

# Annual Implementation Report Research Completed in 2018

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NJDOT Bureau of Research

In cooperation with

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and  
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# Technology Transfer Program Annual Implementation Report – 2018

## 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, 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 benefits 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 2018 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. al, 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 2018, the Bureau of Research received 13 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, Capital Improvement & Infrastructure related research accounted for the most completed research projects and funding followed by Multimodal and Policy and Organization related research.

**Table 1**  
**Number and Value of Completed Research Reports by Research Category, 2018**

Research Category	Number of Reports Completed	Total Contract Value Completed
Capital Improvement & Infrastructure	6	\$ 1,805,772
Multimodal	3	\$ 801,004
Policy and Organization	3	\$ 516,735
Mobility & Operations	1	\$ 31,560
Safety Management	0	\$ -
Planning and Environment	0	\$ -
<b>Total</b>	<b>13</b>	<b>\$ 3,155,171</b>

Source: NJDOT Bureau of Research, Database of Final Reports  
<https://www.njdottechtransfer.net/research/research-projects/>

As shown in Table 2, the completed research reports vary in their approach to research and in their treatment of implementation themes. The completed research reports efforts toward implementation can be characterized into several, sometimes overlapping categories:

- Some research were primarily analytical or evaluative studies which result 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, or have since acted on recommendations that were made at the time of the study's completion.

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: 2018 Research Reports by Type of Research and Treatment of Implementation Theme**

<b>ID</b>	<b>Title</b>	<b>Implementation Activities</b>	<b>Implementation-Minded Recommendations</b>	<b>Recommendations for Future Research</b>	<b>No Discussion of T2</b>	<b>Research Type</b>	<b>Research Category</b>
FHWA-NJ-2018-001	The Use of Porous Concrete for Sidewalks in New Jersey		X	X		Demonstration and Testing, Materials Engineering	Capital Improvement & Infrastructure
FHWA-NJ-2018-002	Research Library Operations – Calendar Year 2016		X			Survey, Literature Review, Data Collection	Policy and Organization
FHWA-NJ-2018-003	Local Access Management Regulations	X	X			Literature Review, Case Studies, Data Collection	Capital Improvement & Infrastructure
FHWA-NJ-2018-004	Evaluation of Raised Pavement Markers	X	X			Literature Review, Software Design	Capital Improvement & Infrastructure
FHWA-NJ-2018-005	FHWA Local Highway Finance Reporting		X			Data Collection	Policy and Organization
FHWA-NJ-2018-006	Evaluation of Different Paint Systems for Over-Coating Existing Structural Steel		X			Testing	Capital Improvement & Infrastructure
FHWA-NJ-2018-007	Research Library Operations – Calendar Year 2017		X			Survey, Literature Review, Data Collection	Policy and Organization
FHWA-NJ-2018-008	HVS Evaluation of Thin Asphalt Overlays on Composite Pavements		X			Demonstration and Testing, Materials Engineering	Capital Improvement & Infrastructure
FHWA-NJ-2018-009	Implementation Plan for Alternatives to Nuclear Density Testing	X	X			Survey, Data Collection, and Training	Capital Improvement & Infrastructure
FHWA-NJ-2018-010	Analysis of Local Bus Markets - Phase II			X		Survey, Data Collection	Multimodal
NJ-2018-001	Benefits of Transit: Making the Case that NJ TRANSIT Brings Real Value to New Jersey's Citizens			X		Literature Review, Survey, Data Collection	Multimodal
NJ-2018-002	Channel Usage Research and Analysis – Phase 3		X			Data Collection, Software Design	Multimodal
NJ-2018-003	High Mast Drone Inspection	X				Demonstration and Testing	Mobility & Operations

## FHWA-NJ-2018-001

### The Use of Porous Concrete for Sidewalks in New Jersey

Research Category: Capital Improvement & Infrastructure  
Project Budgeted Cost: \$164,000  
Project Customer: NJDOT  
Organization: Rutgers University

#### Background

Pervious concrete has been increasing in popularity as a potential solution to reduce the amount of impermeable surface area associated with sidewalks, reduce puddling, and potentially slow stormwater surface high flow rates. As important as these benefits are to surface runoff mitigation, there are concerns with the ability of pervious concrete mixes to provide sufficient structural support and longevity for the expected service life of the sidewalks as well as life cycle costs. The composition of pervious concrete creates limitations to its mechanical strength and challenges in its maintenance to achieve the expected service life. The performance of pervious concrete pavements is relevant to its geographical location and application as well. Eleven different pervious concrete mix designs were evaluated, as well as their mechanical properties and hydraulic conductivities. The research showed that while the initial construction costs of pervious concrete may be slightly higher, the life cycle costs are lower and it would be a more economically competitive option.

#### Implementation

The research team determined that there were many economic advantages to the porous concrete. Several townships and counties were interested to learn more about the study's findings, which has led to a pilot project with Montgomery Township. The researchers will install a sidewalk and then monitor it for short- and long-term performance and document its benefits to the township. For now, the research showed that there could be significant benefits in eliminating stormwater runoff and soil erosion.

The study also heavily researched 11 different mix designs of porous concrete including their strength, density, void ratio, and permeability. This information on the 11 mixes would be





beneficial to porous concrete suppliers and contractors in New Jersey when they want to build porous concrete sidewalks.

The research led to the following presentations:

1. Poster Session at the TRB January 2019

*Poster title: "Evaluation of the Porous Concrete of Sidewalks in New Jersey"*

2. Hencken, J., Tulanowski, M., Bennert, T., and Najm, H. (2017). 'Evaluation of Hydraulic Conductivity for Pervious Asphalt and Concrete Pavements', *International Conference on Sustainable Infrastructure, NYC, October 2017, ASCE Poster Session October 26-28, 2017.*

And the following publications:

1. Chen, X., Wang, H., Najm, H., Venkateela, G., and Hencken, J. (2019). "Evaluating Engineering Properties and Environmental Impact of Pervious Concrete with Fly ash and Slag", *Journal of Cleaner Production*, <https://doi.org/10.1016/j.jclepro.2019.117714>.
2. Chen, X., Wang, H. and Najm, H. (2017). "Environmental Assessment and Economic Analysis of Porous Pavement at Sidewalk", *Pavement Life-Cycle Assessment Symposium Champaign, Illinois, April 2017.*
3. Hencken, J., Najm, H, Abd Ali, A., and Heiwen H. (2017). "Evaluation of Structural Properties of Pervious Concrete Mix Designs", *International Conference on Sustainable Infrastructure, NYC, October 2017, ASCE Poster Session NYC, October 26-28, 2017.*

## **FHWA-NJ-2018-002**

### **Research Library Operations – Calendar Year 2016**

Research Category: Policy & Organization  
Project Budgeted Cost: \$222,828  
Project Customer: NJDOT  
Organization: NJ State Library

#### **Background**

The NJDOT Research Library operates as a branch of the New Jersey State Library and is funded by the FHWA State Planning and Research Program as a research project. The library serves: NJDOT employees; New Jersey State government employees; other libraries, organizations, and businesses; and members of the general public. Research staff saw the opportunity and need for a professional librarian to manage the collection and to provide information services. The current Research Library program was established in February 1998, and since that time, it has been funded annually as a research project by FHWA.



#### **Implementation**

This final report for the calendar year 2016, updating the last final report from 1999, provides an overview of activity for the intervening years including the ramifications and effects of three major moves between 2000 and 2015. It provides monthly and annual statistics regarding library use and identifies broad categories of library users (requestor affiliation), methods of contact, type of services requested, and services provided. The research successfully enhanced library staff knowledge and skills, maintained and expanded the library collection by acquiring and organizing library materials, and began the process of proactively forwarding links to journals, newsletters, research reports, and other materials to relevant units at NJDOT.

As part of the project, library activities were marketed to NJDOT staff and others and monthly reports were issued on new initiatives and significant accomplishments. Plans are in the works for the creation of a new tool to promote workplace productivity and for continued and improved dissemination of current resources, products, and services.

Another project was issued for library operations in the year 2017 for comparative purposes.

## FHWA-NJ-2018-003

### Local Access Management Regulations

Research Category: Capital Improvement & Infrastructure  
Project Budgeted Cost: \$259,469  
Customer: NJDOT  
Organization: Rutgers University

#### Background

New Jersey has an access management code that is highly effective, but it applies only to State highways. As the State code does not apply to local roads, conflicts with property owners/developers may arise when State highway improvements are undertaken, or new developments take place on local roads near intersections with State highways. In recent years, New Jersey Department of Transportation (NJDOT) had to deal with such issues in some instances in different parts of the State.

This research identifies and recommends strategies, tools, and guidelines to facilitate access management on local (i.e., county and municipal) roads intersecting and/or impacting State highways in New Jersey.

#### Implementation

The research was broken into several phases, the first of which was a comprehensive literature review of state departments of transportation from around the country regarding the implementation of their own access management regulations. The research included a review of the literature and best practices, several stakeholder meetings, structured interviews with officials from the DOTs from other states, a survey of State officials, case studies involving intersections between local roads and State highways, and synthesis of results.

The next phase included stakeholder meetings with professionals from around New Jersey to hear about their personal experiences regarding the lack of comprehensive regulations and brainstorm solutions. In doing so, the research team began to identify which best practices from around the country would be most effective in our State. The research also identified that there is considerable support among New Jersey professionals for access management on major local roads. As the State code standards are not always directly applicable to local roads, there is a need to develop guidelines and standards that are suitable to specific local governments.

Major recommendations for NJDOT based on this study are:

- Encourage local governments to develop their own access management guidelines and standards that are consistent with the State code but allow more flexibility for local roads.
- Develop and reach early agreement on project-specific access management criteria

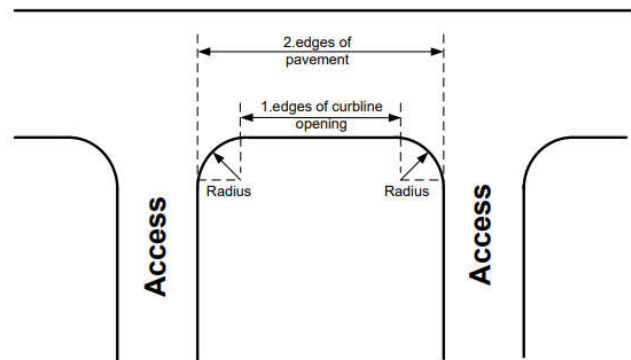


Figure 20. Access spacing measurement types

- Provide incentives to local governments to establish and apply access management policies and guidelines by using an approach similar to those applied to Complete Streets
- Use the stakeholder committee established through this research to augment dialogues between NJDOT and local governments regarding local access management.

The study recommended the development of semi-automatic screening tools and GIS overlays to assess problematic locations based on the case studies that were evaluated. A local access management manual was developed for NJDOT staff, and the idea of co-training for staff and local agencies was recommended as well but has yet to be adopted.

The findings were presented at the 2019 Transportation Research Board Annual Meeting and were compiled in a NCHRP Report <http://www.trb.org/Publications/Blurbs/180445.aspx>

The project team also contributed to the latest round of updates to the New Jersey State Access Management Code: <https://www.state.nj.us/transportation/business/accessmgt/NJHAMC/>

The research study was featured in a “Research Spotlight” article on the NJDOT Technology Transfer that was posted on May 16, 2019: <https://www.njdottechtransfer.net/2019/05/16/local-access-management-regulations/>

## **FHWA-NJ-2018-004**

### **Evaluation of Raised Pavement Markers**

Research Category: Capital Improvement & Infrastructure  
Project Budgeted Cost: \$297,596  
Project Customer: NJDOT  
Organization: Rutgers University

#### **Background**

Raised Pavement Markers (RPMs) are devices used to improve preview distances and provide guidance for drivers in inclement weather and low-light conditions. Different states have particular asset management strategies related to installation, monitoring, inspection, and maintenance of RPMs. The main purpose of this study is to conduct a comprehensive evaluation of RPMs and relevant alternatives to attain cost-effective safety improvements. This project developed a methodological framework for quantifying the safety effectiveness and implementation costs of raised pavement markers (RPMs) and relevant alternatives.

#### **Implementation**

During the research, a literature review was conducted to determine if the use of RPMs had any effect on roadway crash rates. There was no consensus across the review, as the effectiveness varied depending on many factors including traffic, environment, and roadway characteristics. However, this research developed a decision support tool to evaluate and compare the lifecycle cost (LCC) of RPMs and alternatives. The tool accounts for the costs of installation, traffic control, traffic delay, inspection, maintenance, and repair, as well as the liability associated with incidents due to damaged RPMs or alternatives. This tool provides the ability to quantify the cost-effectiveness of RPMs, identifying alternatives for specific road and traffic characteristics, and provide better information to inform safety decisions for NJDOT.



**Raised Rumble Strips**

The findings of this research were cited in the following projects:

- Closed-Course Human Factors Evaluation of Marking and Marker Visibility” by TP Barrette and AM Pike in Transportation Research Record (2019).
- Analysis Method Used by J. Bullough in a discussion of an aforementioned paper by Barrette and Pike (2019), also published in Transportation Research Record (2019).

An article about the project was published at: Bullough, J. D. and X. Liu. 2020. Assessing the visibility of raised pavement markers and alternative forms of delineation. Transport 35(1): 98-107.

The research was also featured in the AASHTO High Value Safety Research brochure:

[https://research.transportation.org/wp-content/uploads/sites/31/2018/07/SafetyResearch2018\\_WEB.pdf](https://research.transportation.org/wp-content/uploads/sites/31/2018/07/SafetyResearch2018_WEB.pdf).

The research study was featured in a “Research Spotlight” article on the NJDOT Technology Transfer that was posted on October 25, 2019:

<https://www.njdottechtransfer.net/2019/10/25/evaluating-use-of-raised-pavement-markers/>

As a next step, this project will develop a methodological framework for quantifying the cost-effectiveness of RPMs and their alternatives according to specified road and traffic characteristics.

## **FHWA-NJ-2018-005**

### **FHWA Local Highway Finance Reporting**

Research Category: Policy & Organization  
Project Budgeted Cost: \$38,384  
Project Customer: NJDOT  
Organization: Rutgers University

#### **Background**

The Federal Highway Administration requires state departments of transportation (DOTs) to compile, analyze, and report state motor-fuel, motor-vehicle, driver license, motor-carrier, and highway finance data associated with expenditures by state and local governments. As a result, research was needed to develop a new methodology and procedures for collecting and analyzing local government roadway revenue and spending data so that NJDOT can complete the FHWA Local Highway Finance Report. The purpose of this study was to develop a new methodology and procedures for collecting and analyzing local government roadway revenue and spending data in New Jersey.

#### **Implementation**

The report made a series of recommendations to assist NJDOT in remaining in compliance with FHWA's requirements.

- In the short-term, NJDOT should allocate sufficient time and resources to replicate the sampling, data collection, and analysis process outlined in this report on a biennial basis. This should include a minimum of 650 labor hours;
- In the longer term, representatives from NJDOT should continue to explore ways to enhance local government reporting of roadway-related revenue and expenditures. This should include working with the Department of Community Affairs, Office of Local Government Services, and representatives from the New Jersey Government Finance Officers Association to develop a guidance document establishing improved procedures for identifying, coding, and reporting roadway-related revenues and expenditures within the current structure of financial reporting requirements; and
- NJDOT should explore the feasibility of requiring local government units to report data on local roadway-related revenue and expenditures as a condition of receiving local aid funding.



Figure 1. Local Road Project, Ocean City, NJ



## FHWA-NJ-2018-006

### Evaluation of Different Paint Systems for Over-Coating Existing Structural Steel

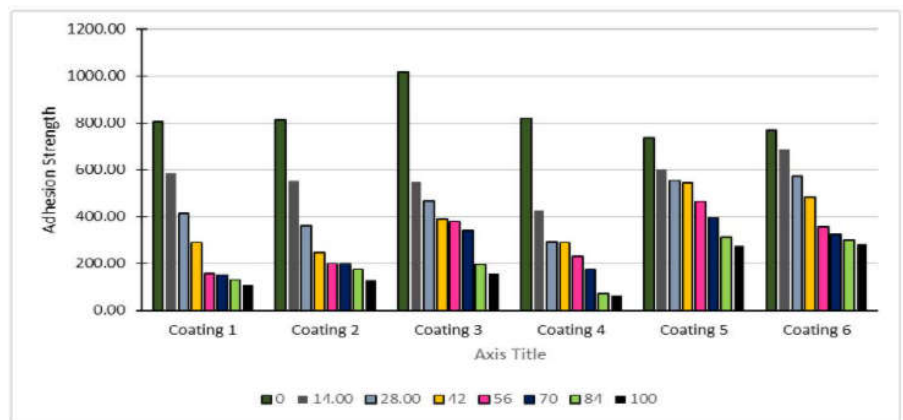
Research Category: Capital Improvement & Infrastructure  
Project Budgeted Cost: \$213,862  
Project Customer: NJDOT  
Organization: Rutgers University

#### Background

This project was undertaken to identify a procedure to accept new coating systems for over-coating of steel surfaces. The practices used by various state transportation agencies and test methods for accelerated testing of coatings with a primary focus on FHWA guidelines were reviewed. It was concluded that a new protocol for accepting new systems that will provide results in a timely manner is required. Therefore, a new protocol for evaluating the durability of coatings and their effectiveness in reducing corrosion of steel structures was developed. A test was developed for NJDOT to evaluate the coatings, and several tests measuring corrosion were conducted in the field. They found that, of the coating systems currently in use, those containing an inorganic zinc or organic zinc primer performed best. The epoxy systems and aluminum-mastic systems performed worst.

#### Implementation

Based on a literature search, it was concluded that a new protocol is needed. Results presented in this report provide the details of a new protocol for evaluation under accelerated corrosion, recommendations for acceptance, and a plan for implementation.



The test protocol developed by this research was adopted by NJDOT through the formation of a working group for approving new coating systems. The research also suggested the implementation of a systematic procedure for reviewing and accepting new coating systems from a wider pool of states through collaborations with other state DOTs.

Implementation of research results will lead to the use of new coatings that can provide better performance. Current test methods are both time-consuming and expensive and therefore very few new coating systems are submitted for approval. Only coating systems manufactured by large companies are currently approved, and even some large companies shy away from submitting new systems. In addition, the new test protocol will provide a good estimate of coating life in actual field conditions, leading to further cost savings.

Recommendations for future studies and to conduct a pooled fund study in collaboration with other states to achieve this goal were made, but not yet undertaken.

The research led to the following paper presented at the 2019 TRB Conference:



Venkiteela, G., Caronia, D. P., & Balaguru, P. N. (2019). *A New Protocol for Evaluating the Durability of Coatings Used for Reducing Corrosion of Steel Structures* (No. 19-00490).

The presentation, [A New Protocol for Evaluating the Durability of Coatings Used for Reducing Corrosion of Steel Structures](#), highlighted the methods and findings of the research and was given at the 2019 NJDOT Research Showcase.

The Research Advisory Committee of the American Association of State Highway and Transportation Officials (AASHTO) selected the project as one of 16 high-value research projects in 2019 in the category of Smart Maintenance and Preservation. In recognition of the award, the research, *New Protocol for Accepting Overcoating Paint on Steel*, was featured as part of the 2020 TRB Annual Meeting as one of the Sweet Sixteen: State DOT High Value Research Projects.

The research's contribution to developing a new testing method for the durability of paint overcoat on steel structures, such as bridges, was also recognized at the 2019 NJDOT Research Showcase.

Initial efforts to produce a short "research to implementation" video highlighting the findings and efficiencies represented by the research were initiated in late summer 2020.

## FHWA-NJ-2018-007

### Research Library Operations – Calendar Year 2017

Research Category: Policy and Organization

Project Budgeted Cost: \$255,523

Project Customer: NJDOT

Organization: NJ State Library

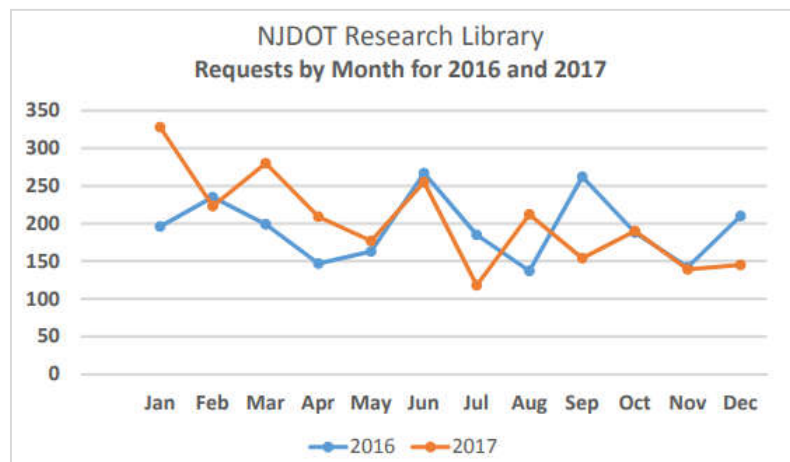
#### **Background**

The main objectives of this research project were to operate and improve the Research Library as a major resource for transportation knowledge sharing and technology transfer. By partnering with NJDOT staff and Department units whenever possible, and with other transportation libraries and entities, Library staff sought to provide support to the organization and the industry, to assist people in their professional endeavors, and to fill gaps in the body of knowledge within the Department and externally.

#### **Implementation**

This report examines the calendar year 2017, with a look back for comparative purposes at the calendar year 2016. The number of requests received remained relatively stable with a slight increase in out-of-State requests. The vast majority of 2017 requests, 87 percent, came from NJDOT requestors. Based on a majority of requests received, whether in-person, by telephone, or email, face-to-face remained the most popular method of contact. Additionally, as in 2016, a majority of the NJDOT requests came from Department staff working in the same building as the Research Library.

The findings found many of the same issues as the previous year's report including, funding, staffing, awareness, technical challenges, noise, among others. Most crucially, the findings of this two-year study in association with other funded research, led to the formulation of a Request for Proposal, "NJDOT Bureau of Research Library Services" that held as a goal the modernizing the NJDOT Research Library.



## **FHWA-NJ-2018-008**

### **HVS Evaluation of Thin Asphalt Overlays on Composite Pavements**

Research Category: Capital Improvement & Infrastructure  
Project Budgeted Cost: \$850,000  
Project Customer: NJDOT  
Organization: Rowan University

#### **Background**

The use of asphalt overlays on rigid pavements as a preservation and rehabilitation technique has become common among many state transportation agencies. Many of the studies conducted on the aforementioned Hot Mix Asphalt (HMA) mixes focused on evaluating the laboratory performance of these mixes and very few studies evaluated the HMA mixes under conditions that are representative of those in New Jersey. Therefore, there was a need to evaluate the field performance of various asphalt overlay treatments before NJDOT could fully implement these treatments on its roadways. The primary research goal of this study was to identify and predict the expected life of thin asphalt overlay treatments used for rehabilitating and preserving Portland Cement Concrete (PCC) pavements. The secondary goal was to compare the relative field performance of the asphalt overlays considered to determine the most suitable asphalt overlay treatment for deteriorated rigid pavement in New Jersey.

#### **Implementation**

Based on the findings of the study, the research team recommended to NJDOT that further field evaluation is required to estimate the life expectancy of the overlays considered in the study. Though the research provided tools to successfully measure and rank the field performance of the six asphalt overlays considered in this study, further field evaluation would be necessary in order to predict the expected life of these overlays. Estimation of the expected life of the six overlays would provide verification for the parameters developed in this study to characterize the asphalt overlays' reflective cracking susceptibility, resistance to horizontal and vertical joint movement, and vertical load capacity.



Thin asphalt overlays could help extend the life of existing pavements by 5 to 10 years; depending on existing pavement conditions. These overlays cost a fraction of a full roadway rehabilitation project, thus, offer significant cost savings. In general, rehabilitation of a lane mile of roadway costs approximately \$350,000 while the cost of a thin asphalt overlay is around \$15,000. As a result, agencies can save a significant amount of dollars by using thin asphalt overlays to extend the life of existing pavements.

The findings of this study were published on the National Transportation Library [https://rosap.ntl.bts.gov/view/dot/43652/dot\\_43652\\_DS1.pdf](https://rosap.ntl.bts.gov/view/dot/43652/dot_43652_DS1.pdf) and highlighted as a featured project in [Rowan CREATES Magazine!](#)

The study was also presented to the Virginia Transportation Research Council and presented at the [North East Asphalt User/Producer Group](#).

The following publications were issued based on the research's findings:

*Rizvi, H., Ali, A., Mehta, Y., Francoise, A., Purdy, C., & Nolan, A. (2017, January). Instrumentation to evaluate the field performance of composite overlays using accelerated pavement testing. In 10th International Conference on the Bearing Capacity of Roads, Railways and Airfields, BCRRA 2017 (pp. 645-652). CRC Press/Balkema.*

*Francois, A., Ali, A., Mehta, Y. A Proposed Approach for Processing and Analyzing Strain Data Collected In Full-Scale Accelerated Pavement Testing. Fifth Conference on Smart Monitoring Assessment and Rehabilitation of Civil Structures, 2018.*

*Francois, A., Ali, A., and Mehta, Y. (2020), "Evaluating the Impact of Hot Mix Asphalt Mixture Properties on the Laboratory Performance of Specialty Hot Mix Asphalt Overlay Mixtures Used in New Jersey," Presented at the 99th Annual Meeting of the Transportation Research Board (TRB), Washington, D.C.*

## **FHWA-NJ-2018-009**

### **Implementation Plan for Alternatives to Nuclear Density Testing**

Research Category: Capital Improvement & Infrastructure  
Project Budgeted Cost: \$20,845  
Project Customer: NJDOT  
Organization: Rowan University

#### **Background**

In New Jersey, the nuclear density gauge (NDG) is used as the method to determine if the compaction quality of a soil layer is passing or failing. Despite the popularity and advantages of the NDG, several concerns are associated with using this device including (1) expensive operational costs, (2) maintenance and transport challenges, and (3) identification of the device as a safety hazard. Therefore, alternative non-nuclear compaction devices are being evaluated for their potential to replace the NDG for compaction quality testing.

The Dynamic Cone Penetrometer (DCP) was identified as the best alternative non-nuclear compaction testing method. The goal of this study was to facilitate the use of the DCP and initiate implementation in New Jersey by providing training to NJDOT personnel and contractors in the State on how to operate the DCP and interpret the test results. To achieve this goal, field demonstrations were conducted at NJDOT job sites to present how to operate the DCP and determine the compaction quality of the unbound layer. The sites were tested with both the NDG and DCP to evaluate the accuracy of the DCP on field sections.



#### **Implementation**

This project followed on the success of the research team's previous project FHWA-NJ-2016-003, identifying the Dynamic Cone Penetrometer to NJDOT as the best alternative non-nuclear compaction device. Based on the testing undertaken in this project, it was determined that the DCP provided the same field compaction quality determinations as the NDG at all NJDOT job site locations, and the majority of the attendees felt comfortable using and implementing the DCP.

Based on the experience of the research team and the results of the questionnaires, a recommendation was made to NJDOT to automate a portion, or the entire, DCP testing process through the use of additional equipment.

## FHWA-NJ-2018-010

### Analysis of Local Bus Markets - Phase II

Research Category: Multimodal  
Project Budgeted Cost: \$411,504  
Project Customer: NJ TRANSIT  
Organization: Rutgers University

#### Background

This market research examines involved a large-scale onboard survey of bus riders on 25 NJ TRANSIT routes serving Burlington, Hudson, Middlesex, and Monmouth Counties. This research had three primary objectives: assess the characteristics of riders and their travel patterns; generate a dataset of riders through a survey to assist NJ TRANSIT with future service planning and forecasting needs, and address a specific research question focused on greenhouse gas (GHG) impacts of local buses by examining how much emissions would have been generated if bus riders deviated to cars. 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.

#### Implementation

Based on the results showing significant positive environmental impacts, the promotion of the local bus services was highly recommended to NJDOT for several other reasons. First, they serve a large proportion of riders who have no other means of travel. Second, local buses serve a large proportion of low-income and minority populations. In that sense, it is beneficial for achieving transportation equity. Third, the surveyed local buses are predominantly used for trips to work – trips that are important and non-discretionary. Fourth, buses on some of the surveyed routes also serve as useful feeder service to NJ TRANSIT trains, thereby helping to increase overall transit ridership.



The research also indicated that a very high proportion of riders on almost all routes stated that they would use an app-based service connecting to services of transportation network companies (e.g., Uber, Lyft, etc.) in the absence of buses; thus, the research also noted the future research may be warranted to explore the possibility of further disruption as current transit riders choose to take app-based services instead of transit.

The study was cited in American Public Transportation Association. 2018. Understanding Recent Ridership.

The following paper was presented at the January 2019 Meeting of the Transportation Research board.

*Deka, Devajyoti, Assessment of the Association of System-Related and Place-Related Variables with Bus Ridership in New Jersey. 2019.*

The study was the subject of a Lunchtime Tech Talk, the [Analysis of Local Bus Markets Webinar](#), held on October 7, 2020 with the Principal Investigator and the research customer, NJ Transit.



**NJ-2018-001**

**Benefits of Transit: Making the Case that NJ TRANSIT Brings Real Value to New Jersey's Citizens**

Research Category: Multimodal  
Project Budgeted Cost: \$250,000  
Project Customer: NJ TRANSIT  
Organization: Cambridge Systematics

**Background**

The New Jersey Department of Transportation (NJDOT) Bureau of Research is working with NJ TRANSIT to document and quantify the value that NJ TRANSIT and other public transit operators bring to the State of New Jersey. The objective of this research was to identify important measures used to assess transit benefits, the stakeholder audiences these benefits are marketed to, and the methods as well as purposes for employing these measures and strategies. The research involved a literature review, interviews to identify best practices in transit benefits communication, and development of a matrix documenting common themes, quantifiable criteria, decision making, and marketing techniques related to identified benefits of transit measures. Based on this information, the Research Team developed a draft annotated outline for a future request for proposal (RFP) to quantify and document these measures within New Jersey.



**Implementation**

A comprehensive scan of the literature on the benefits of transit and communications campaigns revealed that economic impact measures were most commonly employed. Economic impact measures include job creation, increased capital, as well as government revenue. Such measures are likely the most effective because they provide a convincing argument that appeals to all identified stakeholders. The research team recommended that a Statewide benefits of transit campaign should be developed, taking into account, at a minimum, the following measures:

- Job creation (both direct and indirect)
- Effects of transit service on property values
- Procurement mapping that details the flow of money from NJ TRANSIT across the State
- Analysis of land use trends & characteristics in areas near transit facilities
- Overall opportunity access
- Air quality improvements
- Congestion reduction

This research aimed to develop a future RFP for a contractor to work with NJDOT and NJ TRANSIT to identify, quantify, and communicate the benefits of public transit within New Jersey in a thoughtful and strategic manner. The RFP for the follow-up project was issued in 2019.

## NJ-2018-002

### Channel Usage Research and Analysis – Phase 3

Research Category: Multimodal  
Project Budgeted Cost: \$139,500  
Project Customer: NJDOT – Office of Maritime Resources  
Organization: Cambridge Systematics

#### **Background**

The NJDOT Office of Maritime Resources (OMR) is continuing steps towards the development of an asset management system to more effectively manage New Jersey's Marine Transportation System. After a first and second round of vessel count data collection in 2015 and 2016, a third round occurred during the summer of 2017 to better understand the different methodologies for analyzing waterway usage. Insight from all three rounds of data collection were then utilized to establish a framework for a vessel count and classification data on State-maintained waterways, as well as a four-phase data collection and analysis plan. The objective of this research was to develop and implement a reliable, repeatable, and verifiable method or SOP (Standard Operating Procedure) to collect vessel count and classification information by time of day.

#### **Implementation**

This study developed recommendations for how NJDOT can use various methodologies for collecting channel and waterway vessel counts and classification data. By undergoing a third phase of vessel counts through those methodologies identified from Phase 1 and 2 of this project, the research team developed recommendations for how NJDOT can establish their own formal marine transportation system and waterway data collection program.

The results of this project led to guidance that is to be used on future data collection efforts. The team also recommended the creation of a Marine Transportation System data collection program that establishes approved methodologies, procedures, collection techniques, a proposed collection schedule, and considers a waterway classification system.





## NJ-2018-003

### High Mast Drone Inspection

Research Category: Mobility & Operations  
Project Budgeted Cost: \$31,560  
Project Customer: NJDOT  
Organization: Cambridge Systematics

#### **Background**

The NJDOT Bureau of Research helped the Bureau of Aeronautics quantify the benefits of deploying Unmanned Aerial Systems (UAS) for the inspection of 244 high mast light poles in the State and to compare this approach to a traditional, ground-based asset management approach. The objective of this research was to quantify, to the extent possible, the benefits across four project evaluation criteria: safety, efficiency (highway and data), time, and cost. The research utilized interviews with affected NJDOT personnel to understand the different approaches to high-mast inspection, created case studies to explore inspection scenarios, and conducted a benefit-cost analysis to quantify the costs and savings of the various identified approaches.

#### **Implementation**

At a quantifiable level, the UAS approach balances NJDOT's need to comprehensively manage and inspect high mast light pole assets in the State with cost considerations. The research team showed that the UAS inspections were far safer, far more cost-effective, and more time-efficient. It was recommended that the UAS program examine the feasibility of several other deployments of UAS, including for construction project management and traffic incident response and management, providing NJDOT with valuable experience and lessons learned that can be applied across multiple programs in the years to come.

The work here was cited in the research paper "[Unmanned Aircraft Systems Impact on Operational Efficiency and Connectivity](#)", Burgett, Joseph M. December 2019

The research was included in the NCHRP Project 20-68A "[Successful Approaches for the Use of Unmanned Aerial System by Surface Transportation Agencies](#)"

The research was also highlighted on the NJDOT Technology Transfer Website article "[Drone Program Reaches New Heights, Seeks to Go Higher](#)".

The implementation of the UAS program and the use of drones for high-mast inspections were featured in a video, [Drone Technology at NJDOT](#), that also highlighted several other use cases for how UAS is advancing innovation at NJDOT. The video is featured on the NJ STIC Innovative Initiatives page, [Unmanned Aerial Systems](#). An infographic, [Benefits of UAS for High-Mast Inspections](#), has been posted to the NJ STIC UAS page describing the findings from this research, along with other UAS fact sheets that highlight how NJ STIC incentive funding has been used to support and implement the UAS program including the high-mast inspections.

