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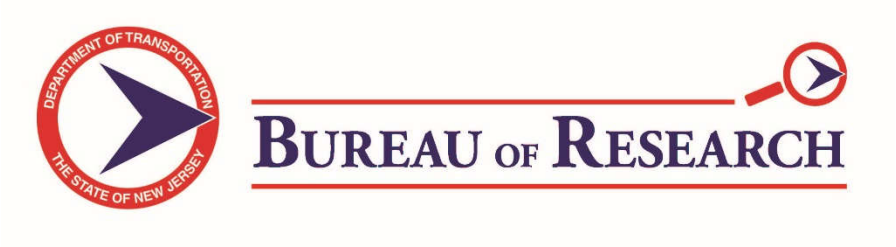

Technology Transfer Program, 2017-2020
FINAL REPORT

March 2021

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In cooperation with

New Jersey
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Bureau of Research
and
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16. Abstract

The NJDOT Technology Transfer (T2) Program, 2017-2020 focused on the development and implementation of a program to increase the level of awareness concerning transportation-related issues within New Jersey, promote an ongoing exchange of ideas, translate the latest state-of-the-art trends and technology practices, showcase innovation, and promote and disseminate research results in a form that can be readily applied to current transportation problems. The T2 Program develops and employs various activities, tools and processes to address identified technology transfer and knowledge management needs. The processes and products of these efforts provide many points of intervention to identify needs and target strategies to address continuing and emerging needs and expand participation and encourage innovation in transportation among all stakeholders.

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EXECUTIVE SUMMARY

Conducted in collaboration with the Bureau of Research (BoR) at the New Jersey Department of Transportation (NJDOT), the NJDOT Technology Transfer (T2) Program, 2017-2020 focused on the development and implementation of a program to promote research, highlight implementable research findings, and disseminate model practices and examples of innovation to the NJ transportation community.

- A **Literature Review** focused on existing and best practices in technology transfer and knowledge management at state DOTs, and other resources in transportation research from academic and practitioner communities. Additional information was gathered through scoping interviews with NJDOT BoR staff and review of NJDOT policies and procedures related to research, innovation, and knowledge management. This material informed the work plan and implementation activities for the T2 program.
- The **NJDOT Subject Matter Expert (SME) Technology Transfer and Knowledge Management Survey** was distributed to NJDOT's SMEs to gather information on: past and current knowledge sharing practices; "go-to" sources for information; knowledge at risk of being lost; critical knowledge, skills and abilities needed; knowledge codification and dissemination; succession and talent management; existing and preferred strategies, tools and processes for identifying and implementing innovative practices, research needs and other technology transfer and knowledge transfer activities to identify current technology transfer and knowledge management needs; and challenges in disseminating information to staff to advance understanding of job responsibilities, policies and procedures.
- The **New Jersey State Transportation Innovation Council (STIC) Innovative Initiatives Survey** was distributed to representatives of the NJ STIC and Local Public Agencies (LPAs) to raise awareness of the Federal Highway Administration (FHWA) Every Day Counts (EDC) initiatives and explore participant insights and experience related to the need for innovation, the identification of examples of implementation of EDC initiatives and other innovative practices in New Jersey, and the challenges of implementing innovative practices. The survey also sought to identify practices that deserve greater recognition and whose lessons learned should be shared to encourage greater deployment, and to identify topics that should receive greater priority in terms of STIC funding, research, technical assistance training and materials development.
- The **Tech Talk! Program** includes lunchtime talks, half-day and other events, and webinars to promote the dissemination and implementation of research, knowledge, and innovative ideas. The Tech Talk! Program was branded and launched, in part, to inform attendees about recent NJDOT-sponsored research and important technological innovations on the horizon. The Lunchtime Tech Talks have highlighted research underway or completed and topics that highlight emerging trends and promising innovations in design, technology, tools and processes. Speakers have included funded researchers, practitioners as well as subject matter resource specialists from FHWA focused on advancing Every Day Counts innovations. The

Tech Talk! series has included half-day events and FHWA innovation Exchange webinars that reinforce the most recent round of Every Day Counts.

- As part of a knowledge capture program, an online **Knowledge Management Toolbox** that presents recognized model practices and case examples for providing knowledge capture and transfer was posted on the T2 website. NJDOT staff may consider use of these strategies to address potential knowledge gaps within their divisions, offices and units, and to make better use of knowledge in various mission critical areas.
- The online **NJ Transportation Research Ideas** portal was deployed for soliciting research ideas through the four rounds of funding between 2017 and 2020. The online portal offers a crowdsourcing tool and greater transparency for research needs identification between potential research "champions" at transportation agencies (e.g., NJDOT, NJ TRANSIT, and NJ Motor Vehicles Commission) and researchers at Institutes of Higher Education, enabling participation from other subject matter experts and interested stakeholders.
- Over the past few years, the **Build a Better Mousetrap (BABM) Competition** has encouraged participants to submit entries to the competition explaining their innovations that help them do their jobs more safely, and result in time and cost savings for NJDOT. A video has been prepared and updated annually with each year's winning innovation to encourage participation.
- To support knowledge sharing and professional development, the T2 program has supported attendance of NJDOT Bureau of Research staff at the TRB Annual Meeting and other research events.
- Various means were established to share NJDOT research, research implementation, and adoption of other innovative initiatives. The **T2 Website** was developed as the repository for articles on research topics, documentation of Tech Talk events, information related to NJ STIC innovations, announcements of events and trainings, and links to research in progress and completed research projects. **Video** was used to document the NJDOT adoption of innovation and the implementation of funded research projects.
- Each year, an **Annual Implementation Status Report** was prepared to describe NJDOT-sponsored research projects undertaken and their benefits, long-term effects and/or steps needed to achieve full-scale implementation. These reports are available on the T2 website. The reports have informed some strategies for the identification of Tech Talk Events, videos, and other technical assistance materials.
- Support for the NJ STIC grew over the life of the project and supportive efforts were added to the annual work plans. The T2 website documents progress on NJDOT's adoption of FHWA EDC innovative initiatives, and as well as NJ STIC meetings. Key informant interviews with STIC Core Innovation Area (CIA) team leads, select NJDOT-funded resource centers, and other groups provide information on the status of implementation of EDC and other innovative initiatives, grants and model practices. These topics were the focus of articles, tech talks or other events, or other technical assistance tools for broader dissemination.

The objectives of the T2 Program set forth at the inception of the project informed the overall scope of work tasks and the annual work program. Working in collaboration with the NJDOT BoR, the priority objectives were achieved through the task activities undertaken for the project.

The Final Report describes the work performed to meet each key objective, highlighting needs identification methods, technology transfer and knowledge management activities, and key measures that were used to monitor activities. The Final Report also describes several benefits, lessons and challenges observed in carrying out the major tasks of the project. Conclusions and recommendations for next steps for the T2 Program are also provided.

BACKGROUND

In 2016, the New Jersey Department of Transportation Bureau of Research issued a Request for Proposal seeking research and technical assistance for the development and implementation of a Technology Transfer Program.

NJDOT retained a research team from two centers based at Rutgers University: the Alan M. Voorhees Transportation Center (Rutgers-VTC) at the Edward J. Bloustein School for Planning and Public Policy, and the Center for Advanced Infrastructure and Transportation (Rutgers-CAIT) to develop, implement, and support an NJDOT Technology Transfer Program.

Over the last four years, the Technology Transfer Program has sought to promote research, highlight implementable research findings, and disseminate model practices and examples of innovation to the NJ transportation community.

OBJECTIVES

Several practical objectives for the T2 Program were defined at the inception of this project, including:

1. Document best practices in technology transfer in use at other state DOTs.
2. Conduct a survey of NJDOT subject matter experts to determine technology transfer needs.
3. Develop a technology transfer program with training and other events and peer exchange program.
4. Develop a knowledge capture program.
5. Create a tool for solicitation of research ideas.
6. Establish a competition for ideas in innovation.
7. Provide support for attendance of NJDOT staff at TRB Annual Meeting and other research events.
8. Plan, organize and administer an annual TRB field visit to NJDOT.
9. Design a process to share NJDOT research.
10. Prepare an annual Implementation Status Report

INTRODUCTION

The New Jersey Department of Transportation Technology Transfer (T2) Program seeks to increase the level of awareness concerning transportation-related issues within New Jersey, promote an ongoing exchange of ideas, translate the latest state-of-the-art trends and technology practices, showcase innovation, and disseminate research results in a form that can be readily applied to current transportation problems.

The NJDOT T2 Program seeks to bridge the gap between the information needs of practicing transportation professionals and the tight budgets of transportation agencies, while engaging other interested stakeholders such as academia, trade and professional organizations, consulting professionals, local public agency decision makers, advocacy and community groups, students and the interested public. Recognized activities leading to the adoption of innovations can include knowledge transfer, training and education, demonstrations and showcases, communications and marketing efforts, technical assistance and more.

Over the last four years, the T2 Program has laid the groundwork for a program of continuing efforts to promote research and implementation, highlight implementable research findings, and disseminate model practices and examples of innovation to the NJ transportation community.

SUMMARY OF THE LITERATURE REVIEW

In the earliest phase of the project, the T2 Research Team conducted a literature review of existing and best practices in technology transfer and knowledge management at state DOTs and reviewed other resources in transportation research from academic and practitioner communities. [1] Supplementing the literature review, the T2 Research Team held scoping interviews with NJDOT BoR staff and reviewed other materials describing policies and procedures related to research, innovation, and knowledge management in place at NJDOT.

Drawing upon the literature review and scoping, several key emerging trends, opportunities and challenges confronting state transportation agencies – including NJDOT – were noted that informed the rationale, context, and scope of the technology transfer program, including:

- **Transportation agencies have increasingly become reliant on technologies to manage infrastructure**. State transportation agency's longstanding obligation to design, build and maintain road infrastructure has been increasingly supplanted by the need to extend the capacity and efficiency of infrastructure through technological means. [2]
- **Changes in workforce skills are needed to adapt to technologies**. Skill demands are changing in the transportation industry due to an influx of new technology that is affecting workforce dynamics. These technological changes alter skill requirements, and employers are challenged to maintain the skills of workers currently on the job, as well as recruit new skilled candidates. [3,4,5]

- **Pace of technology innovation requires training for an educated workforce to build competency and promote retention.** An employee's knowledge of technology can become obsolete once hired because the technology has changed quickly. Employees may seek other employment if they do not feel comfortable with the changing technology and are not provided the proper training to adapt. Therefore, there must a good balance between hiring knowledgeable employees and providing trainings to new employees. (6)
- **Transportation agencies adapt through periods of fiscal constraint and leadership direction to chart a path forward.** Governing regimes at the Federal and State level have adopted distinctly different perspectives on the role and size of the public sector in managing transportation infrastructure and operations. These periods have led over time to an increased use of outsourced services for professional engineering, planning, and other operational functions. These eras have been marked by early retirements, staffing departures and loss of experienced personnel, affecting morale and compelling the need for training and knowledge management.
- **Federal innovation initiatives encourage alignment of state transportation agency with available but limited resources.** The FHWA developed the Every Day Counts (EDC) initiative in cooperation with AASHTO in 2009 to promote innovation and create incentives for technology transfer activities. The program encourages identification and rapid deployment of underutilized innovations in transportation agencies "to shorten the project delivery process, enhance roadway safety, reduce congestion and improve environmental sustainability" and have projects built "better, faster and smarter." EDC seeks the swift deployment of research results and affirms the importance of knowledge sharing of innovative and best practices. Leveraging a network of knowledge resources to support decision-makers and practitioners creates less duplication and can prove efficient in the deployment of innovations. (7)
- **Aging workforce will lead to a loss of institutional knowledge**. The continuing retirement of "Baby Boomers" from key leadership and technical positions promises to be one of the most pressing workforce issues confronting the transportation industry.(4,5) As workers leave, they take with them not only the productive skills for which they were originally employed, but a breadth of knowledge and information about the agency, its programs and its methods of doing business. (8)

An important feature of technology transfer programs is the development of "knowledge management" strategies to identify, organize and disseminate critical knowledge within an organization in anticipation of retirements and workforce transitions as well as to respond to emerging informational needs attributable to demographic and technology trends, innovation and organizational change.

- **Younger professionals may be particularly interested in affiliating with organizations that foster a culture of learning and innovation.** Instituting technology transfer strategies that can match the learning styles of younger

employees may be one way to increase the attractiveness of work at state transportation agencies. Putting in place a robust knowledge management (KM) program requires consideration of the most effective means for conveying workers' knowledge and experience to a newer generation of employees, such as through videos, interviews, lunchtime talks, peer interactions, among other strategies. Mentoring and cross-training opportunities have also been found to be attractive to "Millennials" and may prove to be valuable knowledge transfer strategies. (9)

- **Adapting and modernizing information systems to match the learning culture of the newer generation are one means for attracting and retaining a workforce.** Younger and mid-career employees are also less likely today to remain in one job for the duration of their careers, preferring to shift positions within the organization or leave, resulting in more disruption and loss of knowledge within units. Younger workers are accustomed to accessing information on-line, requiring a shift to codification of procedures and information, and expectations for easy access to data retrieval. (10)

Through the T2 Program, NJDOT BoR sought to provide training opportunities for its employees, information exchange with the public, and to devise approaches that would support the agency in leading and contributing to innovative research and strategies for improving the transportation industry. Several institutional-specific needs were identified from the initial literature review and scoping phase that informed work program and implementation activities for the funding of this project, including:

- an online platform and reporting procedures to share research in progress and completed research through publicly transparent databases;
- communications strategies and events to spotlight NJDOT's research and innovation initiatives to a wider audience;
- procedures to increase opportunities for NJDOT research staff to participate in national and regional research conferences and technology transfer events; and
- tools for NJDOT's BoR to widely solicit innovative ideas to inform research need statements and fundable research topics, as well as to collect, share and advance innovative ideas and practices that aligned well with the mission of the NJ State Innovation Council (NJ STIC).

SUMMARY OF THE WORK PERFORMED

The Technology Transfer Project involved the development and implementation of program of activities, tools and processes to address identified technology transfer and knowledge management needs. The elements of the NJDOT T2 Program that were implemented to address project objectives over the four-year period of performance are described below. The T2 Research Team also considers the benefits along with some lessons and challenges that can be drawn from the implementation of each of the described elements.

Tech Talk! Program

The Tech Talk! Program includes lunchtime talks, half-day and other events, and webinars to promote the dissemination and implementation of research, knowledge, and innovative ideas.

The **Tech Talk! Program** was branded and launched, in part, to inform attendees about recent NJDOT-sponsored research and important technological innovations on the horizon, including: Autonomous and Connected Vehicles, Automated Control Signals, Smart Cities, Crash-Testing and Bridge Design, Automated Condition Assessments, and Orthotropic Bridge Design, among other topics.

The **Lunchtime Tech Talks** have highlighted research underway or completed and topics that highlight emerging trends (e.g., Launching Micromobility in New Jersey and Beyond") and promising innovations in design, technology, tools and processes (e.g., Workforce Safety and Probe Data, Safe Transportation for Every Pedestrian (STEP), Collaborative Hydraulics (CHANGE). Speakers have included funded researchers, practitioners as well as subject matter resource specialists from FHWA focused on advancing Every Day Counts innovations.

The **Tech Talk!** series has included **half-day events** (e.g., Data Visualization in Transportation, Green Infrastructure in Transportation) and FHWA innovation Exchange webinars that reinforce the most recent round of Every Day Counts (Crowdsourcing and Connected Job Site).

The "in-person" Tech Talk events were held at NJDOT Headquarters in the Multi-Purpose Room (MPR) or other training rooms. The events were principally targeted to NJDOT employees. Registration and marketing for the events included flyers, employee intranet notifications, and communications via NJDOT T2 website. Interest for some in-person events exceeded available room capacity requiring waiting lists. In some cases, the number of registrants well-exceeded actual attendance, leading to unoccupied seats on the day-of-event. With COVID-19 restrictions, the T2 Research Team transitioned the events to a webinar platform (i.e., Webex) to enable not only NJDOT staff but a broader audience of transportation stakeholders to attend. Overall, the events held to-date have attracted an estimated 1,200 attendees on-line or in-person.

The Tech Talk! Program required development of event marketing and registration materials, event registration and attendance monitoring, and post-event feedback surveys. After events, articles summarizing the event's proceedings were drafted and posted along with presentations at "Lunchtime Tech Talks and Other Events" on the

NJDOT T2 website. With the transition to webinars, recordings of the events were also posted to the article and NJDOT T2 video library. Post-event communications were distributed via the MailChimp marketing platform, social media, and the T2 newsletter to disseminate information on the completed Tech Talk event. Most events offered participants continuing professional education credits for engineers and/or AICP maintenance credits for planners.

In programming events, the T2 Research Team sought to feature a diversity of topics to address the needs and interests of staff from a multi-disciplinary organization. Table 1 presents a list of the Tech Talk events that have been held, including subject topics, speakers, and whether the event touched upon NJDOT-sponsored research, the Every Day Count's innovations, or other emerging technologies, trends, and policy issues.

Benefits:

- The Tech Talk series has provided events on a wide range of topics.
- The events were generally well attended, whether held in-person or by webinar.
- Documentation of the events has been made available on the T2 website and can referenced at a later date.
- Feedback forms distributed for each event allowed participants to suggest topics for future events and were used to consider possible themes for future events or to address through other strategies to promote technology transfer.

Lessons/Challenges:

- Competition for use of the NJDOT MPR made scheduling of Lunchtime Tech Talk events difficult at times.
- Scheduling events required approvals for proposed topics, speakers, dates and times, and room locations. In select cases, delays in approvals have affected the timing of programmed events or dissemination of marketing and registration materials for planned events.
- Some communications with employees were apparently blocked by IT policies and protocols. Post-event sharing of materials – particularly recordings of events – were blocked when posted to the T2 Video Library Youtube page, limiting the ability to share information.
- Based on feedback forms, the most effective method for marketing of Tech Talk events intended for NJDOT employees was the NJDOT intranet. Use of this required direct coordination with NJDOT BoR staff who were capable of sharing notifications of upcoming events and flyers through the intranet.

Table 1: Tech Talk Lunchtime and Other Events

Title/Theme	Speakers, Title, Affiliation	Research Category						Featured Theme		
		Capital Improvement & Infrastructure	Mobility & Operations	Planning & Environment	Policy and Organization	Safety Management	Multimodal	Research	EDC / STIC	Innovative Technology, Policy & Trends
Autonomous Cars and our Disrupted Future	Scott LeVine, Professor, Geography, SUNY-New Paltz		X	X						X
Design, Modeling, and Crash Testing of an Open-Faced Aesthetic Concrete Barrier at MASH TL-4	Hani Nassif, Professor, Civil and Environmental Engineering, Rutgers	X						X		X
Getting through the Green: Smarter Traffic Management with Adaptive Signal Control	William Kingsland, Asst. Commissioner, NJDOT		X					X	X	
Smart Cities and Transportation	Kenneth Leonard, Director, U.S. Department of Transportation (USDOT) Intelligent Transportation Systems Joint Program Office (ITS JPO),		X	X						X
Getting through the Green: Smarter Traffic Management with Adaptive Signal Control	William Kingsland, Asst. Commissioner, NJDOT		X					X	X	
Automated Condition Assessment of Concrete Bridge Decks by Robotic System-RABIT"	Nenad Gucunski, Professor, Civil and Environmental Engineering, Rutgers	X						X		
Design and Fabrication of Orthotropic Deck Details, Volumes 1 through 7	Sougata Roy, Principal Research Scientist, Lehigh, Advanced Technology for Large Structural Systems (ATLSS) Engineering Research Center	X						X		
Data Visualization in Transportation: Communicating Transportation Findings and Plans	Nathan Higgins, Cambridge Systematics; Matt Taylor, Alabama DOT; Nick Johnson, Nevada DOT; Christopher Pollard, DVRPC; Gabrielle Fausel, NJTPA			X						X
Making Work Zones Smarter - Data Driven Decision Making	Thomas Brennan, Associate Professor, Civil Engineering, The College of New Jersey		X			X		X	X	
Green Infrastructure in Transportation	Sandra Blick, NJDOT; Brian Luce, Maine DOT; Elaine Elbich, Pennsylvania DOT; Edwina Lam, AECOM; Kandyce Perry, NJ Future; Jason Miranda, Passaic County; Caleb Stratton, Hoboken	X		X						X
Collaborative Hydraulics: Advancing to the Next Generation of Engineering (CHANGE)	Eric Brown, Senior Hydraulic Engineer, FHWA Resource Center	X		X					X	

Title/Theme	Speakers, Title, Affiliation	Research Category						Featured Theme		
		Capital Improvement & Infrastructure	Mobility & Operations	Planning & Environment	Policy and Organization	Safety Management	Multimodal	Research	EDC / STIC	Innovative Technology, Policy & Trends
Safe Transportation for Every Pedestrian (STEP)	James Eun, Transportation Safety Engineer, FHWA Resource Center					X				
Crowdsourcing Local Operations (Webinar)	Center for Local Aid Support - FHWA OIPD		X						X	
Connected Job Site (Webinar)	Center for Local Aid Support - FHWA OIPD	X							X	
Launching Micromobility in NJ and Beyond	Mike Manzella, Asbury Park; Ryan Sharp, Hoboken; Charles Brown, Bike Pedestrian Resource Center, Rutgers		X	X				X		X
Weather Responsive Strategies (Webinar)	Ray Murphy, ITS Specialist, FHWA Resource Center		X						X	
Dredging, Dredged Material Management and the NJ Marine Transportation System (Webinar)	Scott Douglas, Project Manager, Office of Maritime Resources, NJDOT			X			X			X
Evaluation of Precast Concrete Pavement Systems: Phase I (Webinar)	Yusuf Mehta, Professor, CREATES, Rowan; Daniel Offenbacker, CREATES, Rowan	X						X	X	
Analysis of Local Bus Markets (Webinar)	Deva Deka, Asst Director, Alan M. Voorhees Transportation Center, Rutgers			X			X	X		

Share Your Ideas: Research and Innovation Tools

The T2 Research Team instituted several tools for encouraging innovation in research and in the evaluation and deployment of technologies and processes. These tools involved online crowdsourcing of research and innovation ideas and an awareness campaign in support of an annual competition to advance innovations.

NJ Transportation Research Ideas. The online **NJ Transportation Research Ideas portal** was deployed for soliciting research ideas through the four rounds of funding between 2017-2020. The online portal offers a crowdsourcing tool and greater transparency for research needs identification between potential research "champions" at transportation agencies (e.g., NJDOT, NJ TRANSIT, and NJ Motor Vehicles Commission) and researchers at Institutes of Higher Education and also enables participation from other interested stakeholders. Individuals on the research ideas and newsletter mailing list – approximately 1,200 contacts – were encouraged to register in order to submit ideas. Registered participants were asked to submit research ideas by the end of the calendar year.

Using the online tool, submitters were asked to classify their submitted research ideas by the categories shown in Figure 1. These "research campaign" categories align with areas of subject matter expertise of the Technical Advisory Groups (TAGs) intended to support the Research Oversight Committee.

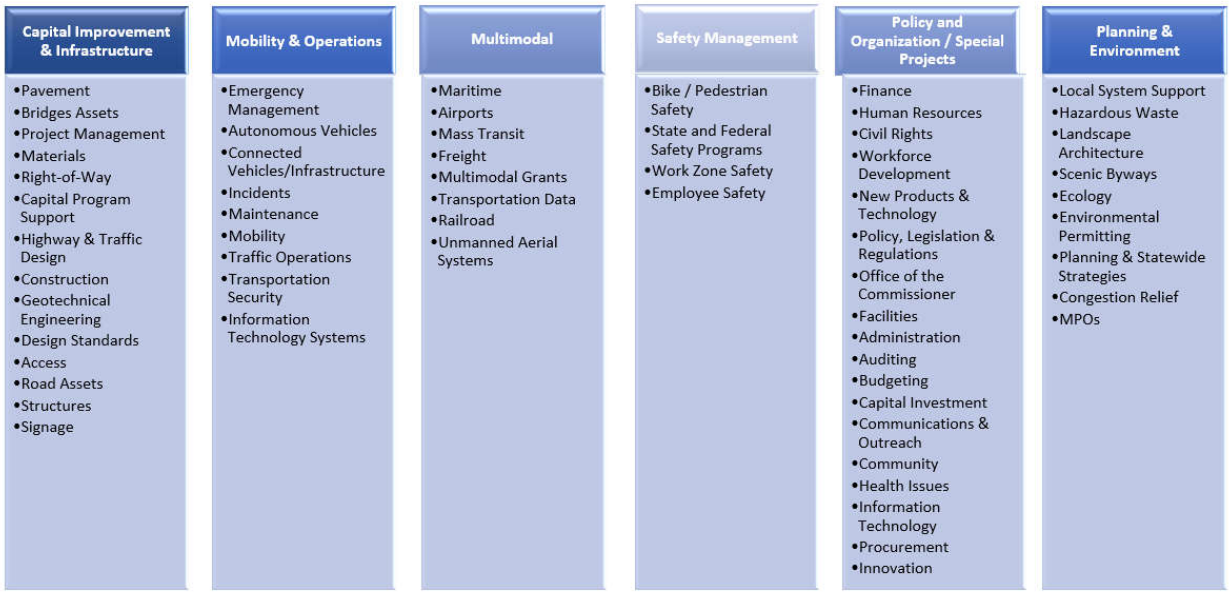


Figure 1: Research Campaign Categories

Ideas are not research needs statements or proposals. After the deadline date of a research idea solicitation round, research ideas were shared with the Research Oversight Committee for screening and prioritization. High priority research needs were eventually posted as proposals. Submission of a research idea does not preclude individuals or groups from Institutes of Higher Education or other eligible organizations from subsequently responding to a Request for Proposal issued by the NJDOT BoR.

At the close of the calendar year, the T2 Research Team has transmitted a list of registrant and research ideas to the BoR for their use in developing research needs statements and the selection of topics for issuance of RFPs for future research study. The aggregate trends have been tracked over the last 4 years to monitor participation levels (see Figure 2).

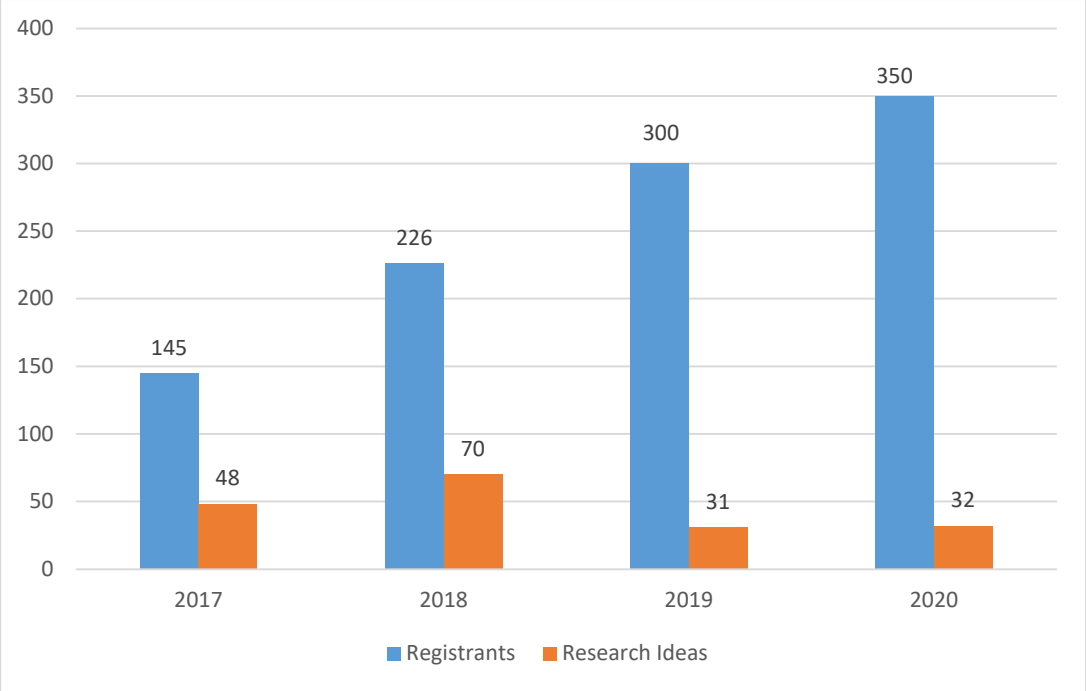
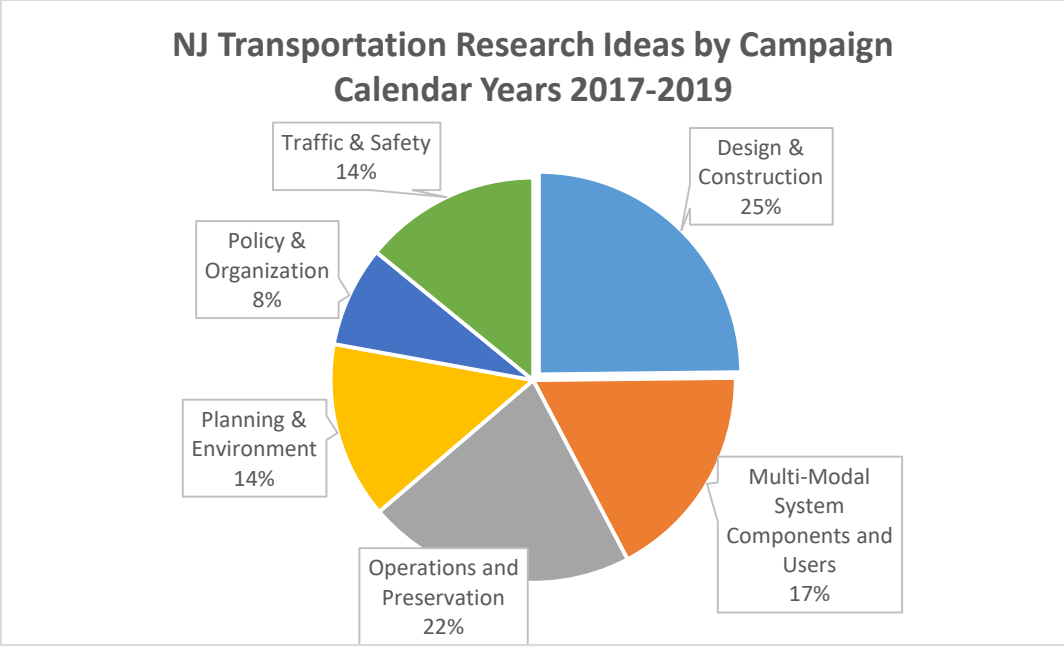


Figure 2: NJ Transportation Research Ideas Portal, Registrants and Research Ideas, 2017-2020

Submitted research ideas have been classified by their research campaign categories to observe patterns in submission (see Figure 3). Some of the research campaign categories changed in year 2020, but aggregate patterns can be roughly observed.



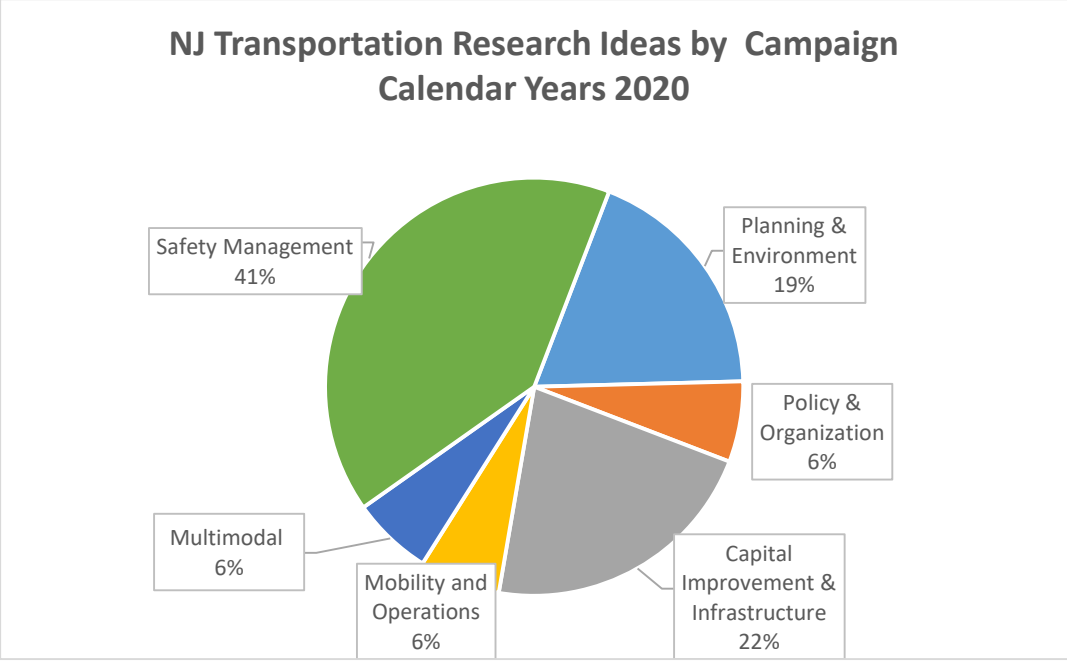


Figure 3: Submitted Research Ideas by Campaign for Years 2017-2019 (top) and 2020 (bottom)

NJDOT Innovative Ideas. In early 2017, NJDOT established a link from its home page to a T2 website "innovative ideas" landing page where interested persons could use an online submission form to submit innovative ideas in support of the STIC. Contributors were invited to describe their ideas, the savings that they foresee (i.e., cost, effort, time), how the innovation could affect the current state of the practice and whether the idea had previously been attempted. Posters, prominently displayed in headquarters and regional offices, flyers and newsletter announcements were used to promote NJDOT's campaign for innovative ideas.

In 2017, the disposition of innovative ideas was screened and shared with STIC leadership and other STIC members. The disposition of submitted ideas were classified into several categories, including: assigned to Core Innovation Area (CIA) Teams, redirected to operating units, not advanced, investigated further, put on hold for additional information, or carried over from a prior quarter. However, only a small subset of ideas submitted through the platform were typically well-aligned with the NJ STIC mission: "to identify, evaluate and deploy new technologies and process improvements that will accelerate project delivery and improve the safety and quality of transportation in New Jersey." In actuality, many submitted ideas were customer complaints about potholes, congestion bottlenecks, weather operations, noise and safety concerns that were more appropriately directed to the responsible state or local governing entities, or other divisions, bureaus, or units at NJDOT for follow-up actions.

In Year 2, an online **Innovative Ideas Database** was developed that continues to be maintained to track idea submissions for sharing with the NJ STIC leadership and the CIA teams. The T2 Research Team regularly collected and distributed the submitted innovative ideas to the BoR and its designated staff responsible for disposition assessment and monitoring. In addition to an intake system, the online database has fields offering the capacity to indicate the current disposition status for submitted ideas to support transparency in the resolution of crowdsourced ideas.

Build a Better Mousetrap Competition. In recent years, the **Build a Better Mousetrap (BABM) Competition** has encouraged participants to submit entries to the competition explaining their innovations that help them do their jobs more safely, and result in time and cost savings for their organization. Winning entries of the BABM competition have been announced at the BoR Annual Research Showcase. The competition has been advertised through the Local Technical Assistance Program (LTAP) and a web page featuring the competition and short interviews with past winners has been added to the T2 website. The competition video has been updated annually and, at times, has been shared with NJDOT operations staff to encourage participation.

Benefits:

- NJ Transportation Research Ideas.
    - With employee turnover at BoR, the T2 Research Team contributed to the development of a new mailing list for raising awareness and soliciting interest in the NJ Transportation Research Ideas porta and, later, to the development of a segmented list of Institutes of Higher Education (IHE) recipients for research-related RFPs. These lists have helped improve the capacity of the BoR to reach an audience for its research mission. The

mailing lists have been periodically maintained throughout the project to keep contact information current.

  - The Transportation Research Ideas portal has served as a transparent tool for encouraging research idea submissions. Through the portal, NJDOT SME staff have the capacity to advance transparency in research needs identification while strengthening connections with researchers in Institutes of Higher Education and transportation stakeholders. The tool can serve as a supportive element in establishing communities of practice around certain research campaigns and topics.

- Innovative Ideas
  - The Innovative Ideas platform invites a crowdsourcing tool to engage with the public. In some cases, submissions may prove to be complaints or concerns that are burdensome to field, but still present an opportunity to strengthen connections with other divisions, bureaus or units to deliver customer service, or identify issues in need of problem solving.

- Build a Better Mousetrap Competition
  - The BABM competition sends the message that NJ staff should be encouraged to foster and share innovations. NJDOT senior leadership also seeks to acknowledge noteworthy accomplishments through staff awards and recognition by senior leadership at the Annual Research Showcase and through other communications

Lessons/Challenges:

- NJ Transportation Research Ideas
  - The *NJDOT SME Technology Transfer and Knowledge Management Survey*[11] revealed that some SMEs were not aware of the NJ Transportation Research Ideas portal and/or were hesitant to serve as a research champion. In early 2020, an estimated one-quarter of SME survey respondents had registered to submit research ideas through the portal, and 14 percent had submitted research ideas. Future targeted communications to SMEs should encourage registration, the championing of research ideas, and participation on research panels or select Technical Advisory Groups. These targeted messages should focus on strengthening SME engagement with research and the identification of pressing research needs in transportation.
  - NJDOT BoR has sought to stand up a Research Oversight Committee with participants from NJDOT, NJ TRANSIT, and others to focus on selection and prioritization of research needs. This initiative can be further informed by the input and active participation of a Technical Advisory Group (TAG). Ideally, the TAG would endeavor to affiliate with a “research campaign” area, contribute ideas, and monitor submitted ideas in their areas of subject matter expertise to promote selection and prioritization of research needs.

- Innovative Ideas
    - Due to staff turnover, NJDOT BoR should consider assigning dedicated staff to field and address concerns reflected in submitted ideas, including redirecting to operating units and updating the disposition status in coordination with the T2 Research Team. Updating the "field" on disposition status in the innovative ideas database would be one means to be responsive and accountable to the public on submitted ideas.
- Build a Better Mousetrap Competition
    - The competition has been effective at reaching NJDOT employees, but less so in connecting to LPAs to participate in the competition.

Technology Transfer Website

In the first year of the T2 Program, the **NJDOT Technology Transfer website** was designed and launched. The purpose of the T2 website mirrors the principal mission of the BoR to promote research, innovation, and knowledge management and serve as a resource for the transportation community.

The T2 website is organized by six principal categories – NJ STIC, Tech Talks!, Share Your Ideas, Research, Resources and Calendar – each of which contains various pages, posts, and links to other websites and stored media. As shown in Table 2, the website includes information about NJ STIC (NJ State Transportation Innovative Council) and the Innovative Initiatives aligned with the Every Day Counts Program; descriptions of upcoming and completed Lunchtime Tech Talks and other Events; idea submission to the NJDOT Transportation Research Ideas portal and the Build a Better Mousetrap Competition, among others.

Among the resources provided, the T2 website includes a Knowledge Management (KM) Toolbox that highlights key elements of an agency-wide knowledge management approach. The toolbox presents information on key roles and responsibilities among state agency staff to advance knowledge transfer and knowledge capture, and briefly highlights several well-recognized strategies for groups and individuals for advancing KM.

The website provides a repository for BoR Research including a database and links to research underway and completed research projects, among other features.

The New and Noteworthy page includes posts that feature "spotlight" articles on research and innovation topics. Several of the innovation spotlight articles describe progress, accomplishments technical assistance and training-related information on innovative initiatives undertaken in New Jersey in the current and prior rounds of Every Day Counts. Other articles provide documentation of Tech Talk! events, announcements of FHWA reports, and notice of opportunities to submit innovative ideas, among other topics posted to the website.

Since the inception of the T2 website, there have been approximately 70 "new and noteworthy" posts. Table 3 lists the titles of these posts and whether they were principally tagged to "spotlight" research, innovation and/or specific innovative initiatives aligned with the Every Day Counts Program that have been advanced in New Jersey.

Table 2: Organization of NJDOT Technology Transfer Website, 2021

<table>
<tr><th>NJ STIC</th><th>Tech Talks!</th><th>Share Your Ideas</th><th>Research</th><th>Resources</th><th>Calendar</th></tr>
<tr><td>Innovative Initiatives
• Infrastructure Preservation
• Safety
• Mobility and Operations</td><td>Lunchtime Tech Talks and Other Events</td><td>NJ Transportation Ideas</td><td>Research Projects</td><td>NJDOT Online and Social Media</td><td>NJDOT Tech Transfer Event Calendar</td></tr>
<tr><td>Innovative Ideas
• Innovation Ideas Searchable Database</td><td>Events</td><td>Build a Better Mousetrap</td><td>Final Reports</td><td>NJDOT Tech Transfer News</td><td>NJLTAP Training & Events</td></tr>
<tr><td>Innovation Spotlight</td><td>Peer Exchanges</td><td rowspan="4">Innovative Ideas</td><td>Requests for Proposals</td><td>NJ State Library - Orientation Video</td><td>FHWA Events</td></tr>
<tr><td rowspan="3">NJ STIC Overview
• NJ STIC Meetings
• NJ Functional Model
• NJ STIC Charter
• NJ STIC Incentive Fund Request
• Outreach and Coordination
• Accelerated Market Readiness Overview</td><td rowspan="3">Webinars</td><td>Research Spotlight</td><td>TRB Research Feeds</td><td rowspan="4">TRB Events</td></tr>
<tr><td>Annual Implementation Reports
• 2017 Report
• 2015-2016 Report
• 2014 Report</td><td>TRB Library Research Snap Searches</td></tr>
<tr><td>New Technology Evaluations</td><td>Knowledge Management Toolbox</td></tr>
<tr><td></td><td></td><td></td><td>New & Noteworthy</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Partners & Resources</td><td></td></tr>
</table>

Table 3: Technology Transfer - New and Noteworthy Posts

Title	Research Spotlight	Innovation Spotlight	STIC/ Innovative Initiative
Drone Program Takes Off in Bureau of Aeronautics		X	Unmanned Aerial Systems; STIC Incentive Funding
Identifying High Risk Bridges in New Jersey	X		
Road Diets Are Making Roads Safer in New Jersey		X	Safe Transportation for Every Pedestrian (STEP)
The New Jersey Transportation Infrastructure Bank Prioritizes Repair of Aging Infrastructure and Pedestrian Safety		X	
FHWA Announces EDC-5 Innovation Areas		X	
New Jersey Pilots Connected Vehicles Program to Protect Safety Service Patrol Staff		X	Crowdsourcing for Operations; Using Data to Improve Traffic Incident Management, STIC Incentive Funding
Weigh-in-Motion Sites Collect Vehicular Data		X	
NJDOT Awarded Accelerated Innovation Deployment Grant to Start Weather-Savvy Roads Pilot Program		X	Road Weather Management – Weather-Savvy Roads; Weather Responsive Strategies; Accelerated Innovation Deployment Grant
New Jersey To Expand Data-Driven Approach to Highway Safety Management		X	Data Driven Safety Analysis; STIC Incentive Funding
The Use of Porous Concrete for Sidewalks	X		
New Jersey STIC Incentive Project Grant Funding Available		X	STIC Incentive Funding
PMGA Divisions Take Lead on Extreme Weather, Climate Risks, and Asset Management		X	
Quantifying Greenhouse Gas Emissions of Asphalt Pavement Preservation at Construction and Use Stages Using Life Cycle Assessment	X		
Get Oriented with EDC-5 Innovations – Webinars and Baseline Report		X	Every Day Counts Program
Local Access Management Regulations	X		
EDC-4 Final Report Highlights Innovations		X	Every Day Counts Program
Local Safety Peer Exchange – 1st Event		X	Safe Transportation for Every Pedestrian (STEP); Data Driven Safety Analysis; STIC Incentive Funding
Local Safety Peer Exchange – 2nd Event		X	Safe Transportation for Every Pedestrian (STEP); Data Driven Safety Analysis; STIC Incentive Funding
Local Safety Peer Exchanges: Summary Report		X	Safe Transportation for Every Pedestrian (STEP); Data Driven Safety Analysis; STIC Incentive Funding
Professional Engineering Design Experience Program Launched at NJDOT – Provides Career Opportunities toward Licensure		X	
Connected Vehicles Program Pilot Testing of Technology for Safety Service Patrol Workers Continues		X	Crowdsourcing for Operations; Using Data to Improve Traffic Incident Management; STIC Incentive Funding
E-Construction and Partnering Peer Exchange		X	E-Construction; STIC Incentive Funding

Title	Research Spotlight	Innovation Spotlight	STIC/ Innovative Initiative
Data-Driven Safety Analysis: New Jersey Case Study		X	Data-Driven Safety Analysis
New Protocol for Accepting Over-Coating Paint on Steel	X		
NJLTAP – Safe Transportation for Every Pedestrian Workshop		X	Safe Transportation for Every Pedestrian (STEP)
NJDOT Safety Countermeasures Training and Education Videos		X	Safe Transportation for Every Pedestrian (STEP)
Paving the Way to Better Roads at Lower Costs		X	Pavement Preservation (How, When, Where)
Focusing on Reducing Rural Road Departures (Video)		X	Reducing Rural Road Departures
Tech Talk! Webinar: Crowdsourcing for Local Operations		X	Crowdsourcing for Local Operations
Evaluating New Jersey's Use of Raised Pavement Markers for Roadway Safety	X		
21st Annual NJDOT Research Showcase	X		
EDC-5 STEP – Safe Transportation for Every Pedestrian		X	Safe Transportation for Every Pedestrian (STEP)
Drone Technology at NJDOT		X	Unmanned Aerial Systems (UAS); STIC Incentive Funding
Spotlight: New Technology Evaluations		X	
Share Your Ideas on the NJ Transportation Research Ideas Collaboration Site!	X		
How SJTPO Refined Their Congestion Management Process with Crowdsourced Data		X	Crowdsourcing for Operations
Tech Talk! Webinar: The Connected Job Site		X	E-Construction
The Impact of SJTPO's Traffic Signal Inventory on Signal Operations		X	
NJLTAP – Proven Safety Countermeasures Workshops – Upcoming Events		X	Safe Transportation for Every Pedestrian (STEP); Data-Driven Safety Analysis
Build a Better Mousetrap Competition 2020		X	
Final Report Released for the Connected Vehicles Program Pilot Testing of Technology for Distributing Road Service Safety Messages from Safety Service Patrols		X	Crowdsourcing for Operations; Using Data to Improve Traffic Incident Management; STIC Incentive Funding
DVRPC's Sidewalk Inventory and Crowdsourcing Platform		X	Crowdsourcing for Operations
Collaboration Demonstration: New Jersey Hosts State Partnership Visit	X		
STEP-Aligned HAWK Signal Installed in Bergen County		X	Safe Transportation for Every Pedestrian (STEP)
How New Jersey Counties are Reducing Rural Roadway Departures		X	Reducing Rural Road Departures
NJ Transportation Agencies Featured for Their Innovative and Virtual Public Involvement Approaches		X	Virtual Public Involvement
Federal Highway Administration Releases Second EDC-5 Progress Report		X	Every Day Counts
FHWA's Ray Murphy Presents EDC-5 Weather-Responsive Management Strategies		X	Weather-Responsive Management Strategies
Reducing Rural Road Departures: Upcoming FHWA Webinar and Other Resources Advance EDC-5 Initiative		X	Reducing Rural Road Departures
Lunchtime Tech Talk! WEBINAR: Dredging, Dredged Material Management and the NJ Marine Transportation System	X		

Title	Research Spotlight	Innovation Spotlight	STIC/ Innovative Initiative
Lunchtime Tech Talk! WEBINAR: Evaluation of Precast Concrete Pavement Systems and State Specifications	X		
Development of Real-Time Traffic Signal Performance Measurement System	X	X	Adaptive Signal Control Technology; Automated Traffic Signal Performance Measures
NJDOT Tech Transfer Innovation Interview: 3D Reality Modeling		X	
How New Jersey is Using Funds from the Volkswagen Settlement to Expand Clean Transportation Infrastructure		X	
Pavement Preservation Treatments at NJDOT		X	Pavement Preservation (How, When, Where)
STIC Incentive Funding Grant Awarded for Local Aid Software Training			Locally Administered Federal Aid; STIC Incentive Funding
FHWA Announces Every Day Counts (EDC-6) Innovation Areas		X	Every Day Counts
Share Your Ideas on the NJ Transportation Research Ideas Portal!	X		
A-GaME: Avoiding Unforeseen Costs on Transportation Projects Through Early Detection of Subterranean Obstacles		X	Advance Geotechnical Methods of Exploration (A-GaME)
Federal Highway Administration Releases Third EDC-5 Progress Report		X	Every Day Counts
Lunchtime Tech Talk! WEBINAR: Analysis of Local Bus Markets	X		
NJDOT's Traffic Incident Management Training Program		X	
22nd Annual NJDOT Research Showcase	X		
NJ Invites You to Participate in Mileage-Based User Fee Study	X	X	
Build a Better Mousetrap 2020 Award Winner Announced		X	
Research to Implementation: Environmental Impacts of Reclaimed Asphalt Pavement	X		
2020 Francis B. Francois Award for Innovation – NJDOT's Marine Navigation Retroreflective Markers		X	
Innovation Spotlight: NJDOT Local Aid Design Assistance Program		X	Locally Administered Federal Aid
Innovation Spotlight: Bicycle-Friendly Resurfacing in Mercer County		X	

After developing several sections of the T2 website, the Research Team began to examine various analytic tools and measures to monitor usage patterns. Several measures were monitored on a quarterly basis, and a subset of these considerations are presented for the last 3-year period.

Sessions. Figure 4 indicates a growth over time in the number of monthly sessions, users and page views over the most recent 3-year period. Newsletters have been issued on a quarterly basis and distributed via the MailChimp platform over the last five quarters. Usage levels have tended to spike upward in the months in which newsletters have been issued – particularly, March, June, and September. Usage levels in December have not had the same bump from the newsletter's issuance, perhaps due to holiday vacations.

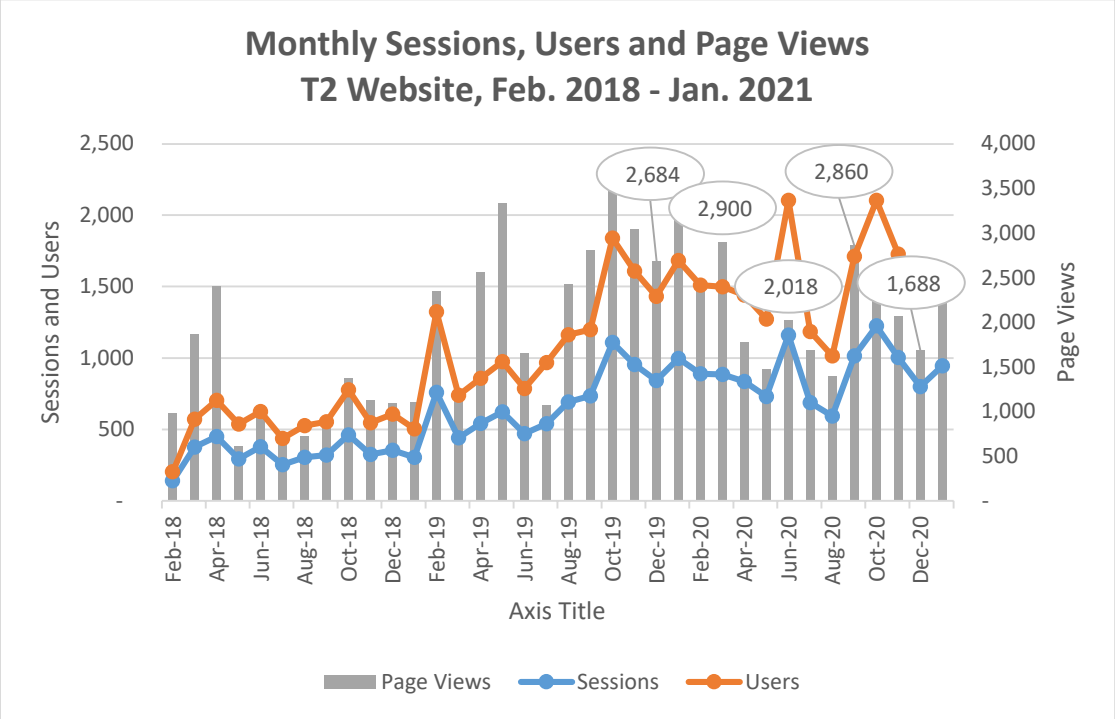


Figure 4: T2 Website Usage Patterns on a Monthly Basis

Pages and Referral. As shown in Table 4, besides the T2 Home Page, the most visited pages in terms of session views have been "Innovative Ideas," "NJ STIC," and "Build a Better Mousetrap." Added early in the website's development, these pages were referenced from the NJDOT Home Page (Innovative Ideas) or benefitted from the marketing of the NJ STIC Program through flyers, posters and newsletters distributed by NJDOT and the NJ LTAP. Similarly, select NJ STIC innovation posts attracted more session views, in part, because their accomplishments were featured in the Tech Transfer newsletters and in targeted NJ STIC communications. In general, session views were lower for posts of individual articles or events, or for those events posted more recently.

Table 4: Most Popular Pages by Sessions

Page	Sessions
Home Page - NJDOT Technology Transfer	5,573
Innovative Ideas - NJDOT Technology Transfer	1,221
NJ STIC - NJDOT Technology Transfer	957
Build a Better Mousetrap - NJDOT Technology Transfer	463
FHWA Announces Every Day Counts (EDC-6) Innovation Areas - NJDOT Technology Transfer	429
2019 NJDOT TRB Roundtable Discussion - NJDOT Technology Transfer	401
Drone Technology at NJDOT - NJDOT Technology Transfer	285
New Jersey Pilots Connected Vehicles Program to Protect Safety Service Patrol Staff - NJDOT Technology Transfer	284
Final Report Released for the Connected Vehicles Program Pilot Testing of Technology for Distributing Road Service Safety Messages from Safety Service Patrols - NJDOT Technology Transfer	271
Peer Exchange - NJDOT Technology Transfer	252
NJDOT Safety Countermeasures Training and Education Videos - NJDOT Technology Transfer	249
NJDOT Tech Transfer Innovation Interview: 3D Reality Modeling - NJDOT Technology Transfer	237
22nd Annual NJDOT Research Showcase - NJDOT Technology Transfer	223
21st Annual NJDOT Research Showcase – Call for Presentations! - NJDOT Technology Transfer	217
EDC-5: Weather-Responsive Management Strategies Webinar - NJDOT Technology Transfer	214
Lunchtime Tech Talks! - NJDOT Technology Transfer	213
Research Project - NJDOT Technology Transfer	209
Searchable Database - NJDOT Technology Transfer	207
Tech Talk! Data Visualization in Transportation: Communicating Transportation Findings and Plans - NJDOT Technology Transfer	207
Evaluation of Precast Concrete Pavement Systems Webinar - NJDOT Technology Transfer	202
Research Projects - NJDOT Technology Transfer	201
Innovative Initiatives - NJDOT Technology Transfer	198
21st Annual NJDOT Research Showcase - NJDOT Technology Transfer	192
Event Calendar - NJDOT Technology Transfer	189
RABIT: Automated Condition Assessment of Concrete Bridge Decks by Robotic System - NJDOT Technology Transfer	188
22nd Annual NJDOT Research Showcase – Virtual “Preparing Today for a Resilient Tomorrow” - NJDOT Technology Transfer	187

Traffic Medium. Channels are groups of sources of traffic. Figure 5 indicates the various ways in which visitor traffic arrived at the T2 website during the 3-year period.

- Organic Traffic is any user that comes to the website without clicking a link on another site (referral traffic) or clicking an ad (paid traffic). These visitors use a known search engine and click a link to view the website. Organic Traffic accounted for 42.9 percent of the traffic.
- Direct Traffic comes from website visits that arrive on the website through a direct entry of the website URL or through a bookmarked site. Direct Traffic accounted for 33.6 percent of the traffic.
- Referral Traffic comes from visitors who click on a link from another website and then land on the website. In Figure 5, such traffic is reported as 18.8 percent of traffic. These “other” websites may include partner sites, blogs, emails, posts on social media sites, etc. Social media is currently the source of about 3.5 percent of traffic.

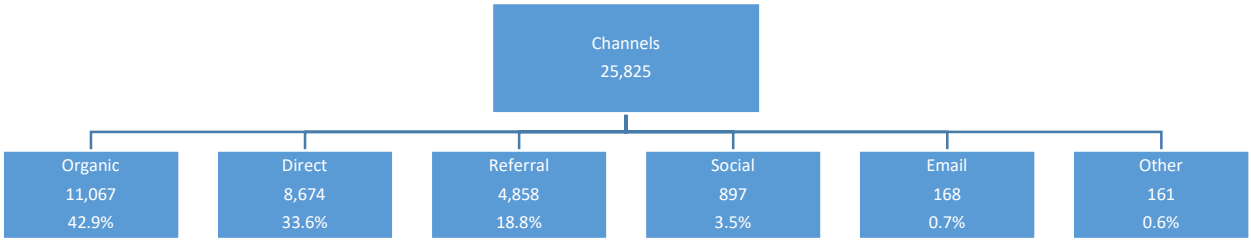


Figure 5: Sources of T2 Website Traffic

Social Networks. The T2 Program made a more concerted effort at building out a social media presence to increase awareness of various T2 events, posts, and activities in the latter half of Year 4. While only a small source of traffic to-date, social network traffic has been split between Facebook (57.8%), Youtube (28.4%), LinkedIn (7.5%), Twitter (4.2%), and other sources.

Visitor Traffic. Over the last 3-year period, 63.4 percent of traffic is from new visits and 36.6 percent is from return visits.

Search Engines. Organic traffic is attributable to search engines. Over the last 3-year period, organic traffic has come from Google (87.4%), Bing (11.5%) and Yahoo (1.1%). The Google share is lower than we usually see for websites, but makes sense as most visitors, historically, are from NJDOT and may rely on the Internet Explorer browser and Bing as the default search engine.

Technology. Most users who visit the T2 website access the site through their desktop (82.1%), followed by mobile phone (13.2%) and tablet (4.6%). The mobile phone use share has grown.

Benefits:

- The T2 website is the principal publicly available means of sharing information on research, innovation, knowledge management and training opportunities.
- The T2 website seeks to raise awareness of transportation-related issues within New Jersey, promote an ongoing exchange of ideas, translate the latest state-of-the-art trends and technology practices, showcase innovation, and disseminate research results.

Lessons/Challenges:

- Considerable efforts were made to build a T2 website that contains relevant information to the transportation stakeholders in New Jersey. Through surveys of SMEs and evaluation of analytic measures, it remains apparent that raising awareness of the T2 website is a continuing challenge.
- NJDOT staff may experience barriers to accessing the website and/or select resources included, such as links to the topical videos posted to YouTube.

- Discussions with NJDOT Communications suggest an opportunity to amplify posted materials through NJDOT social media channels.

Surveys and Interviews

The T2 Program used surveys and interview processes on several occasions for support needs identification and to identify accomplishments and activities in support technology transfer, knowledge management and innovation topics.

Online surveys were designed and fielded to identify research, technology transfer and knowledge management needs, accomplishments and model practices from Local Public Agencies and NJDOT SMEs.

In Winter 2020, the *NJDOT SME Technology Transfer and Knowledge Management Survey* was distributed. The survey targeted NJDOT SMEs and sought to identify current technology transfer and knowledge management needs, as well as the challenges in disseminating information to staff to advance understanding of job responsibilities, policies and procedures. The survey explored several KM themes, including: past and current knowledge sharing practices; "go-to" sources for information; knowledge at risk of being lost; critical knowledge, skills and abilities needed; knowledge codification and dissemination; succession and talent management; among other topics.

The *T2 and KM Survey Report* (May 2020) identified:

- Training as a need among NJDOT staff. Guidance documentation and process documentation also ranked highly as knowledge sharing strategies.
- Go-to individuals who can share experience and expertise within their units through knowledge sharing, and with the broader community through Tech Talk events, articles, videos, etc.
- Knowledge sharing practices, such as job shadowing, cross-training within units, check lists, in use at NJDOT. These practices can be added as resources to the Knowledge Management Toolbox and could be the subject of workshop events, video or other documentation.
- Higher priority topics related to external knowledge that could be promoted.
- The need to promote NJ STIC throughout the organization.
- Potential gaps in information within the NJDOT organization.
- Knowledge sharing practices that would be relevant to the NJDOT organization as a whole.
- The need to reach NJDOT staff working in places other than headquarters.

In Spring 2019, the *New Jersey STIC Innovative Initiatives Survey* was distributed to representatives of the NJ STIC and Local Public Agencies. The survey was designed to raise awareness of the FHWA EDC initiatives and explore participant insights and experience related to the need for innovation, the identification of examples of implementation of EDC initiatives and other innovative practices in New Jersey, and the

challenges of implementing innovative practices. The survey also sought to identify practices that deserve greater recognition and whose lessons learned should be shared to encourage greater deployment, and to identify topics that should receive greater priority in terms of STIC funding, research, technical assistance training and materials development.

The resulting report, *New Jersey STIC Innovative Initiatives Survey: Summary of Responses* [(12)] included observations provided by respondent LPA and consultant, including:

- Examples of EDC-5 initiatives initiated locally that may offer lessons learned and could be ready to share through STIC-related presentations, articles, workshops, or peer exchange type events.
- Higher priority topics for Local Public Agencies, for future STIC-related presentations, peer exchanges, workshops or articles (e.g., STEP, Virtual Public Involvement, Rural Roadway Departures).
- The need to disseminate examples of innovation implemented at the local level to convey model practices, benefits and lessons that could be shared through "new and noteworthy" and "innovative initiatives" pages of the T2 website.
- Lack of available funding, competing priorities, and lack of trained staff were among the constraining factors in piloting and adopting innovative initiatives.

Innovation Topic Interviews have been conducted with NJ STIC Core Innovation Area leads and other key stakeholders to provide insight into innovations in use at NJDOT, anticipated developments in use of innovations, and the best means of knowledge sharing (e.g., Tech Talk, video, article) to communicate information on these topics. The interviews were targeted to persons inside NJDOT to gather information on the status of implementation of EDC and other innovative initiatives, grants and model practices. The interviews were also intended to encourage sharing of information (e.g., awards of grant funding, interim or final research results, presentations, workshop training events, accomplishments, videos, etc.) for possible development into innovation spotlight articles, Tech Talks or other events, or other technical assistance tools (e.g., videos, guidance documents) for broader dissemination. The interviews have explored innovative initiatives including:

- Use of 3D Models and Digital Data at NJDOT (EDC-2 and EDC 3)
- A-GaME: Avoiding Unforeseen Costs on Transportation Projects Through Early Detection of Subterranean Obstacles (EDC-5)
- Traffic Incident Management Training Activities (EDC-2)
- Local Aid Design Assistance Program (EDC-2)

The interviews have assisted in the identification of topics for articles and plans for future Tech Talks and videos.

In addition to these priority topics interviews, other interviews have been held with NJDOT SMEs or LPAs following presentations given at NJ STIC Quarterly meetings, in response to administered surveys, or in follow-up to suggestions made at STIC meeting break-out sessions. These interviews have been conducted to draft and fact-check articles and to

elicit support and engagement with the T2 Research Team in the production of films, or to participate in subsequent Tech Talk events.

Benefits:

- Survey results provided insight into innovations at NJDOT, information needs of employees, and knowledge sharing strategies in use.
- The results suggested topics for future events, articles, or videos and additions to the Knowledge Management Toolbox.
- Surveys and interviews have raised awareness of the T2 website and program, and the NJ STIC.
- Survey results and interviews have provided insight into the status of innovation at Local Public Agencies and higher-priority topics for knowledge sharing.

Lessons/Challenges:

- While informative responses were provided, the online surveys have had a relatively low participation rate. In some cases, emails requesting participation were sent to spam folders at NJDOT and required direct email reminders from the BoR Manager to encourage SMEs to participate.
- Lack of survey participation among LPAs may reflect limited awareness or understanding of NJ STIC or limited resources and insights into how to overcome barriers to implementation to test and deploy innovations.

Knowledge Management Toolbox

An online **Knowledge Management Toolbox** was developed and presents recognized model practices, case examples and links to resources on knowledge capture and transfer. The online Knowledge Management (KM) Toolbox conveys elements of an agency-wide KM strategy, the rationale for KM, key steps to establish knowledge transfer and capture strategies, and roles and responsibilities for advancing KM strategies, among other topics. Both group and individual strategies were briefly highlighted to address potential knowledge gaps within their divisions, offices and units, and to make better use of knowledge in various mission critical areas.

Later, SMEs who received the T2 and KM Survey were introduced to the KM Toolbox and definitions for various knowledge sharing practices. The survey participants were invited to consider the knowledge sharing practices that should be given greater emphasis within their unit.

Benefits:

- The Toolbox can be used by leadership and motivated staff at NJDOT to explore strategies for retaining knowledge and sharing expertise.
- As the Toolbox is built out to provide more examples of strategies in use at NJDOT, more people will be looking to carry out its strategies for groups and individuals.

Lessons/Challenges:

- Developing an expanded portfolio of relevant examples of strategies in use at NJDOT is challenging, but can be facilitated by a KM Task Force or working group. A multidisciplinary KM Task Force could assist in prioritizing strategies and actions relevant to advancing knowledge sharing and knowledge transfer.
- The KM Task Force can help in advancing strategies for knowledge codification and dissemination and succession and talent management that are frequently expressed as concerns by surveyed SMEs.

NJ State Transportation Innovation Council

The BoR's responsibilities for supporting the NJ State Transportation Innovation Council (NJ STIC) have expanded over time. The T2 Program has provided technical assistance for select meetings and prepared reports after these meetings to keep STIC members informed.

The T2 website contains a section devoted to the **NJ STIC** and innovations promoted through the FHWA Every Day Counts program and other initiatives. The NJ STIC pages were developed to highlight efforts in New Jersey to promote new technologies and process improvements in transportation. NJ STIC pages include an overview of the NJ STIC mission, its organization framework (i.e., Executive Team, Core Innovation Areas (CIA) Teams and Innovation Advisory Teams (IAT).

The **NJ STIC Quarterly Meetings** page provides meeting summaries and relevant supporting information. Individual meeting posts include presentations from NJDOT and other STIC members on practices, studies and products produced in institutionalizing innovations or in assessing progress across earlier stages of implementation (i.e., development, assessment and demonstration). Progress and accomplishments resulting from STIC Incentive Funding Grants and Accelerated Innovation Deployment Grants are often featured at meetings.

The **Innovative Initiatives** page holds posted content for 15 FHWA EDC innovations and their benefits in order to promote greater awareness of specific types of innovative practices that are deserving of greater emphasis within NJDOT and among agency partners.

Recent NJ STIC meetings have included a workshop format to invite member participation and information exchange through small group discussion within online meetings. The process was used to prepare for the **FHWA EDC-6 Virtual Summit** and the **NJ STIC Caucus**, and included interactive polling. The Rutgers Team provided technical support to NJ STIC in these efforts and recognizes that this approach may be useful for some future STIC meetings.

Benefits:

- The NJ STIC webpage was mentioned in the FHWA STIC Excellence Award that NJDOT received in 2019.
- Break-out sessions at STIC meetings allowed STIC leadership to find out more about member priorities, needs for technical assistance, and status of

implementation among local agencies.
- Newsletter and website postings keep members up-to-date on NJDOT EDC initiatives and other innovations.

Lessons/Challenges:
- Break-out sessions at recent NJ STIC related meetings have provided an opportunity to provide a mix of activities at STIC Quarterly meetings. The break-out sessions can enhance two-way communications between STIC members to report on and discuss potential actions that could be taken toward deployment. Establishing sufficient time to hold informed discussions, but ensuring that members can contribute meaningfully at the time of such discussion will be an ongoing challenge.
- Access to materials was limited in break-out rooms for NJDOT staff due to restrictions on internet use.

Newsletter, Social Media, T2 Video Library

The **NJDOT Tech Transfer News** was launched, in part, to reach stakeholders who could not attend Tech Talks and other events sponsored by the NJDOT BoR. NJDOT Tech Transfer News is distributed quarterly via an email newsletter. The newsletter seeks to showcase innovation, highlight the latest state-of-the-art trends and technology practices, and disseminate transportation research results. In support of the Tech Talks, the Tech Transfer News will typically include a link to a website post summarizing the event, sharing the presentation(s), and other materials.

Social Media and Mailing Lists. The T2 program has established several social media accounts (i.e., Facebook, LinkedIn, Youtube, Twitter) to disseminate communications and raise awareness of NJDOT T2 related products, events, and research and innovation-related accomplishments. Mailing lists are maintained and segmented to reach IHEs, NJ STIC participants and other stakeholder audiences. Periodic notifications about NJ STIC-related events have been distributed through a separate targeted emails to keep the STIC membership updated between quarterly meetings.

The **T2 Video Library** was launched to repose videos produced under the T2 Program as well as other presentations and videos relevant to the research and innovation topics at the heart of the T2 program and NJ STIC. The NJDOT T2 Video Library includes NJDOT Safety Countermeasures Training and Education Videos and other research and/or STIC-themed videos produced by NJDOT, FHWA and/or other entities that have been referenced and embedded in select posts (e.g., Focus on Rural Roadway Departures, Data Driven Safety Analysis, Safe Transportation for Every Pedestrian) to build awareness of EDC Initiatives. Select convening events such as recorded Tech Talks and the Research Showcase held in 2020 are reposed on the T2 page.

Benefits:

- The website and social media platforms provide alternate media channels to connect to interested transportation practitioners. They enable a wider reach to promote NJDOT accomplishments and innovations, and to inform about opportunities, events, and resources.

Lessons/Challenges:

- The T2 social media platforms — Facebook, Twitter, and LinkedIn — were recently added and to-date have been slow to attract followers. Regular scheduling of posts to social media may pick up additional followers; cross-liking of pages with other organizations such as LTAP may encourage growing awareness of the T2 social media.

Videos

Videos have been used as a means to increase awareness and encourage participation in New Jersey's **Build a Better Mousetrap (BABM) Competition**. An introductory video describes the competition and includes a segment highlighting the most recent award winner. The BABM webpage includes a growing library of interviews to provide examples of past award winners to recognize those who brought about a valued innovation and to highlight the benefits of the award-winning innovations.

Innovation-Oriented Videos were produced to heighten awareness of NJDOT accomplishments and initiatives in the areas of Unmanned Aerial Systems (UAS) and Pavement Preservation Treatments. The purpose and key concepts conveyed in these videos were prepared in coordination with the relevant NJDOT SMEs. The UAS video was featured in the March/April 2020 *FHWA Innovator* newsletter.

The NJDOT BoR supports transportation research that seeks to enhance the quality and cost-effectiveness of the policies, practices, standards and specifications required when planning, designing, building and maintaining the State's transportation infrastructure. Funded research should result 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 enhance the mobility, accessibility and safety of the State's residents, workers and visitors. In Year 4, **Research to Implementation** themed videos were launched to document the value of such implementation-minded research. The videos feature select projects funded through the NJDOT BoR. The videos, including the Environmental Impacts of Reclaimed Asphalt video (recently completed), and the Bridge Scour Evaluation Model (under development) seek to convey the purpose, findings, potential and realized benefits and implementation opportunities resulting from the research.

Benefits:

- Videos promote NJDOT accomplishments, and inform the public and transportation community of innovative initiatives pursued by the agency.
- The Research to Implementation videos help to convey the importance and benefits of funded research leading to implementation and innovation as well as to promote the NJDOT BoR.

Lessons/Challenges:

- Video production schedules have been disrupted occasionally in the Covid-19 due to safety concerns expressed by select interviewees, from scheduling delays caused by imposed safety protocols, or from personnel directly affected by Covid-19.
- Research to implementation topics were vetted and selected as feature topics based upon the annual implementation report research (i.e., through feedback from the researchers themselves), or after projects received awards from NJDOT or AASHTO signaling noteworthy accomplishments. Despite these screening efforts, video production has been delayed by the unavailability of the Principal Investigator from the Institute of Higher Education.
- In general, the T2 Research Team seeks to make contact with researchers and customers at the earliest phase to share film concept and confirm a commitment to participate. Initial video concepts should also be vetted with NJDOT Communications to convey purpose, target audience, screen core messages and avoid any last-minute surprises.

On-Going and Completed Research

Information about the status of NJDOT-sponsored research projects was made available through a new **Research Projects Database.** Historically, NJDOT BoR maintained a database used to inform researchers and other interested parties about on-going and completed projects, but a disruption in NJDOT IT Department support services led to the need for the development of a new database. Final reports and technical briefs completed since 2017 were uploaded to a Research Projects Database on the T2 website that was developed and maintained by the T2 Research Team. Abstracts for in-progress projects were also posted to the database. Persons on the T2 website interested in accessing projects completed between 1968 and 2017 were provided a link to the NJDOT Final Reports database.

The T2 Research Team was also tasked with updating the Transportation Research Board's (TRB) Research in Progress (RiP) database with new and on-going research projects sponsored by NJDOT, and the TRB Transport Research International Documentation (TRID) database with completed research projects to share research results with other researchers, departments of transportation, and stakeholders in the transportation community. A protocol was established to facilitate communications with BoR Research Project Managers to track projects from inception to completion.

The T2 Team coordinated with the BoR to develop a mailing list and distributed notifications of issued RFPs to a target respondent base of researchers in Institutes of Higher Education. The T2 website contains a link to the NJDOT BoR webpage with its posted RFPs.

Each year, an **Annual Implementation Status Report** was prepared to describe NJDOT-sponsored research projects undertaken and their benefits, long-term effects and/or steps needed to achieve full-scale implementation. These reports are available on the T2 website in a section devoted to Annual Implementation Reports. In the first year of

the T2 Program, the report covered research completed in 2014. The next report covered a two-year period, 2015 and 2016 and subsequent reports were prepared on annual basis for research completed in the years 2017 and 2018.

Benefits:

- The results of research are made more readily available to the broader transportation community
- The Annual Implementation Status Report provides insight into the practical applications of transportation research and is a useful means for screening projects for possible next step strategies to advance technology transfer.

Lessons/Challenges:

- Communications to track implementation efforts for the Annual Implementation Status Report can be difficult due to transitions in the researcher's priorities over time and due to research customer turnover.
- The T2 Research Team determined that a two-year lag period between project completion and follow-up inquiries about implementation was optimal to minimize knowledge loss over time. Opportunities to capture meaningful information about implementation efforts that have already been taken, or that could reasonably still be undertaken through a subsequent phase of research implementation warranted this shorter period.

NJDOT Bureau of Research Library

In 2021, the T2 Research Team supported the BoR through the mobilization of a Research Librarian position for the final two months of the T2 Program to address a near-term staffing gap. The Research Librarian provides on-site librarian services and is well-positioned to assist in identifying needs and formulating strategies for creating a 21st Century Transportation Research Library at NJDOT.

Historically, the Research Librarian at NJDOT acquires, processes and stores new books, journals, articles, standards, and magazines (electronic and/or hard copy resources). The Research Librarian also provides reference, database search, document access and referral services to NJDOT technical and administrative staff using a combination of digital and print resources, promotes awareness of library services within NJDOT, including having periodic contact with NJDOT divisions and evaluating their library needs.

Through the use of a LibGuide and other reference tools, the Research Librarian is expected to increase awareness and digital access to transportation resources for NJDOT staff and the general public. The Research Librarian should also assist in the dissemination of research findings and new standards from NJDOT and other states, as well as from AASHTO, Transportation Research Board (TRB), American Society for Testing and Materials (ASTM) and other sources to respective divisions, provides a cataloged collection of print and electronic resources.

The Research Librarian may be called upon to perform literature searches for problem statements, provide technical editing and writing services for the BoR's project reports, technical briefs, and other related documents, and participate in pooled funding studies and other NJDOT research projects.

In early 2021, along with assuming the Research Librarian position, the T2 Research Team added several links on the T2 website to useful transportation research links including TRB Research Feeds, TRB Library Snap Searches and other transportation-oriented research libraries and posted a staff orientation video produced by the NJ State Library. The NJDOT Staff Orientation Video prepared by the NJ State Library provides an overview of resources available to NJDOT employees, including searching the NJDOT Research Library collection, accessing databases, and other helpful resources.

Benefits:

- Ensuring access to transportation research resources is a critical element of knowledge transfer.
- It is anticipated that the ongoing presence of a librarian at the research library will help staff find and use needed resources in a timely way.

Lessons/Challenges:

- The NJDOT Research Library has been operated through a long-standing relationship with the NJ State Library which has included staffing, report cataloging and inter-library loan services. With the retirement and departure of on-premises NJ State Library staff, the report cataloguing function has involved the hauling of materials to the NJ State Library for data entry processing. Establishing a Memorandum of Agreement with the NJ State Library may be warranted to perform cataloging functions. The training and certification of the on-site NJDOT Research Librarian to access the NJ State Library Horizon database might serve as an option to deliver services cost-effectively.
- Further study of the long-term needs and opportunities for instituting new technologies, protocols and procedures for materials procurement, cataloguing, inter-library loans and services should proceed following further study and in coordination with the BoR, the designated lead Research Librarian, and other affected divisions, bureaus and units at NJDOT, as appropriate.
- The NJDOT Staff Orientation video should be posted on the NJDOT Intranet to reach staff who would be otherwise blocked from accessing the posted media by NJDOT IT policies.

CONCLUSION AND RECOMMENDATIONS

The T2 Program addressed the objectives established by NJDOT BoR at the project inception with the exception of supporting the annual TRB field visit to NJDOT and the peer exchange program. These latter activities were not prioritized as areas for T2 Program support by the BoR over the life of the project. Conversely, developing technical assistance and communications strategies to spotlight select innovation topics and support for the NJ STIC grew in importance over the project period. Additionally, the need to support the NJDOT Research Library became a focal point in the final quarter of Year 4. The Research Library holds resources for staff development and can provide access to external sources for technology transfer, offering services well-aligned with the overall activities of a T2 Program at NJDOT.

Several accomplishments of the T2 Program over the last four years have laid the groundwork for future efforts to promote research, highlight implementable research findings, and disseminate examples of innovation and model practices to the New Jersey transportation community. Reflecting on the accomplishments, benefits, lessons and challenges in the implementation of the T2 Program, the Research Team offers several recommendations for consideration.

Recommendations

1. **Literature Review Phase**. The literature review should include a brief scan of recently completed and ongoing research on various topics, including: technology transfer, knowledge management, knowledge capture, innovation, implementation and dissemination of research at state DOTs. The literature review task should supplement the prior literature review and focus on emerging issues of concern to inform “hot topics” for T2, Knowledge Management, innovation and research library tasks.
    - The knowledge management section of the literature review should inform the existing T2 Knowledge Management Toolbox.
    - Model practices for select innovations that are part of EDC-6 (e.g., Virtual Public Involvement and Strategic Workforce Development) may be particularly useful for sharing with the NJ STIC
    - Further peer benchmarking of select state DOT research libraries may be useful for recognizing leading practices and making a transition of library services toward a workable vision of a 21st Century transportation research library.

2. **Online Survey of NJDOT SMEs.** The previously administered T2 and KM Survey of NJDOT SMEs and the resulting report provide a replicable model for needs identification outreach. Periodic surveys of SMEs – approximately every 2-3 years – would benefit the T2 program by tracking the implementation stage of new innovations, research priorities and training needs, and identifying SMEs who can serve as sources of technical expertise and knowledge for promoting knowledge sharing practices and processes. The survey also serves as a useful tracking tool for measuring awareness of T2 Program elements over time.

3. **Online Survey of LPAs and STIC Membership.** The previously administered survey of LPAs provides a replicable model for periodic future surveys of STIC participants. Such surveys should explore STIC participant insights and experience related to the need for innovation, solicit examples of successful implementation of EDC initiatives in New Jersey and consider the challenges of implementing innovative practices. Ideally, the survey should identify practices that deserve greater recognition and whose lessons learned should be shared to encourage greater deployment, and to identify topics that should receive greater priority in terms of STIC funding, research, technical assistance training and materials development. Periodic online survey of the LPAs – approximately every 2-3 years – is recommended to measure awareness of the STIC innovations over time.

4. **Key Informant Interviews - Priority Topics.** Key informant interviews on priority topics relevant to the implementation of the NJ STIC innovative initiatives and other innovation or research implementation-related topics is recommended. The interviews should be conducted annually through online tools, in-person or by phone. The interviews should be targeted to persons inside and outside of NJDOT who are contributors to NJ STIC's Core Innovation Area (CIA) teams, select NJDOT-funded resource centers, and other groups (e.g., Local Public Agencies) in order to gather information on the status of implementation of EDC and other innovative initiatives, grants and model practices. The key informant interviews should be established as recurring processes to encourage two-way communications and the sharing of information (e.g., awards of grant funding, interim or final research results, presentations, workshop training events, accomplishments, videos, etc.) that can be subsequently developed into relevant articles, tech talks or other events or other technical assistance tools (e.g., videos, guidance documents) for broader dissemination.

5. **Research Ideas.** Targeted efforts to encourage registration, the championing of research ideas, and participation on research panels and research oversight committees will continue to be warranted to direct research funding to more pressing research needs.

    - Most marketing of the NJ Transportation Research Ideas portal for solicitation of research ideas has occurred during the 4th quarter of the calendar year, but periodic reminders targeted to NJDOT SMEs throughout the year may also increase awareness of the portal and participation as research champions.

    - The Research Oversight Committee structure could benefit from the identification of select SMEs in support of a Technical Advisory Group. Their role in research identification process could be encouraged, in particular, for the final quarter of the calendar year. These SME members could affiliate with a "research campaign" area, contribute ideas, and monitor submitted ideas in their areas of subject matter expertise to promote selection and prioritization of research needs. Ideally, these individuals should be encouraged to serve as the research customer or a committee

member on select funded NJDOT research projects to be well-positioned to subsequently implement research findings.

6. **Build a Better Mousetrap Competition.** Local Public Agencies have not participated in the BABM competition. They, along with NJDOT employees, should be encouraged to participate in the competition through STIC-related and Tech Transfer New related communications, the LTAP program, the NJDOT Intranet newsletter, and social media channels via the NJDOT Communications unit, among other channels. The BABM video as produced conveys the fact of the competition, criteria for eligibility, deadlines and examples of past award winners and should be updated annually. Award winners and other competitive entries should be memorialized in video and posts stored on the NJDOT T2 website.
7. **Knowledge Management.** Convening a NJDOT KM Task Force, or a working group would be a useful next step for identifying priorities for effectuating strategies featured in the KM Toolbox, and addressing a subset of KM needs identified previously through surveys. A KM Task Force should be cross-cutting, engaging representatives of various NJDOT divisions, bureaus or units in further identifying existing and promising practices, prioritizing needs for attention, and choosing effective strategies to communicate knowledge.
    - The group would define possible roles and responsibilities within NJDOT, such as an agency-wide Knowledge Management officer.
    - The KM Task Force or working group might promote the advancement of a discrete KM element such as knowledge codification and dissemination.
    - Addition of articles to the T2 website under the heading of Knowledge Management Spotlight would bring attention to successful practices within NJDOT and further populate the KM Toolbox with “in-house” examples.
    - Videos could be used to document knowledge management practices in use at NJDOT.

8. **NJ State Transportation Innovation Council**
    - The NJ STIC Innovative Initiatives Survey provided insight into the status of innovation, and awareness of NJ STIC, among LPAs during EDC-5. The survey should be re-circulated every 2-3 years to increase awareness of the NJ STIC and EDC innovative initiatives and invite sharing of accomplishments among the LPAs and other stakeholders.
    - Innovation Case Studies/STIC Innovation Videos should be developed to document implementation of, and promote, STIC innovative initiatives. These short videos should feature EDC Innovative Initiatives in use by NJDOT or by other NJ agencies. Under the current T2 program, videos have been produced on Pavement Preservation Treatments (EDC-4) and Unmanned Aerial Systems at NJDOT (EDC-5); plans were underway to develop a video on the Local Aid Design Assistance Program (EDC-2). The videos should describe the innovation and the benefits of implementation.

- Fostering awareness of the NJ STIC and the FHWA EDC Program and identifying and addressing barriers to the implementation of innovative initiatives among stakeholders remains an important objective. In break-out sessions and surveys to-date, the LPA participants have suggested the need for additional training to participate in STIC-related innovative initiatives. The Local Technical Assistance Program should serve as a vehicle for delivering such training events to local governments. The T2 Program can promote the existence of such training events through targeted STIC communications and/or co-arrange Tech Talk events to leverage FHWA training resources.
- STIC Incentive Funding. Targeted communications may be warranted to notify LPAs of upcoming rounds of STIC Incentive Funding to encourage non-NJDOT applicants for participation. Ideally, the NJ STIC process may benefit from prioritizing select projects for incentive funding that could be jointly performed between state DOTs and other stakeholders to foster collaboration in the development, assessment, and demonstration of innovation efforts.

9. **Website, Newsletter, and Social Media**

- Explore with NJDOT IT whether there are ways to "whitelist" select URLs and other electronic communications to ensure staff access to T2 website, the T2 video library on the YouTube platform, and emails distributed via the Mailchimp platform that promote tech talks events, articles and videos. This might include consideration of whether there are viable platforms (e.g., Intranet, or MS-Teams), or protocols that can be set up for sharing videos to ensure access for NJDOT staff.
- To capitalize on the larger social media audience of NJDOT, select posts should be shared with NJDOT Communications for broader circulation. Assigned NJDOT BoR staff should serve as an intermediary to discern whether a specific post would be appealing to this broader audience.

10. **Research Library**

- In addition to the full time Research Librarian position, it is anticipated that an additional part-time staff person may be required to effectively provide library services to NJDOT staff and other stakeholders at all times.
- The transition to a 21st Century Research library will require further study of the long-term needs of the agency and opportunities for instituting all aspects of library services, in coordination with BoR, the designated lead Research Librarian, and other NJDOT stakeholders.

Implementation and Training

The T2 Program develops and employs various communication tools and strategies to increase the level of awareness concerning transportation-related issues within New Jersey, promote an ongoing exchange of ideas, translate the latest state-of-the-art trends and technology practices, showcase innovation, and disseminate research results in a form that can be readily applied to current transportation problems.

The T2 Program has employed several approaches for identifying technology transfer needs and knowledge gaps and for raising awareness of research findings, innovations and knowledge management strategies through the development of technical assistance materials and training activities. Several methods, tools and processes were used to engage transportation stakeholders and the NJDOT BoR throughout the year. The processes and products of these efforts provide many points of intervention to identify needs and target strategies to address continuing and emerging needs and expand participation and encourage innovation in transportation among all stakeholders.

The T2 Program is focused throughout its scope of activities on emphasizing the importance of implementation on nearly all tasks. These activities are documented in Quarterly reports, Annual Activities Summary Reports, and the Final Report.

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