

Annual Implementation Report – 2014

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Submitted by:

Alan M. Voorhees Transportation Center
Rutgers University



NJDOT Research Project Manager
Amanda Gendek

In cooperation with

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Technology Transfer Program Annual Implementation Report - 2014

Introduction

The New Jersey Department of Transportation, Bureau of Research, supports transportation research necessary in order to provide relevant information, analysis and value-added solutions to transportation agencies and professionals. The results enhance the quality and cost-effectiveness of the policies, practices, standards and specifications required when planning, designing, building and maintaining the State's infrastructure. The funded research results in the discovery of new materials, improvement of processes, refinement of systems, and the generation of innovative ideas that improve the durability and efficiency of infrastructure and the mobility, accessibility and safety of the State's residents, workers and visitors. However, the long-term effects, or the next necessary steps required to achieve full-scale implementation, as well as the benefits, are not always known. The Bureau is often approached by sponsors to justify the value of these projects to a much broader audience.

The purpose of the Annual Implementation Report is to review these effects. Where applicable, and where the results were reported or could be obtained, examples of the return on investment or other economic benefit to the State of New Jersey have been noted.

The Annual Implementation Report is also a means to screen for opportunities and document the strategies that have been used for technology transfer of research findings to the State's transportation community, including its transportation agencies, workforce and the broader community of transportation practitioners.

Several useful definitions for considering the role of technology transfer within the State transportation research program were provided in a recent U.S. DOT Volpe Center study (Cuddy et al, 2016) and shown below:

- "Research and Development (R&D): Any activity that aims to create or improve a technology.
- Technology: Any knowledge, process, system, or other tangible or intangible thing that could be used to create benefits. Examples of new technologies include a survey, hiring process, a piece of software or "app", a traffic model, a new road construction technique or an unmanned aircraft.
- Technology Transfer (T2) Activities: All activities designed to help ensure that technologies created or improved through R&D are widely adopted for use outside or within the research-producing organization.
- Adoption: The decision to make a technology available for use in ordinary operational situations. This may or may not involve commercialization.
- Implementation Activities: Activities led by an adopter to make a technology available for ordinary operational use. These activities are generally preceded by adoption, and they often draw on research organizations for technology information and support."

Research Approach

In 2014, the Bureau of Research received eighteen final research reports for work undertaken in previous years. The contracted value of the completed research projects was approximately \$3.16 million. As shown in Table 1, most of the completed research were in the Operations & Preservation and Multi-Modal System Components & Users categories in terms of completed projects and contract value. Table 2 contains a list of the completed research reports.

Table 1 - Number and Value of Completed Research Reports by Broad Research Category

| Broad Research Category | Number of Reports Completed | Total Contract Value Completed |
|---------------------------------------|------------------------------------|---------------------------------------|
| Operations & Preservation | 7 | \$ 1,125,847 |
| Multi-Modal System Components & Users | 5 | \$ 847,045 |
| Planning & Environment | 2 | \$ 545,498 |
| Traffic & Safety | 1 | \$ 383,308 |
| Policy & Organization | 1 | \$ 220,000 |
| Design & Construction | 1 | \$ 38,000 |
| Total | 17 | \$ 3,159,698 |

Source: NJDOT Bureau of Research, Database of Final Reports
<http://www.state.nj.us/transportation/refdata/research/ReportsDB.shtm>

The completed research reports addressed the treatment of implementation themes in various ways. Some research were primarily analytical or evaluative studies which resulted in the reporting of findings to the stated research question. Some studies made recommendations for future research to further refine technologies or advance research questions to a next stage. Some of the studies made recommendations for implementation that could be taken in the future. Another segment of studies made implementation or technology transfer activities an element of the completed research study.

This report provides results from an investigation into steps taken, if any, at the conclusion of the research efforts. Research faculty, consultants, and NJDOT staff (current and former) were interviewed by telephone, by email or in person. The review of implementation activities that have followed from the research shows that some efforts resulted in research papers and presentations at conferences to disseminate key findings, while implementation in other cases may have been realized through specific policy changes or the institutionalization of new standards or tools for doing business. Where available or discovered, potential benefits related to the research study topic were noted. None of these studies would have been possible without public support.

Table 2 - 2014 Research Reports by Type of Research and Treatment of Implementation Theme

| ID | Title | Future Research | Implementation Activities | Implementation-Minded Recommendations | No Discussion of T2 | Research Type | Broad Research Category |
|-------------------------|---|-----------------|---------------------------|---------------------------------------|---------------------|------------------------------|---------------------------------------|
| FHWA-NJ-2014-001 | Snow Model Analysis | X | X | | | Model Development | Operations & Preservation |
| FHWA-NJ-2014-002 | Correlation Between Multiple Stress Creep Recovery (MSCR) Results and Polymer Modification of Binder | | X | X | | Standards Evaluation/ Design | Design & Construction |
| FHWA-NJ-2014-003 | Streamlining the Project Management Process at NJDOT's Bureau of Research | | | X | | Policy Research | Policy & Organization |
| FHWA-NJ-2014-004 | Teen Driver Safety Metrics: Effectiveness of NJ's GDL Law in Improving Teen Driver Safety | | | | X | Statistical Analysis | Traffic & Safety |
| FHWA-NJ-2014-008 | Offshore Wind Development Research | | | X | | Project Feasibility Study | Multi-Modal System Components & Users |
| FHWA-NJ-2014-009 | Environmental Management System for Transportation Maintenance Operations | | X | X | | Project Feasibility Study | Operations & Preservation |
| FHWA-NJ-2014-010 | Stormwater System Monitoring and Evaluation | X | X | | | Technology Testing | Operations & Preservation |
| FHWA-NJ-2014-011 | Stormwater System Monitoring and Evaluation - Implementation | | X | | | Technology Testing | Operations & Preservation |
| FHWA-NJ-2014-012 | Landfill Closure With Dredged Materials - Desktop Analysis | | | | X | Site Related Investigations | Multi-Modal System Components & Users |
| FHWA-NJ-2014-013-I & II | Feasibility and Efficacy of Public Transportation Partnerships Volume I | | | X | | Policy Research | Multi-Modal System Components & Users |
| FHWA-NJ-2014-014 | Measuring Benefits of Transit Oriented Development | X | | X | | Policy Research | Multi-Modal System Components & Users |
| FHWA-NJ-2014-015 | Study of Public Perception of Traffic Congestion in New Jersey | X | X | | | Technology Testing | Planning & Environment |
| FHWA-NJ-2014-016 | Safety and Accessibility of Dynamic Message Signs (DMS) | | | X | | Standards Evaluation/ Design | Operations & Preservation |
| FHWA-NJ-2014-017 | Impact Analysis of Recreational Transit Services on Local Community Economic Development, Employment and Spending | | | | X | Survey Research | Planning & Environment |
| NJ-2014-001 | Criteria for Multimodal Project Rehabilitation vs. Maintenance | | | X | | Policy Research | Multi-Modal System Components & Users |
| NJ-2014-002 | Local Pavement Management Systems | | | X | | Policy Research | Operations & Preservation |
| NJ-2014-003 | Steel Erection Out of Plumb | | X | X | | Standards Evaluation/ Design | Operations & Preservation |

FHWA-NJ-2014-001

Snow Model Analysis

Research Category: Operations & Preservation
Project Cost: \$352,700
Project Customer: Operations
Organization: NJIT

Background

The New Jersey Department of Transportation (NJDOT) utilizes a wide array of resources to improve road conditions during each winter storm. At the time of this study, NJDOT used a snow model developed in 1978, which was no longer accurate due to significant changes in road geometry, lane-mile and traffic conditions in New Jersey over the previous 30 years. Under mounting pressure of high demand for improved winter road safety and mobility, subject to budget constraints, NJDOT sought the most cost-effective usage of their resources. Hence, a robust snow model was desirable to determine the quantity of salt to spread and fleet size required, subject to a certain service time constraint for both spreading and plowing operations.

Implementation

The study resulted in the development of a new snow model for NJDOT in the form of a spread sheet which allowed management to use a cost benefit analysis to determine how best to allocate materials and reduce costs by optimizing the number of trucks for snow plowing and salt spreading. A working database which integrated geometric, weather, and traffic data was created to improve the accuracy of fleet size estimations in the event of snow storms, as well as a dynamic speed matrix which correlated traffic data and weather during different periods. The new models were well-received by NJDOT and have been employed by Operations. The new formula is currently used for predicting fleet needs before snow events, resulting in considerable cost savings due to more accurate estimations in terms of personnel and material.

Aside from the final report submitted by NJIT, no further literature has been disseminated as a result of this research.

Table 3 – Estimated fleet size for snow plowing each region at 15-mph for 2-hour service time

| NJDOT Region | Number of Trucks | | Difference = Bid Sheet - Model |
|--------------|------------------|----------------------|-----------------------------------|
| | Snow Model | NJDOT 2012 Bid Sheet | |
| North | 393 | 585 | 192 |
| Central | 410 | 581 | 171 |
| South | 294 | 389 | 95 |
| Total | 1,097 | 1,555 | 458 |

FHWA-NJ-2014-002

Correlation Between Multiple Stress Creep Recovery (MSCR) Results and Polymer Modification of Binder

Research Category: Design and Construction
Project Cost: \$380,000
Project Customer: Infrastructure
Organization: Rowan University

Background

The MSCR test was developed in national research and was touted as a better way to specify polymer-modified, performance-graded asphalt binders. The Northeast Asphalt Users Producers Group was working for a few years on implementing this new test method and eliminating the need for an antiquated test method, Elastic Recovery. New Jersey needed an evaluation of the new test method with an emphasis on asphalt binders being supplied in New Jersey. Dr. Mehta and his team performed the testing to evaluate whether the MSCR test was robust enough for NJDOT to rely on the test to specify performance-graded binders.

For this project, the Rowan research team developed a new procedure for quantifying the different types of strains, such as elastic, linear and non-linear viscoelastic, viscoplastic and plastic from the data collected from the traditional MSCR test. This procedure significantly enhanced the understanding of how the type of polymer impacts binder performance, and constituted a new technical innovation within the asphalt industry.

Secondly, they developed guidelines for identifying good and poor performing binders. The research team identified that binders with a low non-recoverable creep compliance value (J_{nr}) of less than 0.5 kPa^{-1} coupled with high MSCR recovery at 3.2 kPa (recovery greater than 40%) and a complex shear modulus elastic portion ($G^*/\sin(\delta)$) high enough to pass the next high grade perform exceedingly well for a broad range of mixes and traffic levels.

Lastly, Rowan developed a MS Access database to make it easier for the State to transition to the new specifications.

Implementation

In a Baseline Document Change dated 8/29/2014, NJDOT formally adopted the use of the MSCR test and AASHTO M 332 as the standard specification and removed the use of Elastic Recovery as a PG plus specification. The agency was able to implement this change due in large part to the research done under this project.

Time and money are now saved in testing due to the testing protocols of MSCR versus Elastic Recovery. The elastic recovery tests require different equipment, which cost approximately \$15,000 and the specimen preparation time is significantly longer than that of the MSCR specifications. The impact of removing the Elastic Recovery from specifications is expected to result in additional savings of approximately \$500 per binder testing, and eventually, savings of thousands of tax dollars in binder characterization over a given construction season. Superior performing asphalt binder using the new test method is also anticipated.

As a result of the study, Dr. Mehta from the Rowan University research team received the 2015 NJDOT Research Showcase Implementation Award.

Several conference proceedings and journal publications from this research project have been reported from this research, including:

Zorn, S., Mehta, Y., Dahm, K., *Batten, E., Nolan, A, and Dusseau, R. "Influence of Microstructure of SBS, SBR, EVA, and PPA Modified Bitumen on Rheological Properties" the *Proceedings of the Geohunan International Conference 2011* and Publication to the *ASCE GSP Series (EI Indexed)* Hunan, June 2011.

Batten, E., Mehta, Y., Nolan, A., Zorn, S., and Dahm, K. "Correlation between PG Plus, Superpave PG Specifications and Molecular Weight from GPC for Different Polymer Modified Binders," *Proceedings of the Geo-Frontiers 2011 Conference* and Publication to the *ASCE GSP Series (EI Indexed)*, March 2011, Dallas, TX.

Dubois, E, Nolan, A. and Mehta, Y. "Correlation between Multiple Stress Creep Recovery (MSCR) Results and Polymer Modification of Binder". *Journal of Construction and Building Materials*, Vol. 65, pages 184-190.

Shirodkar, P., Mehta, Y., Nolan, A., Dahm, K., Dusseau, R., and McCarthy, L. "Characterization of Creep and Recovery Curve of Polymer Modified Binder" *Journal of Construction and Building Materials* 34(2012) 504-511.

One MS Thesis and one MS project from this research project:

Eric Dubois; 2012-2013 *Thesis Topic*: Correlation between Multiple Stress Creep Recovery (MSCR) Results and Polymer Modification of Binder.

Sarah Zorn, 2009-2010; *Project Topic*: A Study to Determine the Influence of Saturates, Aromatics, Resins and Asphaltenes (SARA) on Mechanical Properties of Polymer Modified Binder.

FHWA-NJ-2014-003

Streamlining the Project Management Process at NJDOT's Bureau of Research

Research Category: Policy & Organization
Project Cost: \$220,000
Project Customer: Bureau of Research
Organization: NJIT

Background

In order to enhance customer service and strengthen the capacity of the Bureau of Research to ensure the quality of research products, the Bureau initiated a project to rethink and improve the existing data organization, sharing, and processing systems. The ultimate objective of these improvements is to integrate the existing information resources into a centralized project tracking, document bookkeeping, and performance monitoring system. This system will synthesize the Bureau's research project management processes so as to facilitate effective and efficient communication and information sharing among Bureau staff.

Through a series of interviews, the research team documented the project management process. In order to identify specific streamlining opportunities, the process was broken down into five stages.

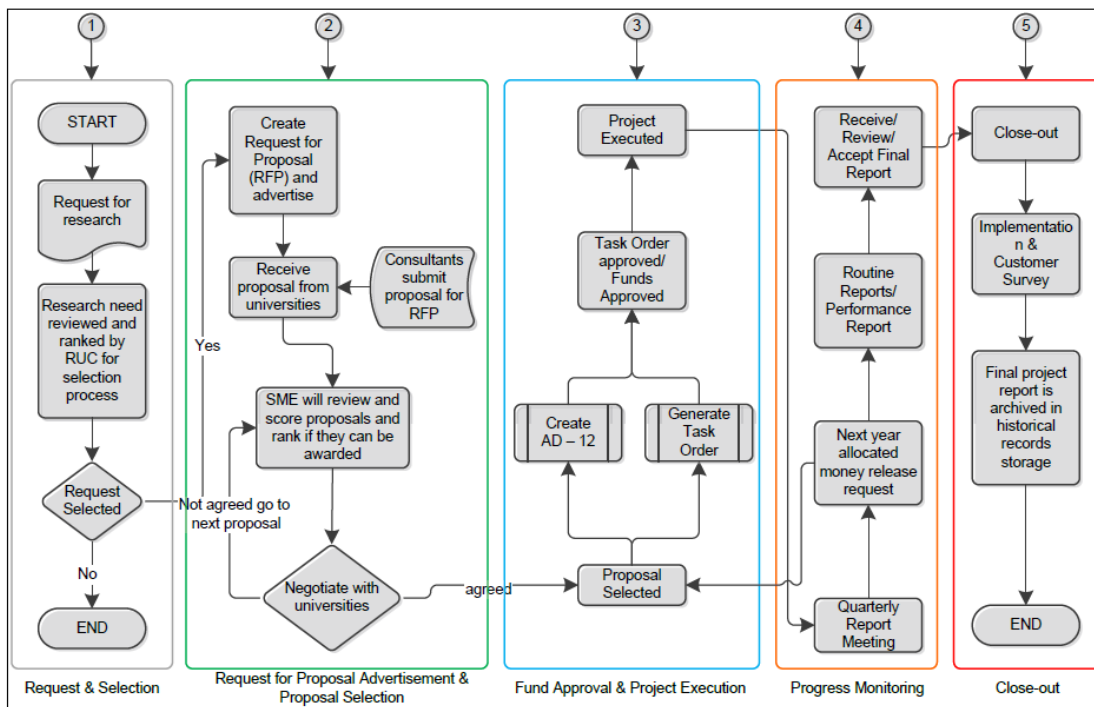


Figure 1. Project management business process at the Bureau of Research

Implementation

The software and models that were produced in this survey were deemed to be too costly and there were various difficulties with compatibility. Ultimately, the project's findings were not implemented.

FHWA-NJ-2014-004

Teen Driver Safety Metrics: Effectiveness of NJ’s GDL Law in Improving Teen Driver Safety

Research Category: Traffic & Safety
 Project Cost: \$383,308
 Customer: Motor Vehicle Commission
 Organization: Rowan University & Virginia Tech

Background

The New Jersey Graduated Driver’s License (GDL) is one of the most progressive and stringent GDL systems in place in the United States. This study sought to evaluate New Jersey crash data to determine if the GDL laws enacted in 2001 had decreased teen driver crashes and violations, as well as to evaluate the May 2010 GDL regulations on an additional hour of curfew and passenger restrictions.

Implementation

The study found that there was a significant decrease in crashes and violation rates for drivers age 16-18 after the GDL law was enacted. Other GDL restrictions were also found to have lowered crash, fatality, and violation rates across the board for teens. As the purpose of the study was evaluative in nature, there were no further policies implemented or reports disseminated aside from the final research report.

Table 4 – Reported crash rate effectiveness measures from other GDL programs in the United States

| State | Author | Teen Population | Adult Population | Pre-GDL | GDL | % Difference |
|----------------|---------------------|-----------------|------------------|---------|-------|--------------|
| Michigan | Shope et al, 2001 | 16* | 25+* | 2.170 | 1.630 | -24.9% |
| Maryland | Kirley et al, 2008 | 16 | 30-59 | - | - | -18.0% |
| California | Rice et al, 2004 | 16 | 25-34 | - | - | -23.0% |
| | | 17 | 25-34 | - | - | -6.0% |
| California | Zwicker et al, 2006 | 16 | 24-55 | - | - | -23.0% |
| North Carolina | Foss, 2001 | 16 | 25-54 | - | - | -27.0% |
| Florida | Ulmer et al, 2000 | 15* | 25-54* | 0.140 | 0.110 | -21.4% |
| | | 16* | 25-54* | 1.230 | 1.090 | -11.4% |
| | | 17* | 25-54* | 1.630 | 1.530 | -6.1% |
| | | 18* | 25-54* | 1.870 | 1.870 | 0.0% |
| Connecticut | Ulmer et al, 2001 | 16* | 25-54* | 1.280 | 1.000 | -21.9% |
| | | 17* | 25-54* | 1.620 | 1.710 | 5.6% |
| | | 18* | 25-54* | 1.820 | 1.990 | 9.3% |
| Kentucky | Agent,2001 | 16-19 | 20+ | 0.168 | 0.160 | -4.8% |
| New Jersey | Daniello, 2013 | 16-20* | 35-55* | 2.34 | 2.19 | -6.3% |
| | | 16* | 35-55* | 0.22 | 0.16 | -27.5% |
| | | 17* | 35-55* | 3.46 | 2.75 | -20.4% |
| | | 18* | 35-55* | 3.11 | 2.89 | -7.1% |
| | | 19* | 35-55* | 2.57 | 2.84 | 10.4% |
| | | 20* | 35-55* | 2.39 | 2.57 | 7.7% |

*Normalized by Population

FHWA-NJ-2014-008

Offshore Wind Development Research

Research Category: Multi-Modal System Components & Users
Project Cost: \$214,998
Project Customer: Multimodal, Maritime Resources
Organization: State University of New York Maritime College

Background

The objective of this study was to identify the critical maritime components of offshore wind (OSW) industry development for installation, construction, operation and maintenance. The goal was to provide information and recommendations that ensure that the maritime aspects, both vessel and port interface, of OSW development do not impede the State's ability to make a significant contribution to the achievement of the green electricity production objectives set by the federal government and New Jersey's 2011 *Energy Master Plan*. Research was to be specific to vessel requirements, characteristics needs and costs, and the land-use and wharf-side aspects of maritime port facilities as they relate to OSW industry development.

The research approach included a literature review of the European experience of equipment needs as a base for analysis. An economic analysis was based on three OSW size development scenarios. Port selection criteria were developed based on New Jersey port characteristics and the European experience.

Implementation

The project presented development scenarios detailing the requirements of an offshore windfarm. The study proposed solutions and recommendations that would position the State of New Jersey to be a national leader in OSW development, including potential interstate or cooperative endeavors. Financial aspects and considerations of vessel acquisition were presented. The research also proposed a port/OSW industry interface strategy for short, mid-, and long-term industry development.

In general, the study identifies the maritime port life-cycle requirements for installation, construction, operation and maintenance based on geographic factors, and the potential for multi-use development at New Jersey's East Coast ports. The study assessed the potential economic impact of OSW development for the State's economy and the energy-generating industry. The bulk of the economic benefit to New Jersey from offshore wind would likely arise from wages and onshore overhead related to turbine installation and operations and maintenance activities. For the 2013-2030 period, these economic benefits could reach \$250 – 500 million in total under the better case scenario.

The study recommended the development of a clear OSW policy with a commitment of budgets and the development of partnerships with industry and other stakeholders. The study recommended an implementation and a maritime training package be developed to advise individuals about the OSW farms, highlighting European examples and New Jersey energy policy and needs. Training could include: OSW farm technology, installation process, vessel requirements, vessel characteristics, associated regulations, operations and maintenance aspects of OSW farms. A training program would need to be designed to accommodate agency plans as a part of the state and regional plan. While the research might appeal to the public as a green energy project, the researchers cautioned that the public might have an objection if the wind farm facilities could be seen or heard from the shoreline beaches.

FHWA-NJ-2014-009

Environmental Management System for Transportation Maintenance Operations

Research Category: Operations & Preservation
Project Cost: \$231,000
Project Customer: Operations
Organization: NJIT

Background

The New Jersey's Global Warming Response Act, enacted in 2007, mandates reductions in greenhouse gas (GHG) emissions to 1990 levels by 2020, approximately a 20 percent reduction, followed by a further reduction of emissions to 80 percent below 2006 levels by 2050. To achieve this goal, NJDOT focused on assessing and monitoring the GHG emissions of both its Capital Program and Operations. The purpose of this research project was to support this effort by focusing on effective monitoring of GHG emissions produced by Operations and Preservation activities and identifying solutions for their reduction. The project evaluated emissions generated by vehicles, equipment, and materials used in maintenance operations projects by applying the life-cycle analysis approach.

Table 5 – Strategies to reduce greenhouse gas emissions

| | |
|--|---|
| Use renewable, energy efficient and recycled materials | <ul style="list-style-type: none">• Materials that require less energy and have a smaller lifecycle footprint• On site recycling and reuse of materials and equipment• Alternative preparation practices, e.g. warm-mix asphalt |
| Use alternative fuels | Biodiesel, ethanol, methanol and compressed natural gas (CNG) |
| Use more efficient vehicles and equipment, retrofit engines | Hybrid, plug-in hybrids, retrofit CNG and biodiesel engines for equipment and heavy machinery |

Implementation

The study recommended several strategies for reducing GHG emissions, but none were directly implemented as a result of this study.

FHWA-NJ-2014-010

Stormwater System Monitoring and Evaluation

Research Category: Operations & Preservation
Project Cost: \$186,080
Project Customer: Maintenance
Organization: CAIT

Background

The New Jersey Department of Transportation (NJDOT) has installed numerous prefabricated stormwater treatment systems throughout the State. The use of such systems, known as manufactured treatment devices (MTDs), is expected to continue in the foreseeable future. As the responsible party for the maintenance of these MTDs, NJDOT initiated this project with the goal of determining optimum maintenance intervals and expected maintenance costs for these MTDs.

Implementation

This project has resulted in long-term water quality performance evaluation, characterization of trapped contaminants, and the development of maintenance procedures and intervals. This initial project resulted in the follow up project, FHWA-NJ-2014-11.

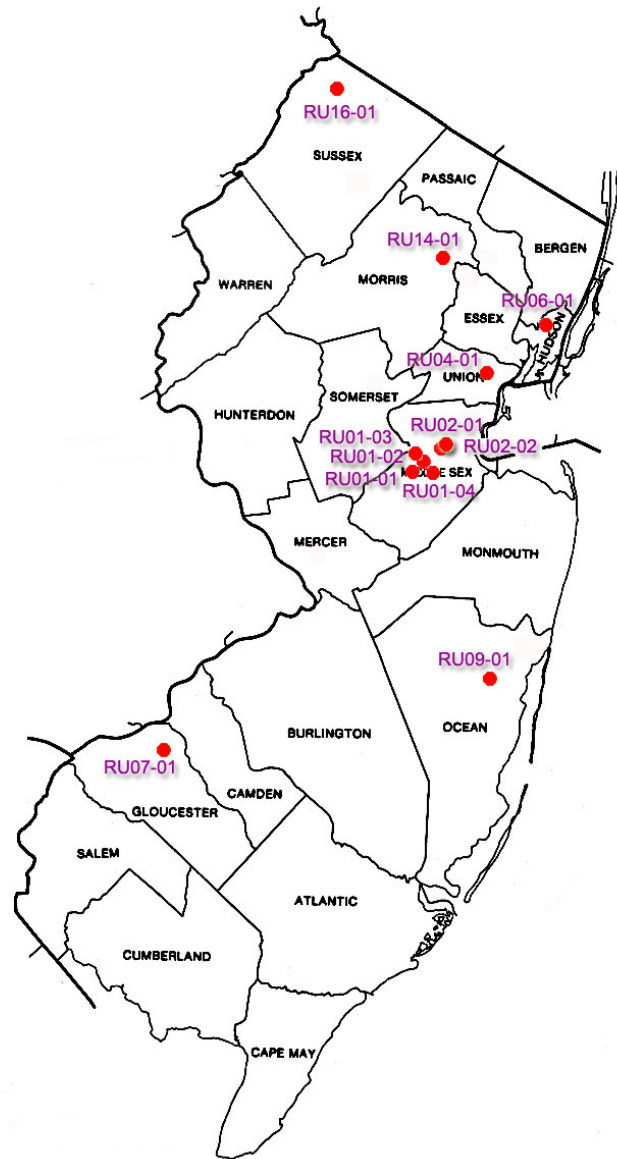


Figure 2. Locations of 12 Vortech MTDs installed at 8 NJDOT project sites selected for extensive monitoring

FHWA-NJ-2014-011

Stormwater System Monitoring and Evaluation – Implementation

Research Category: Operations & Preservation
Project Cost: \$40,000
Project Customer: Maintenance
Organization: CAIT

Background

The previously completed one-year field monitoring indicates that up to half a foot depth of sediment was trapped by the stormwater manufactured treatment devices (MTD). A linear extrapolation of the one-year depth leads to an estimate of maintenance interval of four years. The estimated maintenance interval of four years resulting from this extrapolation is far less often than the one year generally suggested by the device manufacturers. Adoption of the new schedule would lead to a significant savings in maintenance costs for NJDOT. Due to the potential for significant savings and the possible nonlinear sediment accumulation, the extrapolated/estimated maintenance interval should be confirmed by the actual measured maintenance interval.

Implementation

The project has resulted in a model for predicting the maintenance intervals with the number of vehicles on the road(s) and the impervious drainage area as inputs. The estimated cost of cleanouts per site was approximately \$3,500 for pumpout and approximately \$59/ton for disposal at the time of the study. If the oil were to be separately disposed, one oil boom with a cost of \$150 would need to be used per site. The number of MTDs in use in New Jersey is expected to increase into the thousands and the cumulative costs of maintenance will continue to grow into the millions. As a result of this study, the optimization of maintenance intervals and efficient cleanout procedures hold potential to reduce costs significantly.

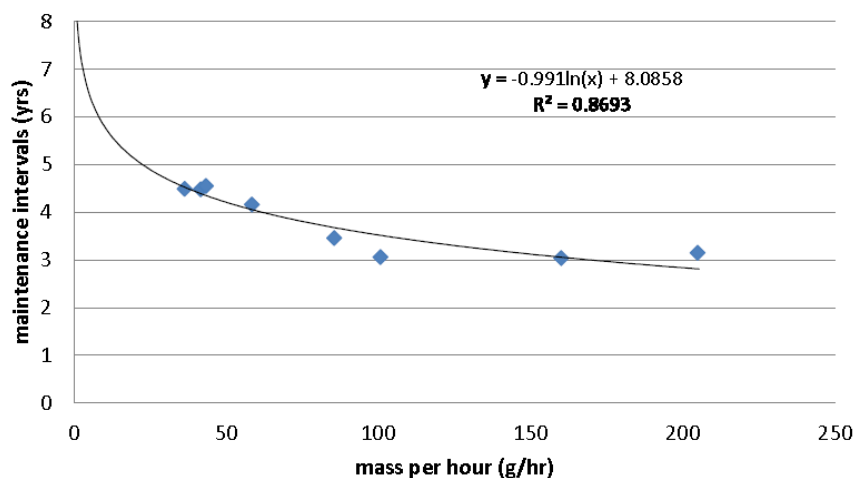


Figure 3. Relation between maintenance interval and sediment load to device under general conditions

FHWA-NJ-2014-012

Landfill Closure with Dredged Materials—Desktop Analysis

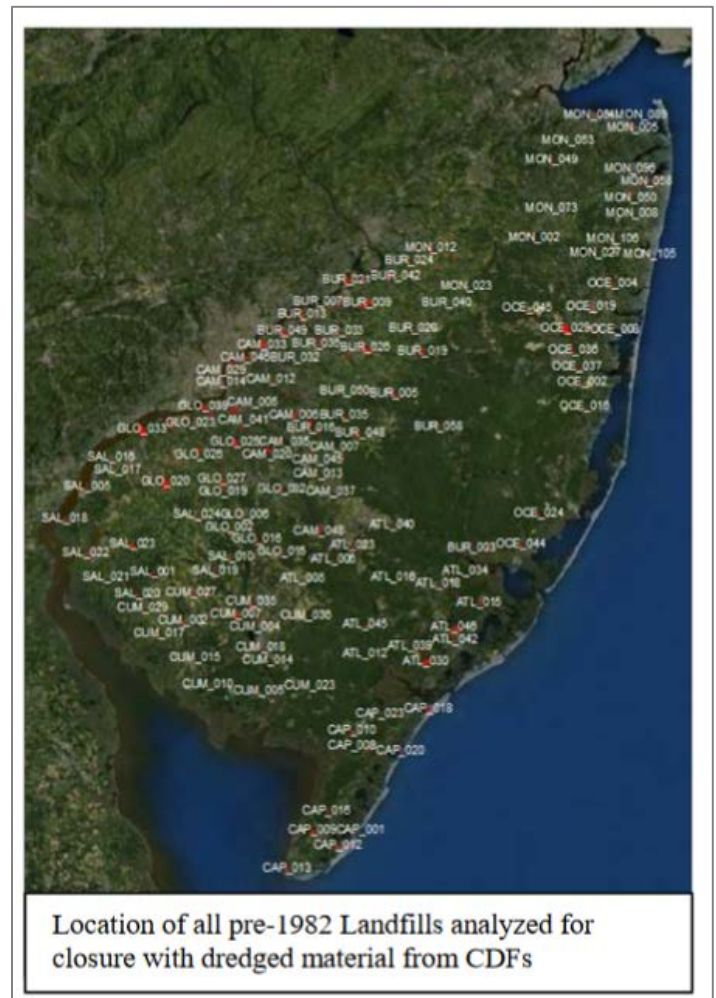
Research Category: Multi-Modal System Components & Users
Project Cost: \$96,183
Project Customer: Office of Maritime Resources
Organization: UTRC

Background

Rutgers University was contracted to investigate the potential for utilizing dredged material from confined disposal facilities (CDF) in the closure of New Jersey's uncapped landfills. The investigation involved the update of the New Jersey Department of Environmental Protection's (NJDEP) existing landfill database to fill existing data gaps. Next, a numerical rating system was established to evaluate landfill/CDF pairs for potential closure of the landfill with dredged materials. The pairs with the greatest potential for closure were identified in collaboration with personnel from the NJDOT Office of Maritime Resources and the NJDEP Solid and Hazardous Waste Management Program. Phase I Environmental Site Assessments were conducted for the selected landfills to determine their suitability for closure.

Implementation

This project yielded several results, most notably being the updating of the NJDEP landfill database. A ranking system was also implemented identifying landfill/CDF pairs with the greatest potential for closure, along with the Phase I Environmental Assessments that were completed for those selected landfills.



FHWA-NJ-2014-013-I & FHWA-NJ-2014-013-II

Feasibility and Efficacy of Public Transportation Partnerships Volume I & II

Research Category: Multi-Modal System Components & Users
Project Cost: \$152,974
Project Customer: Capital Planning
Organization: NJIT

Background

The overall objective of this research was to identify and assess examples of local government and public transportation agency partnerships and the funding mechanisms used to improve or expand public transportation. In addition, the research sought to identify what needs to be done to ensure successful partnerships can be pursued on a continuous programmatic basis.

Findings included:

1. Evaluate the adequacy of existing state laws to enable innovative funding mechanisms to sufficiently fund projects.
2. Increase organizational capacity to respond to private sector interests in partnership. Project leaders for partnership projects should be people wholly committed to success and knowledgeable about how to interact with other people and organizations involved in the project.
3. Project plans and expectations may need to be modified to fit within existing or future statutory environment, as well as within leadership strengths and based on the overall economic climate.

Implementation

In March 2014, Hindy Lauer Schachter and Janice Daniel used this study to present *Creating Viable Public-Private Transportation Projects: The Role of Political and Administrative Leadership* at the American Society for Public Administration Annual Conference, Washington DC.

The research team also presented findings in March 2017 at the post-TRB Capital Investment Planning and Grant Administration (CIPGA) Roundtable given at NJDOT.

Overall, research presented at NJ TRANSIT and the New York Metropolitan Transportation Authority (MTA) assisted with further defining the various opportunities to create NJ-based public/private partnerships in support of continued and expanded investment in NJ's transit infrastructure.

The knowledge base of the Capital Planning staff at NJ TRANSIT was enhanced and expanded as a result of this research.

FHWA-NJ-2014-014

Measuring Benefits of Transit Oriented Development

Research Category: Multi-Modal System Components & Users
Project Cost: \$318,000
Project Customer: NJ TRANSIT
Organization: Rutgers-VTC

Background

For this study, transit-oriented development (TOD) in New Jersey is evaluated using a variety of methods and different outcome measures. Data was gathered from respondents residing around eight train stations in New Jersey and up to two miles away from those stations. Additional data was gathered from four focus groups of those living near various train stations with some development, and interviews with stakeholders engaged with the land development process. Three areas were also selected for a detailed case study analysis. Qualitative analysis focused on the perceptions of the benefits of TOD and any shortcomings that are seen. Analytical work included an analysis of travel behavior, including frequency of walking, driving, and transit use; potential health benefits associated with living in proximity to a train station; social capital or civic engagement in areas proximate to the train station; traffic safety associated with proximity to the train station and other built environmental measures; residential property valuation associated with train station access and TOD amenities; benefits to users of rail transit for commute access to New York City and other destinations; and, an analysis of regional impacts using a regional travel demand model to examine changes in train usage and highway congestion. Beneficial effects of TOD and development near train stations is found in most of the results.

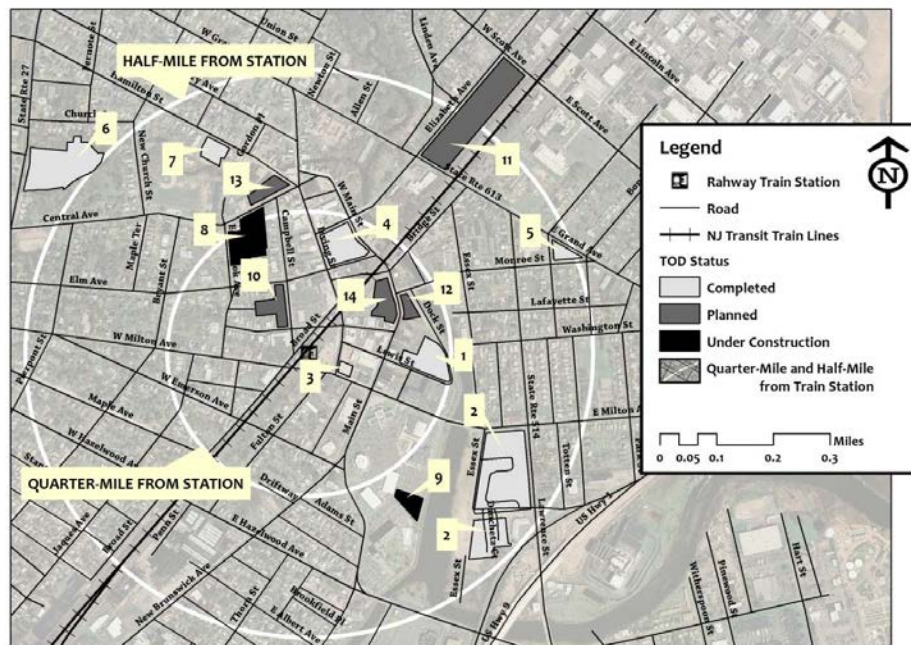


Figure 4. TOD locations in Rahway

Sources: NJ Geographic Information Network; Census TIGER/Line Shapefiles (US Census Bureau; <http://www.rahwayrising.com>; <http://www.state.nj.us/treasury/taxation/lpt/TaxListSearchPublicWebpage.shtml>)

Implementation

The investigators examined data from key informant interviews, focus groups, and surveys. Numerous findings were released and papers written and presented on the topic. In addition to the final report, an additional report was submitted to the Mineta National Transit Research Consortium in October 2016, titled “*The Impact of Transit Oriented Development on Social Capital.*”

The following papers were published in peer-reviewed journals:

Kay, Andrew I., Robert B. Noland, and Stephanie DiPetrillo, “Residential Property Valuations near Transit Stations with Transit-oriented Development,” *Journal of Transport Geography*, 39 (2014), 131–140.

Mudigonda, Sandeep, Kaan Ozbay, Ozgur Ozturk, Shrisan Iyer, and Robert B. Noland, “Quantifying Transportation Benefits of Transit-oriented Development in New Jersey”, *Transportation Research Record: The Journal of the Transportation Research Board*, 2417 (2014), 111-120.

Noland, Robert B. and Stephanie DiPetrillo, “Transit-oriented Development and the Frequency of Modal Use”, *Journal of Transport and Land Use*, 8(2), (2015), 21-44.

Weiner, Marc D., Orin T. Puniello, and Robert B. Noland, “Conducting Efficient Transit Surveys of Households Surrounding Transit-Oriented Developments”, *Transportation Research Record: Journal of the Transportation Research Board*, 2594, (2016), 44-50.

Noland, Robert B., Marc D. Weiner, Stephanie DiPetrillo, and Andrew I. Kay, “Attitudes Towards Transit-Oriented Development: Resident Experiences and Professional Perspectives”, *Journal of Transport Geography*, 60 (2017), 130-140.

Laham, Maria Luz and Robert B. Noland, “Non-Work Trips Associated with Transit-oriented Development”, *Transportation Research Record: Journal of the Transportation Research Board*, (in press, Mar 2017).

Numerous conference presentations were also made based on this research:

Kay, Andrew I., Robert B. Noland, and Stephanie DiPetrillo, *Residential Property Valuations near Transit Stations with Transit-oriented Development*, presented at the 93rd Annual Meeting of the Transportation Research Board, 2014.

Weiner, Marc D., Orin T. Puniello, and Robert B. Noland, *Conducting Efficient Transit Surveys of Households Surrounding Transit-Oriented Developments*, presented at the 95th Annual Meeting of the Transportation Research Board, 2016.

Laham, Maria Luz and Robert B. Noland, *Non-Work Trips Associated with Transit-oriented Development*, presented at the 96th Annual Meeting of the Transportation Research Board, 2017.

Noland, Robert B. and Stephanie D. Petrillo, *Transit-Oriented Development and the Frequency of Modal Use*, presented at the *World Symposium on Transport and Land Use Research*, Delft, June 2014.

Noland, Robert B. and Stephanie D. Petrillo, *Transit-Oriented Development and the Frequency of Modal Use*, presented at the *Annual Meeting of the Association of Collegiate Schools of Planning*, Philadelphia, Oct. 2014.

In addition, the website nitod.org functions as an ongoing means of disseminating further reports and updates about the status TOD in New Jersey. Presentations made to municipalities around New Jersey are available, as are reports evaluating the availability of housing in transit areas.

FHWA-NJ-2014-015

Study of Public Perception of Traffic Congestion in New Jersey

Research Category: Planning & Environment
Project Cost: \$155,734
Project Customer: Systems Planning
Organization: NJIT

Background

The objective of this research project was to enhance the capabilities of the New Jersey Congestion Analysis Model (NJCAM) currently used by the NJDOT Bureau of Commuter & Mobility Strategies. The enhancements included development of a corridor-level congestion analysis and updated methodology for calculating congestion performance measures in support of the NJDOT asset management goals and analysis framework. The enhanced performance analysis model provides estimates of economic impact of congestion to supplement "Hot Spot" Analysis, such as the Bottleneck Identification and Ranking capabilities of the I-95 Corridor Coalition's Vehicle Probe Project (VPP) Suite, thereby helping to better understand economic impact of recurring bottlenecks.

Additional benefits of the model enhancements include: (a) improved capabilities for identifying needs and analyzing impacts of congestion mitigation improvements on a corridor level; (b) improved capability to effectively present the benefits of specific improvement and express their monetary value; (c) improved ability to provide readily available input to capital programming and project development process; and (d) extended useful life of the Cost of Congestion Analysis Model by addressing the software compatibility issues and migration to a more robust database and analytical software platform.

Implementation

This study resulted in the development of a corridor-level congestion analysis tool and updated methodology for calculating congestion performance measures in support of the NJDOT asset management goals. In response to the feedback from NJDOT users of NJCAM, the user interface was redesigned to enable more user-friendly data entry. Numerous software updates were also made to NJCAM to ensure the calculation methodology better reflects the adopted criteria for evaluating congestion on New Jersey roadways.

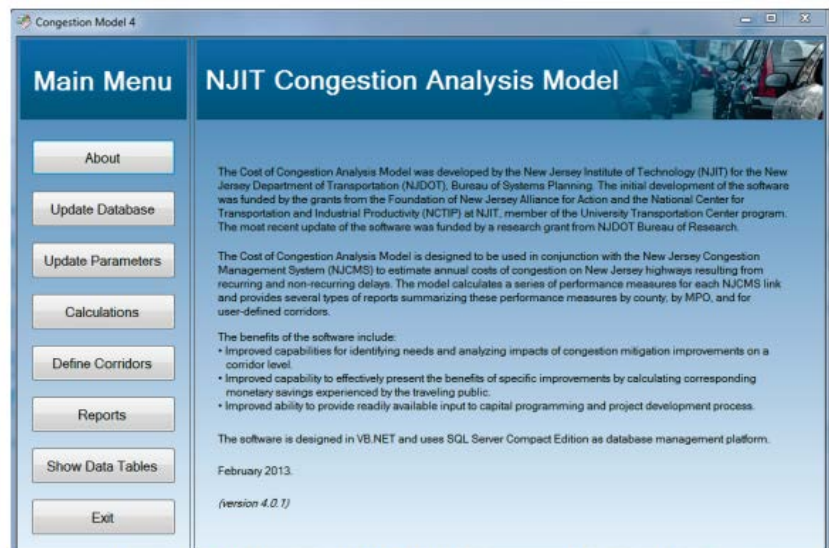


Figure 1: Main screen of the NJIT Congestion Analysis Model

FHWA-NJ-2014-016

Safety and Accessibility of Dynamic Message Signs (DMS)

Research Category: Operations & Preservation
 Project Cost: \$97,323
 Project Customer: Maintenance
 Organization: NJIT




Background

The project described in this report involved an evaluation of older Dynamic Message Signs (DMSs) to identify safe maintenance practices. Although DMSs in New Jersey are now designed to meet Occupational Safety and Health Standards (OSHA), older generation signs have limited or no safe access. The overall objective of the research was to perform an evaluation of all older DMS designs to allow employees to safely access overhead DMSs. The research involved performing a systematic inspection of the approximately one hundred and seventy DMSs located in the State of New Jersey to determine the safety and accessibility for maintenance of the signs. An assessment was also performed to determine whether existing procedures used for accessing newer signs can also be used for the older signs or whether revised procedures are needed. Safe work practices were identified and engineering or alternative solutions identified to allow employees to safely access overhead DMSs.

Implementation

Inspections were performed at 171 DMSs in 19 counties in New Jersey. Criteria were developed to identify minimum standards that should exist at each DMS to be deemed safe for access. Recommendations were made to NJDOT about the replacement, modification, and installation of DMS signs around the State. The inventory of signs created as part of this study was used by NJDOT engineers during their visits to the signs and helped prepare them for the potential hazards they would face when attempting repairs or maintenance.

Table 6 – Recommendations for improving safety and access to DMS

| Location | DMS | Rating | | | Recommendation |
|---------------------------|---|---------|--------|--------------|---|
| | | Catwalk | Access | Utility Line | |
| ID 1, Route 1 NB, MP 6.2 |  | 0 | 2 | 2 | This is a front-access DMS with no catwalk. No catwalk recommended. |
| ID 2, Route 1 SB, MP 8.7 |  | 2 | 2 | 2 | No modification required. |
| ID 3, Route 1 SB, MP 26.1 |  | 1 | 2 | 2 | No kickplate provided. Verify presence of kickplate and modify catwalk to meet minimum standards. |

FHWA-NJ-2014-017

Impact Analysis of Recreational Transit Services on Local Community Economic Development, Employment and Spending

Research Category: Planning & Environment
 Project Cost: \$389,764
 Project Customer: NJ TRANSIT
 Organization: Rutgers-VTC

Background

Transit service provided by NJ TRANSIT is used by a large number of riders to travel to and from recreational activities throughout New Jersey. This study estimates the local economic benefits and certain environmental benefits from such services by focusing on three transit markets: the summer weekend service of the North Jersey Coast Line (NJCL); transit services to recreational activities at the Prudential Center in Newark; and the Express Route #316 that provides service between Philadelphia and the Wildwood/Cape May area in the summer time. Efforts to estimate environmental benefits, such as the reduction of vehicle miles traveled (VMT) and greenhouse gas (GHG) emissions, from transit service to recreational activities have been rare. By estimating the local economic benefits and environmental benefits in three transit markets, this research helps to bridge the gap in the existing knowledge base.

Implementation

The findings of this study determined that transit services to recreational activities throughout the State will help generate economic, environmental, and congestion-reduction benefits. Most notably, these services help create jobs and generate substantial earnings and taxes. As a result of the recommendations made, NJ TRANSIT added some routes.

The study also resulted in a tool that could calculate congestion along certain TOD points. The study was disseminated in both a published article in a peer reviewed journal, as well as a paper that was presented at TRB:

Deka, Devajyoti, Michael Lahr, Thomas Marchwinski, and Maia de la Calle. (2015). "Economic Impacts of Rail Transit on Recreational Shore Communities – The Case of the North Jersey Coast Line." *Transportation Research Record*, No. 2531, 1-8.

Deka, Devajyoti, Michael Lahr, Thomas Marchwinski, and Maia de la Calle. *Economic Impacts of Rail Transit on Recreational Shore Communities – The Case of the North Jersey Coast Line*. Paper presented at the 94th Annual Meeting of the Transportation Research Board, January 2015

Table 2 – Economic Benefits from Transit Users' Spending in the Three Markets

| Benefit | NJCL (All summer weekends) | Hockey Season (41 games) | PINK Concert (One event) | Express Bus #316 (All summer) |
|------------------------|----------------------------|--------------------------|--------------------------|-------------------------------|
| Jobs (annualized) | 225 | 135 | 3 | 20 |
| Earnings | \$9,115,448 | \$4,734,551 | \$125,493 | \$915,475 |
| State Taxes | \$1,100,480 | \$592,083 | \$16,172 | \$109,520 |
| Local Taxes | \$587,919 | \$318,964 | \$8,453 | \$60,547 |
| Gross Domestic Product | \$15,478,042 | \$8,055,205 | \$214,118 | \$1,553,482 |

Table 3 – Environmental Benefits from the NJCL Summer Weekend Service and Transit Services to the Prudential Center

| Measure | NJCL Summer Weekend Service (All Summer Weekends) | Prudential Center Hockey Games Involving NJ Devils (41 games) |
|---|---|---|
| Vehicle miles travel (VMT) | 6,791,586 | 2,766,637 |
| Gasoline consumption (gallons) | 314,425 | 128,085 |
| Gasoline consumption (barrels)* | 7,486 | 3,050 |
| Cost of gasoline used** | \$1,100,488 | \$448,298 |
| Crude oil barrels used | 16,549 | 6,741 |
| Cost of crude oil used*** | \$1,688,131 | \$687,682 |
| CO ₂ emissions (metric tons) | 2,794 | 1,138 |

* One barrel = 42 gallons

** At \$3.50/gallon (http://www.gasbuddy.com/gb_retail_price_chart.aspx)

*** At \$102.01/barrel (<http://www.bloomberg.com/energy/>)

NJ-2014-001

Criteria for Multimodal Project Rehabilitation vs. Maintenance

Research Category: Multi-Modal System Components & Users
Project Cost: \$64,890
Project Customer: Multimodal
Organization: Cambridge Systematics

Background

The purpose of this research project was to help the Bureau of Multimodal Grants and Programs to resolve conflicting information regarding the types of projects that qualify for grants supported by the New Jersey Transportation Trust Fund (TTF). Specifically, the threshold between “routine (or scheduled) maintenance,” which the TTF cannot support, and “rehabilitation” project, which can be supported by the TTF, appears to be inconsistent. The ultimate goal of this research was to develop criteria for the New Jersey Department of Transportation (NJDOT) that reflects the spirit of the TTF and Multi-Modal Grants program legislation and rulemaking, and is harmonious with other states, and rational for grant applicants. This research project was completed in three tasks: conduct literature review and interviews; develop recommended definitions and threshold criteria, establishing bounds for which activities qualify as rehabilitation versus maintenance; and prepare a final report.

Implementation

The research team developed policy definitions that define projects eligible for assistance using the State’s airport and rail grants programs. The definitions, list of eligible project types, and suggested application questions are available in the final report.

NJ-2014-002

Local Pavement Management Systems

Research Category: Operations & Preservation
Project Cost: \$118,824
Project Customer: Local Aid
Organization: Cambridge Systematics

Background

New Jersey Department of Transportation (NJDOT) Local Aid, which interfaces with county and local entities to fund roadway resurfacing and reconstruction projects, among other duties, commissioned this research to help identify a path toward the advancement and standardization of sub-regional pavement management in New Jersey. The long-term goal was to achieve more consistency in the condition and performance of pavements across the State, and to help sub-regional entities stretch limited funding by promoting strategic investment decision-making for pavements and other roadway assets.

To support these objectives, the research team conducted the following activities:

- Reviewed best practices in local/sub-regional pavement management from Michigan, Wisconsin, Utah, and California and identified a set of critical pavement management elements for inclusion in a framework for NJ, with focus on data collection and rating, development and implementation of a system investment plan, and ongoing monitoring and reporting.
- Conducted a survey and held subsequent workshops with New Jersey sub-regions which revealed that few county or municipal agencies are collecting data and rating the condition of their pavements, and that most agencies pursue a 'worst first' approach. The workshops revealed a strong interest from county and municipal engineers and planners in gaining experience with alternative treatment options to more cost-effectively maintain and improve the condition of their road networks.
- The research team identified suggested next steps and a potential 10-year implementation pathway to help advance the state of the practice in pavement management at the sub-regional level in New Jersey in the short, medium, and long terms.

Implementation

The research team made several policy recommendations to NJDOT, suggesting the agency pursue a three-pronged approach.

- Increase training and capacity building by holding more workshops, with a suggested list being provided to NJDOT
- Implementing program objectives by identifying "low hanging fruit" projects where large gains could be quickly realized through small changes
- Building towards a full lifecycle approach through the development of a potential implementation pathway, and utilizing a program for reporting, collecting, and tracking data on pavement systems

NJ-2014-003

Steel Erection Out of Plumb

Research Category: Design & Construction
Project Cost: \$100,000
Project Customer: Construction
Organization: Cambridge Systematics

Background

This study reviews available research papers, reports, presentations, design and construction guidelines from various agencies and universities related to the construction engineering of curved and/or skewed steel I-girder highway bridges, with a main focus on the recently published *NCHRP Report 725 - Guidelines for Analysis Methods and Construction Engineering of Curved and Skewed Steel Girder Bridges*.

The study also compiles design and construction engineering guidelines/checklists to address out-of-plumb issues based on literature review and the authors' past project experience from both design and construction inspection projects of curved and/or skewed steel I-girder bridges.

Implementation

The study resulted in a set of Guidelines for Design and Contract Documents for Skewed and/or Curved Steel I-girder Bridges which has provided cost benefits, and there is now a series of checklists for bridge designers, (Erection Plan and Procedures Checklist and Calculation Checklist), which NJDOT will implement moving forward.

A paper was presented by V.L Liang of Greenman-Pedersen, Inc. at the 2015 New York City Bridge Conference. The research was also published in 2015's *Sustainable Bridge Structures*.