Annual Implementation Report Research Completed in 2017

March 2020

Submitted by:

Alan M. Voorhees Transportation Center
Rutgers University

NJDOT Bureau of Research

In cooperation with

New Jersey
Department of Transportation
Bureau of Research
and
U. S. Department of Transportation
Federal Highway Administration

DISCLAIMER STATEMENT

"The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy *of* the data presented herein. The contents do not necessarily reflect the official views or policies of the New Jersey Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation."

Table of Contents

Technology Transfer Program
Annual Implementation Report – 2017

Executive Summary

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 of research, or the next necessary steps required to achieve full-scale implementation of solutions, 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 consider 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.

Introduction

The project team collected information for this report through review of technical briefs, final research reports, and interviews with principal investigators and NJDOT research managers and customers. A summary of each funded project completed in 2017 was developed.

The role and importance of technology transfer within the State transportation research program function has been the subject of continuing study. Several useful definitions for considering the role of technology transfer that were provided in a U.S. DOT Volpe Center study (Cuddy et. at, 2016) help frame and inform the process of considering effects and are 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 2017, the Bureau of Research received 16 final research reports for work undertaken in previous years. The contracted value of the completed research projects was approximately $3.5 million. While research reports were completed in all research categories, Table 1 shows that the Design & Construction category accounted for the most projects and contract value in 2017.

Table 1
Number and Value of Completed Research Reports by Broad Research Category, 2017

Broad Research Category	Number of Reports Completed	Total Contract Value Completed
Design and Construction	4	$ 1,392,084
Planning and Environment	2	$ 555,288
Multi-Modal System Components and Users	2	$ 537,746
Traffic and Safety	2	$ 527,771
Policy and Organization	3	$ 418,697
Operations and Preservation	3	$ 140,385
Total	16	$ 3,571,971

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

As shown in Table 2, the completed research reports can be characterized by their approaches to research and their treatment of implementation themes into several, sometimes overlapping categories:

- Some research comprised primarily analytical or evaluative studies which resulted in the reporting of findings to the stated research question with no attention to implementation.
- 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 pursued 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: 2017 Completed Research Reports by Type of Research and Treatment of Implementation Theme

ID	Title	Recommendations for Future Research	Implementation Activities	Implementation-Minded Recommendations	No Discussion of T2	Research Type	Broad Research Category
FHWA-NJ-2017-001	Drainage Identification Analysis and Mapping, Phase 2		X			Software design	Planning and Environment
FHWA-NJ-2017-003	Reducing Costs of Purchased Transportation for State Agencies			X		Literature Review	Policy and Organization
FHWA-NJ-2017-004	Increasing Representation of Minorities, Females and Underrepresented Individuals in Journey Level Jobs on Highway Construction Projects			X		Survey	Policy and Organization
FHWA-NJ-2017-005	Feasibility of Lane Closures Using Probe Data	X	X			Data Analysis, Software Design	Traffic and Safety
FHWA-NJ-2017-006	Fiberglass Composite Materials Specification Redevelopment	X				Literature Review, Materials Engineering	Design and Construction
FHWA-NJ-2017-007	Worker Safety Issues of Wi-Fi Devices				X	Testing	Operations and Preservation
FHWA-NJ-2017-008	Environmental Impacts of Reclaimed Asphalt Pavement (RAP)		X	X		Materials Engineering	Planning and Environment
FHWA-NJ-2017-009	NJDOT Federal Funding Accountability and Transparency Act (FFATA) Reporting		X			Literature Review	Operations and Preservation
FHWA-NJ-2017-010	Assessing NJ TRANSIT's Mobile App for Users' Receptiveness to Geotargeting				X	Survey	Multi-Modal System Components and Users
FHWA-NJ-2017-011	Design and Evaluation of Scour for Bridges Using HEC-18	X		X		Engineering	Design and Construction
FHWA-NJ-2017-012	Route 139 Rehabilitation: Pulaski Skyway Contract 2	X				Engineering	Design and Construction
FHWA-NJ-2017-013	Analysis of Local Bus Markets	X		X		Data Collection	Multi-Modal System Components and Users
FHWA-NJ-2017-014	Review of NCHRP Study Implementation at the New Jersey Department of Transportation			X		Literature Review	Policy and Organization
FHWA-NJ-2017-015	Scour Evaluation Model Implementation Phase		X			Engineering	Design and Construction
NJ-2017-001	Crash Records Collection Policy Examination and Best Practices Review			X		Literature Review	Traffic and Safety
NJ-2017-002	Contractor Supplied Device Survey				X	Survey	Operations and Preservation

FHWA-NJ-2017-001

Drainage Identification Analysis and Mapping, Phase 2

Research Category: Planning & Environment
Project Budgeted Cost: $105,288
Project Customer: NJDOT
Organization: New Jersey Institute of Technology

Background

The Drainage Identification Analysis and Mapping System (DIAMS) is a computerized database that captures and stores relevant information associated with all aboveground and underground hydraulic structures owned by NJDOT. The database retrieves relevant performance and financial information so that NJDOT can remain compliant with Phase II of the Government Accounting Standards Board Statement 34. It also retrieves all relevant environmental information to comply with the Clean Water Act and reporting requirements of NJDEP. DIAMS was initially developed based upon the NJDOT contractors using WinCAN7. However, some of the inspection contractors have already begun to utilize the newly released version (i.e., WinCAN8) which reportedly may not be entirely compatible with the DIAMS front-end MS™ Access database. Consequently, the ability of NJDOT personnel to upload data into the DIAMS was restricted to data produced by the earlier version. Hence, DIAMS was upgraded to be compatible with the current versions of NJDOT vendor pipeline inspection software packages.

Implementation

The DIAMS structure is laid out to simplify the process of using the system to allow efficient and productive sequential flow of the information performance system. Benefits of DIAMS include long-term savings that accrue by adopting optimized preventive maintenance strategies and facilitating compliance with governmental accounting standards bureau (GASB-34) and federal stormwater regulations. This pilot project demonstrated benefits including but not limited to:

- Reduction in highway expenditures
- Knowledge of future trends & challenges
- Pavement & bridge life extension
- Improved rehabilitation & maintenance methods
- Improved management

From this project, a searchable database was created that allows NJDOT to quickly determine the most critical drainage structures needing intervention based on the data uploaded into the portal, saving time and allowing NJDOT to identify future trends and challenges quickly. The research also resulted in the following report:

Meegoda, J. N., Juliano, T., Potts, L., Tang, C., and Marhaba, T., "Implementation of a Drainage Information, Analysis and Management System," Journal of Traffic and Transportation Engineering, March 20
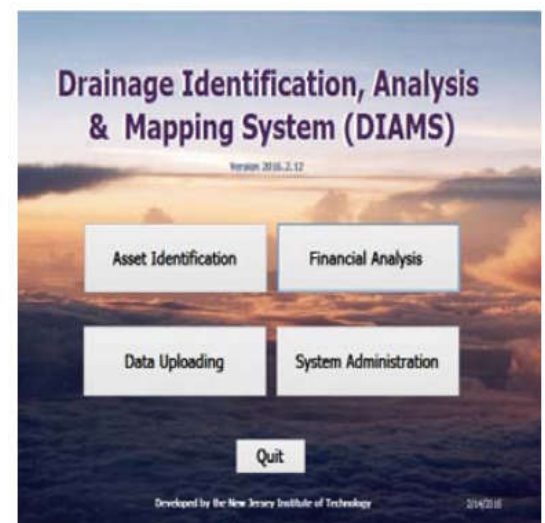
FHWA-NJ-2017-003

Reducing Costs of Purchased Transportation for State Agencies

Research Category: Policy & Organization
Project Budgeted Cost: $262,264
Customer: NJDOT
Organization: Rutgers - Alan M. Voorhees Transportation Center

Background

To better fulfill the transportation needs of human service customers, the research team sought to inventory passenger transportation services used by State Divisions when serving their customers, evaluate strategies, and identify promising practices that could be deployed to improve the acquisition and provision of transportation services to achieve cost savings. The study provided recommendations to the State Divisions and transportation providers on ways to reduce costs and/or enhance services for human service consumers. The research team conducted a literature review and national scan to identify promising practices; convened a series of key informant interviews with staff of the State Divisions under inquiry; gathered relevant data from the Divisions regarding the transportation services they support and known customer origins/destinations; and performed analyses to determine potential transportation options that would yield cost savings and/or enhance services for the human service consumers supported by the Divisions.

Implementation

The research team documented levels of accessibility for human service consumer origins and destinations, examined optimal paths between known origins and destinations, and identified 17 promising practices that can be used by State Divisions, their service providers, and or transportation providers.

The North Jersey Transportation Planning Authority (NJTPA) used this research and the information gained in the development of the Human Services Transportation Visualization Tool: https://njtpa.maps.arcgis.com/apps/webappviewer/index.html?id=246efe3db3de41edab2dcc1b86db15b3

NJTPA also used the material in their "*Go Farther" Coordinated Human Services Transportation Plan*: https://www.njtpa.org/Planning/Plans-Guidance/Human-Services-Plan.aspx

The study has led to an interest in a follow-up study recommended by Essex County, and a *Promising Practices Guide* available through the New Jersey State Library. https://dspace.njstatelib.org/xmlui/bitstream/handle/10929/46301/t7642016g_PPG?sequence=3&isAllowed=y

FHWA-NJ-2017-004

Increasing Representation of Minorities, Females and Underrepresented Individuals in Journey Level Jobs on Highway Construction Projects

Research Category: Policy & Organization
Project Budgeted Cost: $86,800
Project Customer: NJDOT
Organization: New Jersey Institute of Technology

Background

Despite the expected growth of women and minorities in the workforce, women and minorities are still underrepresented and underutilized in highway construction employment. NJDOT is committed to addressing these underutilized groups' participation in the heavy highway construction industry and assisting construction contractors to improve their workforce diversity. The overall objective of the research was to develop a framework for use by New Jersey Department of Transportation to establish a viable On-the-Job Training/Support Services (OJT/SS) pre-apprenticeship training program aimed at moving women, minorities and other under-utilized groups into journey-level positions in highway construction skilled crafts.

Implementation

Recommendations were made on the development of an On-the-Job Training pre-apprenticeship program, involving contractors, unions, and non-profits as well as other government agencies. An emphasis was placed on the need for champions who can create a network of stakeholders within the agency to help advance the programs. It was also advised that programs provide academic and financial support for participants to make it easier to take courses, provide for child care, or buy work supplies. It was also recommended that contractors be invited to participate in the trainings, and that it be made mandatory for contractors involved on federally funded projects to be involved in the training.

In some cases, NJDOT had already started instituting some of these ideas, however, the report provided the basis to formalize and strengthen these initiatives.

FHWA-NJ-2017-005

Feasibility of Lane Closures Using Probe Data

Research Category: Traffic & Safety
Project Budgeted Cost: $450,341
Project Customer: NJ Transit
Organization: New Jersey Institute of Technology

<u>Background</u>

To develop an adequate congestion mitigation plan for roadway reconstruction projects, transportation agencies need accurate and reliable estimates of traffic impacts associated with pertinent maintenance and reconstruction projects. This study developed an on-line system analysis tool, the Work Zone Interactive Management Application-Planning (WIMAP-P), an easy-to-use and easy-to-learn tool for predicting the traffic impact caused by work zone lane closures on freeways and arterials. WIMAP-P is supported by a working database that was developed based on the data feeds from various sources, including OpenReach, Plan4Safety, New Jersey Straight Line Diagram (NJSLD), New Jersey Congestion Management System (NJCMS), and INRIX.

<u>Implementation</u>

This study developed an on-line system analysis tool called the Work Zone Interactive Management Application-Planning (WIMAP-P), an easy-to-use and easy-to-learn tool for predicting the traffic impact caused by work zone related lane closures on freeways and arterials. WIMAP-P was applied to estimate/predict work zone impacts, such as spatial and temporal speed changes and delays incurred by vehicles depending on the schedule and configuration of a work zone. Since WIMAP-P links a very complicated database associated with traffic volumes and road geometry, the user can input limited information (e.g., the location and duration of a work zone) and the results can be visualized in snap shots and pdf reports. This feature can reportedly reduce user time and errors, compared to other tools (e.g., iPeMS, RILCA, QUEWZ, and QuickZone). The graphical user interface of WIMAP-P can facilitate data input and analysis in an efficient and reasonably intuitive manner while producing graphical results and customized reports. The researchers noted that WIMAP-P has yielded the following benefits:

- Understanding industry advancements
- Knowledge of future trends & challenges
- Improved rehabilitation and maintenance methods
- Congestion mitigation for commuters

The software was utilized in estimating/predicting congestion impacts (e.g., speed, delay and associated cost, and queue length) caused by pre-planned work zones. The results on freeway work zones seem reliable and consistent with what the NJDOT users expected. The project has

yielded numerous digital media results and online tools that are in use by various professionals from industry as well as researchers from academia:

- *NJIT's WIMAP-P,* http://transprod04.njit.edu/WiMAPP/
- *National Work Zone Safety Information Clearinghouse (NWZSIC),* https://www.workzonesafety.org/publication/feasibility-lane-closures-using-probe-data.
- *New Jersey State Publications Digital Library,* https://dspace.njstatelib.org/xmlui/handle/10929/42028
- *USDOT - National Transportation Library (NTL) - ROSAP,* https://rosap.ntl.bts.gov/view/dot/32153
- *University of Kentucky, UKnowledge. Thesis, 2018,* https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1073&context=ce_etds

The following presentations were made based on the project:

Abdullah Shabarek, Steven Chien, and Soubhi Hadri, "A Deep Learning Framework for Freeway Speed Prediction under Adverse Weather Conditions," The 99th Transportation Research Board Annual Meeting, Washington, D.C., Jan. 2020

Joyoung Lee, Zijia Zong, Jeevanjot Singh, Branislav Dimitrijevic, Steven Chien, and Lazar Spasovic, "Real-time Performance Measure Monitoring System for Long-Term Freeway Work Zone," ITS World Congress 2017, October 29 - November 2 in Montreal, Quebec, Canada

Bo Du, Steven Chien, Joyoung Lee, Lazar Spasovic, and Kyriacos Mouskos, "WIMAP-P: A Work Zone Impact Prediction Tool Using Big Data Analytics," ITS World Congress 2017, October 29 - November 2 in Montreal, Quebec, Canada

Steven Chien, Transportation Seminar, "WIMAP-P: A Work Zone Impact Prediction Tool Using Big Data Analytics," University of Calgary, Calgary, Alberta, Canada, October 30, 2017

Steven Chien and Kyriacos Mouskos, "WIMAP-P," New York City DOT, NY, August 29, 2017

The following publications were issued based on the findings:

Bo Du, Steven Chien, Joyoung Lee, and Lazar Spasovic, "Predicting Freeway Work Zone Delays and Costs with a Hybrid Machine-Learning Model, Journal of Advanced Transportation, Volume 2017. https://www.hindawi.com/journals/jat/2017/6937385/.

Liuhui Zhao, Steven I. Chien, and Bo Du, "Optimizing Work-Zone Schedule with Floating Car Data Considering Traffic Diversion and Managed Lanes," Journal of Transportation Engineering, Part A: Systems, 2019, Volume 145, No. 1. https://ascelibrary.org/doi/pdf/10.1061/JTEPBS.0000202

Bo Du, "An artificial neural network model for predicting freeway work zone delays with big data," PhD Dissertation, NJIT, 2017. https://digitalcommons.njit.edu/cgi/viewcontent.cgi?article=1001&context=dissertation,

Bo Du, Steven Chien, Joyoung Lee, Lazar Spasovic, and Kyriacos Mouskos, "Artificial Neural Network Model for Estimating Temporal and Spatial Freeway Work Zone Delay Using Probe-Vehicle Data," Transportation Research Record, No. 2573, pp. 164–171, 2016. https://journals.sagepub.com/doi/pdf/10.3141/2573-20

FHWA-NJ-2017-006

Fiberglass Composite Materials Specification Redevelopment

Research Category:	Design & Construction
Project Budgeted Cost:	$333,487
Project Customer:	NJDOT
Organization:	The College of New Jersey

Background

Polymer-based structural members have been shown to be economically viable when used in marine environments. These polymer materials have a higher initial cost than traditional materials (i.e., steel, concrete, and timber), but generate return on the investment with longer useful lives. These materials are currently being implemented in a variety of geotechnical structures in the State of New Jersey. This research was performed because the requirements of Section 916 of the NJDOT Standard Specifications limited the State of New Jersey to a small subset of the commercially available products. Expanding the number of viable products allows for greater competition, making it possible for the NJDOT to efficiently spend funds.

Implementation

The project focused on conducting a thorough literature review, evaluating existing standards, and performing engineering analysis of commercially available polymer-based, fiberglass-reinforced composite structural members. Based on the findings, the engineering analysis found that each of the polymer-based products could be successfully implemented in design. However, due to the unique nature of each of the four products, it was not beneficial to dictate a minimum design property. The various technical issues that complicated the implementation of standards were identified and provided to NJDOT in a report.

Figure 1

As the current specifications favor a limited number of manufacturers, the project recommended that these specifications be revised to encourage participation by a wider variety of composite pile manufacturers that are currently available in the market. This revision, according to the researchers, would likely encourage a more competitive bidding environment, reducing costs in the long run. Furthermore, recommendations for further research were made to examine Long Term Behavior, Field Experimentation, and System Level Behavior.

FHWA-NJ-2017-007

Worker Safety Issues of Wi-Fi Devices

Research Category: Operations & Preservation
Project Budgeted Cost: $46,000
Project Customer: NJDOT
Organization: The College of New Jersey

Background

The effect on health of non-ionizing radiation from electromagnetic (E&M) sources has been a public concern for more than 20 years. As a result of new protocols such as Bluetooth, Bluetooth Low Energy (BLE), cellular Long-Term Evolution (LTE), and new Wi-Fi standards, there has been a proliferation of wireless-based sensors which transmit E&M energy. These sensors have significantly added to the existing radiated Radio Frequency (RF) spectrum, and increased RF E&M field exposure. The NJDOT uses these devices to collect data on the State roadway system to transmit accurate information to the motoring public. During the repair of these sensors, concerns have been raised as to the safety of NJDOT employees in the presence of this increased radiation, and what actions, if any, are needed to eliminate possible risk.

Implementation

In no case was a radiation level measured that exceeded the safe level as documented in the existing specifications, which sets the RF exposure standards for OSHA, DOD and other organizations; in fact, no level was measured according to the researchers that came close to unsafe. E&M sources were investigated for WiFi (under various standards), Bluetooth and BLE, and Cellular for both US and European Standards (including LTE). The measurements were made at 17 sites and all known standards were considered in the analysis.

The results of the study were presented during a training session for NJDOT personnel on RF/microwave radiation safety. Even though the hazards were well within safety limits, recommendations were made on methods to review new equipment to make sure it had passed the FCC Part 15 Certification. The findings of the study were presented at the NJDOT Research Showcase, and a PowerPoint presentation can be viewed at:

Allen Katz and Joseph Jesson, "Worker Safety Issues of Wireless Devices", NJDOT Research Showcase, October 25, 2017.
https://www.state.nj.us/transportation/business/research/pdf/presentations/WorkerSafetyIssuesofWirelessDevices.pdf

FHWA-NJ-2017-008

Environmental Impacts of Reclaimed Asphalt Pavement (RAP)

Research Category: Planning & Environment
Project Budgeted Cost: $450,000
Project Customer: NJDOT
Organization: Rowan University

Background

Reclaimed asphalt pavement (RAP) is obtained through milling and removal of existing pavement surfaces. RAP materials have been successfully reused and recycled into new asphalt pavements since the 1970s. Despite the benefits of recycling RAP materials, not all of it can be recycled into new asphalt pavements. Therefore, the unused RAP materials have to be either stored on site for long periods of time or disposed of in waste landfills which is often costly. To address these concerns in NJ, a research study was initiated with the goal of investigating the environmental impacts of unbound reclaimed asphalt pavement (RAP) while it is freshly processed (i.e., when it is obtained directly after mixing from the plant) and after subjecting it to an accelerated weathering process. The secondary goal was to explore potential engineering solutions to meet federal and state environmental standards or guidelines.

Batch Extraction Experiments

Implementation

Several recommendations were made to NJDOT as a result of this study:

- RAP may be used as an unbound material in all environments except those which are highly acidic such as, but not limited to, mines with sulfur-containing minerals or landfills where other materials may decompose creating an acidic environment.
- Acceptable, beneficial uses of unbound RAP materials may include, but are not limited to: using the unbound RAP as surface materials for parking lots, farm roads, or pathways; for quarry reclamation; as non-vegetative cover underneath guiderails; and mixed with other materials for subbase or base materials.
- Due to the inconsistent pollutant levels found among the three RAP stockpiles evaluated in this study, it is also recommended, as a precautionary measure, to determine the releasable levels of metals and PAHs for RAP stockpiles before using RAP in highly acidic environments.
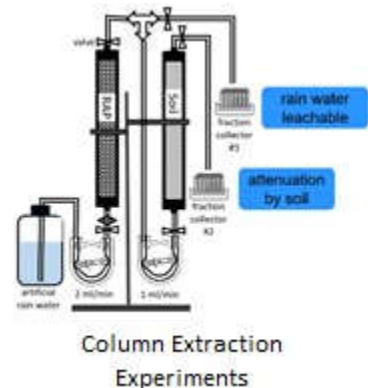
Column Extraction Experiments

Based on the results of this study, the NJ Governor signed legislation, S3521, in early January 2018 that expanded the permissible uses of Recycled Asphalt Pavement material. The purpose of the legislation was to allow RAP's use in quarry reclamation in stone quarries, establish a regulatory framework for quarry reclamation in sand quarries, and allow RAP materials to be used for a host of other beneficial applications including farm roads, pothole repair, and parking lots.

FHWA-NJ-2017-009

NJDOT Federal Funding Accountability and Transparency Act (FFATA) Reporting

Research Category:	Operations & Preservation
Project Budgeted Cost:	$48,245
Project Customer:	NJDOT
Organization:	New Jersey Institute of Technology

Background

Enacted into law in 2006, and amended in 2008, the Federal Funding Accountability and Transparency Act (FFATA) requires information about federal awards to be made available for public access. Early in the process of adopting FFATA requirements, NJDOT began preparations to conduct periodic data uploads to the FFATA Sub-award Reporting System using established criteria that was captured and entered into an automated process. During this process, NJDOT identified certain areas where the agency's reporting process was deficient and recognized that they needed help to address these deficiencies. To achieve the goal of the responsive reporting system and to ensure NJDOT's compliance with the regulatory requirements, the NJIT research team was tasked with assisting in the evaluation and improvement of the reporting mechanisms used by the NJDOT.

Implementation

The NJIT research team conducted a detailed review of FFATA reporting requirements, focusing on format and content of the data records included in the required data fields for online submission. Looking for inaccuracies and inconsistencies in data records, the team focused on those records that could not be successfully uploaded into the federal reporting system. Once these inconsistencies were identified, the data was scrubbed by correcting corrupt or inaccurate information. The project team documented data cleaning actions, assisted NJDOT with refining the software code for the online data submission, and provided recommendations to ensure efficient submission of required data under the FFATA mandate.

The following recommendations and improvements were made to the existing data collection system as a result of this project:

1. Cleaned up the vendor file information, which is expected to improve the FFATA reporting counts to the government significantly.
2. Performed a successful upload of the 2013 data. Researched and updated the data for the year 2014. During this phase of the work, other causes for data rejection were investigated to ascertain the exact nature and causes of the discrepancies.
3. Developed a methodology for determining the degree of compliance with what NJDOT was reporting and what the federal government requires.
4. Achieved a better understanding of the causes of upload failures, which led to designing an improved reporting process.
5. Finally, NJIT assisted NJDOT teams in developing corrective protocols to ensure improved compliance in future FFATA submissions.

FHWA-NJ-2017-010

Assessing NJ TRANSIT's Mobile App for Users' Receptiveness to Geotargeting

Research Category: Multi-Modal System Components and Users
Project Budgeted Cost: $125,000
Project Customer: NJ TRANSIT
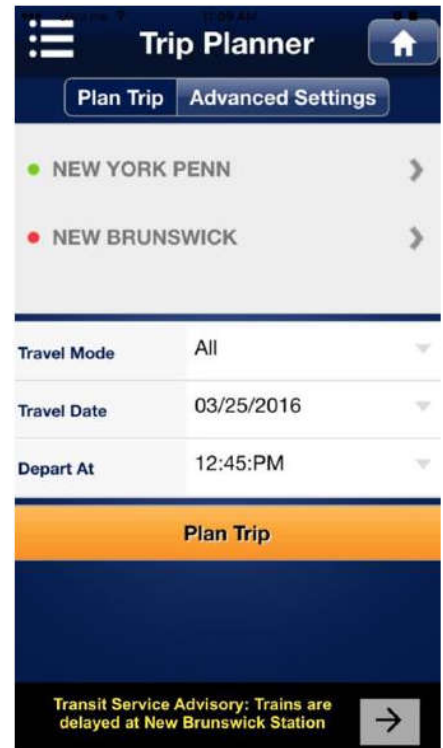Organization: City University of New York

Background

NJ TRANSIT customers can use a smartphone application ("app") to purchase tickets directly on their phone and access transit information (see figure on the right). Most smartphones are equipped with technology that can determine a user's location; however, this feature is currently used in a limited capacity in NJ TRANSIT's app. By knowing a passenger's location, NJ TRANSIT could potentially provide customized information directly to riders based on their location, a process referred to as geotargeting. The objective of this research project is to assess NJ TRANSIT passenger receptiveness to geotargeting in NJ TRANSIT's mobile app.

Implementation

The project was broken out into three parts. First, comparable transit smartphone apps were downloaded and examined. Secondly, researchers conducted focus groups based around a structured discussion with participants about use of the NJ TRANSIT app. Lastly, more than 5,000 NJ TRANSIT passengers participated in an online survey about the mobile app. In summary, the results suggest that NJ TRANSIT customers find it acceptable for NJ TRANSIT's app to know their location, and they are particularly receptive to receiving targeted transit information relevant to their NJ TRANSIT trips.

The findings from this report were presented at the 2018 Transportation Research Board's Annual Conference https://trid.trb.org/view/1494392, and as a University Transportation Research Center – Region 2 Report http://www.utrc2.org/sites/default/files/Final-Report-Assessing-NJ-Transit-Mobile-App-Geotargeting.pdf

FHWA-NJ-2017-011

Design and Evaluation of Scour for Bridges Using HEC-18

Research Category: Design & Construction
Project Budgeted Cost: $50,296
Project Customer: NJDOT Bureau of Materials
Organization: Rutgers University CAIT

Background

Prevention of bridge scour has been a national priority for nearly three decades. Beginning in the 1990s, NJDOT launched a robust Plan of Action to identify scour critical bridges and to perform corrective work. In carrying out the plan, the Department decided to develop New Jersey's own modified method of scour analysis that reflects the State's unique geology and hydrology. This was the genesis of the current study and the development of the Scour Evaluation Model (SEM).

	Geotechnical Risk		
	High	**Medium**	**Low**
High	Scour Priority 1	Scour Priority 2	Scour Priority 3
Medium	Scour Priority 2	Scour Priority 3	Scour Priority 4
Low	Scour Priority 4	Scour Priority 4	Scour Priority 4

(Hydrologic/Hydraulic Risk)

Implementation

This project developed a new approach for evaluating erosive scour at New Jersey bridges over non-tidal waterways. The main deliverable was the Scour Evaluation Model (SEM), which offers new analysis procedures, expanding on the existing best practices detailed in the Hydraulic Engineering Circular no. 18. The overall goal is to improve public safety and to expend bridge repair funds more strategically.

This project directly led to the Scour Evaluation Model Implementation Phase (FHWA-NJ-2017-015), wherein the SEM that was developed and evaluated in this project was tested at several locations in New Jersey.

While the current model reflects New Jersey's geology and hydrology, it can be recalibrated to other regions or states. The model is principally designed to evaluate scour risk of existing bridges, but many model components are useful for designing new bridges as well.

FHWA-NJ-2017-012

Route 139 Rehabilitation: Pulaski Skyway Contract 2

Research Category: Design & Construction
Project Budgeted Cost: $569,974
Project Customer: NJDOT
Organization: Rutgers University

Background

Many historic concrete balustrades on bridges in New Jersey are reaching the end of their design service lives, and must be replaced with new ones during the bridge rehabilitation programs. This study addressed the need for an aesthetically pleasing historic concrete balustrade design alternative for the Pulaski Skyway in Jersey City, Hudson County. In this study, a crashworthy design was developed according to AASHTO Section 13 specifications and was modeled using the nonlinear transient dynamic finite element analysis software, LS-DYNA, and the AASHTO Manual for Assessing Safety Hardware.

Implementation

The barrier was successfully crash tested, and the computer simulations have been validated establishing various standards of safety. The outcome of this research is an optimized open balustrade design that meets the design safety and aesthetic criteria for AASHTO and HPO, respectively, as well as the crash test requirements for FHWA.

The optimized deign will not only enable the New Jersey Department of Transportation to use the Historic Preservation Office approved design in the Route 139 Rehabilitation project, but also enable NJDOT to replace other similar historic barriers while avoiding, or at least mitigating, the adverse effects to similar historic bridges. For now, the Route 139 project is the only one to utilize the approved design (pictured).

The principal investigator shared the methods and findings of the research at a July 2017 NJDOT Lunchtime Tech Talk! event. A summary of the talk and the presentation can be found here: https://www.njdottechtransfer.net/2017/07/17/more-than-a-pretty-facade/

FHWA-NJ-2017-013

Analysis of Local Bus Markets

Research Category: Traffic & Safety
Project Budgeted Cost: $412,746
Project Customer: NJTRANSIT
Organization: Rutgers - Alan M. Voorhees Transportation Center

Background

NJ TRANSIT runs bus operations on more than 250 routes throughout New Jersey. Buses on such a large number of routes are expected to have an effect on both traffic congestion and Greenhouse Gas (GHG) emissions since many of the current riders would have traveled by automobile if buses on these routes did not operate. This research examines the congestion and GHG impacts of transit by exclusively focusing on local buses in selected parts of the state. It involved a large-scale onboard survey of bus riders on 23 NJ TRANSIT routes serving Hudson, Middlesex, and Monmouth Counties. Data collected through the survey were used to estimate how many riders would travel by automobile modes in the absence of buses and how much GHG

would be generated from the diversion of bus riders to automobile modes. A microsimulation model was used to estimate traffic impacts of buses on one route.

Implementation

The study showed that nearly 10,200 metric tons of C02 would be generated annually from automobiles if bus riders on the 23 routes diverted to that mode, with an increase of traffic times by 10.4 percent. The study found that, in addition to having substantial GHG and traffic impacts, the local buses provide highly equitable service as they serve a very high proportion of persons from minority, low-income, and car-less households and also provide mobility to a large number of workers traveling between home and work.

Based on the results showing significant positive impacts, the promotion of the local bus services can be highly recommended. Local bus services are associated with other benefits: they serve a large proportion of riders who have no other means of travel; they serve a large proportion of low-income and minority populations and are thus beneficial for achieving transportation equity; the surveyed local buses are predominantly used for trips to work and school – trips that are important and nondiscretionary; and buses on some of the surveyed routes also provide useful feeder service to NJTRANSIT trains and PATH trains, thereby helping to increase overall transit ridership.

As a result of this research, NJ TRANSIT used the compiled data in their own corridor studies, air quality studies, contingency planning, station parking studies, and fare equity analysis, and was able to optimize bus service based on this research. NJ TRANSIT further reviewed the

survey data obtained and immediately began to realign bus service on several routes based on rider comments.

The following paper was presented at the January 2017 Meeting of the Transportation Research board.

Deka, Devajyoti, and Chihuangji Wang. Assessment of the Association of System-Related and Place-Related Variables with Bus Ridership in New Jersey. 2017

FHWA-NJ-2017-014

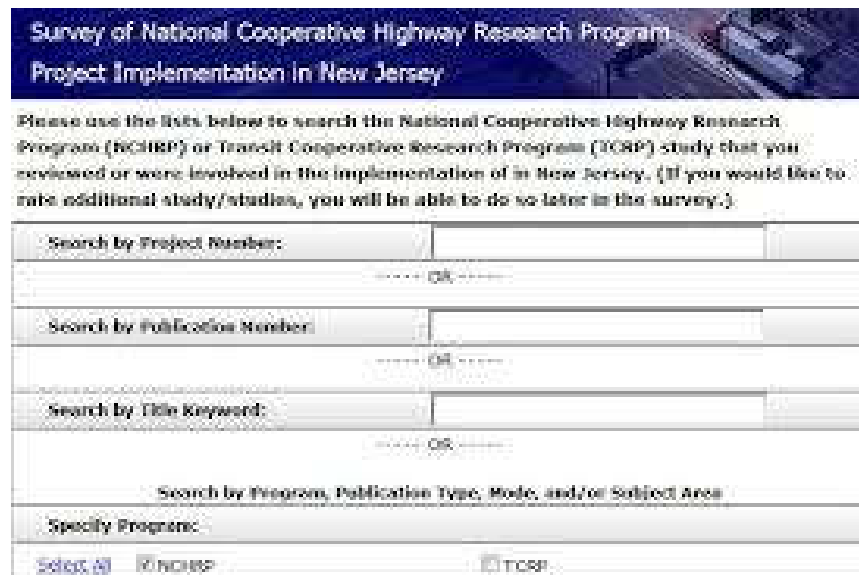**Review of NCHRP Study Implementation at the New Jersey Department of Transportation**

Research Category: Policy & Organization
Project Budgeted Cost: $70,433
Project Customer: NJDOT
Organization: New Jersey Institute of Technology

Background

The study investigated the implementation of NCHRP research results at NJDOT and estimated the usefulness of the projects' results in New Jersey. The research team designed a web-based survey of potential and actual users of NCHRP research in NJDOT's Divisions and Bureaus, as well as research partners at New Jersey Transit and New Jersey Motor Vehicle Commission. The survey identified current criteria and procedures that were used in implementation of NCHRP project results, and the key factors that contribute to the success of the reviewed projects. The study also investigated any NCHRP project considered for application, but not implemented and examined the reasons for not implementing it.

Implementation

The research confirmed that, overall, NCHRP research was successful in applying the outputs of the research projects; however, recommendations were made to increase the usefulness of NCHRP research findings for practical applications in the transportation field. While this project was mostly an implementation report itself, it provided recommendations for those projects that failed to yield useful results in New Jersey. In those cases, it was recommended that all projects which were classified as not implemented undergo a second review. Recommendations were also made to the NJDOT Bureau of Research to review and disseminate the more relevant findings from TRB newsletters to the appropriate units and personnel at NJDOT, NJ MVC and NJ Transit.

FHWA-NJ-2017-015

Scour Evaluation Model Implementation Phase

Research Category: Design & Construction
Project Budgeted Cost: $438,327
Project Customer: NJDOT
Organization: Rutgers University CAIT

Background

Beginning in the 1990s, NJDOT launched a robust Plan of Action to identify scour critical bridges and to perform corrective work. In carrying out the plan, the Department decided to develop New Jersey's own modified method of scour analysis known as the Scour Evaluation Model (SEM). The model is risk-based and reflects the State's unique geology and hydrology. More information about SEM and its development is available in the report, "Design and Evaluation of Scour for Bridges Using HEC-18," FHWA-NJ-2017-011.

Bridge 1227-159 Upstream Fascia, Facing Downstream
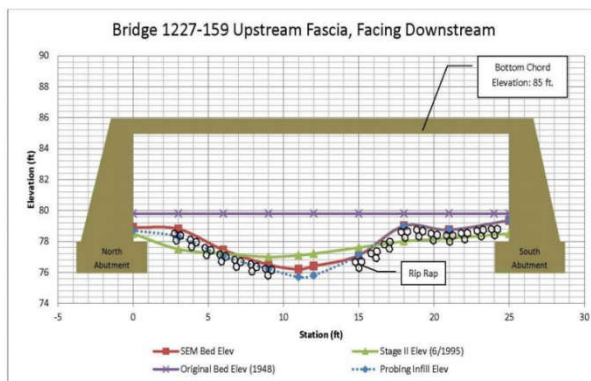
This implementation-oriented project launched the new Scour Evaluation Model (SEM) and was used to evaluate bridges across the State to help identify those that require repair from others that have low scour risk. This study identified and evaluated 19 bridges using the SEM to demonstrate its benefits.

Implementation

The bridges studied during the Implementation Phase were located in all four of the New Jersey's physiographic provinces, including the Coastal Plain, Highlands, Piedmont, and Ridge and Valley. The bridges also featured a wide variety of characteristics, including age, span, drainage basin size, and flooding history. The research team is now assisting NJDOT with incorporating the SEM method into the Department's Bridge and Structures Design Manual. The research provided New Jersey with a new tool to identify and manage bridges on the Scour Critical list.

The findings were also presented at the 2017 Annual NJDOT Research Showcase and can be accessed here: https://civil.njit.edu/sites/civil/files/Showcase%20Present%2010-25-17.pdf

NJ-2017-001

Crash Records Collection Policy Examination and Best Practices Review

Research Category: Traffic & Safety
Project Budgeted Cost: $77,430
Project Customer: NJDOT
Organization: Cambridge Systematics

Background

Vehicle crashes cost states tremendous amounts of resources, in terms of lost life and property damage, as well as maintenance of crash reporting operations. The costs to maintain crash reporting are great and require the involvement of State and local law enforcement agencies, the NJ Motor Vehicle Commission (MVC), NJDOT and private vendors. New Jersey's property damage only (PDO) crash reporting threshold affects costs, and raising the threshold could result in cost savings for all, or some agencies.

The performed research was designed to provide the NJDOT Bureau of Research with a specific set of crash reporting threshold information. This information includes the marginal - average cost of a crash report, the legislative requirements to update the threshold, and the best practices of crash reporting policies and procedures. In addition to this information, the report provides recommendations on what New Jersey should update its threshold to, how to maximize private vendors in the crash reporting process, and the impacts of upgrading from manual to electronic crash reporting.
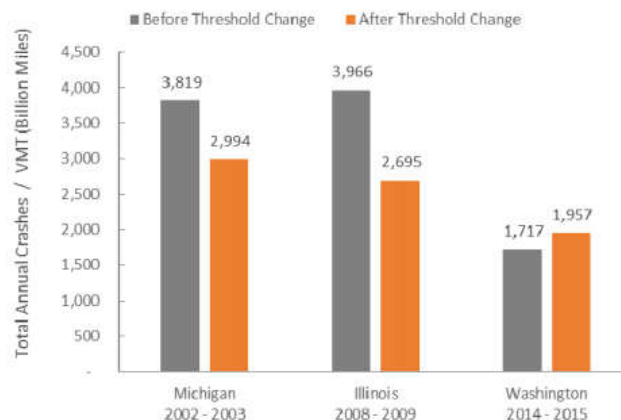

Figure 11. Ratio of Total Crashes to Billion Miles VMT (Right) Before and After PDO Threshold Changes (Source: Interviews with agency staff and FHWA)

Implementation

Among other findings, the study found that NJDOT's current PDO threshold was low by national standards and that the state should raise its Property Damage Only threshold to at least $1,000. The state should also collaboratively develop legislation to improve crash data quality and timely crash submissions. Furthermore, the study recommended that the State move to electronic crash reporting systems to improve timeliness and data quality. The study also produced a report on the findings of a state by state crash reporting survey.

NJ-2017-002

Contractor Supplied Device Survey

Research Category: Operations & Preservation
Project Budgeted Cost: $46,140
Project Customer: NJDOT
Organization: Cambridge Systematics

Background

Contractor supplied devices have generally played an important role in the day-to-day operations of NJDOT Staff, and in some cases has become a necessity to carry out statewide projects and operations. The fact that these devices are owned by independent contractors, however, presents multiple complexities regarding how data used for NJDOT purposes is managed as well how the subject devices are managed and allocated. The performed research was designed to provide NJDOT Bureau of Research with a comprehensive understanding of the use and management of contractor supplied devices (CSDs). The information includes best practices regarding state DOT management of CSDs including administrative procedures, contractual mechanisms, data storage, information transmission, among other topics.

Implementation

The goal of this research was to provide NJDOT with a comprehensive understanding of the use and management of CSDs. The research team determined that contractor supplied devices are necessary in the NJDOT work environment. The following findings were made:

- CSDs are necessary given limited supply and functionality of NJDOT-supplied devices.
- Policies regarding the use and management of CSDs vary noticeably across state DOTs.
- Some DOTs permit third-party VPN access, while others do not.
- Security best practices are evident and include anti-virus software installment and enforcement, restricted VPN access and project close-out procedures.
- Most NJDOT staff have not sought technical support for technology devices.
- NJDOT staff do not appear to have a preference for whether devices are supplied by the Department or by a contractor.
- At a national level there is only limited information available on best practices for managing CSDs.

Based on these findings, the research enhanced NJDOT efforts to develop a roadmap entailing optimal CSD management procedures. Ultimately, as NJDOT employees exhibited no preference as to the seemed source of their devices, the recommendation was made that NJDOT should perform an economic cost analysis to determine which, if any devices NJDOT should supply and which should be relied upon through third parties.