. Traffic impacts and analysis of other externalities
6. Recommendations for improving NJDOT's Rail Grants Program
7. Conclusion

LITERATURE REVIEW

The Staggers Act of 1980 significantly loosened federal rail regulation and led to increased rail line abandonments. Since then, the number of short line railroads--short distance rail lines that connect freight origins or destinations to major (Class I) long-haul rail freight lines--has grown over 260%, to more than 500 operators in the United States [(1)]. Short line railroads are crucial to economic activity and the transport of goods, and their operations are critical for maintaining a low volume of goods transported by trucks on highways. While they connect with Class I railroads, the nation's major long-haul freight railroads, their state of repair often is unequal to Class I railroads. In order to preserve the railroad system's operations and network, many state DOTs have programs which provide loans or grants for rehabilitation and improvement projects. Short line railroads receive the most grant money at the state and local level [(2)].

Babcock [(3)] outlined the advantages and disadvantages of short line railroads. He listed the advantages as follows:

- Short lines have lower labor costs than Class I railroads and are more likely to be able to profitably operate low-density lines.
- Short lines can provide superior shipper service.
- If short lines are successful, they reduce the number of truck shipments, and ultimately reduce highway maintenance and rehabilitation cost.

Direct benefits of rail transportation also include environmental health and safety benefits (fuel efficiency and less air pollution, shipment of hazardous materials efficiently).

Studies on the consequence of additional trucks on highways resulting from short line abandonments have focused on the congestion, pollution, and pavement deterioration impacts of trucks on the highway network. Pavement degradation effects are twofold: first, highway agencies fill more potholes, repave more roads, and generally conduct more road maintenance; second, the deteriorated pavement conditions also reduce speeds and increase travel times for all vehicles using the roadways. The more time a vehicle spends on the road, the greater are the emissions released. In addition to lower travel speeds, dilapidated pavement also increases the operating and vehicle maintenance costs of all users. The Federal Highway Administration and other agencies measure the impact of trucks on pavement degradation and detailed speed roughness estimate poor pavements' effects on decreased travel speeds and reduced capacity [(4,5)]. A study using a New Jersey-specific model found that pavement roughness reduces vehicle speeds by up to 20 mph and capacity by up to 25% [(4,6)].

Feser and Cassidy [(7)] performed an ex-post evaluation of rail investment and highlight that there are many benefits to preserving railways that are often overlooked. These benefits include job creation, shipper impacts, highway damage, and safety. They found that the benefits to highway maintenance and operation were the most critical in terms of savings, and that evaluations of infrastructure investment focused too heavily on job creation [(7)]. Several researchers have found the negative consequences of railway

abandonment to include increased transportation costs and slowed economic activity and growth. Likewise, funding results in economic development and productivity. Freight rail provides shippers with cost-effective transportation, especially for heavy and bulky commodities, and can be a critical factor in retaining and attracting industries that are central to state and regional economies. These railroads provide shippers with an alternative to trucks. Moreover, the reduction of trucks on highways leads to lower maintenance costs for the state, as well as decreased congestion, noise, and air pollution, and increased safety [8,9,10].

Babcock and Sanderson [11] found that short line abandonment in Kansas would be detrimental to the agriculture industry and commodities transport, and would lead to $58 million in road damages because of increased trucking [11]. Activity on short-line railroads also has been found to have positive effects to Class I railroads, increasing their cost savings by 23% [12].

The case against short line railroad funding is composed of the following three components:

- Short lines are not likely to survive in the long run because of large, deferred maintenance expenses.
- Short lines are too dependent on a few commodities for most of their revenue.
- Short lines are too dependent on Class I railroads for equipment and market access.

Indeed, there are cost-benefit studies that have shown the cost of maintenance due to the abandonment of some railways is not in the same scale of the costs imposed by equivalent trucking trips. A North Dakota study estimated that impacts to highways from the conversion to trucking trips to be $1 million—but the cost to upgrade the rail infrastructure would be $191 million [13].

In the literature, federal studies consider several common factors and useful approaches that should be considered during the rail freight assistance evaluation processes. Besides the benefits of improving the transportation network and avoiding truck-related highway improvements, environmental impact and economic development potential are given the highest priority in the evaluation of the railway grant proposals. Regarding these benefits, there are also evaluation measures for rail grants that can be summarized as follows:

1. Benefits to short line operators & Class I operators
2. Benefits to shippers and receivers
3. Change in cost of goods and economic growth
4. Impacts to highways due to fewer truck trips, and their externalities
5. Impacts to the trucking industry

However, there is no singular evaluation methodology within the literature for the estimation of public benefits of rail transportation investments. Among the national studies, the NCHRP Report 586 – Rail Freight Solutions to Roadway Congestion [14]

presents guidance on evaluating the potential feasibility, cost, and benefits of investing in rail freight solutions to alleviate highway congestion from heavy truck traffic. It also summarizes key observations drawn from national case studies on the approaches of public agencies to rail freight benefits analysis:

- There is no single methodology for assessing projects with multiple categories of benefits and costs that include weighting factors varying from agency to agency.
- Equity and political issues involved in infrastructure financing must be considered.
- All approaches to benefit estimation are subject to debate concerning which types of projects are be analyzed and how public-private projects should be structured.
- Cost-benefit analyses must show that total project benefits exceed total costs, using the time value of money to compare the current and future costs and benefits. Cost-benefit analysis should also include non-monetary aspects, which must be quantified and weighted according to agency needs and considerations. Among the items to be considered are:
    - The effects of rail investments on rail cost and system performance.
    - Anticipated effect on the highway network, congestion, and air quality.
    - Predicted effects to land use, employment, growth, and the economy.
    - Effectiveness of the investment relative to other investments in the rail system and overall transportation system.

The American Association of State Highway Transportation Officials' (AASHTO) Freight-Rail Bottom Line Report [15] addresses several critical concerns regarding the overall capacity of the nation's freight-rail system to cope with the next 20 years of expected economic growth. It notes several categories of public benefits that should be considered for rail grants, including transportation system capacity and highway cost savings. Another benefit is related to economic development and productivity, as freight rail provides shippers with cost-effective transportation, especially for heavy and bulky commodities. Freight rail can also be critical to retaining and attracting industries central to state and regional economies. As the report notes, "if all freight-rail were shifted to trucks tomorrow, it would cost current rail shippers an additional $69 billion this year alone - or $1.4 trillion over the next 20 years - causing significant changes in business and consumer costs."

Furthermore, to increase the economic advantage and attractiveness of freight rail, many states are engaged in initiatives to raise the maximum allowance of rail car weight to 286,000 pounds (286 kips). While major Class I railroads have been designed or upgraded to the 286-kip standard, several of the older short-line railroads built for 263-kip or 220-kip cars are not able to handle these loads [16,17,18,19]. In some cases, older lines are allowed to run heavier cars but at much lower speeds, as per Federal Railway Administration guidelines. However, since most short line railroads cover a short distance and do not require high-speed standards, their rehabilitation and reconstruction costs are more manageable compared to long-distance Class I railroads. A 1999 study by AASHTO found that 59% of railroads surveyed were not constructed for 286-kip weight cars. The 185 surveyed railroads needed rehabilitation and construction totaling

$3 billion. Extrapolating this finding to all short line railroads, this represented a need of $7.9-11.8 billion, 23% of which was estimated to be funded privately [20]. A 2000 Zeta-Tech Associates study found that $6.8 billion was needed to upgrade short lines to 286-kip rail car standards [21]. Similarly, a 2007 Cambridge Systematics Inc. study found that the nation's freight rail network required $148 billion in rehabilitation and reconstruction expenses to keep pace with 2035 demand projections, $13 billion of which would exclusively spent on short lines [22]. Texas's short line railroads alone require $250 million (not including bridges) to meet 286-kip standards. If the lines were not upgraded and the goods formerly transported on rail were moved to trucks, the pavement damage over a seven year period was estimated at $49.8 million to rural interstates or $226.1 million if they used only rural major collectors [18].

The literature confirms the private and social benefits of maintaining short line railroads, but the cost of doing so is often prohibitive for short line operators. Thus, several assistance programs have been established—most of which are operated by state DOTs for rail lines within their states. Since there is no single methodology for administering the programs, several state DOT programs are reviewed in the following section.

Review of Other State Programs

The preliminary compilation of existing studies includes reviews of a wide variety of reports and documents, as well as the policies of the FRA, AASHTO, NCHRP, USDOT, and several states. The main goal of this compilation is to assemble the most relevant lessons learned from federal and state-based studies for the purpose of building a decision-making framework to reform the railway grant program and evaluation process. Ultimately, this review will help realize a consistent and systematic evaluation approach for each grant application.

Rail freight financial assistance is an important funding mechanism to promote and maintain railway infrastructure development. Today, state and federal departments of transportation fund freight railway projects. Though, until recently, most of the money has been appropriated for maintenance and rehabilitation, rather than new construction (23). Funding sources include federal and state grants and loans, as well as tax incentives for expansion and rehabilitation projects. NJDOT funds freight railway construction and rehabilitation projects with up to 90% of project cost (remaining funds are usually provided by railroad operators or contractors) [24]. The Federal Railroad Administration sponsors the Railroad Rehabilitation & Improvement Financing (RRIF) program (established by TEA-21 and SAFETA-LU) which provides loans of up to $35 billion for rail rehabilitation and construction projects [25].

In the past, the Local Rail Freight Assistance program (established in 1978) assisted states in maintaining light density railroads [26]. The Local Rail Service Assistance (LRSA) Program was established by the Regional Rail Reorganization Act of 1973 to provide financial support to bankrupt railroads in the Northeast for the continuation of rail freight service on light density lines threatened by abandonment. The Railroad

Revitalization and Regulatory Reform Act of 1976 expanded the program to all states. In 1978 the program was further expanded and amended to allow capital assistance for rehabilitation prior to, rather than after, abandonment proceedings. Amendments in 1981 prohibited the use of these funds for operating subsidies.

The program was reauthorized in 1989 and renamed the Local Rail Freight Assistance (LRFA) Program. When federal contributions to this program stopped in 1995, state-funded programs were formed to address rail needs while providing grants and loans for freight rail projects. Now, many states have local transportation rail grant programs to fund local and short line railroads—providing support for maintenance that will, in turn, attract and expand local industry. The cost-benefit methodology developed within the LRFA program to evaluate projects still exists or serves as the precursor to the cost-benefit evaluation methodologies used by states in their programs' evaluation criteria. States have developed their own evaluation methods, with different levels of complexity, to identify the public and transportation benefits of rail projects.

Program Provisions

Many state DOTs have rail grant programs designed to help fund local rail improvement projects needed to maintain or grow rail freight. The research team investigated how states evaluate the public benefits of freight rail projects as well as applications for funding. Certain states have developed evaluation methods, with different levels of complexity, to identify the public and transportation benefits of rail projects. In the following subsections, current state programs, which provide rail freight assistance on a project-application basis, are described based on information made available through the initial literature search. It is important to note that the information gathered may not cover all grants programs, and is largely based on reports or website content.

Federal Government

While TIGER grants are not specifically targeted at rail grants for freight shippers, they are studied for the evaluation criteria developed for grant applications [27,28,29]. Much government grant programs employ similar criteria or model their program evaluation criteria on the TIGER grants evaluation. The TIGER grant program targets major national and regional transportation projects that are in many cases difficult to pursue through other government funding programs. Selected projects for these grants must accelerate job creation, show strong economic benefits, and promote safer, cleaner, and more livable communities. The rating factors are as follows:

- **Rating Factor 1—Purpose and Outcomes (35 points):** Purpose and outcomes are based on six "Livability Principles":
  - ✓ Provide more transportation choices
  - ✓ Promote equitable, affordable housing
  - ✓ Enhance economic competitiveness
  - ✓ Support existing communities
  - ✓ Coordinate and leverage federal policies and investment.
  - ✓ Value communities and neighborhoods

- **Rating Factor 2—Work Plan and Program Evaluation (35 points):** This scoring category considers the quality of the project application and its cost effectiveness.
- **Rating Factor 3—Leveraging (15 points):** In kind matching or contributions from other public and private funding sources, supporting DOT funds.
- **Rating Factor 4—Capacity (15 points):** Regarding the applicant's capacity to successfully implement the project. Prior experience and collaboration with public and/or private organizations is preferred.
- **Department of Housing and Urban Development (HUD) Policy Priorities if necessary (5 points):** This criterion is federal government specific, with regard to HUD goals and objectives.

The Local Rail Freight Assistance Program methodology [30] was published by the Federal Railroad Administration for the former Local Rail Freight Assistance Program in 1990. After the LRFAP was completed, many state grant programs were initiated with similar scoring procedures and benefit-cost methodologies. The analysis is a nine-step procedure, each of which is briefly defined below.

1. **Establish the Project Alternative**
2. **Determine Project Costs**
3. **Determine the Null Alternative**
4. **Use the Standard Planning Horizon**
5. **Use a Discount Rate**
6. **Calculate Transportation Efficiency Benefits:** For operating railroad and its shippers.
7. **Calculate Secondary Benefits:** For example, reduction in State spending on highway maintenance from removing truck traffic from highways.
8. **Calculate Salvage Value**
9. **Calculate the Cost-Benefit Ratio:** The ratio is equal to the present value of the benefits divided by the project cost.

The following subsections detail cost-benefit methodologies and monetization factors used by other state rail freight assistance programs that have recently improved/revised their methodologies.

New York

New York State DOT (NYSDOT) runs the Industrial Access Program (IAP), providing 60% grant funding and 40% loan funding for several types of infrastructure improvements via an application basis [31]. As part of the 2005 Transportation Bond Act, $47 million in annual funds were authorized for the Passenger and Freight Rail Assistance Program (PFRAP) and bond program, which provides funding for AMTRAK Adirondack service and capital improvements to passenger rail, freight rail, and ports. Eligible projects include track/bridge construction and rehabilitation, the elimination of clearance obstructions, yard, terminal and siding construction and rehabilitation, signal and train control systems, grade crossing elimination, and rolling 20-year stock acquisition. Projects are funded that meet the following objectives:

- Promote rail safety.
- Preserve and improve short line railroads infrastructure with an emphasis given to projects that help attain line capacity for 286,000-pound rail cars.
- Increase capacity along Class I railroad corridors to provide more timely rail service between rail-truck terminals, along with promoting the development of rail-truck freight terminals to reduce the distance that goods need to be moved.
- Save for salvage cost, all engineering, construction, planning, design, and associated costs are eligible for funding, provided that applicants receive a 10% match. Projects must also be maintained and operated for a minimum of 30 years.

NYSDOT rail freight assistance program utilizes a cost-benefit procedure to evaluate applications using the following criteria: [32,33]

- Environmental
    - Carbon Emissions reduction
    - NOx Emissions reduction
    - Particulate Matter (PM) Emissions reduction
    - Conservation of fossil fuels (reduction in gallons used)
- Safety
    - Heavy truck crash reduction
    - Grade Crossing crash reduction
    - Rail accident reductions (derailments)
- Reduced Public Expenditures
    - Heavy Truck VMT reduction
    - Congestion Mitigation

Gathering necessary input data and assumptions are left to the applicant, but monetization factors for cost-benefit ratios are pre-defined.

Pennsylvania

The Pennsylvania Department of Transportation (PennDOT) funds two major freight rail programs: the Rail Freight Assistance Program (RFAP) ($10.5 million annual program) and Capital Budget Transportation Assistance Program (TAP) ($20 million annual program) [34]. The Pennsylvania Rail Freight Assistance Program uses the Pennsylvania Rail Benefits Estimator (RBE), a Microsoft Excel spreadsheet-based model developed in 2010 to evaluate grant applications and conduct cost-benefit analysis. The process of evaluating these grant applications includes the following:

- Funding offered for operations and construction, with planning, engineering, property acquisition, and construction aid is available
- Application requires data on carloads, commodities, routes, and employment
    - Direct and indirect effects of employment
    - Jobs created (short term like construction) and long term
    - Last 3 years of car loadings and 5–year future projected car loadings
- Projects limited to $700,000, with a 30% match requirement
- Staff review application and conduct site visit to ascertain viability and cost

- Applicants provide 20-minute overview presentation to the PennDOT project selection committee
- Staff score projects based on site visit and compatibility with state goals (e.g., safety, capacity, 286-kip network, economic development, connectivity, etc.)
- Cost-benefit analysis is conducted based on the developed RBE spreadsheet tool, which is based on economic analysis IMPLAN methodology and multipliers
- Post-evaluation of projects is conducted
    - Applicants are expected to achieve 50% of the projected carloads after 5 years
    - Department has special provisions for extreme circumstances

The Rail Freight Assistance Program uses the Pennsylvania Rail Benefits Estimator (PRBE), a Microsoft Excel spreadsheet-based model developed for PennDOT in 2010. The considered benefits include reduced highway maintenance costs, lower highway safety costs, and lower emissions which result from moving goods by rail and subsequently removing trucks from roads. The tool also estimates the direct and indirect effects on employment, including short-term (construction) and long-term (railroad) jobs created or maintained. The model is organized by modules for the following inputs:

- Project overview information (type, location, railroad, cost, etc.)
- Quantitative inputs (future job creation, carload projections)
- Qualitative assessment (scoring by PennDOT staff, based on several criteria)
- Default parameters and multipliers (factors used to assess impact; economic multipliers from the IMPLAN economic analysis model)

The key input is car loadings for truck-rail diversion. Qualitative scoring criteria include several categories: Infrastructure, Coordination, Economic, Environmental Sustainability, Safety and Security, Financial and Institutional, Benefits of Truck Reduction, Types of Benefits, and Track Condition. Each category contains several qualitative measures assigned a numeric score by the PennDOT review staff, usually between -10 and 15. The qualitative scoring sheet automatically sums the scores to provide a composite qualitative score. Finally, using the inbuilt factors and multipliers, the PREB uses the quantitative input and qualitative assessment to score the project.

Florida

The Florida Department of Transportation (FDOT) selects freight rail projects for state funding from its surface transportation program and Strategic Intermodal System (SIS) program [(35)]. The annual allocation for both programs varies, recently exceeding $100 million. Short line rehabilitation projects are required to have a 25% match from the applicant. The FDOT evaluates the project proposals using Florida Strategic Intermodal System (SIS) goals, and uses the Florida Rail Investment Calculator (FRIC) to carry out a cost-benefit analysis.

FDOT cost-benefit model, along with the Florida Rail Investment Calculator (FRIC), considers the following benefits when evaluating applications (36,37):

- Transportation Impacts: reduction in highway maintenance and reduction in costs for shippers
- Economic Impacts: job creation, tax revenue, and reduction in passenger delays
- External impacts: land use, safety, security, and environmental impacts

Once the benefits are quantified, they are combined, considered, and discounted over a total project span (e.g. 10 years) for the purpose of computing cost-benefit ratios.

Idaho

The Idaho Rural Economic Development and Integrated Freight Transportation (REDIFiT) is a revolving loan program with a low interest rate (<4%) [38]. Grants are also provided at a $100,000 maximum and require a 100% match. The typical loan amount is $5 million, and repayment periods may not exceed 15 years. Applicants are required to match loans with 10% of the project costs, although greater matches can be negotiated.

Illinois

The Illinois Rail Freight Program (RFP) provides low interest loans, and in some cases grants, on a project- by-project basis [39]. There is no formal application process. Applicants requesting funds from the state send in letters that detail the project's potential costs and benefits.

Iowa

The Iowa Rail Revolving Loan and Grant Program (RRLG) receives appropriations for loans and grants [40]. Projects that include job creation are eligible for grants with a 50% matching contribution, or loans with a 20% matching contribution. New jobs created because of the project must be at a wage level equal to 100% of the average county wage for the county where the project is sited. A minimum of $200,000 or 10% is set aside annually for rail network improvement projects that lack immediate job creation. Projects for rail network improvements with no anticipated job creation are eligible for a 10-year term with 0% interest and a 20% matching contribution.
The Rail Revolving Loan and Grant Program is administered by the Office of Rail Transportation through the Iowa Department of Transportation. This program focuses on two distinct evaluation processes for different kinds of projects:

- **Targeted Job Creation:**
  - **Jobs Leverage Score (40 Points):** Based on the total grant amount divided by the number of jobs created, up to 40 points are gained with a maximum of $6,000 per job created or retained from the total grant amount.
  - **Wage Quality Score (20 Points):** The percentage the project wage is above the county average wage, multiplied by 20.
  - **Capital Investment Leverage Score (20 Points):** Private investment per grant amount, with $3000 private investment per $1 granted equivalent to 20 points.

    - **Loan Leverage Score (20 Points):** The ratio of the loan amount requested to the grant amount requested.
- **Rail Network Improvement:** Service improvements, rail yard expansion and improvement, rehabilitation, and industrial park development. The review process for Rail Network Improvement Projects includes the following criteria:
    - **Other public benefits:**
        - Immediate benefits to shippers
        - Additional sales opportunities to shippers
        - Projected economic impacts of the rail development for the community/region
        - Expected private and public investment supporting the proposed rail project
        - Projected transportation savings from the proposed project

Kansas

The Kansas Department of Transportation conducted a review of the Kansas Short Line Rehabilitation program in 2005[41]. The program provides low-interest revolving loans and selected grants for both rehabilitation and to deter railroad abandonment. Increased speeds and the subsequent ton-hours saved are calculated based on the traffic, length of the segments rehabilitated and speeds across the segment. Ton-hour savings are calculated by:

- Annual tons across the rehabilitated section x miles of rehabilitated section ÷ average speed prior to the rehabilitation = pre-rehab ton hours
- Annual tons across the rehabilitated section x miles of rehabilitated section ÷ average speed after the rehabilitation = post-rehab ton hours
- Ton hour savings = pre rehab ton hours – post rehab ton hours
    - Average payload per rail car is assumed to be 100 tons per car
    - Average total variable cost per ton hour set at $1.20
    - Ton hour variable cost based on average operating cost of 6 cents per ton mile x 20 mph = $1.20; 40 percent of average variable cost per railroad ton hour is assumed to be variable with railroad operating hours

To calculate the benefit of preventing rail abandonment, rail cars by commodity are converted to rail car miles and then truck miles, assuming the commodities will be transported by truck after the rail lines are abandoned. The following assumptions are used:

- An average hopper car payload of 100 tons in a rail car
- Railcars are converted to trucks on an average truck payload of 20 tons per truck
- Average rail operating cost per ton mile = 6 cents per ton mile
- Average truck operating cost per ton mile = 12 cents per ton miles

Shipper surveys were conducted to determine if businesses would survive or relocate after a railroad had been abandoned. Six of the 27 shippers interviewed indicated that they would go out of business. Others indicated they would relocate. Assuming an

average wage rate of $20,000, lost yearly wages, state income taxes, and sales and local taxes were calculated for current rates. Highway maintenance and rehabilitation cost savings were calculated based on an assumed average highway maintenance cost of $0.00265 per truck ton-mile.

Kansas T-WORKS maintains a rail service improvement fund that provides both loans and grants to short lines at approximately $5 million annually. A 30% local match is required.

Maine

The Industrial Rail Access Program (IRAP), operated by the Office of Freight Transportation within Maine DOT, provides $1 million in state funds to cover a maximum of 50% of estimated project costs [(42)]. Projects eligible for funds include accelerated maintenance, rehabilitation, new siding improvements, right-of-way acquisition, and inter-modal facility construction. Project applications are solicited from any interested parties and are ranked using a competitive rating scheme that focuses on economic enhancement and public benefit.

Maryland

Maryland provides capital funds to state-owned rail lines operated by a short line railroad operator [(43)]. These funds are provided on a case-by-case basis, with varying funding depending on available funds and project criteria.

Minnesota

The Minnesota Rail Service Program (MRSI) Program was created in 1976 with appropriations totaling $16.0 million and bond appropriations totaling $25.5 million over the life of the program, in addition to other small legislative appropriations added [(44)]. The 10-year capital improvement loans are granted at a maximum of $200,000. The loan fee is equivalent to 10% of the loan unless the applicant has demonstrated an investment of $10,000 or more, in which case the loan is interest-free.

With the adoption of the Minnesota Statewide Transportation Plan in 2003, the Minnesota DOT (MnDOT) began implementing a performance-based approach to investment decision-making [(44)]. The Department's general performance measure selection criteria were developed upon the following basis: the quantitative evaluation of individual and corridor projects proposed for the strategic rail plan and the qualitative assessment of public and private sector roles in project implementations. Also considered is the qualitative assessment of the level of financial participation from public and private sectors. Depending on the application and its purpose, one or more of the identified performance measures can be used for evaluation criteria of rail grants. Within each category six major groupings are defined as performance measures:

- **System Performance:** demand, service characteristics and reliability, and available/existing right of way

- **System Condition**: condition of track and structures, and supporting 286-kip loads
- **Connectivity and Accessibility:** to businesses, population, and the multi-model transportation system
- **Safety and Security:** accident rates, severity, grade separation, etc.
- **Environment:** air quality, noise, and land use impacts
- **Financial/Economic:** Costs vs. benefits, financing, and economic growth

With the adoption of the Minnesota Statewide Transportation Plan in 2003, MnDOT began implementing a performance-based approach to investment decision-making [(44)]. Their general performance measure selection criteria consider quantitative measures, qualitative measures, and an assessment of the level of financial participation from the public and private sectors. For freight rail, the following categories of performance measures are considered:

- System performance
    - Demand (mode share, value)
    - Service (tonnage, value, travel time, % system with service speeds > 25mph/level
    - Physical system characteristics (available right of way)
    - Reliability (service interruptions, delays, customer satisfaction)
- System condition
- Connectivity (rail access, intermodal connections, employment) and Accessibility (shipping rates, highway impacts, proximity to population)
- Safety and Security (grade crossings, rail and truck crashes, accident severity, access security)
- Environmental (emission reduction, land use impacts, noise, local support)
- Financial (costs, revenues, jobs created, induced economic growth, reduced highway costs)

Ohio

To encourage companies to locate or expand in Ohio, The Ohio Rail Development Commission (ORDC) offers loans and grants and may issue bonds for qualified rail projects [(45)]. The legislature allocated nearly $5 million in 2002, most of which was spent on grant programs. Funds are available for the construction or rehabilitation of industrial lead tracks, rail spurs or other rail infrastructure, and passenger rail facilities. The program provides both grants and loans, offered to both public and private entities. Qualified applicants can include railroads, private corporations, and industries requiring rail service; political subdivisions, government agencies, and boards or commissions; regional transit boards; and port authorities. Grants are used for cases that exhibit the most need or that lack a direct revenue stream, but are generally limited to less than 50 percent of project costs and up to $1,000 per each job created or retained. Grants are also limited to projects with significant job creation or retention (25+ jobs), and clawback is employed either when creation/retention numbers are not met or for rail usage. The loan program provides a five year loan with a two third prime interest rate.

Applications require sources of revenue generated by the line, and an average net profit/mile and investment/mile for the last three years. Benefit analysis is often used to determine eligibility for assistance. Eligible benefits include but are not limited to job creation and retention, transportation cost savings, new investment, increased viability of rail, relief of highway congestion and maintenance, and safety improvements.

To encourage companies to locate or expand in Ohio, The Ohio Rail Development Commission (ORDC) conducts a benefit analysis that considers the following:

- Job creation and job retention
- Transportation cost savings and preservation of existing competitive costs
- New investment in plant and facilities by rail users and the associated tax benefits
- Increased viability of the rail operation
- Relief of highway congestion and maintenance
- Safety improvements.

Ohio DOT uses the following scoring criteria based on percentages to evaluate the applications for rail grants:

- Transportation Factors (55%)
- Community Economic Growth and Development Factors (25%)
- Local and Private Investment Factors (20%)

To assess these impacts, inputs are added to a spreadsheet-based tool to conduct cost-benefit analysis. Several monetization factors are utilized and built into the spreadsheet tool.

- The employment data calculation, total job, and wage impacts are calculated by applying a factor of 1.7 to the applicant-reported data. This suggests that for every job created by the applicant and applicant's customer, 0.7 indirect jobs are also created in Ohio.
- Transportation costs are calculated as \$0.103 *x* net new ton-miles calculated under section II – commodity data.
- Similarly in Section VI, highway maintenance cost savings are taken as \$0.0056 *x* net new truck ton-miles, and highway congestion cost as \$0.048 *x* net new truck miles.
- In Section VII, reduced fatalities are calculated as (3.702/1,000,000,000) *x* net new ton-miles, with a cost monetization of \$6,000,000 per fatality. For injuries the factors are (93.226/1,000,000,000) *x* net new ton-miles, with a cost monetization of \$93,000 per injury.
- Rail fuel usage is calculated as 0.00231 gallons *x* net new ton-miles calculated under section II – commodity data and truck fuel usage at (1/5.1) gallon *x* net new truck miles. The net savings in rail fuel usage over truck fuel usage is monetized by the current per gallon fuel price, a user input.
- Environmental emissions are calculated as follows:
    - CO reduction is calculated at 3×10^{-6} *x* 5.1 *x* truck fuel usage calculated in Section VIII minus 3×10^{-5} *x* rail fuel usage. However, the CO is monetized.

- NOx reduction is calculated at 3.7×10^{-5} *x* 5.1 *x* truck fuel usage minus 2.67×10^{-4} *x* rail fuel usage. NOx is monetized at $4,000 per reduction value calculated.
- Particulate Matter reduction is calculated at 5×10^{-7} *x* 5.1 *x* truck fuel usage minus 7×10^{-6} *x* rail fuel usage. PM is monetized at $168,000 per reduction value calculated.
- CO_2 reduction is calculated at 3.7×10^{-5} *x* 5.1 *x* truck fuel usage minus 2.67×10^{-4} *x* rail fuel usage. CO_2 is monetized at $4,000 per reduction value calculated.

Oregon

The Oregon Department of Transportation (ODOT) administers ConnectOregon, a lottery-based bond program to improve highway, air, and rail infrastructure [46]. The program was authorized in 2005 and reauthorized in 2007 and 2009. Since 2005, the ConnectOregon program has funded $300 million in projects, nearly 50 percent of which are rail projects. ConnectOregon stipulates that all regions in the state must have at least 10% of the funds allocated to them. Applications are reviewed by stakeholders, transportation experts, local residents, and then approved by the Oregon Transportation Commission. In lieu of projections from the railroads/applicants, an independent consultant calculates the economic benefits of each application.

Virginia

The Virginia Department of Rail and Public Transportation (VDRPT) administers three programs that support freight-rail investments [47]:

1. Rail Enhancement Fund (provides a 70% funding match for all types of passenger or freight rail projects)
2. Rail Industrial Access Grants
3. Rail Preservation Grants (supports short line railroads)

Three variations of the cost-benefit model customized to each of the respective programs are used as part of a broader evaluation conducted by VDRPT. As part of the applications, data is collected throughout Virginia on current and future carloads (or intermodal units), trucks diverted, and mileage. The analysis considers secondary benefits such as reduction in state spending on highway maintenance, leveraging public and private funds, and contributing to the overall transportation system, as well as the timeline for construction. 90% of funds are reserved for capital improvements (limiting planning and engineering to 10%). A contractor conducts a cost-benefit analysis over a 20-year horizon, and the projections are audited every 5 years. The auditing measures annual traffic data, and the applicant is required to pay back grants on a prorated basis (plus interest) if targets are not met.

Washington

There are two freight rail funding programs administered by the Washington State Department of Transportation (WSDOT) [48]: the Washington Rail Bank ($5 million every two years) and the Freight Rail Assistance Program ($2.75 million per year). Because

the state constitution prohibits transfer of public funds to private enterprises, WSDOT cannot provide funds directly to railroads. Therefore, the applicants for freight rail funding assistance are municipalities and other public agencies or port and other special districts. WSDOT uses a spreadsheet-based cost-benefit analysis (CBA) methodology to evaluate applications [49]. The key elements of the evaluation process are:

- Internal CBA calculation on all applications. WSDOT updates the approach each year to reflect current needs for transportation improvements.
- The State Department of Commerce provides input on approximately 25% of the evaluation having to do with job creation and other economic variables. Depending on the nature of the application, other state agencies are involved.
- WSDOT conducts workshops each year to provide potential applicants with instructions and training on preparing applications.
- Applicants are required to provide car loadings with an indication of “empty or full” and data for audit purposes.
- All projects are subject to legislative approval.

WSDOT uses a spreadsheet-based cost-benefit analysis tool based on the recommendations provided in the Statewide Rail Capacity and System Needs Study finalized in December 2006. The Cost-Benefit Analysis Calculator is a spreadsheet with areas of benefit, equations for calculations, and benefit parameters to calculate the cost-benefit ratio for a given project or action on a project.

Summary

A summary for the characteristics of rail grant programs of various states is given in Table 1 below. It is important to note that this information is based on what was available to the research group during the literature review. The table contrasts program provisions of other states with New Jersey, which is further described in following chapters.

Many states utilize loans to further extend limited funding, and negotiate loan terms and matching requirements based on the ability of the applicant or funding situation. Clawback provisions are used by many programs, several of which are in conjunction with mandatory post-evaluation. Post-evaluation requires data collection for several years following construction completion to ensure projected carloads, job creation/preservation, and the critical components of cost-benefit analysis are not unrealistically inflated. The projections must be realized (usually to a certain minimum level) or some or all of the grant money must be returned. While a cost-benefit analysis is required by all states, the details for each analysis vary, with some states (such as Oregon and Virginia) outsourcing their economic analysis to third parties.

Table 1: Comparison of Select State Programs

State	NJ	NY	PA	MN	FL	ID	IL	IA	KS	MD[1]	ME	OH	OR	VA	WA
Grant Only	X		X		X						X		X	X	
Grant & Loan		X		X		X	X	X	X			X			X
Match required	X	X	X	X	X	X		X	X		X	X		X	
Clawback/ Collateral		X	X	X		X		X				X		X	
B/C and/or Economic Analysis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Independent Economic Analysis													X	X	
Post-Evaluation			X		[2]			X				X		X	X

Previous studies on short line railroad maintenance and abandonment all indicate the following consequences of short line railroad abandonment:

- Lack of an alternative option to trucks for shippers and receivers
- Increased cost of goods movement and goods, and consequent economic effects
- Decrease in revenue for Class I railroads
- Increase in trucking, and its effects on highways including:
    - Pavement and structural maintenance
    - Noise and air pollution
    - Safety
    - Congestion

In response, the Local Rail Freight Assistance Program and other state programs run by state departments of transportation have allocated public funding for the maintenance and rehabilitation of freight railroads. A review of these programs revealed that these programs have several common elements but several different characteristics and criteria for disbursing funding. The review process revealed the following key results:

- No single methodology is used to manage rail freight assistance programs and evaluate applications submitted for funding.
- Several states solely offer loans or use loans in conjunction with grants to make use of limited funds. At some percent of project cost applicant matching is often required. Requirements differ from state to state. Several states also negotiate or

[1] Maryland's program provides loans/grants to private operators of state-owned lines, with terms on a case-by-case basis
[2] Considered but abandoned

offer higher match contributions based on the ability of the applicants and the needs of the project.

- States tend to measure the same types of public benefits – largely relying on quantitative measures such as rail traffic (carloads) and job creation (short- and long-term). Network improvements, connectivity, and other, less precise measures are also considered, as are safety and pollution impacts.
- The factors used to weigh the evaluation criteria in the respective analyses differ from state to state but in all cases, a positive cost-benefit ratio is required for funding eligibility.
- Most states require applicants to provide basic information about the forecast of the change in freight rail traffic and projected job preservation/creation. Some states post-evaluate projections to ensure they are not inflated and unrealistic. To accommodate certain findings ascertained during post-evaluation, clawback provisions are usually employed to recover loan/grant money from the applicants.
- Some states employ outside consultants to conduct the cost-benefit analyses, while others utilize other state agencies involved in economic development.
- Site visits to project locations by the funding agency staff are often employed and applicants make in-person presentations to agency staff—measures that allow application evaluators to better understand the purpose and need for the proposed projects.

The provisions of rail grant programs run by other states are highlighted as potential areas for the future enhancement to the NJ rail freight assistance program.

Several cost-benefit calculation methodologies and example tools are presented in the previous sub-sections. Table 2 compiles several other rating criteria used by different programs in the summary, all of which can be compared with NJDOT's criteria in Table 3 *(14, 15, 20)*. NJDOT's scoring criteria can be broadly grouped into the following categories:

- **Economic factors: 0-7 points (27%)**
- **Transportation factors: 0-13 points (50%)**
    - Service and reliability: 0-5 points (19%)
    - System improvements, continuation of previous projects: 0-5 points (19%)
    - Highway congestion, energy, and environmental savings: 0-3 points (12%)
- **Cost-benefit ratio: 0-3 points (11.5%)**
- **Application quality: 0-3 points (11.5%)**

New Jersey's factors are comparable to the other factors listed in Table 2. There are some issues in the scoring used by NJDOT that were investigated by the research team in this study. For example, double counting is an issue, where the factors considered individually and then again in the cost-benefit calculation may be counted twice. Jobs and carloads questions are based on maintaining or increasing numbers and can only be scored as 0, 1, or 2; no weights are given to percentage growth or total numbers. It may be redundant to ask if the project reduces trucking emissions as well as if the project reduces long-haul trucking. This study evaluated the weights and factors considered by the New Jersey Program considering several questions, for example:

- Should economic justification be given greater weight?
    - If a project shows promise for inducing productive investment and job creation/retention in NJ, then the amplitude of points available should be expanded.
- Should applications that seek improvements that would enable a short line to carry 286,000 lb. carloads be accorded a high priority?
    - Rail cars with a gross weight of 286,000 lbs. are becoming standard in the U.S. This improvement could affect the ability of a short line to retain its customers and thus substantiate its future economic viability. Adding this improvement could then become a priority category.
- Should the amount of financial assistance requested be always fully granted?
    - In some cases, other sources of financial assistance can be suggested and/or encouraged.
- Should tax revenues be included in benefit/cost calculation?
- Should monetization of emissions, safety, maintenance, and congestion costs be included in both the benefit/cost calculation and application evaluation?

Table 2: Scoring Criteria for Selected Program

State	Scoring Criteria	
Iowa	Targeted Job Creation	Jobs Leverage Score (40 points)
		Wage Quality Score (20 points)
		Capital Investment Leverage Score (20 points)
		Loan Leverage Score (20 points)
	Rail Network Improvement	*Immediate Job Creation is not required for these projects*
Ohio	Transportation Factors	55%
	Community Economic Growth and Development Factors	25%
	Local and Private Investment Factors	20%
Indiana	Transportation Efficiency	50%
	Safety	25%
	Economic Development	15%
	Customer Input	10%
	Bonus Points on Urban Revitalization	10%
Maryland	Long Term Outcomes	These two criteria are given more weight than others
	Job Creation & Economic Stimulus	
	Innovation	These are rated equally
	Partnership	
TIGER II Grants	Purpose and Outcomes	35 points
	Work Plan and Program Evaluation	35 points
	Leveraging	15 points
	Capacity	15 points
	Departmental Policy Priorities (if necessary)	5 points

Like New Jersey, most states only consider benefit - cost (B/C) ratio to be one component in the overall analysis. Pennsylvania stands out for using a tool that combines both quantitative B/C measures as well as qualitative application scoring in a logical manner to evaluate applications. Jobs questions can only be 0, 1, or 2 points, on top of their dollar value in the B/C analysis. Some factors rated individually are also implicit in the benefit/cost calculation. These implicit factors include the following: Reducing trucking emissions and other impacts/reducing long-haul trucking, No points for volume of jobs created/retained (though this is part of the B/C analysis) or emphasizing job growth. Some projects could affect the ability of a short line to retain its customers and, thus, determine its future economic viability. Consider the amount of financial assistance requested and encouraging other sources of financial assistance. Tax revenues in the B/C calculation include the monetization of emissions, safety, maintenance, and congestion costs in both the benefit/cost calculation and application evaluation.

Table 3: Benefit Cost Calculations of other States compared to NJ

B/C Analysis	NJ	NY	PA	FL	IA	OH	WA
Analysis tool	Spreadsheet	None; Applicants provide B/C	Spreadsheet-based tool	Spreadsheet-based tool	Internal DOT	Spreadsheet-based tool	Spreadsheet
Multipliers/ Factors set by	State	State	Tool (IMPLAN)	State/Tool	State	State/Tool	State
Combines B/C Calculation with Application Scoring	No	No	Yes	No	Yes	Yes	No
Includes Jobs	Yes	No	Yes	Yes	Yes (with a Cap)	Yes	Yes
Includes Indirect/ Induced Jobs	No	No	Yes	Yes	Yes	Yes	No
Includes Trucking Jobs Lost	Yes	No	No	No	No	No	No
Includes Highway Maintenance and/or Congestion	No	Yes	Yes	Yes	No	Yes	Yes
Includes Emissions and/or Fuel Usage	No	Yes	Yes	Yes	No	Yes	Yes
Includes Highway Safety	No	Yes	Yes	Yes	No	Yes	Yes
Includes Tax Revenue	No	No	No	Yes	No	No	Yes
Includes Operator/ Shipper Costs	Yes	No	No	Yes	Yes	No	Yes

FREIGHT RAIL IN NEW JERSEY

In this and the following section, the research team presents findings specific to New Jersey. Railroads within New Jersey are introduced first, as they are the recipients of the NJDOT grants.

The trend that has emerged in recent years is the ownership of multiple lines, dubbed the “conglomeratization” of the short line industry. There are some scale economies in marketing, safety (hiring specialists for larger conglomerates), and purchasing, as well as leverage with connecting carriers. Many short lines only have a connection with the railroad that originally owned the line-as a branch line off their main system. As the short line’s only connection, the line is vulnerable in regard to service as well as getting a share of the total rail rate (from origin to destination). In New Jersey, most short lines interline with Conrail, so the carriers have a choice of CSX Transportation (CSX) or Norfolk Southern railway (NS). A few carriers also have a third choice of Canadian Pacific (CP).

The disparate ownership of lines is important for spending allocation leeway. For instance, New Jersey grant funding could free up money to be spent on a conglomerate’s railroad in another state. For example, the Belvidere and Delaware River has tracks in PA; SMS has tracks in PA and NY; the Winchester and Western have tracks in VA and WV; Raritan Central has tracks in PA; Morristown and Erie have tracks in PA and ME; U.S. Rail has tracks in NY, OH, IN, and KY; and New York, Susquehanna, and Western have tracks in NY.

Nationwide, ownership can be public such as the ownership of right of way by the NJDOT, NJ Transit, counties, Port Authority of New York and New Jersey). Ownership can also be shared with Class I railroads, as in the case of Conrail, New York, Susquehanna, and Western by NS and CSX. Likewise with company railroads such as Winchester and Western-owned by Unimin with extensive sand mining in Cumberland County and East Jersey Railroad and Terminal Company owned by International-Matex Tank Terminals (IMTT). There can also be ownership with rail short line “conglomerates” as pointed out below), or individual rail entrepreneurs. In other words, the right of way and operations ownership is either separate or it is combined.

Freight Rail Operators

In 2009, the Association of American Railroads (AAR) lists the following New Jersey railroads and their mileages as short line and regional railroads. Note that the AAR’s miles are usually rounded up to the next mile and sometimes differ from the miles given by the corporate websites as well as the Surface Transportation and Railroad Retirement Boards. This does not include Conrail (aside from their mileage), which is wholly owned with 50-50 voting rights by NS (58%) and CSX (42%).

Regional Railroads

1. New York, Susquehanna, and Western Railroad with 91 miles in Hudson, Bergen, Passaic, Morris, and Sussex Counties

Local Railroads

1. Belvidere and Delaware River Railway Company with 20 miles in Hunterdon County
2. Morristown and Erie Railway Inc. with 42 miles in Morris and Union Counties
3. New Jersey Rail Carriers LLC with 2 miles in Hudson County
4. New York and Greenwood Lake Railway with 2 miles in Bergen and Passaic Counties
5. SMS Rail Service Inc. with 13 miles in Gloucester County
6. Southern Railroad Company of New Jersey with 53 miles in Camden, Atlantic, and Cumberland Counties
7. Winchester and Western Railroad with 54 miles in Cumberland County

Switching and Terminal Railroads

1. Black River and Western Railroad with 17 miles in Hunterdon County
2. Conrail Inc. with 469 miles in NJ
3. East Jersey Railroad and Terminal Co. with 3 miles in Hudson County
4. New York, New Jersey Rail LLC with 1 mile in Hudson County
5. Port Jersey Railroad with 5 miles in Hudson County
6. Raritan Central Railway LLC with 17 miles in Middlesex County
7. US Rail Corporation with 18 miles in Salem County

There are at least three other railroads in New Jersey:

1. Cape May Seashore Lines with 27 miles in Cape May County
2. New Jersey Seashore Lines with 13 miles in Ocean and Burlington Counties
3. Hainesport Industrial Railroad with 1 mile in the Hainesport Industrial Park in Burlington County

NJ Rail Grants Program[3]

Precursor to the Current NJ Rail Freight Assistance Program

In 1975, NJDOT released a “State Rail Plan” that documented various rail transportation projects that sought to preserve specific freight transportation needs as part of the Federal Rail Freight Assistance Program (RFAP). In 1978, the New Jersey State Plan for Rail Transportation and Local Rail Services “Goals and Objectives” published criteria for the evaluation of candidate projects to be included in the state rail plan following the guidelines of the RFAP. The following key goals and objectives were identified:

[3] The information below is taken from corporate websites (which, in a number of cases, are quite dated and inconsistent) and from other public sources (cited if not a website) as well as from the websites of the Railroad Retirement Board and Surface Transportation Board (the abbreviations are the formal railroad codes recognized by the Surface Transportation Board).

- **Goal**: Provide freight transportation systems, which support the economic development of the State of New Jersey.
- **Objective**: Provide for the continuation of efficient freight transportation systems which service existing industrial and business demands.
- **Objective**: Implement systems of freight transportation, which conform to the planned development of the State of New Jersey.
- **Goal**: Provide passenger transportation systems which equitably satisfy the travel desire of the population of the State of New Jersey.
- **Objective**: Protect and maintain all existing rail passenger services determined to be essential by the NJDOT transportation planning processes.
- **Objective**: Protect all railroad rights-of-way identified as necessary for proposed rail passenger services.
- **Goal**: Provide transportation systems consonant with the environmental well-being of the State of New Jersey.
- **Objective**: Minimize the loss of any mode of transport, which is more energy efficient than a substitute mode.
- **Objective**: Minimize the loss of any mode of transport that is less polluting than a substitute mode.
- **Goal**: Provide alternative means of transportation wherever possible, giving consideration to the economic equity provided to the entire State populace.
- **Objective**: Implement projects, which minimize the direct cost to the general population of the State of New Jersey.
- **Objective**: Provide documented recommendations identifying transportation demands within the State of New Jersey.

Detailed explanation on each of the goals and objectives is provided, as is a sophisticated cost-benefit analysis methodology. The following data was collected for each candidate project to evaluate the job loss prevented by the project being included in the state rail plan:

- Estimated railroad job losses (from railroad company estimates)
- Increased transportation costs for shippers switching to truck (from shipper)
- Business sales, volume, and employment of shippers
- Secondary jobs in basic industries
- Average area wages and transportation costs

The methodology also analyzed tax revenue losses that would be incurred by not funding freight improvement projects. This included income tax for employees based on job losses calculated, property tax losses based on companies closing or moving, and increased unemployment compensation paid by the state. Finally, data was collected to estimate air and noise pollution impacts, increased energy consumption, and increased highway maintenance costs. In total, 12 sophisticated analyses were recommended for the consideration of each candidate project, as follows:

1. Primary job losses
2. Secondary job losses

3. Income tax losses
4. Property tax losses
5. Increased transportation costs
6. Wage and salary losses
7. Increased unemployment compensation
8. Personal income losses
9. Energy consumption
10. Air pollution
11. Noise pollution
12. Increased highway maintenance costs

Current Application Requirements

Today, the application requirements and review process are simpler than those recommended in 1978. The application itself asks for information on the project and cost estimate, along with descriptions on how the project benefits the state rail system and overall transportation goals. Benefit descriptions are provided by the grant applicants in the following categories:

- Economic benefits to the State of New Jersey
- Efficient and Responsive Freight Distribution
- Energy and Environmental Factors
- Highway Congestion Mitigation
- Benefits to Applicants
- Benefits to the Community

Applications are then individually scored in each category based on the responses provided by the NJDOT staff. Data is collected from each of the applicants regarding their customers, the number of carloads served, and revenue per carload. Data is also collected on projections for future car loadings and the number of jobs estimated to be saved or created. The NJDOT uses this data within a cost-benefit spreadsheet analysis to determine the strength of the candidate projects. Up to $10 million is awarded annually (except during the fiscal year 2011) for the strongest projects.

Since 1983, the NJDOT's Rail Freight Assistance Program has distributed state funds for rail freight improvement projects in accordance with the NJ State Rail Plan. The NJ rail grant program funds work on the state's rail lines for land acquisition, rehabilitation/reconstruction of existing lines, new construction, and efficiency improvement costs, but not operating costs. The projects are funded between 50%-90% by the NJDOT, depending on the recipient of the grant. Most recently, projects for Class I railroads were funded with 50% state funds, 70% state funds for Class II railroads, and 90% for Class III railroads. However, this tiered structure was not always in place. The published criteria for project selection are as follows:

- Economic Impacts (job creation, benefit to business and shipping)
- System Preservation and Enhancement
- Energy and Environmental Impact Savings
- Highway Congestion Savings

Since 2005, the program has funded approximately $10,000,000 worth of projects annually (except in 2011). The funding levels prior to 2005 are provided[4] in Table 4.

Table 4: NJDOT Rail Grants Funding Level 1994-2005

Funding Year	Funding	
2005	$	10,000,000.00
2004	$	13,000,000.00
2003	$	5,400,000.00
2002	$	9,000,000.00
2001	$	2,000,000.00
2000	$	7,000,000.00
1999	$	2,000,000.00
1998	$	10,000,000.00
1996	$	1,000,000.00
1994	$	3,704,721.00
TOTAL	**$**	**63,104,721.00**

Statute and Administrative Code

The rail freight assistance program is governed by the New Jersey Statute Title 27:1B-5, and further clarified in the administrative code under NJAC 16-53c. According to NJAC 16-53c, which is valid until January 13, 2016, financial assistance shall be provided for 3 types of projects:

1. Rail facility construction to improve the quality and efficiency of existing rail freight service, such as new connections between two or more existing lines, the relocation of lines or sidings, modernization of existing facilities, construction of freight facilities and construction of new facilities.
2. Rail line rehabilitation or reconstruction requiring a one-time investment of financial assistance in order to ensure the continuation or creation of safe, adequate, and efficient rail freight services on the rail line for a period of five years or more.
3. Demonstration projects that use non-standard or experimental methods and materials, which have the potential to offer long-term cost savings or environmental benefit over the life of the material or facility.

Projects must prove to have a B/C ratio greater than 1.0, as determined by NJDOT, to be included in the state rail plan, unless the project is deemed to be a system-critical link or emergency in nature. Projects cannot be for routine maintenance, and must prove that they have the potential to serve more than one user. The administrative code specifies financial assistance for projects up to 90% of the total eligible cost to rehabilitate or reconstruct a rail line to the safety standards of the Federal Railroad

[4] Data was not available for 1995 and 1997

Administration. For bridges or state-owned lines, funding may be provided up to a maximum of 100%, and up to 95% for demonstration projects. Funds are provided as reimbursement to the grant applicant, and only cover the cost of construction, construction supervision, inspection, and material testing. Engineering and right-of-way acquisition costs are not covered, unless specifically allowed by NJDOT.

Data Obtained by the Research Team

The research team visited the NJDOT on several occasions during 2011-2012 to obtain electronic records of the rail freight assistance program applications received by NJDOT. In addition, the team copied and scanned several documents, including scorecard evaluations used by freight applications evaluators at the NJDOT.

The file provides basic information about the projects including if a project was funded, the project name, project number, requested funding, the state share of cost, municipalities, agreement dates, and invoice information.[5] The file contained some MS Excel formula errors in certain cells, and has been corrected. Table 5 below provides a summary of the file, which highlights:

- The rail grant program between FY 2003 to 2011 approved 143 of 242 considered projects. [6]
- New Jersey paid an average of 78% of the project cost, which totaled $68 million of the $88 million costs incurred by the 136 funded programs.[7]
- The New York, Susquehanna and Western Railway (NYS&W) railroad was by far the most frequent user of the program, and sent 61 applications between FY 2003 and 2011.

Since 2003, the NJ Rail Freight Assistance Program has received an average of 26 applications per year, and, on average, has funded 16.5 annually. The funding levels since 2003 have fluctuated between $7 million and $14.5 million per year, with an average funding of $10.5 million. Note that the number of funded projects has steadily reduced while the funding level has remained stable. This suggests that the program is now funding fewer projects but providing those projects with a higher level of support. As previously noted, the fiscal year 2011 projects were approved but never funded. Table 5 provides a summary of applications and funding by fiscal year[8].

[5] Data Notes: The grand summary file is a database of unique railroad applications, and does not fully capture the phenomenon of freight rail companies resubmitting previously rejected applications. This was tracked in the Grand Summary File, which indicates the earliest known year that an application was submitted. However, it is difficult to capture this information; it was only found in 14 records.

[6] In FY2011 the program approved 7 projects, but has yet to fund them.

[7] This does not include the FY2011 numbers because they have yet to be funded

[8] For seven (7) projects in the original grand summary database had no FY attached to the record, and could not verify the year through other sources.

Table 5: Number of Applications by Year – FY 2003 to FY2011

Year	Applications	Funded	Approved/ Not Funded	Missing	Requested	Allocated	% Allocated
2003	33	28			$14,547,856	$9,751,449	67%
2004	27	23			$10,817,068	$8,610,583	80%
2005	33	21			$11,330,881	$8,569,298	76%
2006	30	13		1	$9,577,624	$7,065,025	74%
2007	20	11			$7,326,241	$6,316,410	86%
2008	19	11			$6,513,172	$5,398,849	83%
2009	29	11			$12,636,613	$10,200,152	81%
2010	30	15		2	$14,300,869	$12,292,255	86%
2011	13		7		$7,086,495	$6,377,846	90%
Missing	*7*	*3*			*$938,734*	*$709,861*	*76%*
Total	**241**	**136**	**7**	**3**	**$95,075,553**	**$75,291,726**	**79%**

NJDOT APPLICATION EVALUATION

Application Scoring

Since 2003, the NJ Rail Freight Assistance Program has received an average of 26 applications per year, and, on average, has funded 16.5 annually. The funding levels since 2003 have fluctuated between $7 million and $14.5 million per year, with an average funding of $10.5 million. The evaluation process can be divided into two time periods: pre-scorecards and scorecards. The pre-scorecard period runs from at least 2001 until 2009, and the scorecard period encompasses 2009 to the present. 2009 was the first year that the program implemented a formal evaluation process where evaluators ranked every application by a set of criteria. Prior to these scorecards, applications were reviewed by a panel of NJDOT staff and prioritized. The NJDOT evaluation process was conducted as follows:

1. Solicit applications from freight operators
2. Compile applications received
3. Hold a public meeting to present the state rail plan
4. Use information from the application and public input to make recommendations for projects to fund
5. Finally, the NJDOT Assistant Commissioner approves the award lists.

From FY2009 to FY2011 the rail grant program used evaluation scorecards to rate each proposal on the project's ability to improve the economy, freight efficiency, and environment. The scorecards were completely overhauled after the first year (FY2009), and tweaked in FY 2010 and FY2011 but these criteria remain essential in all three iterations.

FY 2009 Form

The 2009 form was relatively simple (compared to the next two iterations), and scored projects using the following categories:

1. NJ Economy (4 points max per reviewer)
2. Efficient Freight (3 points max per reviewer)
3. Energy and Environment (4 points max per reviewer)
4. Passenger Benefit (1 point per reviewer)
5. Urgency (1 point per reviewer)

The freight rail program had a scoring suggestion sheet for reviewers reprinted below:

> *Enhancing NJ's Economy: (To reflect in the awarding aspects of the project that offer economic benefits that may not be captured under the B/C criteria)*
>
> - *Will support NJ job gains*
> - *Maintaining current Jobs/prevent Job losses*
> - *Contains element of urgency/timeliness significant to its ability to deliver long-term benefits*
> - *Improves competitiveness of business served by the operator*
> - *Improves the attractiveness of NJ new business*

So the score can range from 0-4. 0= No impact, 1=Minimal impact, 2= Fair impact, 3= Maintaining a good level, 4= Significant growth.

Environment Benefits: (To reflect in the awarding aspects of the project that offer environmental benefits that may not be captured under the cost-benefit ratio criteria)

1. *Reduce Urban highway congestion*
2. *Reduce petroleum fuel consumption*
3. *Reduce emission of air and/or water pollutants*
4. *Improve safety of Hazardous material transport*
5. *Improve road or pedestrian safety*

So the score can range from 0-4. 0= No impact, 1=Minimal impact, 2= fair impact, 3= Maintaining a good level, 4= Significant impact.

Efficient Freight System: Points can be awarded on the basis of the project's raw B/C ratio, which is impacted greatly by car loading

B/C Ratio	***Points***
1.00 - 5.99	*1*
6.00 - 9.99	*2*
10.00 - Above	*3*

Passenger Benefit and Urgency: If such factors exist for project, 1 additional point

Therefore, the most total points and application could receive was 39 points (13 points from each of the 3 reviewers)

FY 2010 & 2011 Forms

In FY2010 the evaluation form had major changes, and then minor changes were made in FY2011. The 2010 version has one additional score category for ESSENTIAL CRITERIA:

- *Energy and Environment: Does it promote a "good neighbor" relationship? (0-2 points)*

The 2010 version also has three additional score categories for SECONDARY CRITERIA:

- *Is the project part of a larger planning effort within the host community? Is the improvement in support of municipal objectives such as a town center or freight village? (0-2 points)*
- *Interagency Coordination: Does this project coordinate with the known activities of another state agency? (0 or 1 points)*
- *Urgency: Is there an issue of timeliness to this project? (0 or 1 points)*

The 2011 version has none of the three score categories for SECONDARY CRITERIA as listed above. The 2011 version, however, has a score category for SECONDARY CRITERIA that is absent in the 2010 version:

> *Quality Assurance: Applicant provides a clearly define [SIC] scope of work and cost estimation (0 or 1 points)*

Numeration and ordering of score categories under SECONDARY CRITERIA is different between 2011 and 2010 versions. (Though the ordering of categories varies across versions, the data is uniformly ordered in the Excel spreadsheet.) Finally, the 2011 version has a rarely used TIE BREAKER section.

From the FY2011 freight rail digital archives is a file that outlines the selection process for that year (BRS Project Selection Process (MK 20 Jan 10).doc). The document outlines the FY2011 selection process as:

Project Selection Process

- *Applications are reviewed for completeness*
  - *Applicants will be asked to supply missing information*
- *Applications are reviewed for eligibility*
  - *Ineligible projects will not be evaluated*
- *2-part selection forms are developed*
  - *Primary – criteria per regulation:*
    - *economic benefit*
    - *efficient and responsive freight distribution*
    - *energy and environmental factors*
    - *highway congestion mitigation*
  - *Secondary – additional criteria reflecting additional concerns such as:*
    - *Benefit to rail system*
    - *Continuation of partially funded project*
    - *Interagency coordination*
    - *Urgency*
- *Eligible projects are reviewed by a selection committee*
- *Projects are ranked by primary criteria*
- *The secondary criteria will then be applied to differentiate projects with the same primary score.*
- *No more than two projects will be awarded to any railroad.*
- *Critical projects may be considered separately.*

From the electronic records it is clear that before 2009 every rail operator had to fill out an application and complete a cost-benefit sheet (at least since 2001). However, it is unclear how the information in the applications and the cost-benefit sheets were evaluated.

Table 6: Scoring Summary – FY 2009 to FY2011

Fiscal Year 2009	
Number of Applications	32
Average Score	28.7
Average Winning Score	33.6
Number of Accepted Projects	12
Requested Cost	$14,391,113.00
Allocated Cost	$10,986,751.70
Allocated %	80.0%
Fiscal Year 2010	
Number of Applications	26
Average Primary Score	31.6
Average Winning Primary Score	33.8
Average Secondary Score	19.2
Average Winning Secondary Score	19.7
Average Total Score	50.7
Average Winning Total Score	53.5
Number of Funded Projects	12
Requested Cost	$11,337,491.00
Allocated Cost	$9,999,999.70
Allocated %	90.0%
Fiscal Year 2011	
Number of Applications	16
Average Primary Score	22.7
Average Winning Primary Score	26.4
Average Secondary Score	16.4
Average Winning Secondary Score	18.1
Average Total Score	39.1
Average Winning Total Score	44.6
Number of Accepted Projects	7
Requested Cost	$7,086,495.00
Allocated Cost	$6,377,845.50
Allocated %	90.0%

This list of selection criteria implies that at least for the FY2011 evaluations the secondary criteria was only used in the event of a primary criteria score tie. The current criteria are summarized in Table 7:

Table 7: Current NJDOT Application Scorecard

Criteria	Definition	Points
Economic	Does the project maintain existing jobs?	0 - 2
	Does the project support new jobs?	0 - 2
	Does it increase the number of businesses served by rail?	0 - 3
Freight Distribution	Will the project improve customer service?	0 - 2
	Will the project increase service reliability?	0 - 3
Energy and Environment	Does the project reduce truck emissions and fuel consumption?	0 or 1
	Does it improve the safety of transportation of hazardous materials?	0 or 1
Highway Congestion Mitigation	Does the project reduce long haul trucking?	0 or 1
System/ safety	Is the project a systematic or line improvement, which improves the state's rail system?	0 - 3
Continuation of Previous	Is this a continuation of a partially funded RFAP project from a prior year?	0 or 2
Benefit cost Ratio	How strong is the benefit cost ratio?	1,2, or 3
	Ratio between 1 and 5.9: 1 point	
	Between 6 and 9.9: 2 points;	
	Above 10: 3 points	
Quality Assurance	Applicant provides a clearly define scope of work and cost estimation	0 - 2
Applicant Performance	Has this applicant met previous requirements for program implementation? Does the applicant have a history of executing agreements within 6 months and preparing error-free invoices?	0 or 1

In FY 2009, the most points possible for an application was 39, and the average winning application received a 33.6, which is 4.9 points higher than the average score of all applications (28.7). In FY 2010, the total achievable points were variable because an uneven number of reviewers evaluated the projects. In FY 2011, the highest primary score possible was 45 points (15 points per reviewer times 3 reviewers), and 30 points for secondary criteria (10 points per reviewer time 2 reviewers). The average winning primary criteria score in FY2011 was 26.4, which was 3.7 points higher than the average score of 22.7.

Scoring Discrepancies

In the selection process score sheets play an extremely important role. During FY 2009 and FY 2010, there were a number of reviewers for each project, which led to errors in the score average. In 2011 there were three reviewers for each project and the score from a total of 45 points was considered (15 points from each reviewer). On close inspection, it is clear that reviewers scored each category differently. Even a small discrepancy might have led to a project losing by half a point. Moreover, the reviewers differed a great deal on certain score categories. For instance, for the B&DRR FY 2011 project, see the scores given to each category by four different scorers below in Figure 1. *The horizontal axis shows the four different scorers while the vertical axis shows the number of points.*

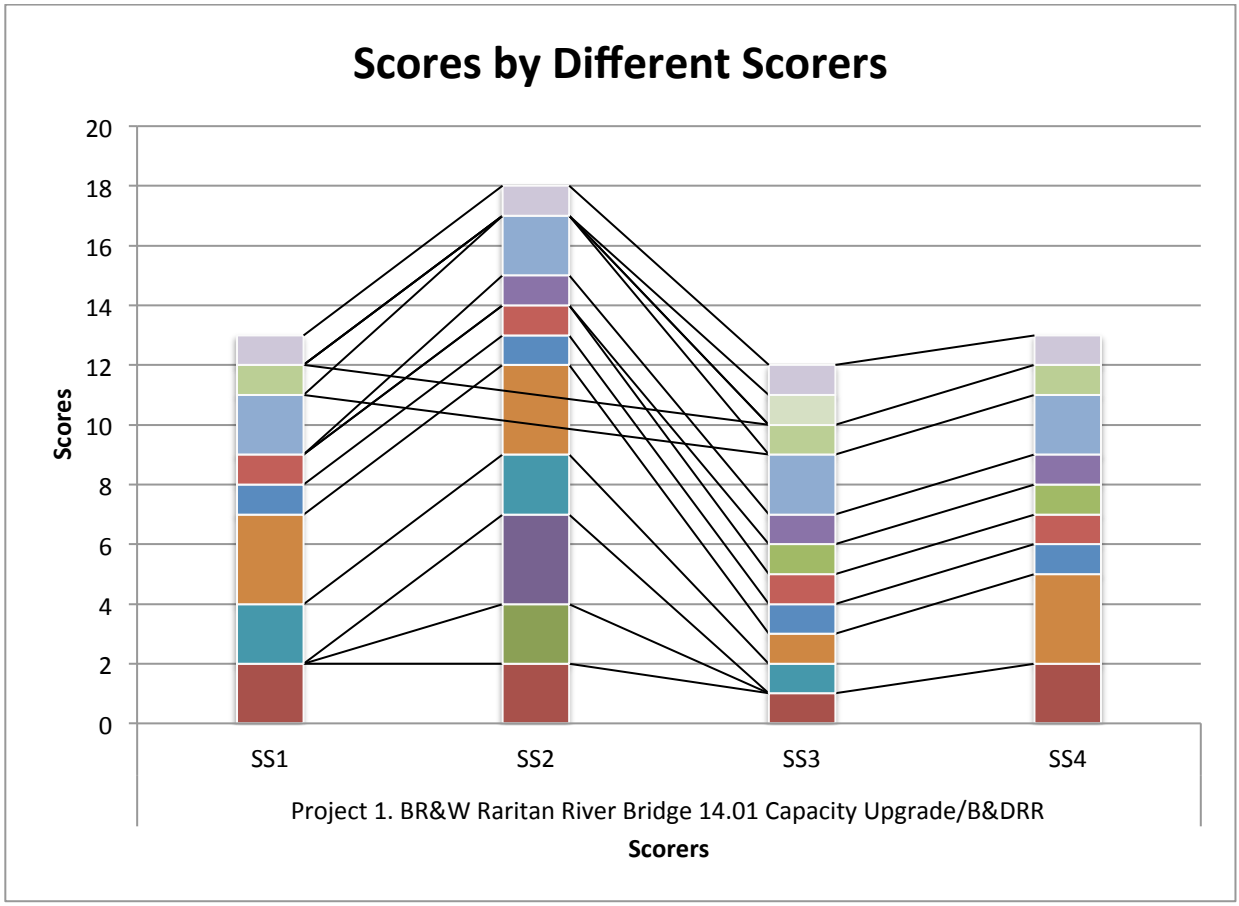

Figure 1: Scores by Different Scorers for the Same Application

Each color represents a different criteria category and the stacked column chart thus represents that the scores in each criteria differ from one scorer to another. Some of the important primary criteria, such as if the project provides reliable service, shown in the orange stack, differs greatly with the third scorer. Likewise, for the green stack that represents how well the project creates new jobs, it is not seen for scorer 1, 3 and 4. The standard deviation of the score values are seen Table 8.

Table 8: Standard deviations of the Scores by different graders

FY 2011, Project #	Average Scores (Mean)	Standard Deviation of scores from different scorers
Project 1	14	2.7
Project 2	13	2.16
Project 3	9.75	3.77
Project 4	13.25	2.21
Project 5	10.5	1.91
Project 6	6.625	3.9
Project 7	9.625	4.19
Project 8	11.125	3.56
Project 9	8.625	2.13
Project 10	9.875	2.71
Project 11	10.625	2.13
Project 12	14.625	2.56
Project 13	14.875	2.25
Project 14	13.625	1.88
Project 15	14.375	1.49
Project 16	14.625	2.28
Project 17	15.375	1.49
Project 18	14.625	1.7
Project 19	9.375	5.02
Project 20	9.25	3.68
Project 21	16.25	1.5
Project 22	13	1.82
AVERAGE STD DEV		2.59

The standard deviation for some of the projects is as high as 4 and on average the scores deviate by 2.59. This is a considerably high deviation between scores given to projects by each reviewer.

Recommendation

Each criterion should be scored with a standard method and the documents supporting the scoring of each criterion by the individual scorer should be carefully reviewed for any errors. Also, instead of scoring the projects individually by each scorer, a collective decision should be made by all the scorers. This collective decision should be made following a thorough discussion about the application and analyzing the benefits associated. This practice might avoid discrepancies. For example, the criteria based on energy and environment requires air quality check using emissions analysis. Economic

criteria can be tested on the basis of the historical data of jobs created and maintained by the customers served by the respective railroad.

Cost-Benefit Analysis

The NJDOT utilizes a standard spreadsheet for the cost-benefit analysis of each project. Existing and predicted job increases and carloads are added to the spreadsheet but in most cases these numbers are self-reported by the applicants and the validity of the estimates are not considered in the cost-benefit ratio calculations.

Other input variables include average wages to monetize the new jobs created, as well as to quantify the loss of trucking jobs that might result from the project. For example, the loss of trucking jobs is calculated as the product of new carloads, 2.5 truck drivers per carload, and average wage, divided by 260 working days per year.

Railroad revenues are the product of current and future carloads and revenue per car, while average costs are considered [(miles of railroad x $800) – (total carloads x $160)]. In cases of salvage value, a salvage value of $6,000 per mile is considered, as well as an average $8,000 per mile of track maintenance fee. Present value and the discount rate of 4% are also considered. A full example of the cost-benefit ratio calculation for a project is show in Table 9.

Table 9: NJDOT Cost-Benefit Sheet for an Example Project

	Existing Conditions	1st Year of Operation	2nd Year of Operation	3rd Year of Operation	4th Year of Operation	5th Year of Operation	Totals
		2010	**2011**	**2012**	**2013**	**2014**	
Number of New Jobs (permanent only)		**100**					
Revenue/Car	$500.00						
New Carloadings		***1000***					
Current Carloadings	*2000*	3000	3000	3000	3000	3000	
Discount Rate	4						
Miles of Track	**2.00**						
Manufacturing Salary	***$31,000***						
Project Cost	**$ 2,000,000.00**						
Net Wage Impacts		$ 2,801,923.08	$ -	$ -	$ -	$ -	$ 2,801,923.08
(Includes trucking losses year 1)							
Railroad Revenues		$ 1,500,000.00	$ 1,500,000.00	$ 1,500,000.00	$ 1,500,000.00	$ 1,500,000.00	$ 7,500,000.00
Railroad Costs		$ (464,000.00)	$ (464,000.00)	$ (464,000.00)	$ (464,000.00)	$ (464,000.00)	$ (2,320,000.00)
TOTAL BENEFITS							**$ 7,981,923.08**
Present Value of Benefits	$1,995,480.56						
Present Value of Costs	$499,999.95						
Benefit / Cost Ratio	**3.991**						

INTERVIEWS AND SURVEYS

To collect data for this study, researchers contacted the DOT/agency program managers from several states, as well as NJ railroad managers and railroad industry experts and consultants. Researchers conducted in-depth telephone interviews with several DOT/agency program managers, consultants and industry experts from New York and Pennsylvania, as these two states border New Jersey and have a profound reciprocal impact on the New Jersey rail system. The list of participants contacted is summarized in **Table 10**. Select short line railroads in New Jersey who responded to inquiries were visited for personal interviews. Several railroads provided data on their operations and traffic spanning the past several years. They also detailed their experiences with NJDOT's rail grants program. Additionally, the research team attended New Jersey Short Line Railroad Association meetings, where railroads, program managers, and consultants gathered to discuss industry issues and opportunities.

Table 10: Rail Grants Contacts

Organization
Strategic Rail Finance/OnTrack America
McKavanaugh Consulting
Railroads
New York Susquehanna & Western
M&E Railway
PJRR/NYNJ Rail
SMS Lines
W&W Railroad
Raritan Central Railroad
Agencies
PennDOT
NYSDOT
Ohio RDC
Florida DOT
Virginia DRPT
Oregon DOT
Maryland DOT
Minnesota DOT
Idaho TD
DVRPC
NJ Economic Development Authority
NJ Business Action Center

Along with the NJDOT personnel, the research team attended a New Jersey Economic Development Authority (NJEDA) meeting to learn about their grant and loan program procedures. Rutgers and the DOT introduced and described the Rail Grants program. There was a discussion on strategic projects that are not in the best interest of railroads but are in the best interest to the state. There was a consideration of adding a subjective "strategic objectives" element, to save the lowest match requirement for those projects. The stated purpose and goals of the rail grants program may have evolved since the program's start.

The NJEDA often invites sister agencies to participate in its application evaluation process. Through this participation, agencies can share intelligence about where and why rail freight-related development might occur. The NJEDA and the Business Action Center could also identify where a rail investment could leverage other economic development. The NJEDA considers location and leverage particularly important when disbursing a defined pool of grant money. They run programs that offer loans and grants, all of which have different provisions. Loans are underwritten like every other loan in the state; while grants are treated as business ventures and require a business plan. Applicants to NJEDA loans must provide:

- 3-year revenues
- Business plan
- Demonstration of financial need of applicant
- Gap analysis – is there a gap in finances of the railroad this loan is being used to fix?
- Matching funds

The NJEDA follows a "trust and verify" approach. They require third party verification of financial data through an auditor's certification, and also a Sarbanes-Oxley highest officer's certification of truth for the application. Post-audit metrics are built into contracts, and an annual audit is required, signed off on by the CEO. Typical reporting requirements include:

- Evidence of jobs created
- Audited financial statement with third party review
- Certified report on matching funds

The NJEDA is able to maintain a stream of program funding by issuing loans and using repayments to support other loans. The NJEDA also enters into installment grants; reimbursements from awardee are spread out over five years. Agreements provide for multi-year compliance periods and include waning opportunities (over time) for recapture. A sliding scale of recapture and multi-year agreements can be used for clawback enforcement.

The NJEDA provided details on the input-output model used to evaluate grant applications under several different programs, and expressed an interest in participating in the economic analysis of grants applications. The model is used to assess economic

outputs, impacts and likely job creation, and personal and corporate earnings yield from a given project.

The model also contains final demand, employment, and earnings multipliers from the database as well as “direct effect” multipliers to estimate the portions of total impact attributable to direct and indirect activity. Whenever actual values are known, staff will override the model’s estimates to use the known values rather than the model’s calculated results. In addition to direct and indirect economic effects, tax revenue collected up to 20 years is calculated.

Researchers also studied an example of application instructions for a similar grants program administered by the NJ Board of Public Utilities in conjunction with NJEDA was provided. Results show that the NJEDA reviewed application financials and administered the underwriting, closing, and disbursement of funds to the Awardees. The applicant was required to provide evidence of the source of funds needed to complete the project, and were expected to provide detailed descriptions of for three years worth of business and financial statements (income statement, balance statement, cash flow) for the previous three years. They were also required to submit regular project progress reports documenting progress throughout the funding.

Interviews with Consultants / Industry Experts

The interviews provided key carload traffic data from railroads (utilized below in the further analysis in this study)) as well as several key suggestions for improving the program. Many suggested that the program could benefit from more rigorous financial analysis of the applicant railroads and further studies should investigate how to accomplish this. During the interviews, the research team went back and forth with NJDOT program managers to share ideas and discuss the potential implementation of program changes. Although NJDOT was interested in a more rigorous evaluation of applicants, including finances and an in-person application presentation. It was noted that while NJDOT does not post-evaluate grants, it is a possibility for the future. They are likewise open to anything allowed by the statute and administrative code governing the program. Some practical problems were noted with regard to implementing clawback, such as the lack of manpower/expertise.

If requested, the research team can continue to work closely with NJDOT in the future in suggesting program improvements and learning practical issues regarding the operation of the program and potential program changes. Economic and externalities analysis are which will connect with program provisional changes and improvements are discussed in the next sections of this report. Final recommendations, which include things learned during this task and all other analyses, are also presented in the conclusion section of this report.

Surveys

Between December 2012 and January 2013 the research team conducted a survey of rail grants evaluators and applicants that focused on awards criteria. The survey employed the Analytic Hierarchy Process (AHP) created by Thomas L. Saaty in the early 1970's, which was inspired by mathematics and psychology [50]. The AHP provides users with a rational framework for making a complex decision and evaluating numerous alternate solutions. The Analytic Hierarchy Process gives the user the ability to derive ratio scales from paired comparisons. A paired comparison is when a decision maker compares elements two by two. This allows the decision maker to incorporate judgment into the decision.

In order to translate the judgments from the paired comparison, Saaty [50] recommends using the scale given within Table 11 below. This numerical scale allows the decision maker to quantify the intensity of the judgments while introducing a mathematical basis for the overall analysis. For example, elements that are viewed as being equal in importance are assigned the numerical value of 1. An element that is viewed as being extremely more important than another element is assigned a numerical value of 9. Likewise, if an element is viewed as extremely less important than another element, the first element is assigned a numerical value of 1/9.

Table 11: AHP Fundamental Scale for Pairwise Comparisons

Intensity of Importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

Once all of the surveys are completed, the numerical values for each of the questions are averaged among all of the survey participants and the weights using the Analytic Hierarchy Process. The survey questions were taken from the NJDOT application scoring rubric. The questions were limited to 10, with some combination and elimination

of criteria in agreement with NJDOT personnel. The basic survey questions were as follows:

1. The project has a high benefit/cost ratio
2. The project maintains existing jobs
3. The project supports new jobs
4. The project increases the number of businesses served by rail
5. The project improves customer service / increases service reliability
6. The project reduces long haul trucking, emissions, and fuel consumption
7. The project improves the safety of transportation of hazardous materials
8. The project is a systematic or line improvement which improves the state's rail system
9. The project continues / builds upon previously funded improvements
10. The project upgrades load rating to 286-kips

The survey was uploaded to http://www.rits.rutgers.edu/railgrants/ with instructions for completion, and distributed to all the contacts seen in Table 10 as well as additional railroad contacts that were unresponsive. We requested all NJDOT program managers to complete the survey as well. A partial screenshot of how the survey appeared in the web browser is shown in Figure 2.

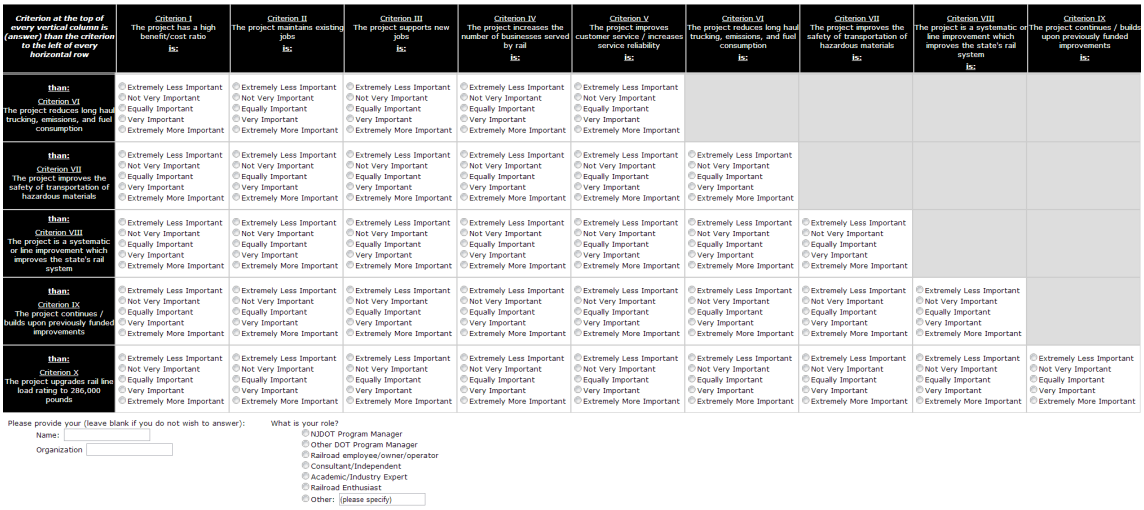

Figure 2: Distributed Survey

Overall, participation was poor. 10 responses were received (12/18/12 - 1/6/13): 5 NJDOT respondents, 2 other DOT respondents, 2 other anonymous, and 1 railroad member. Differences in scoring point values versus the current NJDOT scoring value weights are shown in Table 12. Given the small sample size, these new points are not recommended for adoption. Instead, the research team recommends that a consolidation of the scoring criteria to the 10 questions listed in the survey to avoid double counting.

Table 12: Survey Results

Primary Criteria	Old max points	Eigenvalues from AHP	Scaled	New max points
The project maintains existing jobs	2	0.12	3.08	3
The project supports new jobs	2	0.12	3.11	3
The project increases the number of businesses served by rail	3	0.11	2.85	3
The project improves customer service / increases service reliability	5	0.09	2.21	2
The project reduces long haul trucking, emissions, and fuel consumption	2	0.09	2.34	2
The project improves the safety of transportation of hazardous materials	1	0.09	2.39	2
Secondary Criteria				
The project is a systematic or line improvement which improves the state's rail system	3	0.09	2.28	2
The project continues / builds upon previously funded improvements	2	0.11	2.86	3
The project has a high benefit/cost ratio	3	0.10	2.52	3
The project upgrades load rating to 286-kips	-	0.08	1.92	2
Integrity of application / history of applicant	3	-	-	-

During the development of the survey questions, the criteria used in the current NJDOT evaluation procedures were examined. One year of application (FY 2010) scores in each category for winning applications were compared with scores for unselected applications. This was done to determine which criteria really discerned between strong and weak applications, and which questions received or did not receive points across all applications. The results are shown in Table 13. Categories that have a small difference between selected and unselected applications indicate those that may not be useful scoring criteria.

Table 13: FY2010 Application Review Scoring Comparison

Primary Criteria		**Weight**	**Score/Max Points (Selected)**	**Score/Max Points (Not Selected)**	**Difference**
Economic	Does the project maintain existing jobs?	0 - 2	79%	58%	21%
	Does the project support new jobs?	0 - 2	26%	9%	17%
	Does it increase the number of businesses served by rail?	0 - 3	9%	4%	5%
Freight Distribution	Will the project improve customer service?	0 - 2	68%	60%	8%
	Will the project increase service reliability?	0 - 3	68%	56%	12%
Energy and Environment	Does the project reduce truck emissions and fuel consumption?	0 or 1	79%	53%	26%
	Does it improve the safety of transportation of hazmat?	0 or 1	22%	19%	3%
Highway Congestion Mitigation	Does the project reduce long haul trucking?	0 or 1	58%	47%	11%
Secondary Criteria					
System/ safety	Is the project a systematic or line improvement, which improves the state's rail system?	0 - 3	81%	77%	3%
Continuation of Previous	Is this a continuation of a partially funded RFAP project from a prior year?	0 or 2	11%	21%	-10%
Benefit cost Ratio	How strong is the benefit cost ratio?	1,2, or 3	53%	39%	11%
	Ratio between 1 and 5.9: 1 point				
	Between 6 and 9.9: 2 points;				
	Above 10: 3 points				

ECONOMIC IMPACTS

Economic Impacts are effects on the level of economic activity in a given area. They can be observed by various parameters such as the output[9] in terms of the total value of industry production, value added, wealth, wages or jobs. Any impact can be described as the indicator of economic impacts. “The net economic impact is usually viewed as the expansion or contraction of an area’s economy, resulting from the changes in a facility, project or program” (51). They are different from both social impacts and the valuation of the individual user benefits of a particular facility or service. Economic impacts also lead to fiscal impacts, which are changes in government revenues and expenses. Impacts on employment and associated population levels can affect government expenditures by changing demand for public services. While related, fiscal impacts are not the same as economic impacts.

Before making an investment, it is important to complete an economic impact analysis, conduct project accountability studies and assess all the alternatives. A systematic analysis of the economic impacts on regions affected by the project should be conducted to answer pre-investment questions, such as:

- What is the economic impact of any project?
- How is this project compared to another competing project or investment beneficial? What benefits are obtained for in return of the dollar spent?

Measures of Economic Impacts

Various measures of economic impacts have very different interpretations (52):

Total Employment

The total employment reflects the number of additional jobs created by economic growth. This is the most popular measure of economic impact as it is easy to comprehend. However, this measure comes with two major limitations: 1) They do not essentially reflect the quality of employment opportunities and 2) They can’t be easily compared to the public costs of attracting those types of jobs (53).

Value Added

Value added is generally equivalent to the gross regional product—it is a broader measure of the full income effect. This measure essentially reflects the sum of wage income and corporate profit generated in the study area. However, in today's increasingly global economy, value added can be an over-estimate of the true income impact on a local area. Thus, while value added is now a more effective of impact on

[9] Output is the measure of economic activity created by FY 2010 spending. It refers to the change in the dollar value of production is all sectors of economy to satisfy the new demands resulting from spending.

overall economic activity in a geographic area, the personal income or wage measure is often preferred as a more conservative measure of the income benefit to area residents.

Business Output

Business output is also called revenue or sales value. It is the broadest measure of economic activity as it generates the largest numbers. It includes the full gross level of business revenue, costs of materials, labor, and net profit. However, it does not distinguish between a high value added activity and low value added activity and thus can be misleading [52].

Type of Economic Impact Analysis Methodologies

Direct Economic Benefits

There are many ways to capture the direct economic benefits of investments in fright rail. First, because benefits such as travel time or cost savings are often estimated at the network level, it is necessary to assign benefits to geographic regions. Rather than allocating benefits based on where a transportation improvement occurs, standard economic practice uses estimates of the O-D pattern of the affected trips. This methodology ensures that the benefits are allocated to the shippers and receivers of goods. Second, converting travel time savings, modal diversion, and other transportation impacts into monetary economic impacts is a crucial step for accurate economic analysis. Traditionally, especially for highway analysis, factors to convert travel time savings, operating costs, and accident reductions into monetary terms have been imbedded within different hybrid models, which usually are more focused on carrier costs. Finally, another key aspect of determining direct economic effects is allocating benefits to industries. There are two basic approaches commonly used to link transportation benefits to industries. The first method relies on the commodity data of the affected trips and links commodities to the industries that ship and receive those goods. This is a sound approach if detailed commodity flow data is available, but it does present some challenges. With sound economic analysis using Input /Output tables to determine industry demand, reasonable estimates are developed.

Input / Output Models

Input / Output models capture the industries' internal linkages of a regional economy and estimate economic multipliers. Standard economic multipliers estimate two kinds of secondary impacts from direct changes to an economy--namely indirect and induced, both of which manifest in the medium term. In the case of a transportation capital investment, direct regional impacts exist in the form of employment and wages in construction and related firms. Indirect impacts result from the intermediate purchases necessary to operate a business. To the extent that local firms buy from local suppliers, the indirect impact will be larger. Induced effects stem from the re-spending of wages in the local areas earned by workers affected by direct and indirect activities. The I /O

models do not forecast how jobs will be created or retained by a change in transportation. Rather, they estimate the associated indirect and induced effects. The projections of anticipated jobs created or retained can be the product of some other analysis approach such as interviews with local businesses and economic development experts (53).

The most commonly used I/O models are IMPLAN and RIMS II. The IMPLAN model is privately developed by Minnesota IMPLAN Group, Inc., and can be applied to any county or group of counties in the country (54). The features of IMPLAN are discussed in detail in the later part of this chapter. BEA developed the RIMS-II model with a county level of geographic specificity[10]. The model simply produces multipliers[11] by industry type (e.g. Construction, Railroad, Highway, Food, etc.) while IMPLAN allows more flexibility and direct calculations of total employment, output[12], and income impacts based on county-based models. The economic multiplier approach is most applicable to transportation projects that directly impact business attraction/expansion/retention, or tourism. Examples include “new rail sidings that could be catalysts for industrial recruitment or retention”[13].

Economic Impact of America's Freight Rail Roads

According to the Association of American Railroads, railroads deliver 40 percent of intercity freight volumes. Consumers save billions of dollars by transporting freight through railroads. In addition, freight railroads reduce pollution, lower emissions, cut highway gridlock, and also reduce highway construction and maintenance costs. For hundreds of years freight railroads have played an important role in the overall economic development for every state. They provide millions of American jobs and their employees are among the nation’s most highly paid compensated workers (according to the Association of American Railroads). According to the US Department of Commerce Model of the US economy, in addition to their own employees, freight railroads sustain millions of additional jobs to the industries that 1) provide goods and services to the railroads or, 2) that are recipients of spending by the employees of railroads and their suppliers. The model also notes ”e*very job in day-to-day freight rail operations sustains another 4.5 jobs elsewhere in the economy".*

Freight railroads are the support system of the United States transportation network, moving 70% of all American automobiles manufactured; 30% of the nation's grains and 70% of the coal, which in turn provides electricity for almost half the nation[14].

[10] RIMS II information can be obtained at http://www.bea.doc.gov/bea/regional/rims.
[11] These are further multiplied with the input values to obtain the respective output
[12] Output is the measure of economic activity created by the spending. It refers to the change in the dollar value of production is all sectors of economy to satisfy the new demands resulting from spending.
[13] "Analyzing the economic impact of transportation projects using RIMS II, IMPLAN and REMI
[14] As per the All shipment data from Association of American Railroads (AAR)

IMPLAN

Introduction

This study makes use of the IMPLAN (IMpact Analysis for PLANning) input-output economic modeling system to quantify the economic impacts of projects supported by New Jersey's Rail Grants Program. If an industry hires employees because of a tax incentive, the economic payoff does not stop there. Businesses, which sell products to those industries, benefit as well. In turn they hire more workers. The new employees then can spend their increased income locally and further multiply the benefits. Although such ripple effects are difficult to measure, they can be evaluated with an economic impact analysis method. IMPLAN is an example of such a software package.

IMPLAN and associated local area data are supported and developed by the Minnesota IMPLAN Group, located in the Twin Cities. IMPLAN is a widely used, nationally recognized economic impact model, first developed by the U.S. Forest Service [(54)].

IMPLAN is used to estimate the economic changes caused by local economic activity. An example for such activity can be an extension of railroad connecting the industrial park to the main rail line. This new construction will be able to transfer more goods via rails. In turn, there will be an increase to local business. The level of overall economic activity causes changes. IMPLAN can be used to provide an estimate of the new level of overall economic activity. The indirect economic activities associated with the original economic activities are also estimated by IMPLAN. If a business purchases goods at another local industry, the business is supporting the local industry and IMPLAN estimates all levels of economic activity supported by that business.

Other Agencies Using IMPLAN

Many State and Local Governments use IMPLAN (Table 14). For Example, NJEDA uses IMPLAN for the New Jersey Urban Enterprise Zone (NJ UEZ) Assessment Program. From the previous economic impact analysis of NJ UEZ, job creation was the initial input for the impact modeling. This approach measured the ripple effects of the actual business activity of the qualified UEZ businesses and IMPLAN was used to estimate such ripple effects. Some important results were obtained: the analysis of estimated economic impacts for previous years by uses of funds. The impacts included direct, indirect, and induced effects for employment, employee compensation, industry output, labor income, value added and state and local tax revenues. The consultant team, Delta Development Group, Inc. for NJEDA, used IMPLAN to calculate the impacts of initial expenditures. The IMPLAN model estimated the direct, indirect, and induced effects of the State's investment, measured by the number of jobs created, the increase in industry output, increase in employee compensation and other indicators. The IMPLAN model estimated the tax revenues generated for every dollar spent as a part of State's investment. It also estimated the number of permanent jobs created as a result of every million dollar spent on behalf of the State investment. Moreover, a study from

the PEW center showed that when researchers compared the expected results to what was actually happening, the program was falling short. [55]

PennDOT uses IMPLAN as a tool for the freight rail-funding program. They use the Pennsylvania State Multipliers for the employment calculations. IMPLAN impacts show how the direct, indirect, and induced jobs are estimated per $1 million investment. *In the future, PennDOT may update this portion of the model by purchasing the county-level economic model from IMPLAN and amending the model accordingly to show county-level economic results* [56]*.*

Table 14: Other States and Local Governments Using IMPLAN are as below [54]

State	Department
Alaska	Department of Fish and Game
Alabama	Department of Economics and Community Affairs
Arkansas	Department of Economics Development
Arizona	Department of Commerce
California	Department of Fish and Game
	Department of Finance
	Department of Transportation
	Department of Water Resources
	State Water Resources Control Board
Colorado	Department of Labor and Employment
Connecticut	Department of Community and Economic Development
	Department of Labor
	Economic Resource Center
Delaware	Economic Development Office
Florida	Department of Environmental Protection
	Agency for Workforce Innovation
	Fish and Wildlife Conservation Commission
	Governor's Office
	Labor Market and Legislature
	Office of Tourism
Hawaii	Department of Health
	Research and Economic Analysis Division
Illinois	Department of Natural Resources
Indiana	Department of Workforce Development
Kansas	Department of Commerce
Kentucky	Cabinet of Economic Development
Louisiana	Department of Wildlife and Fisheries
Maryland	Department of Business & Economics
	Department of Natural Resources

	Department of Transportation
Maine	Office of Rural Health
	State Planning Office
Michigan	Department of Natural Resources
Minnesota	Department of Agriculture Marketing Section
	Department of Economic Security
	Department of Natural Resources
	Economic Development Office
	Office of Legislative Auditor
	Pollution Control Agency
Missouri	Department of Economic Development
	Department of Health and Human Services
Mississippi	Department of Forestry
	Institutions of Higher Learning
Montana	Department of Commerce
	Department of Labor and Industry
North Carolina	Department of Commerce
	Department of Parks, Recreation and Tourism
	Division of Marine Fisheries
North Dakota	Jobs Services
Nebraska	Department of Health and Human Services
	Economic Development Office
	Department of Revenue
	Department of Labor
	Legislative Fiscal Office
New Jersey	Commerce Commission
	Department of Labor
New Mexico	Department of Tourism
	Department of Agriculture Marketing Section
	Department of Labor
	Legislative Finance Committee
	Office of Management & Budget
	Tax and Revenue Department
Nevada	Department of Conservation and Water
New York	Department of Labor, Division of Budget
	Office of State Comptroller
	State Assembly
Ohio	Department of Development
Oklahoma	Department of Commerce
	Department of Economic Analysis
	Office of State Finance

Oregon	Department of Forestry
	Economic Development Office
South Carolina	Department of Natural Resources
	Employment Security
	Parks, Recreation and Tourism
	State Office of Rural Health
Texas	Department of Economic Development
	Forest Service
	Water Development Board
Utah	Bureau of Primary Care
	Department of Game and Inland Fisheries
	Department of Economic Development
	Department of Parks, Recreation and Tourism
	Office of Planning and Budget
Virginia	Department of Forestry
	Department of Planning and Budget
	Department of Transportation
	Department of Mental Health
	Employment Commission
	Department of Agriculture Marketing Section
Washington	Department of Community and Economic Development
	Department of Ecology
	Department of Health
	Department of Revenue
	Department of Transportation
	Office of Insurance Commissioner
Wisconsin	Bureau of Forestry
	Department of Transportation
	Department of Workforce Development
West Virginia	Department Office
	State Tax Department

The IMPLAN Input-Output Model

A commodity flows from the producers, to the intermediate business owners, to final consumers. This flow is described by the input-output accounting. The services, goods, employment compensation, value added, imports and other total input values are equal to the value of the commodity that is produced. Producers buy goods and services from other producers in order to produce the commodities for purchase. This indirect purchase forms a cycle and continues until imports or other leakages from the region stop the cycle. *Multipliers are mathematically derived which uniquely describe the*

change of output for each and every industry as a result of producing one dollar of final demand which are unique to each industry in the input-output model.[57]

Creating regional input-output models requires a tremendous amount of data. It's cost prohibitive to survey industries within each region to derive a list of commodity purchases (production function). IMPLAN was developed as a cost-effective means to develop regional input-output models [54]. IMPLAN was developed by the USDA Forest Service in cooperation with the Federal Emergency Management Agency and the USDI Bureau of Land Management to assist the Forest Service in land and resource management planning. The IMPLAN accounts closely follow the accounting conventions used in the "Input-Output Study of the U.S. Economy" by the Bureau of Economic Analysis (1980) and the rectangular format recommended by the United Nations.

IMPLAN serves three functions: 1) data retrieval, 2) data reduction and model development, and 3) impact analysis. Comprehensive and detailed data coverage of the entire U.S. by county, and the ability to incorporate user-supplied data at each and any stage of the model building process, provides a high degree of flexibility both in terms of geographic coverage and model formulation. The IMPLAN database consists of two major parts: 1) a national-level technology matrix and 2) estimates of sectored activity for final demand, final payments, industry output and employment for each county. In the version used for the study, the data is derived from 2010 for all the counties as well as the entire New Jersey.

IMPLAN Multipliers

The IMPLAN model uses functions for nearly 500 industries nationally to determine the spending pattern of an industry to produce commodities. The model also uses a national matrix to determine the *by-products*[15] that each industry generates. IMPLAN combines the national level production functions with the local county level economic data to determine the impacts of economy changes.

The multiplier measures the amount of total economic activity that results from an industry spending an additional dollar in the local economy. The notion of a multiplier rests upon the difference between the initial effects of a change in the final demand and the total effects of that change [57]. Total effects can be calculated either as direct and indirect effects, or as direct, indirect, and induced effects. Direct effects are changes associated with the immediate effects or final demand changes. Direct impacts refer to the dollar value of economic activities available to circulate through the overall economy. Indirect effects area production changes in backward-linked industries caused by the changing input needs of directly affected industries. For example, the additional purchases needed to produce additional output. Indirect impacts refer to the "inter-industry impacts of the i/o analysis". Induced effects are the changes in regional household spending patterns caused by changes in household income generated from

[15] Byproducts are secondary commodities that industry creates

the direct and indirect effects. Five different sets of multipliers are estimated by IMPLAN corresponding to five measures of regional economic activity; total industry output, personal income, total income, value added, and employment. For each set of multipliers, two types of multipliers are generated namely, Type I and Type III. Type I and Type III employment multipliers are the direct, indirect, and induced employment effects from the production of one million dollars of output. Employment is determined in terms of annual average full-time and part-time jobs. For example, the Railroad Industry in Hunterdon County has an employment type multiplier of 1.850. This means that for each job created directly by the railroad industry, 0.850 jobs are created indirectly[16].

Type I Multiplier

A Type I multiplier is the direct effect produced by a change in the final demand, plus the indirect effect divided by the direct effect. Increased demands are assumed to lead to increased employment and population with the average income level remaining constant. The result is a matrix of the total requirement coefficients; the amount each industry must produce in order for the purchasing industry to deliver one dollar's worth of output to final demand.

Type III Multiplier

The IMPLAN Type III multiplier is a modification of the Type III multiplier developed by Miernyk (58). Type III multipliers compare direct, indirect, and induced effects to the direct effects generated by a change in final demand (direct + indirect + induced, all divided by direct). The Type III induced effects are quite different from the induced effects of a Type II multiplier. A Type II multiplier captures induced effects by assuming a linear relationship between income and consumption changes. The assumption is that an increase in output will raise income levels, and therefore increase household spending proportionately. It is assumed that the population remains stable. To estimate induced effects, IMPLAN first converts direct and indirect effects to changes in employment, based on each sector's employment-to-output ratio. Employment change is then multiplied by the region's population-to-employment ratio, converting it into population change. Population change is multiplied by average regional per-capita consumption rates by sector to estimate the regional household consumption generated by the initial final demand changes. This change in household consumption is treated as additional final demand changes. These changes in final demand are multiplied by the Leontief matrix to generate the first round of induced (additional direct and indirect) effects. This procedure is repeated, thereby capturing successive rounds of induced effects, until the population change is zero. Often, induced effects are larger than indirect effects.

[16] IMPLAN, Economic Model of Hunterdon County. Multipliers for Rail Road Industry FY2010 FY2010

Methodology

IMPLAN provides the multipliers for different industries. For this study, the Transport by Rail industry is chosen. The multipliers as stated above are "value multiplier" (output value) and "employment multiplier" (total employment). Any dollar change assigned to the industry is to be directly multiplied with the value multiplier to obtain the change in output value. After the change in industry, the change in job numbers is multiplied by the employment multiplier to determine the number for total employment. Multipliers are different for each industry in different counties. Table 15 is one of the examples of multipliers in Hunterdon County for the transport by rail industry.

Table 15: Multipliers for Hunterdon County for the Transport by Rail Industry[17]

Value_Multiplier			Employment_Multiplier		
Direct + Indirect	**Induced**	**Total**	**Direct + Indirect**	**Induced**	**Total**
1.300	0.300	1.600	1.850	0.850	2.700

To find the impact of investment in a specific industry in a particular county, an activity can be set up and analyzed in the single region scenario. Each project is termed here as an activity. The transport by rail industry is imported under the industry spending pattern and the level of activity is set as the proposed project cost. After setting up the activity, a scenario is created with the single activity; the scenario level is 1. Analyzing the scenario can provide the effect of the change upon the industry. The effect is obtained in the form of employment, income, value added, and total output values. IMPLAN also provides detail results of the impact on each industry. The tax impacts and impact of projects over various future years can also be determined. An example of such output is shown in Table 16.

Table 16: Scenario Result for Hunterdon County with investment of $395,000 in the Rail Industry[18]

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0.0	$0	$0	$0
Indirect Effect	0.9	$40,032	$61,265	$117,875
Induced Effect	0.2	$7,672	$16,115	$24,689
Total Effect	1.0	$47,704	$77,381	$142,564

In order to observe the cumulative effect of the series of the projects, multiple projects can be assigned to a particular county. The labor income and the value added fields are simply the addition of respective single activities. However, the employment is not simply the addition of the respective single activities. It is more than the value obtained

[17] IMPLAN, Economic Model of Hunterdon County. Multipliers for Rail Road Industry FY2010
[18] IMPLAN, Economic Model of Hunterdon County. Multipliers for Rail Road Industry FY2010 with activity of $395000 in Rail Industry

from adding the individual scenario result. The most efficient combination of the projects in a particular county can be obtained using a trial and error method, observing the changing employment numbers in different combinations of projects. For instance, if a researcher wished to check the optimum combination of the projects in Morris county FY2010, that person first selects the model with Morris County, then sets up the activities according to the given data of the project. For example, in FY2010, there were a total of five projects proposed for Morris County (Table 17).

Table 17: List of Projects in Morris County FY 2010[19]

Number	Name	Project Cost
1	East Fredrick Place Culvert	$996,518
2	Whippany Line Rail Replacement	$1,138,850
3	Dover & Rockaway Repair	$677,500
4	High Bridge Branch Resurfacing	$1,585,000
5	Kenvil Team Track Expansion	$349,133

Note: The projects in red are not funded and green are funded

In IMPLAN, researchers can set up the activities for the five projects above by importing the industry of Transport by rail from the industry spending pattern, and assigning the names of projects and cost as the activity level. Researchers can then assign the five projects as one scenario and analyze over a single region to see the cumulative effect of all five together. The results are shown in **Table 18**.

[19] From the data Rail Grants FY2010

Table 18: Combined Scenario Results for all the five projects in Morris County FY 2010[20]

#	Name of the Project	Cost	Impact Type	Employment	Labor Income	Value Added	Output	Average Scores
1	East Fredrik Place Culvert	$996,518	Direct	0	$0	$0	$0	10.88
			Indirect	2.1	$149,273	$193,943	$318,026	
			Induced	0.8	$44,830	$80,124	$116,576	
			Total	2.8	$194,103	$274,067	$434,602	
2	Whippany Line Rail Replacement	$1,138,850	**Impact Type**	**Employment**	**Labor Income**	**Value Added**	**Output**	**Average Scores**
			Direct	0	$0	$0	$0	11.13
			Indirect	2.3	$170,594	$221,644	$363,450	
			Induced	0.9	$51,233	$91,568	$133,226	
			Direct	3.2	$221,826	$313,211	$496,675	
3	Dover&Rockaway Repair	$677,500	**Impact Type**	**Employment**	**Labor Income**	**Value Added**	**Output**	**Average Scores**
			Direct	0	$0	$0	$0	8.50
			Indirect	1.4	$101,486	$131,855	$216,216	
			Induced	0.5	$30,478	$54,474	$79,256	
			Direct	1.9	$131,964	$186,329	$295,471	
4	High Bridge Branch Resurfacing	$1,585,500	**Impact Type**	**Employment**	**Labor Income**	**Value Added**	**Output**	**Average Scores**
			Direct	0	$0	$0	$0	9.88
			Indirect	3.3	$237,424	$308,474	$505,833	
			Induced	1.2	$71,304	$127,440	$185,418	
			Direct	4.5	$308,728	$435,914	$691,251	
5	Kenvil Team Track Expansion	$349,133	**Impact Type**	**Employment**	**Labor Income**	**Value Added**	**Output**	**Average Scores**
			Direct	0	$0	$0	$0	10.63
			Indirect	0.7	$52,298	$67,948	$111,421	
			Induced	0.3	$15,706	$28,072	$40,843	
			Direct	1	$68,005	$96,020	$152,264	

According to the data, only two of the five projects are funded. There cumulative effect is found by analyzing the scenario with a combination of these two projects. The results are shown in Table 19.

[20] Scenario Results, IMPLAN

Table 19: Combined Scenario Results of two funded projects in Morris County FY 2010[21]

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	4	$289,723	$376,422	$617,254
Induced Effect	1.5	$87,010	$155,512	$226,261
Total Effect	5.5	$376,733	$531,934	$843,515

To determine if the combination of projects selected was the optimum choice, researchers can analyze the scenarios with a combination of two or three different projects at one time.

Table 20: Combined Results of (2+4) [22]

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0
Indirect Effect	5.6	$408,018	$530,117	$869,282
Induced Effect	2.1	$122,536	$219,008	$318,644
Total Effect	7.7	$530,555	$749,125	$1,187,926

As seen in the tables above, the combination of the 2nd and 4th projects is found to have more benefits in terms of employment and outputs. Hence, rather than combining the 4th and 5th projects, the 2nd and 4th project should have been funded and more jobs would have been created. Moreover, the second project had more scores than the fifth project. Since IMPLAN is a multiplier-based software it will provide higher output values for higher investments.

The effect of one project on multiple counties can also be determined by using multiple region scenarios. The effect on other dependent counties is determined irrespective of the number of projects or activities in those counties. Note that the effect on each county changes as we add the number of depending on counties to the model. IMPLAN allows the observation of the effect on such neighboring counties individually.

[21] Scenario Results, IMPLAN
[22] Adding the values in table for 2nd and 4th project number

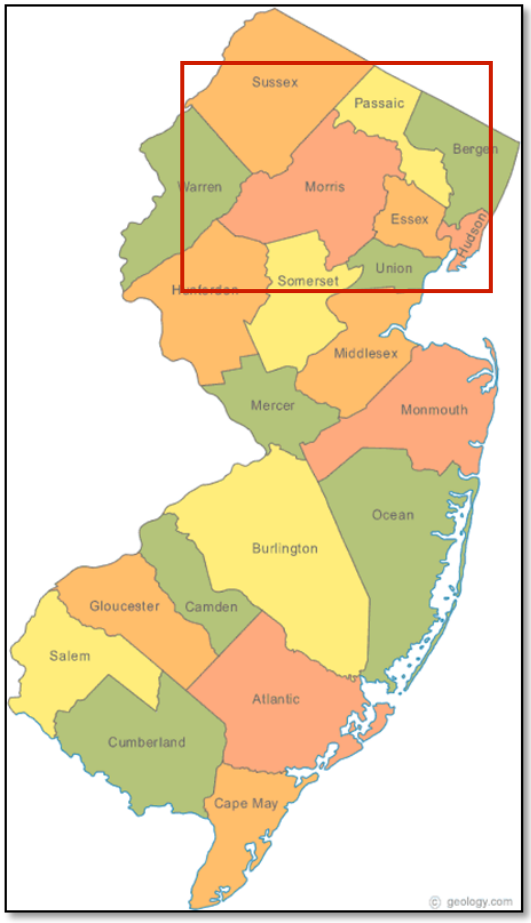

Figure 3: New Jersey Counties [59]

It can be very useful to see the effect of a group of projects on different counties (Figure 3). More specifically, it is important to find the combination that shows the maximum economic benefit on the county. In such a scenario it is likely that the results will show which projects should be funded be carried out, as well as which neighboring counties will be directly or indirectly affected by those projects.

For instance, if one considers the neighboring counties of Sussex, Passaic, Essex and Morris (Figure 3), then the effect of investments in Passaic County can be observed in neighboring counties as shown in Table 21 and Table 22.

Table 21: Scenario Result from IMPLAN[23]

Impact Type Passaic	Emplo-yment	Labor Income	Value Added	Output	Impact Type Sussex	Emplo-yment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0	Direct Effect	0	$0	$0	$0
Indirect Effect	1.1	$61,511	$90,451	$163,683	Indirect Effect	0	$253	$318	$424
Induced Effect	0.3	$15,114	$28,146	$42,777	Induced Effect	0	$139	$221	$313
Total Effect	1.5	$76,624	$118,597	$206,460	Total Effect	0	$392	$539	$737

Table 22: Scenario Results from IMPLAN[24]

Impact Type Passaic	Employm ent	Labor Income	Value Added	Output	Impact Type Sussex	Employment	Labor Income	Value Added	Output
Direct Effect	0	$0	$0	$0	Direct Effect	0	$0	$0	$0
Indirect Effect	1.1	$61,511	$90,452	$163,683	Indirect Effect	0	$257	$323	$430
Induced Effect	0.3	$15,114	$28,146	$42,777	Induced Effect	0	$143	$227	$322
Total Effect	1.5	$76,625	$118,598	$206,461	Total Effect	0	$400	$550	$752
Impact Type Essex	**Employm ent**	**Labor Income**	**Value Added**	**Output**	**Impact Type Morris**	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	0	$0	$0	$0	Direct Effect	0	$0	$0	$0
Indirect Effect	0	$81	$133	$228	Indirect Effect	0	$84	$119	$198
Induced Effect	0	$63	$112	$177	Induced Effect	0	$60	$103	$163
Total Effect	0	$144	$245	$405	Total Effect	0	$144	$223	$361

[23] Model with Passaic county as the primary and Sussex as the second region for analysis
[24] Scenario Results from IMPLAN with activity in Passaic County and its scenario analysis on Sussex, Essex and Morris County

A multiple region analysis is conducted to determine the effect of investments in one county on neighboring counties. The effects on the neighboring counties occur regardless of the activities created in them. The effects are found with respect to the basic model of the county. By increasing the dependency of neighboring counties on the county under study, the scenario results of the county under study remains the same regardless of the scenario analysis of multiple regions. At the same time, the scenario results of the multiple neighboring counties are observed to change with the addition of regions. The changes are not very significant with small dollar investments below $300,000.

Type of Jobs Predicted by IMPLAN

The jobs created, according to IMPLAN in any county due to the industry change by new activities or projects, are of different categories. Customers served by the proposed and/or improved railroads are responsible for the estimated jobs created. The types and numbers of jobs are significantly different from the type and number of jobs predicted by the customers being served by the respective railroads. Jobs estimated by IMPLAN are mostly indirect jobs and not direct jobs. The jobs created by activities in IMPLAN are based on the multipliers with respect to the dollars invested. The impact of the change in any industry on all the other industries is obtained with the help of IMPLAN. The jobs estimated by IMPLAN are divided into three major categories: transportation, service and manufacturing. Most of the jobs fall under the category of service. Hence, IMPLAN focuses more on indirect service-oriented jobs that would be created as a result of an investment in the railroad industry in the respective county. At the same time, the jobs created by customers are mainly manufacturing-oriented. The jobs in the service-oriented category include jobs in maintenance and repair, retail stores, security and insurance agencies, employment services, medical offices, and hotels.

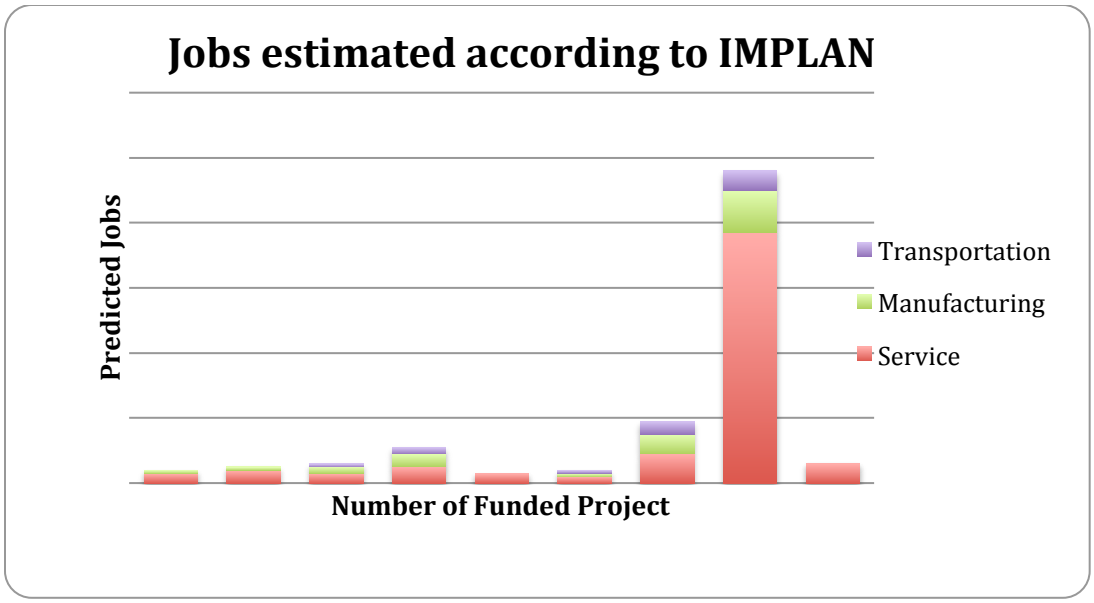

Figure 4: Graph of Jobs estimated by IMPLAN for the nine funded projects FY 2010[25]

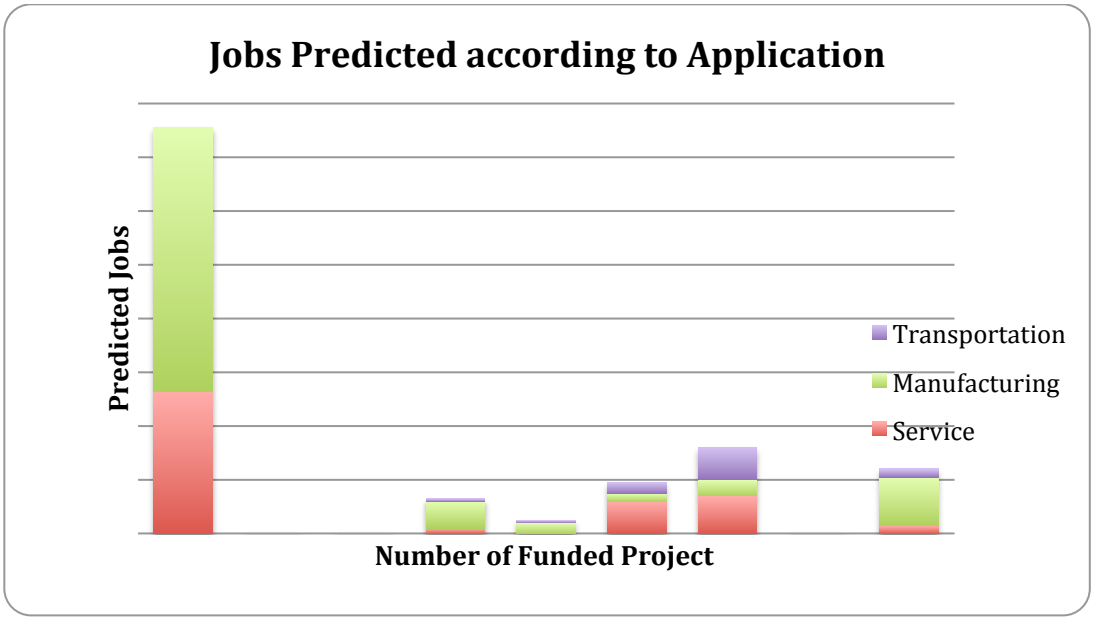

Figure 5: Graph of Jobs Predicted FY 2010 according to NJ Rail Grants Applications of the customers[26]

[25] Employment numbers estimated by IMPLAN when projects in the form of activities are assigned to the respective county models

[26] Jobs predicted by Applications according to the Rail Grants Data FY2010

It is clear from the graphs in Figure 4 and Figure 5 that IMPLAN estimates more jobs in the service-oriented category while applications predict more jobs in the manufacturing category for the customers. Also, the jobs as predicted by applications can be considered to be much larger than the numbers obtained by IMPLAN from the following graph in Figure 6.

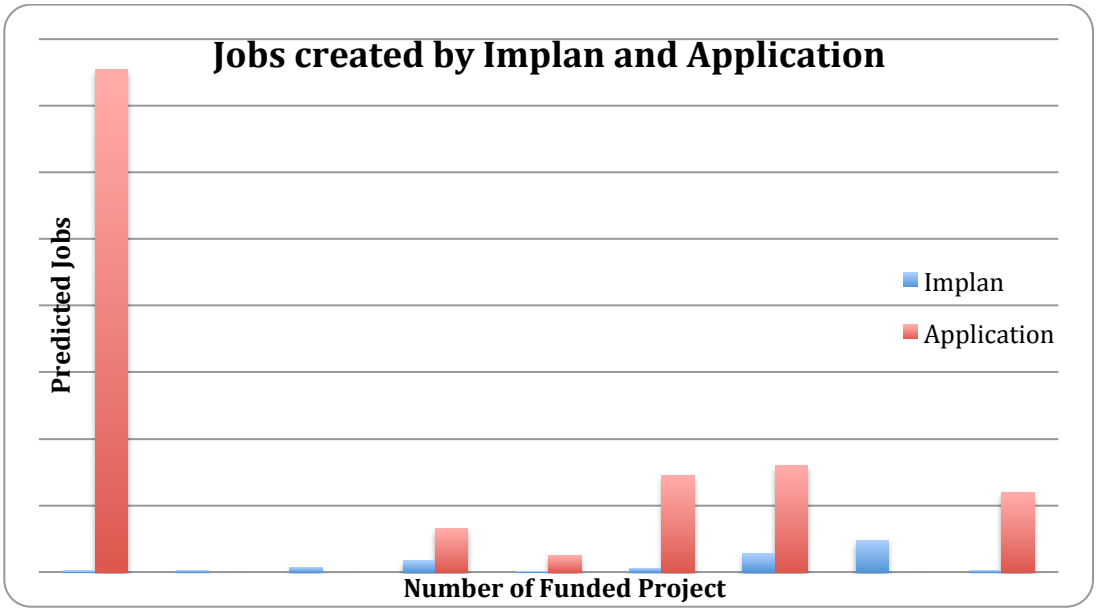

Figure 6: Graph of Jobs estimated by IMPLAN and predicted by NJ Rail Grants applications FY 2010

For each project, the red column represents the jobs predicted by the 2010 NJ rail Grants Program applications. The blue column represents the jobs predicted by IMPLAN. The applications might be over-estimating the number of jobs. Indirect jobs are important elements to consider while deciding which projects will be funded. This information can be considered alongside information relating to the indirect jobs created along with the direct jobs estimated by the applications.

A project can be ranked with respect to four different criteria, as shown in Table 23. First, according to the jobs predicted by IMPLAN. Then, jobs estimated by the application for the customers. Then, the benefit cost ratios. Finally, the average or total scores provided by reviewers.

Table 23: Ranks of projects based on different aspects FY 2010

	IMPLAN Based Ranking		NJ rail Grants Program Applications Based Ranking					
Prj.#	Jobs	Rank_Jobs	Jobs	Rank_Jobs	BC ratio	Rank_BC ratio	Scores	Rank_Scores
1	1	17	151	1	5.1	14	14	8
2	1.4	15	0	12	46.437	1	13	11
3	0.2	19	0	12	3.744	16	9.75	17
4	2	11	0	12	10.274	8	13.25	10
5	18.5	1	0	12	1.221	22	10.5	15
6	2.5	10	8	9	1.28	21	6.625	22
7	2.8	9	51	2	4.36	15	9.625	18
8	3.2	8	45	3	6.27	13	11.125	13
9	1.9	12	23	7	2.836	17	8.625	21
10	4.5	6	13	8	1.92	19	9.875	16
11	0.7	18	5	11	1.88	20	10.625	14
12	1.2	16	26	5	36.029	2	14.625	4
13	1.7	14	8	9	27.137	4	14.875	3
14	6.9	3	32	4	27.1	5	13.625	9
15	5.1	5	32	4	8.163	12	14.375	7
16	3.5	7	32	4	12.987	7	14.625	4
17	1.8	13	32	4	29.147	3	15.375	2
18	6.7	4	32	4	8.32	11	14.625	4
19	18.5	1	5	11	9.868	9	9.375	19
20	18.5	1	7	10	2.74	18	9.25	20
21	10.7	2	0	12	13.33	6	16.25	1
22	1.2	16	24	6	9.825	10	13	11

Using the table above, each project has been ranked on the basis of four different categories. If IMPLAN is estimating the highest number of jobs for a particular application, it is ranked as 1. If the project number is 5 according to the criteria of jobs estimated by IMPLAN, it is ranked as 1, 12, 22 and 15—rankings, in other words, based on the jobs predicted by the applications for the customers, benefit cost ratio, and scoring, respectively.

Conclusion

This study used a version of IMPLAN with FY 2010 county-based and State data. In the future it can be updated with the most recent dataset available. The value multipliers can be used to find the total output value for investment dollars. Similarly, employment multipliers can be used to find the total employment for the county investments. The scenario results are in the form of direct, indirect, and total output value, and employment. In addition, a detailed impact of an activity in

the form of investment can be obtained. The detailed results show the impact of the change in economy on each of some 500 industries. The single region scenario feature can be used to find the economic impacts of one or more projects in the county. Different combinations can be compared to obtain the most appropriate and beneficial project combination. Being a multiplier-based software, IMPLAN creates output values that are higher for higher investments.

The multiple region scenario is an important feature, which can be used to see the effect of any investment in a county on the neighboring counties. The employment multipliers provide the total number of permanent jobs created by the dollar investment in a particular industry. The ripple effects of those changes are reflected across many industries. IMPLAN can be useful to estimate such indirect impacts on the changes to the economy. The jobs estimated are mostly service-oriented and based on the multipliers. No changes in the database are allowed in the available version. Hence the creation of industry jobs cannot be governed, a potentially useful feature for certain industries not considered while estimating the economic impact due to the investments in the railroad industry.

Several times the applications over estimate job numbers that are not supplemented with any supporting documents. Also, the estimated numbers cannot be verified. IMPLAN, however, can be used to estimate the number of jobs created. In doing so, the projects are analyzed with a singular trusted source and over estimation can be eliminated. Moreover, IMPLAN can be used along with the B/C analysis and score sheets to estimate the overall impact of the investment in the Railroad industry. Many other states use an economic impact analysis models like IMPLAN. For example, PennDOT uses IMPLAN and Benefit Cost Analysis for their Freight Rail Grant Assessment program.

TRAFFIC AND OTHER IMPACTS

Introduction

According to the Freight-Rail Bottom Line Report by the American Association of State Highway And Transportation Officials (AASHTO), "The Rail and Trucking industries are competitors, but they are also partners." Rail transport usually begins or ends with a truck movement. Rail and trucking companies can work as partners if the integrated optimized transfer of freight is made possible for each mode. At the same time, using the railroads instead of trucks on highways provides significant environmental benefits. The US Environmental Protection Agency estimates that every ton-mile emits roughly three times more nitrogen oxides and particulates than a locomotive. According to the American Society of Mechanical Engineers, 2.5 Million fewer tons of Carbon dioxide would be emitted into the air annually if 10 percent of intercity freight now moving by highway were shifted to rail [60].

Railroads in normal conditions are three or more times more fuel efficient than trucks, as per the AASHTO. Rail is also preferred for shipping hazardous materials due to the risks associated with trucking, including more accidents, spills, and leakages. In March 2002 the Idaho Department of Commerce said "Idaho's economy relies heavily on the freight rail system and most companies stated that they could not exist without access to railroads". [67]

Rail costs have dropped over recent decades due to competition with trucks. This benefits the shippers, consumers, and the economy. On the other hand, shipment-tracking technologies have advanced in their applications for intermodal shipments. However, consistent tracking and reporting consistently on carload shipments still remains a challenge. Trucking has an advantage over rail in areas of visibility, reliability, and speed. It is a challenge to increase the performance in these areas at competitive costs for the rails [60].

Often, rails provide shippers of heavy materials or larger volumes of materials with a transportation option that can be significantly more cost-effective than trucking. Depending on the density of the commodity, one railcar may move the same weight or volume as four or five trucks. The Railroad industry also makes direct contributions to the nation's economy. The railroads help reduce pressure on the nation's highways. According the AASHTO, if everything moving by rail were to move instead by truck, an additional 61.4 billion truck Vehicle Miles Traveled (VMT) would be logged every year. The Mid-Atlantic Rail Operations Study is a joint effort of five states (New Jersey, Pennsylvania, Maryland, Delaware and Virginia), the I-95 Corridor Coalition, and three railroads (NS, CSX and Amtrak), to examine rail infrastructure choke points and opportunities for improvements paralleling I-95, I-81 and other critical highway corridors. Freight railroads in New Jersey are shown in Figure 7.

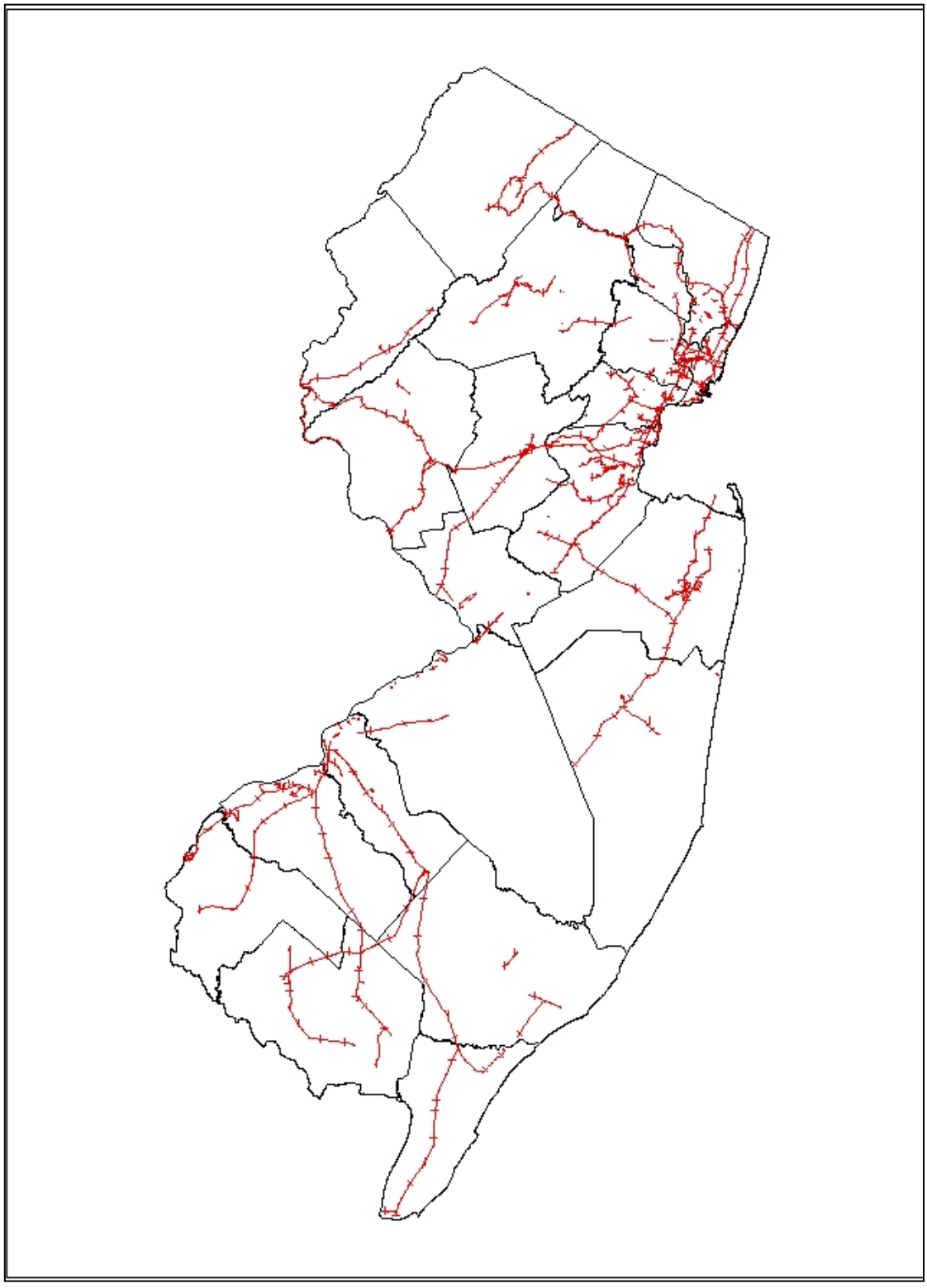

Figure 7 - Map of New Jersey with freight railroads [68]

Estimation of Highway Impacts

To estimate highway impacts, this project uses a software application called ASSIST-ME (Advanced Software for State-wide Integrated Sustainable Transportation System Monitoring and Evaluation) was used to calculate the average costs for trucks making a trip on the highways in lieu of rail [61]. ASSIST-ME was developed as a tool to visualize and analyze the output of transportation planning models in a GIS environment. The tool is based on a flexible framework that allows for any traditional transportation planning model. Here, we used the output of North Jersey Transportation Planning Authority's (NJTPA) North Jersey Regional Transportation Model – Enhanced (NJRTM-E) running in CUBE.

ASSIST-ME was conceived as a tool to allow agencies and planners to analyze and visualize a transportation planning model output. The software tool offers four key functionalities:

1. Data Visualization
2. Demand Analysis
3. Path Analysis
4. Benefit/Cost Analysis

It is updated with the latest pollutant emission estimation procedures used by Environmental Planning Agency, Motor Vehicle Emissions Simulator (MOVES). Among the various functionalities of ASSIST-ME, the Trip Cost estimation is of major importance. It compares the costs of freight distribution through rail and highways and obtains maximum annual average and marginal costs savings due to freight being moved by different railroads is obtained.

Methodology

The analysis is based on the NJRTM-E 2010 Base AM peak highway assignment. There are two major cases: (1) Where detailed Origin-Destination (OD)for the shipments data is not available and (2) Where detailed Origin-Destination for the shipments data is available. In most cases the detailed OD for shipment data is unavailable. In such instances the longest OD pair is identified and used as the benchmark. When trucks transfer goods in lieu of rail, all rail traffic is halted and moved by truck to obtain the impacts on the highway. The average costs are determined in terms of unit costs per truck per mile. ASSIST-ME can be used to estimate the following cost strategies:

- Vehicle Operating Cost
- Congestion Cost
- Accident Cost
- Roadway Maintenance Cost
- Air Pollution Cost
- Noise Cost

The vehicle operating costs include the ownership variable costs and the operating costs, which increase with vehicle mileage. All vehicle operating costs,

save for depreciation, are defined by their respective unit cost values per mile (obtained from the American Automobile Association [62] and the USDOT [63]). Congestion costs are estimated by using the link travel times from the transportation planning model output and a value of time assumption. The accident costs are referred to as the economic value of total human and property damages caused by vehicle crashes. ASSIST-ME uses the accident cost function developed by Ozbay et al [64]. Maintenance costs are comprised only of the pavement resurfacing work. ASSIST-ME uses the resurfacing cost function estimated by Berechman et al [65]. Highway transportation contributes to air pollution due to the release of pollutants during motor vehicle operations. ASSIST-ME uses emission rate functions estimated by Ozguven et al.[66] using MOVES for hydrocarbons, carbon monoxide, nitrogen oxide, and particulate matters. The noise costs are the estimated rate of depreciation in the value of residential units located at various distances from the highways. ASSIST-ME uses the noise cost function estimated in Ozbay et al [64].

Results

When the approximate maximum annual cars and the miles travelled by them are known, the total savings can be determined by multiplying the unit costs obtained from the ASSIST-ME and the miles and the number of cars.

Based on the NJRTM-E 2010 Base AM Peak highway assignment, the maximum annual average and marginal costs savings due to the freight being moved by NYS&W is calculated using ASSIST-ME (see Figure 7 and Table 24). All rail traffic was halted and moved by only trucks assuming the value of time to be $25 per hour and the trips to be inbound. The following savings were observed on different rail lines.

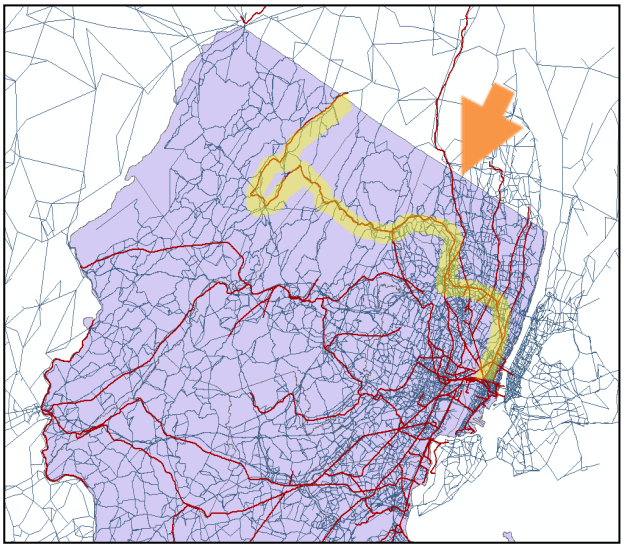

Figure 8 – NJRTM-E Model's clip for NYS&W route

Table 24: Transportation Network Impacts (NYS&W)

Average Costs	4 trucks/railcar
Operating Cost	$409,917
Congestion Cost	$1,654,220
Accident Cost	$11,292
Air Pollution Cost	$73,835
Noise Cost	$1,617
Maintenance Cost	$129
Total Max Annual Cost Savings	**$2,151,109**

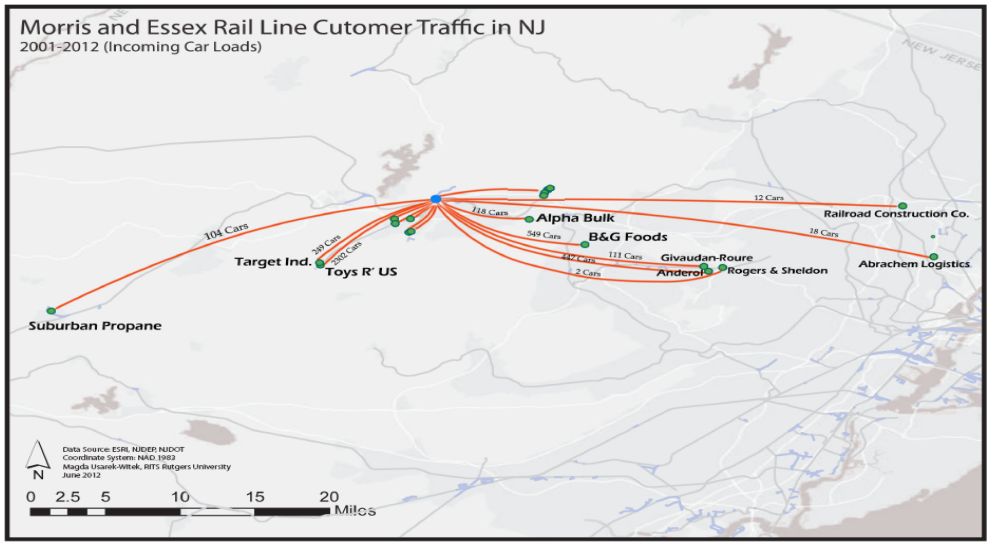

Figure 9: Inbound Trucking Pattern for Morris and Essex is known from the detail origin and destination of the shipments (68)

Table 25: Transportation Network Impacts (Morris and Essex)

Average Costs	4 trucks/railcar
Operating Cost	$30,575
Congestion Cost	$96,503
Accident Cost	$742
Air Pollution Cost	$6,348
Noise Cost	$136
Maintenance Cost	$62
Total Max Annual Cost Savings	**$134,367**

On average, the inbound trucking on the Raritan Central Line (shown in Figure 9) is 15,000 cars/year. The Rail line serves 14 to 15 customers located at the Raritan Center in Edison, New Jersey.

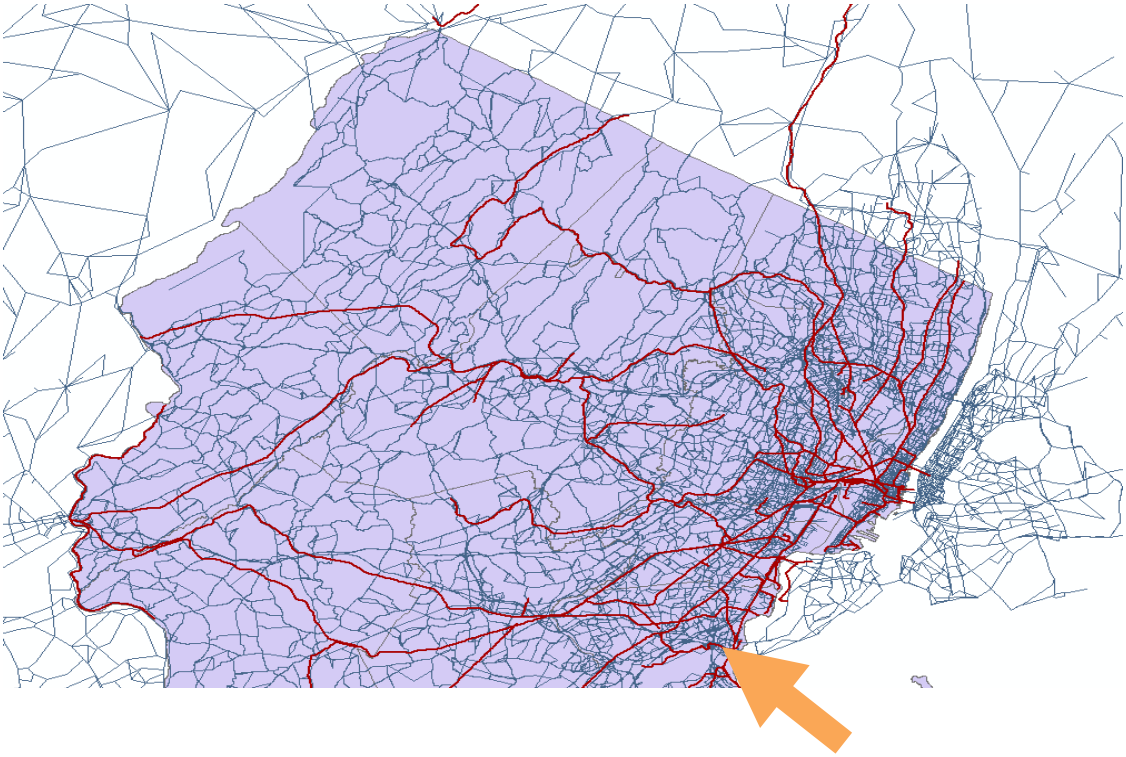

Figure 10: Location of Raritan Center, Edison, NJ

Table 26: Transportation Network Impacts (Raritan Central Line)

Average Costs	**4 trucks/railcar**
Operating Cost	$690,565
Congestion Cost	$1,814,086
Accident Cost	$12,811
Air Pollution Cost	$179,023
Noise Cost	$4,951
Maintenance Cost	$3,314
Total Max Annual Cost Savings	**$2,704,750**

For the SMS Inbound Trucking Impacts, the unit costs of trucking from the North Jersey Model are obtained. The shortest path of the route is obtained using Google Maps; and the inbound trucking costs per truck per trip are determined. For the Pureland and Paulsboro Refinery destinations, the cost savings are obtained (see Table 27 and Table 28).

Table 27: SMS Inbound Trucking Transportation Impacts

Average Costs	**4 trucks/railcar**
Operating Cost	$152,531
Congestion Cost	$501,747
Accident Cost	$4,098
Air Pollution Cost	$37,287
Noise Cost	$812
Maintenance Cost	$740
Total Max Annual Cost Savings	**$697,216**

Table 28: Winchester and Western Inbound Trucking Impacts

Average Costs	**4 trucks/railcar**
Operating Cost	$234,323
Congestion Cost	$770,799
Accident Cost	$6,296
Air Pollution Cost	$57,281
Noise Cost	$1,248
Maintenance Cost	$1,137
Total Max Annual Cost Savings	**$1,071,083**

Hence, the total theoretical maximum savings due to rail, if all the trips were made by truck is as below in Table 29.

Table 29: Total Theoretical Maximum savings due to rail

Line	**Approximate Max Annual Cars (2002-2011)**	**Max Annual Cost of Trucks**
NYS&W	18,000	$ 2,151,109
M&E Railway	1,000	$ 134,367
Raritan Central Railway	15,000	$ 2,704,750
SMS Lines	30,000	$ 697,216
Winchester & Western	9,000	$ 1,071,083
Total (5 lines)	**73,000**	**$ 6,758,525**

Few example applications of short rails are considered in the study of the traffic impact. If the proposed rehabilitation or construction of new infrastructure on those short rails was not completed, then the following unit costs in Table 30

could have surfaced because of impaired short rails. The Unit costs are the costs per truck per mile.

Table 30: Examples of Unit costs used in various applications

Short Rail	Operating Cost	Congestion Cost	Accident Cost	Air Pollution Cost	Noise Cost	Maintenance Cost	Total Unit Costs
B&DRR	$0.16167	$0.1614	$0.1579	$0.029	$0.0004	$0.000005	$0.5099
M&ER (Morris County)	$0.1625	$0.1472	$0.0059	$0.367	$0.001	$0.0007	$0.3808
NY&SQ (Hudson Region)	$0.1619	$0.1659	$0.006	$0.313	$0.0009	$0.0001	$0.3619
M&ER (Essex County)	$0.1616	$0.1613	$0.0074	$0.037	$0.0011	$0.0002	$0.369

Response of the Customers served by Railroads to the Additional Phone Interviews

Customers served by different railroad companies were also interviewed with questions regarding an increase to business and/or shipment as brought on by the rehabilitations/new infrastructure of railroads. Nearly 25 customers were contacted via phone; 10 customers were contacted by email. It was difficult to get in touch with the right person who could answer our questions. From the responses obtained, most were passive. Moreover their answers suggested that they were unaware of any changes to the railroads as a result of the funding obtained from the program. This can be due to the fact that the communication between the businesses contacted and the shorty rail companies might not exist. Thus, they were not really aware of the improvements resulting from the investment. Moreover, there is a time lag between the acquisition and use of the grants and the time these interviews are conducted. A more efficient approach would be to identify businesses to be contacted at the time of the application with a plan for a several follow-up interviews / surveys after the completion of the improvements.

Table 31: Types of Responses given by Customers of Railroads

Responses	**Percentage**
Not Interested	15%
Not Reachable/Voicemail	55%
Not really affected	15%
Do not Use Railroads anymore/would transfer to trucks soon	15%

CONCLUSIONS

Redefinition of Program Objectives

The genesis of the rail freight assistance program administered by the New Jersey Department of Transportation (NJDOT) can be ascribed to the federal re-organization of the bankrupt railroads in the Northeast in the 1970s. That re-organization created the Consolidated Rail Corporation (Conrail) as the primary trunk freight rail carrier for Northeastern states, New Jersey included, and the paring of light density rail lines from Conrail's trunk system. Congress created a light density line assistance program through which federal funds could be allocated to assist states in supporting continued rail freight service over light density lines. Many of these lines had suffered considerable deferred maintenance during the latter years of the predecessor railroads' bankruptcies. A variety of short line rail carriers stepped forward to operate rail freight services and to maintain the physical plant.

Eventually, the federal government discontinued their financial support for the light density lines program. Some states, including New Jersey, continued to provide assistance, usually in the form of capital. In these early years, the NJDOT staff directed the bulk of their financial support to the rehabilitation of these lines, with the aim of maintaining safe operations and speeds that met customers' freight traffic needs. For a number of years, the annual budget for numerous New Jersey governors included $10 million to be distributed to short line carriers.

During the past 35 years New Jersey's industrial and distribution landscape changed and the structure of the Northeast's railroad industry and the corporate structure of the short line and regional rail operators were all forced to evolve. Many New Jersey manufacturing sites such as auto plants and oil refineries closed or shifted their goods distribution to trucks. Accordingly railroads adapted to establishing long unit trains for container shipments out of the region's major port facilities, for tanker car shipment of North American crude oil to the remaining State's refineries and for transporting solid waste. To reduce the sharing of revenues with short line operators, Conrail established transload operations and team tracks where commodities could be transferred to trucks for a short distance distribution to end-users.

Several fundamental institutional changes occurred in the past 14 years. These include the purchase of Conrail in 1999 by two Class 1 multi-state carriers, CSX and NS; the creation of those carriers' joint operating territory in sectors of New Jersey managed by Conrail Shared Assets Organization (Shared Assets); and the sale of the majority of the stock of the principal smaller regional carrier, NY Susquehanna & Western, to CSX and NS. During the Conrail era, financial relationships between the trunk line carriers and short lines were strained. Although NS has aggressively built freight (rail-truck) transfer facilities along lines

it exclusively operates in Allentown and elsewhere Pennsylvania, the relationships between CSX, NS, and Shared Assets and the short lines have improved. The one remaining area of short line carrier concern is NS's inclination to divert incoming traffic to its intermodal terminal in Allentown.

During this period, New Jersey State government has had episodic dealings with the Class 1 railroads to support overarching goods movement policy goals. This support has been expressed in previous State Rail Plans, encouraging Port Authority to improve the physical plant for the transfer of containers from ships to the railroads; to improve clearances; and to expand capacity, which enables the railroads to move goods efficiently to and from the Port facilities in Newark, Elizabeth, and Staten Island. These occasional transactions, all supported by Port Authority funds, have been conducted outside the confines of the rail freight assistance program.

In recent years the NJDOT policy has shifted to expanding the extent of the State's rail freight system in such a way that the system can safely carry shipments in rail freight cars weighing as much as 286,000 lbs. The maximum weight of 286,000 lbs. is the emerging industry standard for national rail freight traffic. Where short lines cannot safely carry freight cars up to this standard weight, they can be precluded from participating in longer distance shipments. If they do participate, they must operate at very low speeds over structures that do not meet the national load-bearing standard. This deficiency has the effect of discouraging the development of rail-served industrial sites along lines with below-weight structures. This policy goal has been addressed in a limited capacity through the rail freight assistance program. This is typical of the program's uneven policy concerns regarding major goods movement.

Another set of important institutional changes have occurred over the past 35 years. The program's applicant pool has evolved. New Jersey short lines are now owned by international corporations, domestic non-rail corporations, large real estate/industrial park developers, and state and county agencies. One short line in New Jersey, Winchester & Western, has been acquired by Unmin, a multi-state holding company. Other New Jersey short lines have expanded their operations to other states, such as Morristown & Erie Railway, now affiliated with the Maine Eastern RR. SMS has expanded operations into Pennsylvania and New York State. Raritan Central has expanded operations into Pennsylvania. It is expected that these expanded corporate operations have a greater financial capability than the independent short line operators that had once regularly applied for rail freight assistance program funding.

The single measure applied by the NJDOT to differentiate between carriers' financial capability is the match required on an application –Class 1 railroads require 50 % and Class 3 railroads require 10 %. The applicants that can meet these requirements are often affected greatly by internal corporate restructuring. Most noteworthy are the changes in corporate structure that have affected the

NY Susquehanna & Western, a Class 3 Railroad, and Shared Assets, a *wholly-owned subsidiary of two Class 1 railroads.* In the case of NY Susquehanna & Western (a frequent applicant and recipient of rail freight assistance from the NJDOT), it changed its corporate ownership from an independent regional railroad to one in which the preponderant majority of its shares are now owned by CSX and NS, which are two Class 1 carriers. Since the financial responsibility for this carrier now rests with two Class I railroads, should capital needs be financed by the two Class I railroads or the NJDOT? In another example, Shared Assets, a wholly-owned subsidiary of CSX and NS, has occasionally applied and received NJDOT rail freight assistance. It will be useful to better understand if the specific project proposed by a subsidy of a Class I railroad short line application serves the goal of connecting the short line to the national rail system. These are the types of emerging issues that suggest the NJDOT, as a result of this corporate restructuring, reconsider and refine the purposes of its rail freight assistance program.

The NJDOT may need to further consider that applicants have disparate financial needs, especially based on the variety of corporate and public structures identified among applicants in this study. One possible approach would be for NJDOT to request additional information in the application process regarding an applicant's corporate structure, financial capability, or business plan.

Financial analyses of private sector firms requesting grant funds to maintain or expand their business is not necessarily one of the core competencies of the NJDOT. So, how can the NJDOT accurately test an applicant's capacity to finance improvements? How can the NJDOT determine if an applicant was capable of taking a loan instead of a grant–and if so, on what terms? One answer is that the NJDOT may consider incorporating these kind of financial analyses into managing this program as well as using it to redefine the program's purpose.

Current conditions suggest another reason that this program demands additional scrutiny. The Transportation Trust Fund is being stressed, and all current uses could be re-examined to guarantee the funds are used prudently. More importantly, New Jersey has a high unemployment rate so expenditures that are made with the asserted purpose of fostering economic growth, such as the rail freight assistance program, can be reviewed to determine how effective they have been in achieving that goal and how that performance might be improved.

While the rail freight assistance program project evaluation criteria attempt to highlight the economic development potential of an applicant, this study's research determined that the primary nature of NJDOT's grants has been directed toward the basic renewal of rail infrastructure. Economic development and job creation generally have a limited impact on project selection. This might also be the result of the fact that fund are small and thus less capable of underwriting large projects. At the same time, the current program lacks the

flexible structure to encourage large projects. As it stands now, in practice, the primary objective of the program appears to be to maintain the safety and service reliability of short line railroads.
As the NJDOT approaches this responsibility to redefine the rail freight assistance program, it must consider whether the program should remain the "funder of last resort" for the New Jersey's short lines, concentrate on strategic rail freight investments benefiting any worthy carriers that possess a reasonable chance of retaining or attracting industry in competition with other states, or, re-mold the program to function as something that accomplishes both or some of these objectives.

New Approaches to Consider

The NJDOT generally does not use loans as a means to effectuate its goals or achieve applicants' objectives. Introducing a loan option would expand the program's annual revenue stream and effect greater impact on New Jersey's freight railroad system. The program would need to draw guidelines to distinguish where loans are appropriate and where grants are necessary. A required financial analysis for loans would mandate applicants to submit more corporate and financial information, and require a knowledgeable review of that material. As previously noted, this would require securing additional expertise than what is currently available within the NJDOT.

The study team found that several states solely offer loans or employ loans in conjunction with grants to make use of limited funds. Applicant matching is often required to a certain level of the project cost, with requirements differing from state to state. Several states also negotiate higher or offer higher match by the applicants depending on the applicant's ability to pay and the needs of the project. Among the industrial states that use these approaches are New York, Illinois, Ohio, and Washington State.

The study team also found that other states' programs have committed to post-implementation monitoring and reporting, which are largely missing from the New Jersey rail freight assistance program. This monitoring and reporting is necessary to maintain program integrity. Post-award monitoring and reporting would determine whether applicants' projections will have been realized by the assistance and whether initial projections about job creation or preservation or carloads or other selected measures were realistic. This regimen of monitoring and reporting (as practiced in Pennsylvania, Iowa, Ohio, Virginia, and Washington State) is often accompanied by "clawback" provisions whereby all or a portion of the grant money must be returned if projections are not realized.

Overhaul of project applicants' submissions

Following the rigorous practices of the New Jersey Economic Development Authority in evaluating private sector proposals for grants and loans, the NJDOT is advised to review the contents required from rail freight assistance applicants. The review could address the following aspects of an applicant's submission: corporate structure, applicant and parent's or affiliate's financial capacity, capital project programming needs, operating projections, availability of funds from federal or other states' assistance programs. The provided data should be in a uniform format and certified by the carriers' CEO. Projections on increases in car loadings, retention and growth in jobs and beneficial effects on customers' service or prices dependent on the receipt of the assistance sought should be corroborated, in writing, by the rail customers.

Revision of project evaluation criteria

This study found that ratings derived from current evaluation criteria do not sufficiently differentiate between projects. More specifically the current structure produces evaluation results within a small range. Based on a review of the cost/benefit analysis and other rating categories, this research demonstrates a need to improve the quantification of benefits. For example, tax revenues could be included in the cost/benefit calculation. The NJDOT could consider adopting a more vigorous cost/benefit that discards jobs a primary metric if those job numbers are reported without detailed justification.

Additional weight can be included in the strategic objectives as articulated in the *State Rail Freight Plan.* There is also an opportunity to rigorously monetize emissions, safety, road maintenance and congestion costs in the benefit-cost calculation. In the application form there is some double counting between the sub-criteria used for the BC analysis and other criteria in the NJDOT scorecard. The weights assigned to each criterion in the scorecard could also be revised so they can be used to differentiate between feasible (realistic) and infeasible applications, and also to reflect the priorities of the NJDOT.

Modification of project evaluation roles

If the economic development is re-affirmed as the paramount objective of a rail freight program, NJDOT could also institutionalize its sharing of program decision-making with the Governor's Business Action Center. Doing so would allow that policy group to participate fully during the project review phase. This institutionalized role would improve the likelihood that synergy would be identified between economic development initiatives endorsed by state government, perhaps unknown to the NJDOT staff and the applicant rail carriers.

The NJDOT has asked the Department of Environmental Protection (NJDEP) to review applications on an ad hoc basis and his type of interagency relationship

can also be institutionalized. For example, railroads are sometimes involved in enforcement proceedings regarding the handling of trash, or hazardous or other environmentally sensitive materials, and if any such proceedings exist, the NJDOT and the NJDEP could confer about collaborative action.

Similarly, NJ TRANSIT could be given the opportunity to review the applications. Several short line applicants operate on NJ TRANSIT-owned lines or could conceivably be operating on trackage that may serve as a potential route for future passenger service.

Options for project administration

Beyond the need to redefine the purpose of rail freight assistance funding, the central findings of this study focus around administrative changes to assure that limited State funding goes to the private sector recipients capable of realizing maximum economic benefits. The study has found that the long-standing practices of the New Jersey Economic Development Authority (NJEDA) address the same issues in dealing with private sector applicants for assistance: is the applicant deserving of State financial support and did the aid produce the asserted economic development benefits? These practices are among the core competencies of the NJEDA.

This study recommends that the NJDOT staff confer with the NJEDA staff to determine which alternative course of action to follow:

1) Consider requesting NJEDA to study and make recommendations on the rail freight assistance program's financial analysis of applicant carriers and post-award monitoring of results; or
2) Consider contracting with NJEDA to administer those same stages of the rail freight assistance program; and, to provide advice in the project evaluation process. NJEDA has a similar arrangement with the Board of Public Utilities, whereby it assists that agency in the financial analysis of financial assistance requests (f this approach were followed, an annual fee would be deducted from the annual appropriation.)

Following either course of action, in addition to a thorough examination of the program's purpose, would profoundly improve NJDOT's management of this annual appropriation. In turn, the program could better meet New Jersey's rail freight needs and perhaps increase public confidence in an expanded capital program.

Finally, maintaining and rebuilding railroad infrastructure is a core competence of the NJ TRANSIT Rail Operations. The NJDOT could consider contracting with NJ TRANSIT to perform evaluations of applicants' capacity to perform work outlined in the application and in-the-field inspections during the application and implementation phases.

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