## New Jersey Department of Transportation

## 27th Annual NJDOT

# Research Showcase

## October 29, 2025

The Conference Center at Mercer
1200 Old Trenton Road
West Windsor, NJ 08550

## WELCOME

The 27th New Jersey Department of Transportation Research Showcase is an opportunity for New Jersey's transportation community to experience the broad scope of ongoing academic research initiatives and share technology transfer activities being conducted by institutions of higher education (IHE) partners and their associates. It also serves to highlight the benefits of transportation research, including NJDOT's own program. As part of the event, the annual implementation award and recognition of outstanding university students will be presented. The agenda will include a general session, topic breakout sessions, and a poster display. Continental breakfast and lunch will be provided.

This program is organized by the NJDOT Bureau of Research, Innovation & Information Transfer in partnership with the Rutgers Center for Advanced Infrastructure and Transportation (CAIT) and the Alan M. Voorhees Transportation Center (VTC). It meets requirements for up to 2 professional development hours (PDHs) for continuing professional competency for licensed professional engineers. The 27th Annual Research Showcase is sponsored by the Federal Highway Administration and the New Jersey Department of Transportation.

---

## AGENDA

| | |
|---|---|
| 9:30 a.m. | **Introduction and Housekeeping**<br>David Maruca, Program Development Administrator,<br>Rutgers Center for Advanced Infrastructure and Transportation |
| 9:40 a.m. | **Welcoming Remarks**<br>Eric Powers, Assistant Commissioner of Statewide Planning, Safety, and Capital Investment, New Jersey Department of Transportation |
| 9:45 a.m. | **Opening Remarks**<br>Francis K. O'Connor, Commissioner,<br>New Jersey Department of Transportation |
| 9:50 a.m. | **Keynote Address**<br>Debra Sabatini-Hennelly, Founder & President,<br>Resiliti |
| 10:30 a.m. | **Break** |
| 10:45 a.m. | **Panel Discussion: How Are New Jersey Transportation Agencies Preparing the Workforce for the Future?**<br>Moderator: David Maruca<br>Anthony Ennas, Senior Director of Statewide Operations, NJDOT<br>Kelly Hutchinson, Assistant Commisioner of Human Resources, NJDOT<br>Savita Lachman, Deputy Chief of Human Resources, NJ TRANSIT<br>Christen Thomas, Senior Manager, Deloitte Consulting LLP |
| 11:45 a.m. | **Presentation of 2025 Awards**<br>Giri Venkiteela, Innovation Officer, BRIIT<br>New Jersey Department of Transportation<br>2025 Outstanding University Student in Transportation Research Award<br>2025 NJDOT Research Implementation Award<br>2025 Best Poster Award<br>2025 NJDOT Build a Better Mousetrap Award<br>2025 NJDOT Research Excellence Award<br>2025 AASHTO High Value Research Supplemental Award |

12:00 p.m. **Buffet Lunch/Break**

1:00 - 1:20 p.m.

**Infrastructure** ***Room: Auditorium | Moderator: Shane Mott***
***Evaluating Storage Stability and Performance Characteristics of Recycled Composite Plastic Modified Asphalt Binders***
Presenter: Sk Md Imdadul Islam, Rowan University

**Safety** ***Room: 214/215 | Moderator: Ryan Stiesi***
***New Jersey Micromobility Guide (2025)***
Presenter: Hannah N. Younes & Sam Rosenthal, Rutgers University

**Workforce Development** ***Room: 213 | Moderator: Mackenzie Vasile***
***Mapping the Future: GIS and GPS Applications for Modern Engineering and Surveying***
Presenters: Avinash Prasad and Indira Prasad, NJIT and Stevens

1:30 - 1:50 p.m.

**Infrastructure** *Room: Auditorium | Moderator Shane Mott*
***Evaluating Internally Cured High-Performance Concrete Life Cycle Cost Savings in New Jersey Bridges***
Presenter: Kaan Ozbay, New York University

**Safety** ***Room: 214/215 | Moderator: Ryan Stiesi***
***Time-to-failure and Socioeconomic Data Analysis for Bridge Assessment and Funding Allocation***
Presenter: Lawrencia Akuffo, Rowan University

**Workforce Development** ***Room: 213 | Moderator: Mackenzie Vasile***
***Introducing Transportation Careers to Youth in New Jersey***
Presenter: Todd Pisani, Rutgers University

2:00 - 2:20 p.m.

**Infrastructure** *Room: Auditorium | Moderator Shane Mott*
***Real-time Monitoring of Far-Field Concrete Cracks Using Distributed Acoustic Sensing***
Presenter: Yao Wang, Stevens Institute of Technology

**Safety** ***Room: 214/215 | Moderator: Ryan Stiesi***
***A Multi-State Auxetic Metamaterial with Enhanced Stability and Energy Absorption***
Presenter: Linzhi Li, Stevens Institute of Technology

**Workforce Development** ***Room: 213 | Moderator: Mackenzie Vasile***
***GPI's Workforce Development Challenges and Solutions***
Presenter: Dave Wagner and Dave Kuhn, Greenman-Pederson, Inc.

2:30 - 2:50 p.m.

**Infrastructure** *Room: Auditorium | Moderator Shane Mott*
***Beyond the Clock: Sustainable Solutions for Returned Ready-Mix Concrete***
Presenter: Mohamed Mahgoub, NJIT

**Safety (Mini-Presentation)** ***Room: 214/215 | Moderator: Ryan Stiesi***
***Harsh Braking as a Surrogate for Crash Risk: A Segment-Level Analysis with Connected Vehicle Telematics***
Presenter: Md Tufajjal Hossain, NJIT

**Workforce Development** ***Room: 213 | Moderator: Mackenzie Vasile***
***Multi-Agent Large Language Model Framework for Code-Compliant Infrastructural Design***
Presenter: Jinxin Chen, Stevens Institute of Technology

## POSTER SESSION

*Room: 116/117*

*Introducing Transportation Careers to Youth in NJ*
Presenter: Todd Pisani, Rutgers University

*From Data to Decisions: Engineering Intelligence for AI-Enabled Bridge Maintenance and Workforce Excellence*
Presenter: Indira Prasad, Stevens Institute of Technology

*Developing Sensor-Based Mapping System for Soil Characterization*
Presenter: Ayodeji Aderibigbe, NJIT

*Rock Mass Grouting for Coastal Infrastructure*
Presenter: Matthew Sonibare, NJIT

*Mechanistic Understanding of Low-Carbon Concrete Through Integrated Lab Testing and Field Performance Analysis*
Presenter: Md Maruf Hasan, NJIT

*Electric Curing of Concrete for Large-Scale Application at Subfreezing Temperature*
Presenter: Mohamed Masbouba, Rowan University

*Electric Curing of Concrete: Methodology, Validation, and Field Scale-Up*
Presenter: Rim Najmeddine, Rowan University

*Microwave Heating for Concrete Demolition: Experimental and Empirical Study*
Presenter: Mehdi Roshanbin, Rowan University

*Protecting Critical Infrastructure: Combine Seismic-Rainfall Landslide Assessment and Advanced Stabilization Technologies for New Jersey Transportation Corridors*
Presenter: Prabhakar Khadka, NJIT

*Integrated Evaluation of Distracted Driving and Seatbelt Non-Use Among Truck Drivers: Insights from Field Observations and Crash Data Analytics*
Presenter: Md Sadman Islam, Rowan University

*Evaluating State DOT Practices and Priorities in Pavement Marking Implementation and Maintenance: Insights from Multi-State Interviews and Comparative Analysis* Presenter: Ahmed Imtiaz Zamee, Rowan University

*Harsh Braking as a Surrogate for Crash Risk: A Segment-Level Analysis with Connected Vehicle Telematics*
Presenter: Md Tufajjal Hossain, NJIT

# ABOUT OUR PRESENTERS

**Eric Powers**, Assistant Commissioner of Statewide Planning, Safety and Capital Investment, New Jersey Department of Transportation

Eric joined the Department in 2001 as a Transportation Planner in the Division of Statewide Planning, serving as project manager for the State's first Statewide Freight Transportation Plan. From 2008 to 2011, he worked directly for the Assistant Commissioner of Planning. In 2011, he returned to the Division of Statewide Planning to lead the MPO Liaison unit.

He was promoted to Section Chief in the Bureau of Trucking services 2013 and in 2014 he joined the Division of Capital Investment Planning and Development as the Manager of the Bureau of Capital Program Coordination. He was promoted to Director of Capital Investment and Program Coordination in 2017 and served in that capacity until being appointed to the position of Assistant Commissioner of Statewide Planning, Safety and Capital Investment in October 2023.

Eric earned a B.S. in Economics with a concentration in Public Sector Finance from Florida State University and a Master of City and Regional Planning (MCRP) degree from Rutgers University. He is a licensed Professional Planner in the State of New Jersey and is certified by the American Institute of Certified Planners. He is a graduate of the NJDOT Succession Planning Program and a Certified Public Manager.

**Francis K. O'Connor,** Commissioner, New Jersey Department of Transportation

Francis (Fran) O'Connor was confirmed as the 20th Commissioner of the New Jersey Department of Transportation on Friday, June 28, 2024. He was nominated by Governor Murphy in January 2024 and began serving as Acting Commissioner on February 12, 2024.

Fran returns to New Jersey State service with over 40 years of public and private sector transportation experience. He began his public service career at the New Jersey Turnpike Authority as a toll collector and rose to be the Deputy Director of the NJTA's Electronic Toll Collection Program. In that role he launched the Authority's first electronic toll collection installation.

While in the private sector, Fran advised transportation agencies across the country on the development and execution of critical projects with a strategic focus on toll roads. In this work, Fran has overseen hundreds of employees at a time, implemented large-scale customer service centers, and engaged with regulatory entities at all levels of government. He graduated summa cum laude with a bachelor's in accounting from St. Peter's University.

**Debra Sabatini Hennelly,** Founder and President, Resiliti

For more than 25 years, Debbie has been creating innovative approaches to managing compliance and fostering ethical leadership—from boardrooms to break rooms—with organizations ranging from small entities to some of the largest multinationals. Her methodology engages stakeholders directly to manage ethical, compliance, and ESG risks and opportunities, integrating those insights into operations and culture.

She facilitates experiential learning and workshops to help teams and leaders identify and address obstacles to psychological safety and ethical decision-making, increasing collaboration, engagement, well-being, and productivity. Her pragmatic approach is informed by her engineering and legal background and decades of corporate leadership, C-suite, and advisory roles in compliance and ethics, legal, environment and safety, and strategic management.

Debbie is an adjunct professor in Fordham University Law School's Program on Corporate Ethics and Compliance, a Master of Legal Studies (MLS) program. She coaches ethics and compliance professionals, helping them lead effectively and develop strategies for personal resilience. Debbie is passionate about helping navigate the challenges of influencing culture change, leading strategically, and addressing the potential for burnout. She holds a Certificate in Wellness Counseling from Cornell University.

**Anthony J. Ennas,** Senior Director of Statewide Operations, New Jersey Department of Transportation

Anthony began his career with NJDOT as a Maintenance Worker in 1996 and worked his way up through the Department holding many titles, such as Construction & Bridge Repairer, Engineering Technician, Assistant Engineer, Senior Engineer, Principal Engineer, Supervising Engineer, Assistant Director South, Assistant Director Central, and then by 2019 became Director in Central Region.

In 2024, Anthony achieved the Senior Director of statewide Operations position overseeing all three (3) Regions (North, Central, South), the Bureau of equipment and the Operations Training Unit.

Anthony's achievements include managing high level emergencies such as Route 80 Sinkhole in Wharton, Post-Hurricane Sandy clean-up coordination efforts, supervised and coordinated various Bridge Repair projects, improving our Winter Operations Support Team (WOST) program, and most recently the Development of our new NJDOT Training Center establishing many in-house training programs resulting in cost savings to the Department.

**David Maruca,** Program Development Administrator, Rutgers Center for Advanced Infrastructure and Transportation

David Maruca is a Program Developer for Rutgers Center for Advance Infrastructure and Transportation (CAIT) since 2013. Dave is responsible for developing, coordinating and administering several CAIT transportation safety programs.

Prior to joining CAIT, he was an enlisted member of the New Jersey State Police where he served in many different capacities to include an Academy Instructor and Unit Head of both Construction and the Motor Coach Compliance Safety Audit Review Unit. Dave ultimately achieved the rank of Lieutenant before retiring from the Transportation Safety Bureau after 27 years of service. Mr. Maruca holds a master's degree in education from Seton Hall University.

**Kelly Hutchinson,** Assistant Commissioner for Administration, New Jersey Department of Transportation

Kelly Hutchinson was appointed to the position of Assistant Commissioner, Administration in September 2023. As a key strategic member of the New Jersey Department of Transportation's leadership team, she directs the programs and services of the Divisions of Human Resources and Facilities/Support Services serving to support the greater mission of the New Jersey Department of Transportation (NJDOT) with a staffing complement of approximately 3,500 employees, and a building structure complement of over 500 in over 94 locations statewide. Kelly began her career in state service in 2005 and has been with NJDOT since 2015. Prior to becoming Assistant Commissioner, Kelly served as NJDOT's Director of Human Resources. Kelly earned a B.A in Psychology from Stonehill College.

**Savita Lachman,** Deputy Chief Human Resources Officer, New Jersey TRANSIT - Talent Management

Dr. Savita Lachman is a renowned human resources executive with over 25 years of experience in strategic leadership. She specializes in organizational development, talent management, Retention and Succession Planning, Mentorship, and HR transformation.

With a Doctorate in Organizational Leadership Management, she brings a data-driven, forward-thinking approach to workforce strategy, ensuring alignment between business objectives, employee engagement, and culture.

As Deputy Chief Human Resources Officer at NJ TRANSIT, Dr. Lachman leads enterprise-wide initiatives that drive organizational effectiveness, leadership development, and cultural transformation. She has played a pivotal role in implementing innovative talent development programs, performance management systems, learning management systems, and workforce engagement strategies designed to enhance retention, boost productivity, and create a high-performing, inclusive workplace.

Prior to her role at NJ TRANSIT, Dr. Lachman held senior HR leadership positions at SKF USA, where she successfully designed and executed large-scale HR initiatives that strengthened talent pipelines, enhanced DEI strategies, and fostered a culture of continuous learning and employee empowerment. Her expertise spans leadership development, change management, employee engagement, and workforce planning, including the rollout of LMS platforms, mentorship programs, and 360-degree feedback systems.

**Christen Thomas,** Senior Management, Deloitte

Christen Thomas is a Senior Manager within Deloitte's Government and Public Sector (GPS) Human Capital Offering Portfolio. She currently serves as Deloitte's Human Capital Leader for New Jersey and Massachusetts and serves as Deloitte's National HR

Strategy Leader. She has served clients across State, Local and Federal government, including local and state level transportation entities. Christen is experienced in HR and workforce strategy, organizational change management, and organizational design. Her experience includes leading large-scale future of work and culture assessments and HR and workforce transformation efforts. Prior to Deloitte, Christen worked at SAIC. Christen earned a B.S. in Finance from Oakwood University, and an MBA from the George Washington University.

**Giri Venkiteela,** Innovation Officer, Bureau of Research, Innovation & Information Transfer, New Jersey Department of Transportation

Dr. Giri Venkiteela is the Innovation Officer at NJDOT BRIIT, where he manages a variety of research and innovation project and programs. He is also the NJDOT transportation pooled fund program manager and the lead for NJDOT LCTM grant program. With over 14 years of experience in transportation research and innovation, he has a strong background in both research execution and administration. Dr. Venkiteela serves as a chair and member of various NCHRP research projects and participates in several TRB and AASHTO standing committees.

He is also a reviewer and judge for research proposals and journals from USDOT, NCHRP, ASCE, and TRB. He has published numerous journal articles and delivered many invited talks. Currently, he is the vice-chair for AASHTO RAC-Region 1 and the TRB-RIIM Emerging Topics Committee. Dr. Venkiteela holds a Ph.D. in Civil Engineering from the University of Louisville, KY, and has served as a research scholar at Northwestern University and Rutgers University.

**Pragna Shah,** Manager, Bureau of Research, Innovation & Information Transfer, New Jersey Department of Transportation

Pragna Shah has over 20 years of experience at NJDOT. She has managed numerous state and federal programs while serving in the Division of Local Aid & Economic Development and the Bureau of Research, Innovation & Information Transfer. She has been instrumental in implementing and overseeing various programs and research projects.

As the project manager for the Annual Research Showcase, the Bureau was recognized for the 2023 Best Virtual Event Award from the AASHTO Communications Committee. In addition to her role at NJDOT, Pragna is a member of the AASHTO Research Advisory Committee (RAC), the Transportation Research Board (TRB) Research Innovation Implementation Management (RIIM) committee, and the AASHTO Knowledge Management Committee. She holds a B.S. in Electrical Engineering from the New Jersey Institute of Technology.

# Evaluating Storage Stability and Performance Characteristics of Recycled Composite Plastic Modified Asphalt Binders

Presenter: Sk Md Imdadul Islam

Organization: Rowan University

## Abstract

The utilization of plastic has escalated over the past five decades, rising from 15 Mt to 311 Mt where a significant portion is regarded as waste after their end of use life. These waste plastics can be single or composite type, depending on how many polymers/plastics they include. Merely 12% of all plastics are recycled, while rest are disposed of in landfills, subjected to incineration, and some escape the collecting system, ultimately contaminating oceans and environment. To overcome this issue, utilizing waste plastics in flexible pavements looks promising. However, in wet mixing inadequate storage stability, attributed to compatibility issues between the plastic and asphalt is very frequent. This study evaluated the storage stability and performance characteristics of composite plastic modified binders at dosages of 1% to 3%, using polyethylene grafted maleic anhydride (PE-g-MA) and Reactive Elastomeric Terpolymer (RET) stabilizers. Thermal characterization of plastics was carried out using differential scanning calorimetry, showing melting points between 130–155°C, suitable for wet blending applications. Storage stability was evaluated using complex shear modulus separation index and fluorescence microscopy.

The results revealed improvement in storage stability with both stabilizers up to 2% dosage, with RET achieving more uniform and homogeneous plastic dispersion in asphalt binder matrix. Furthermore, rheological properties were evaluated through Superpave performance grading (PG), Multiple Stress Creep Recovery (MSCR), and Linear Amplitude Sweep (LAS). RET increased the high PG of plastic modified binders by up to three grades for HP (HDPE+PP) and two grades for LHP (LDPE+HDPE+PP), while PE-g-MA had a minimal impact on high PG. Both stabilizers maintained the low PG of the base binder, with RET providing greater improvement than PE-g-MA. The rutting performance increased significantly with RET, by enhancing recovery and lowering Jnr, outperforming PE-g-MA. With the addition of plastic, the fatigue performance was degraded. However, the use of stabilizers mitigated this effect, with RET and PE-g-MA enhanced fatigue lives by approximately 1500% and 270%, respectively. Overall, RET stabilizer was more effective than PE-g-MA in improving storage stability and performance characteristics. These findings suggest that composite plastic modified binders with up to 2% dosage combined with stabilizers can offer better storage stability and performance for sustainable pavement applications.

**Sk Md Imdadul Islam** is a PhD student in Civil and Environmental Engineering and a graduate research fellow at Center for Research and Education in Advanced Transportation Engineering Systems (CREATES) at Rowan University, conducting research under the guidance of Dr. Yusuf Mehta. His current work, funded by the U.S. Army Engineer Research and Development Center (ERDC) and Cold Regions Research Engineering Laboratory (CRREL), focuses on the "Incorporation of Recycled Plastics into Asphalt Binder and Mixtures," aligning with his research interests in Pavement Engineering, Sustainability, and Materials & Solid Waste Management. Prior to his doctoral studies, he earned an M.S. in Civil Engineering from The University of Texas at RGV and B.S. in Civil Engineering from the Khulna University of Engineering & Technology. His professional background also includes practical experience as a Project Estimator 1 at Millennium Engineers Group Inc., further fueling his motivation to contribute meaningfully to the field of engineering materials and advanced transportation systems.

# Evaluating Internally Cured High-Performance Concrete Life Cycle Cost Savings in New Jersey Bridges

Presenter: Kaan Ozbay

Organization: New York University

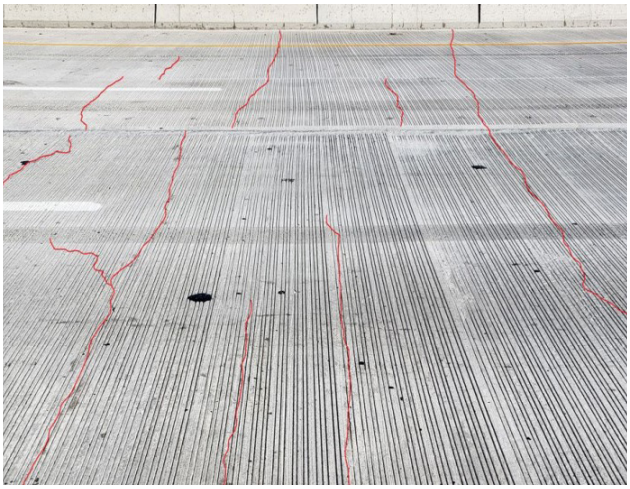
## Abstract

Effective bridge management requires balancing long-term economic efficiency with resilience against risks posed by aging infrastructure and various hazards. Traditional life cycle cost analysis (LCCA) frameworks primarily focus on cost minimization, often underrepresenting risk and uncertainty factors that are critical for sustainable decision-making. To address this gap, our joint team from Rutgers' RIME Lab and NYU C2SMART center, in collaboration with the NJDOT, developed a highly flexible and customizable Excel-Python integrated decision-support tool, ASSISTME-LCCA, that incorporates multi-objective optimization into the LCCA process. The framework enhances an existing Excel-based LCCA tool with Python-based automation and optimization capabilities, enabling the evaluation of bridge maintenance and rehabilitation strategies under budget constraints.

Using the Non-dominated Sorting Genetic Algorithm II (NSGA-II), the model generates Pareto-optimal solutions that jointly minimize life cycle costs and prioritize bridges with greater susceptibility to risks by maximizing risk scores, which can be customized through weighted parameters to emphasize different risk types. Additional objectives such as Annual Average Daily Traffic (AADT) can also be included in the optimization to align with agency priorities. A case study using representative bridge inventory and condition data demonstrates how the tool produces insights. Results highlight trade-offs between cost efficiency and risk mitigation, demonstrating the value of risk-integrated planning compared to cost-driven approaches. The approach offers a practical, data-driven methodology for allocating resources while ensuring long-term resilience. By equipping stakeholders with advanced optimization capabilities, this research supports the development of an improved transportation workforce prepared to address future challenges and contributing to resilient infrastructure management strategies.

**Dr. Kaan Ozbay** joined Civil and Urban Engineering at NYU Tandon School of Engineering as a tenured full Professor in 2013. He is the founding Director of the C2SMART Center at NYU Tandon School of Engineering which was established in 2017. Prior to that, Professor Ozbay was a tenured full Professor at Rutgers University's Department of Civil and Environmental Engineering where he joined as an Assistant Professor in July 1996. In 2008, he was a visiting scholar at the Operations Research and Financial Engineering (ORFE) Department at, Princeton University. Dr. Ozbay is the recipient of several awards including the prestigious National Science Foundation (NSF) CAREER award, IBM faculty award, INFORMS Franz Edelman Finalist Award, in addition to several best paper and excellence in research awards. His research interests in transportation cover a wide range of topics including data-driven AI/ML applications in smart cities, development and calibration of large-scale complex transportation simulation models. He has co-authored 4 books and published approximately 500 refereed papers in scholarly journals and conference proceedings. Prof. Ozbay is also an Associate Editor of the ITS journal and serves as the Associate Editor of Networks and Spatial Economic journal and Transportmetrica B: Transportation Dynamics journal. Since 1994, Dr. Ozbay, has been the Principal Investigator and Co-Principal Investigator of 125 research projects funded at a level of more than $35M by USDOT, National Science Foundation, NCHRP, NJDOT, NY State DOT, NYC DOT, New Jersey Highway Authority, FHWA, VDOT, Dept. of Homeland Security, among others.

# Real-Time Monitoring of Far-Field Concrete Cracks Using Distributed Acoustic Sensing



Presenter: Yao Wang

Organization: Stevens Institute of Technology

## Abstract

Monitoring cracks is critical for the safety and quality of construction and operation of civil infrastructure. Distributed fiber optic sensors have been utilized to monitor near-field cracks but are insensitive to far-field cracks. This paper presents an approach for real-time monitoring of far-field cracks based on distributed acoustic sensing.

The approach was implemented into a concrete highway bridge, and the performance of the approach was evaluated using a computational model for multi-physics simulations. The results showed that the approach was able to accurately detect and locate far-field cracks six meters away from fiber optic cables with appropriate threshold and temperature compensation. The configurations of the sensing system, such as gauge length, channel spacing, and sampling rate, exhibited significant impacts on crack monitoring results and localization performance.

The capability of real-time monitoring of far field cracks advances the construction and operation of infrastructure.

**Mr. Yao Wang** is a Ph.D. student in the Department of Civil, Environmental, and Ocean Engineering at Stevens Institute of Technology, advised by Professor Yi Bao. His research focuses on structural health monitoring using advanced acoustic sensing technologies, including Distributed Acoustic Sensing, Acoustic Emission, and Guided Wave. He integrates experiments, multi-physics finite element modeling, and machine learning to investigate wave propagation, signal processing, and sensing configuration optimization for damage detection in civil infrastructure.

# Beyond the Clock: Sustainable Solutions for Returned Ready-Mix Concrete

Presenter: Mohamed Mahgoub

Organization: NJIT

## Abstract

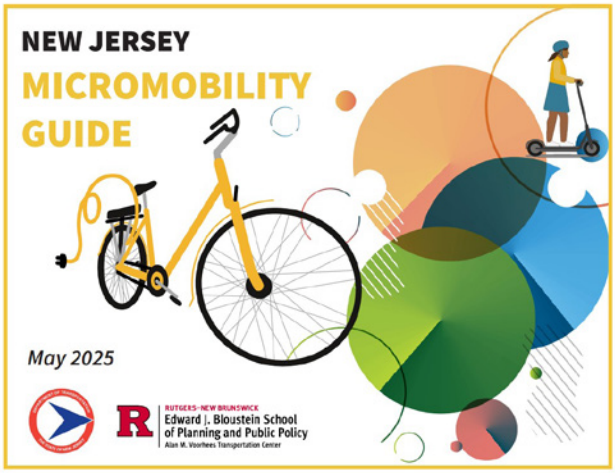
A significant portion of ready-mixed concrete, estimated at around 3% of total production, is returned to plants for disposal each year due to issues such as slump loss during transport, surplus production, and strict adherence to the 90-minute discharge time limit set by ASTM C94 and referenced in ACI 318-19. While this rule aims to preserve concrete quality, it often leads to the rejection of truckloads, particularly in congested urban areas, thereby increasing costs, waste generation, and environmental impacts.

To address this challenge, research funded by the Ready Mixed Concrete (RMC) Research & Education Foundation and Portland Cement Association (PCA) examined the effects of extending discharge time on durability and performance. Concrete mixtures, representative of field practice, were prepared and tested at intervals up to 150 minutes, with properties such as air content, slump, temperature, compressive strength, freeze-thaw resistance, and surface resistivity evaluated.

The findings revealed that extending discharge time to 150 minutes had no significant adverse effect on fresh or hardened properties, suggesting that current specifications are overly conservative and could be revised to reduce unnecessary waste, costs, and environmental burdens.

**Mohamed Mahgoub, PhD and PE**, is an NJIT Associate Professor and Concrete Industry Management Program Director. He is also a Fellow of ACI. He is an expert in bridge rehabilitation, inspection, rating, design and analysis. Dr. Mahgoub received his Master's Degree from McMaster University in Hamilton, Ontario, Canada and his doctorate from Carleton University, Ottawa, Canada. Prior to joining NJIT, he was the lead bridge engineer for the Chicago consulting firm Alfred Benesch & Company, working on bridge design for the Michigan DOT. His personal experience includes: highway bridge analysis and design, rehabilitation and construction, and scour analysis. Dr. Mahgoub has designed several bridges in Michigan, Illinois, Wisconsin and Pennsylvania. He has also performed several bridge inspections and load rating in several big cities in Michigan. He was in charge of performing annual scour analyses of all primary and secondary bridges in Calhoun County, MI. After joining NJIT, Dr. Mahgoub was involved in research of several construction material projects for several associations, companies, and state institutions. He was also involved in RAC research. Dr. Mahgoub has served as a member in organizations such as ASCE, PCI, ICRI, and ACI. Dr. Mahgoub has been appointed as the vice president of the local New Jersey ACI Chapter, has been selected as a judge for their annual award, and is also the advisor of NJIT ACI Student Chapter. Dr. Mahgoub has more than 20 technical and scientific publications and presentations to his credit. Dr. Mahgoub has been also serving as a panelist for the NSF and NRC.

# New Jersey Micromobility Guide (2025)




Presenters: Hannah Younes
& Sam Rosenthal

Organization: Rutgers University

## Abstract

The New Jersey Micromobility Guide serves as a resource for micromobility users across the state, collecting and summarizing the laws and safety best practices that can make riders safer. Micromobility, which includes e-bikes, e-scooters, and other low-speed devices, is an affordable, energy-efficient, eco-friendly alternative to driving.

For short-distance travel, micromobility can replace car trips, thus lowering transportation costs and helping to reduce congestion and car parking demand on local streets. For longer trips, this guide clarifies if and how micromobility riders can bring their devices onto public transportation.

By providing tips, answering common questions, and clarifying how different devices are regulated, this guide serves as a resource that promotes the safe and legal use of e-bikes, e-scooters, and other forms of micromobility throughout New Jersey.

NJDOT Bicycle and Pedestrian Resource Center. (2025). New Jersey Micromobility Guide. Retrieved from https://njbikeped.org/new-jersey-micromobility-guide-2025

**Dr. Hannah Younes** is a Senior Research Specialist at the Voorhees Transportation Center in the Edward J. Bloustein School of Planning and Public Policy, Rutgers University. Her research interests revolve around sustainable and safe transportation. In her role at Rutgers University, Dr. Younes focuses on crash and medical records research, built environment and geometric roadway design, and active travel research. She has qualitative methodological experience with focus groups, surveys, and interviews and quantitative methodological expertise with statistical regression methods. Dr. Younes has extensive experience interviewing transportation practitioners in numerous fields, including state departments of transportation, transit agencies, municipal engineers, and academic researchers. Before coming to Rutgers, she was a research assistant for the Maryland Transportation Institute (MTI) in the Department of Civil and Environmental Engineering at UMD, focusing on transport geography issues.

# Time-to-failure and Socioeconomic Data Analysis for Bridge Assessment and Funding Allocation

Presenter: Lawrencia Akuffo

Organization: Rowan University

## Abstract

This study examines the structural health and socioeconomic variables influencing the condition of all bridges in New Jersey. Starting by examining the resilience of bridges under various load scenarios (Average Daily Traffic (ADT)/Live Loads, Environmental Loads/Conditions) categorized by bridge materials.

First, a Kaplan Meier model was used to determine the time to failure for the various load scenarios categorized by the bridge materials; giving the percentage of failed bridges at year 0,50,100,150 and 200 indicating the proportion of bridges that remain functional without failure after the marked years; additionally, a Cox PH model was used to determine the relationship between the covariates and the bridge failure risks.

Second, we investigate the impacts of local socioeconomic factors on bridge conditions. Since tolls, gas taxes, user fees and taxes, and federal road funds, provide most of the funding for bridge reconstruction, this analysis sought to identify any relationships between (a) bridge condition history (the time it takes to reach failure criteria), (b) the percentage of good and fair bridges in each county, and (c) the socioeconomic factors that are present.

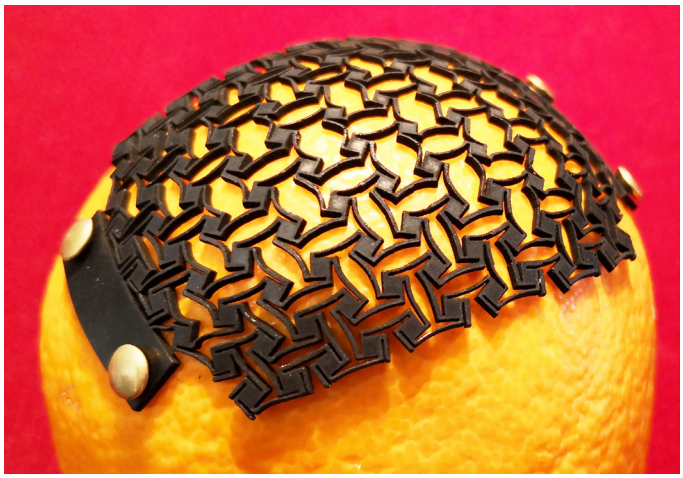
Using K-means clustering we first conducted an exploratory analysis to evaluate the data behavior, then using Multiple Linear Regression we found how much the various factors combination impacted the bridge health. The importance of each affecting factor was ranked through Random Forest. The results showed that AADT contributed 31.4% to the bridge deterioration, followed by Population contributing 22.73%, and Business 16.38%, with Median Income contributing to the 1.08%. This reinforces the need for targeted funding relying on each locality's specific needs to support equitable bridge maintenance and improve overall infrastructure quality. This insight, combined with time-to-failure analysis, suggests prioritizing specific bridge types in low-income areas to ensure longevity despite limited funds.

**Lawrencia Akuffo** is a civil engineer and researcher whose work bridges the fields of structural engineering, data science, and infrastructure resilience. As a Graduate Fellow at Rowan University's Department of Civil and Environmental Engineering, her research focuses on structural health monitoring and remaining capacity estimation of bridges and prestressed concrete girders using advanced modeling tools like Abaqus and machine learning. Lawrencia's innovative studies integrate LiDAR data, point cloud analysis, and socioeconomic modeling to understand infrastructure performance and deterioration across New Jersey's bridges. Her multidisciplinary approach, which combines statistical modeling, structural simulation, and data-driven insights, positions her at the forefront of next-generation transportation infrastructure research.

# A Multi-State Auxetic Metamaterial with Enhanced Stability and Energy Absorption for Transportation Protection

Presenter: Linzhi Li

Organization: Stevens Institute of Technology



## Abstract

Protective barriers in transportation engineering require materials that are lightweight, highly energy-absorbing, and capable of mitigating vibration. Auxetic metamaterials, with their negative Poisson's ratio (NPR) arising from geometric design, offer significant potential. However, conventional lattices often suffer from low load-bearing capacity and unstable deformation, restricting their application in infrastructure.

This study designs a multi-stage auxetic metamaterial that integrates rotating, re-entrant, and chiral mechanisms to enhance energy absorption, load-bearing capacity, and structural stability, evaluated through quasi-static compression analysis. Results show that the lattice sustains NPR behavior up to 60% strain, forms two distinct stress plateaus, and achieves nearly twice the specific energy absorption of existing multi-stage designs while maintaining stable deformation.

By combining lightweight architecture, enhanced energy absorption, and reliable multi-phase stability, the proposed metamaterial provides a promising solution for crash barriers, bridge protection, and vibration-damping systems in transportation engineering.

**Linzhi Li** is a Ph.D. student in the Department of Civil, Environmental, and Ocean Engineering at Stevens Institute of Technology, supervised by Professor Yi Bao. Her research focuses on the design and optimization of mechanical and auxetic metamaterials for vibration mitigation, energy absorption, and structural protection in civil and transportation engineering. Her recent work develops multi-stage auxetic lattices that integrate rotating, re-entrant, and chiral mechanisms to achieve enhanced stability and load-bearing performance.

# Harsh Braking as a Surrogate for Crash Risk: A Segment-Level Analysis with Connected Vehicle Telematics

Presenter: Md Tufajjal Hossain

Organization: NJIT

## Abstract

*Details pending*

**Md. Tufajjal Hossain** is a Ph.D. student in Transportation Engineering at the New Jersey Institute of Technology (NJIT). His research focuses on traffic flow modeling, intelligent transportation systems, and AI-driven traffic safety analysis. His recent work includes developing real-time incident detection models using crowdsourced Waze data and designing a data-driven framework for optimal Safety Service Patrol route identification based on historical crash data. He also explores crash severity prediction using large language models to enhance roadway safety analytics. At NJIT, he serves as a Teaching Assistant and has contributed to NJDOT-funded research at the Intelligent Transportation Systems Research Center. He is the recipient of the 2025 ITSNJ Outstanding Graduate Student Award and the Best Poster Award at the 2024 ITSNJ Annual Meeting, recognizing his academic excellence and contributions to advancing intelligent and data-driven transportation systems.

# Mapping the Future: GIS and GPS Applications for Modern Engineering and Surveying

Presenters: Avinash Prasad
& Indira Prasad

Organizations:
NJIT & Stevens Institute of Technology

## Abstract

Geospatial technologies such as Geographic Information Systems (GIS) and Global Positioning Systems (GPS) are transforming the landscape of engineering and surveying, offering powerful tools for precision, efficiency, and data-driven decision-making. GPS enables accurate location tracking through satellite-based positioning, while GIS integrates spatial data with descriptive attributes to create dynamic maps and analytical models.

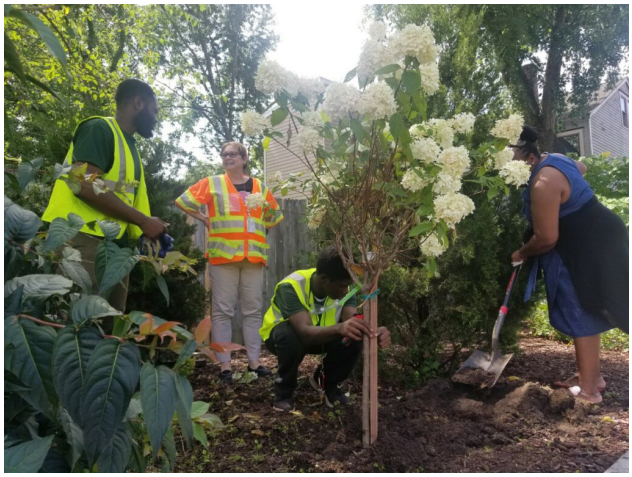
This presentation explores the practical applications of GIS and GPS in contemporary engineering and surveying, encompassing land management, infrastructure planning, environmental monitoring, and asset tracking. It highlights how these technologies streamline workflows, enhance communication, and support smarter project execution.

As the industry evolves, proficiency in geospatial tools is becoming essential for engineers and surveyors. This work highlights the importance of interdisciplinary training, hands-on experience, and digital literacy in preparing the workforce for emerging roles in innovative infrastructure systems. By bridging technical innovation with skill development, GIS and GPS are not only reshaping how we build, but also who builds it.

**Indira Prasad** is a dynamic change agent and accomplished expert in project management, sustainability, and infrastructure, with decades of experience spanning both public and private sectors. At the City of New York, as Associate Director, she leads high-impact initiatives that drive innovation and organizational improvement. She holds a Master of Arts from Harvard University, a dual Master's in Engineering and Technology Management, an MBA in Operations Management, and a Bachelor's in Computer Science and Engineering. Indira is currently a Ph.D. candidate in Civil and Environmental Engineering at Stevens Institute of Technology, where her research focuses on sustainable and resilient infrastructure, life cycle assessment, urban transportation, climate resilience, and the integration of artificial intelligence in civil engineering. Indira holds multiple professional certifications, including PMP, CMQ/OE, ENV-SP, and Six Sigma Lean and Black Belt. Her technical work has been widely recognized, with publications and presentations through ASCE, AREMA, ISI, and Railway Age.

**Dr. Avinash Prasad** is a Licensed Professional Engineer, Land Surveyor, and Professional Planner with over 30+ years of experience in civil engineering, land surveying, and management. He is a registered Land Surveyor in New York and Connecticut (since 2017 and 2004, respectively) and holds a Ph.D. in Civil Engineering from New York University. He also has dual Master of Science degrees in Civil Engineering and Engineering Management from the New Jersey Institute of Technology, as well as a Bachelor of Science degree in Civil Engineering. In addition to his engineering credentials, Mr. Prasad holds certifications as a certified Emergency Medical Technician (EMT), Emergency Medical Responder (EMR), firefighter (FF), and CPR/AED administrator in New Jersey. He is a Fellow of the American Society of Civil Engineers and an active member of several professional organizations, including AREMA, PMI, AISC, IPWE, IRT, and IIBE. His technical work has been widely recognized, with publications and presentations through ASCE, AREMA, Railway Age, and Railway Track & Structures.

# Introducing Transportation Careers to Youth in New Jersey



Presenter: Todd Pisani

Organization: Rutgers University

## Abstract

*Details pending*

**Todd Pisani, MPA,** is a Research Project Manager at the Center for Advanced Infrastructure & Transportation at Rutgers University, where he's spent over 12 years advancing workforce development initiatives, particularly for justice-impacted and underserved populations. He is the architect of the Rutgers Employment Success Program and has secured over $7 million in grant funding to support reentry and career development efforts across New Jersey. Todd has led multiple research and training programs, including collaborations with the NJ Department of Labor, U.S. DOT, and the National Academies of Sciences. His work has focused on integrating Credible Messengers—leaders with lived experience—into workforce programs, providing powerful community connections and outcomes. He also serves in local leadership roles on youth services and interagency councils and was awarded the Rutgers Chancellor's Award for Diversity and Inclusion in 2022. Todd's mission continues to center around building more inclusive, effective systems of support and opportunity.

# GPI's Workforce Development Challenges and Solutions

Presenters: **Dave Wagner & Dave Kuhn**

Organization: **Greenman Pederson, Inc**

## Abstract

*Details pending*

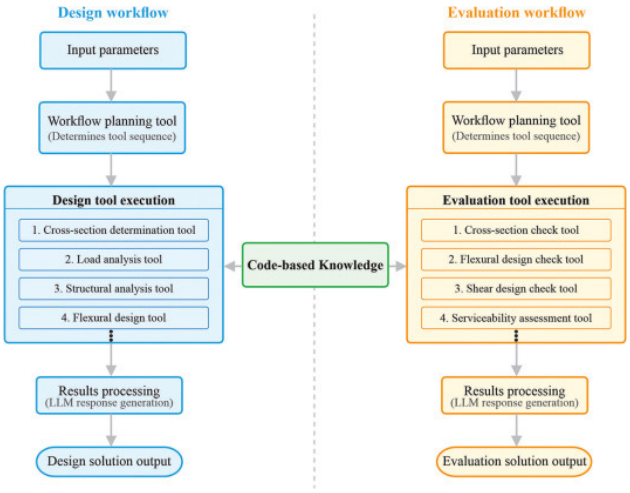
**Dave Wagner** is an experienced Department Director, Project Manager, and an expert in Asset Management Systems, Geographic Information Systems (GIS), and custom application developments for transportation projects. Mr. Wagner has 30 years of project experience for New Jersey public agencies including NJDOT, NJ Transit, DRJTBC, NJDEP, NJ Treasury, counties, and numerous transportation agencies throughout the United States. Mr. Wagner is actively involved in GPI's workforce development efforts. He is involved in recruiting and interviewing prospective talent, along with developing and retaining them once they are part of the GPI Team. He has worked at the ground level with summer interns, as well as the continuous development of project managers and key office staff. Mr. Wagner is a certified Geographic Information Systems Professional (GISP), and also holds a Master of Business Administration (MBA).

**David Kuhn, PE,** serves as Vice President and Director of Philadelphia Operations at GPI while continuing to lead and support projects in New Jersey, including the Strategic Highway Safety Plan and Local Road Safety Plans in South Jersey Counties and Municipalities. Dave's 38 years of experience includes 30 years at NJDOT, where he served as Assistant Commissioner of Capital Investment, Planning and Grant Administration for over seven years.

# Multi-Agent Large Language Model Framework for Code-Compliant Infrastructural Design

Presenter: Jinxin Chen

Organization: Stevens Institute of Technology




## Abstract

Current structural design practices for infrastructure projects rely on time-intensive manual calculations and code compliance verification, creating bottlenecks in project delivery and potential for human error. This research presents a multi-agent Large Language Model (LLM) framework that automates code-compliant infrastructural design while maintaining interpretability and verifiability which is essential requirements for infrastructure applications.

The framework employs specialized LLM agents coordinated through task distribution: a Task Dispatcher routes design queries to dedicated Design and Evaluation agents, which interface with deterministic calculation tools programmed according to structural design codes. An Expert Consultation agent enables iterative refinement through natural language interaction, supporting the design optimization process. Case studies on reinforced concrete beam design demonstrated exceptional performance: 97% accuracy compared to industry-standard software (SAP2000), 90% time reduction compared to traditional methods, and complete transparency through step-by-step calculations with explicit code references. Statistical validation across 30 design cases showed Mean Absolute Percentage Error below 3% for critical structural parameters.

The framework's modular architecture enables adaptation to various infrastructure applications by incorporating different design codes and specialized calculation modules. Engineers can specify requirements in natural language while receiving compliant solutions with detailed explanations, facilitating rapid design iteration and supporting workforce development through transparent educational content. This research demonstrates an approach to infrastructure design automation that preserves engineering judgment while eliminating routine calculation tasks. The framework represents a significant step toward preparing the engineering workforce for AI-enhanced infrastructure development.

**Jinxin Chen** is a PhD candidate in Civil Engineering at Stevens Institute of Technology, specializing in the integration of artificial intelligence and machine learning into structural design and infrastructure applications. His research focuses on developing automated design tools that enhance workforce efficiency while maintaining engineering rigor and code compliance. Mr. Chen has authored multiple peer-reviewed publications on computational methods in structural engineering, including work on machine learning for ultra-high-performance concrete and AI-assisted design frameworks. His current research on large language model frameworks for infrastructure design aims to streamline project delivery while supporting knowledge transfer and workforce development in the engineering profession.

RUTGERS–NEW BRUNSWICK
Center for Advanced Infrastructure and Transportation
School of Engineering

# Introducing Transportation Careers to Youth in NJ

## Building NJ's Transportation Employment Pipeline

The Rutgers Employment Success Program (RESP) provides workplace readiness and pre-apprenticeship training from experienced staff to young people throughout New Jersey — using transportation and infrastructure to create bridges to youth employment tailored to the unique, local needs of youth and the transportion industry here in New Jersey.

## Our Programs

RESP runs multiple apprenticeship and workforce training programs that are aimed at helping youth and young adults enter the local transportation industry. RESP directs participants into one of the following programs where they receive specialized training related to:

**BRIDGES** sponsored by NJDOL, connects youth aged 16-24 with career development opportunities.

**EDC-7** RESP staff are researching youth workforce centers nationwide as part of a UTC project to identify and develop a set of best practices.

**Auto Tech** conducted pre-apprenticeship training with NJDOL preparing participants to enter the automotive industry.

**Heavy Equipment** conducted pre-apprenticeship training with NJDOL introducing youth to the heavy equipment operator career path.

**Continuing Ed** RESP partners with NJ community colleges to connect youth participants with opportunities to further their education.

## Our Impact

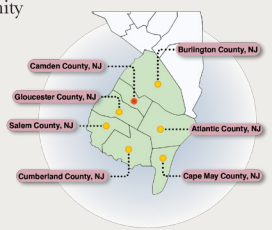
**755**

Youth and young adults served over the last 4 years. Highlights include auto technician and heavy equipment operation pre-apprenticeship training programs with 80 youth participants and graduates, many of them also taking their first college courses.

## Grassroots Approach

Based out of Camden, NJ, RESP is active throughout South Jersey. RESP staffare involved in the communities they serve, visiting local schools and community centers to provide workforce development services including:

- Return to School
- College Prep
- Job & Apprenticeship Attainment
- Construction Workforce Development




## Involving Community and Industry Partners

**Agency:**
NJDOL, NJ TRANSIT, NJDOT
**Community:**
African American Chamber of Commerce, NJ Youth Services Commission
**Industry/Academia:**
Amalgamated Transit Union, NuPath, NJ Community College Consortium

# From Data to Decisions: Engineering Intelligence for AI-Enabled Bridge Maintenance and Work Force Excellence

STEVENS INSTITUTE OF TECHNOLOGY

Presented at NJDOT 2025 Research showcase by: Indira Prasad, Department of Civil, Environmental and Ocean Engineering, Stevens Institute of Technology, iprasad@stevens.edu Research Advisor: Dr. Yi Bao

POSTERS

## Abstract

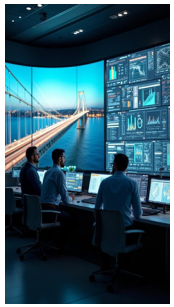
Bridge inspection is entering a new era of engineering intelligence, powered by Artificial Intelligence (AI) tools that transform raw data into actionable insights. This poster showcases AI-enabled workflows that automate defect detection, prioritize inspection zones, and predict structural deterioration using machine learning, computer vision, natural language processing (NLP), and digital twin modeling.

It highlights recent innovations in robotics, sensor fusion, and real-time data acquisition that enhance inspection precision and scalability. Technical challenges—such as data heterogeneity, model transparency, and integration with legacy systems—are addressed through modular frameworks and adaptive analytics. Instead of replacing human engineers, AI acts as a powerful tool that automates data collection and analysis, which allows inspectors to focus on high-level decision-making and complex problem-solving.

Designed for engineers and researchers, this poster offers a visual walkthrough of AI applications in bridge maintenance, including annotated workflows, tool comparisons, and performance metrics. It emphasizes how engineering intelligence can streamline operations, reduce risk, and support smarter infrastructure decisions—laying the groundwork for scalable, resilient systems in the AI era.

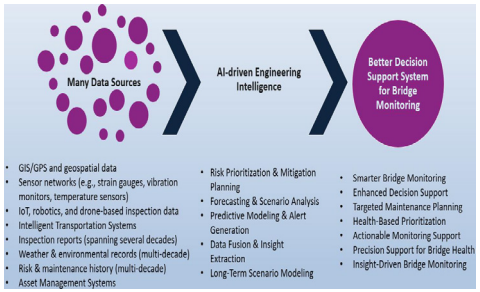
## Smarter Maintenance, Stronger Infrastructure

Integrating **AI and engineering intelligence** into bridge maintenance is transforming traditional practices. By strategically applying data analytics and machine learning, organizations can transform raw inspection data into actionable insights, enabling the early prediction of structural issues, enhancing safety, and streamlining operations. This data-driven approach fosters continuous improvement and empowers the workforce through targeted training and support systems. Engineering intelligence not only optimizes maintenance workflows but also elevates team performance, ensuring infrastructure management adapts to evolving demands with precision and resilience. Ultimately, this modernized strategy drives effective resource allocation and supports a sustainable maintenance model that prioritizes public safety and long-term infrastructure health.



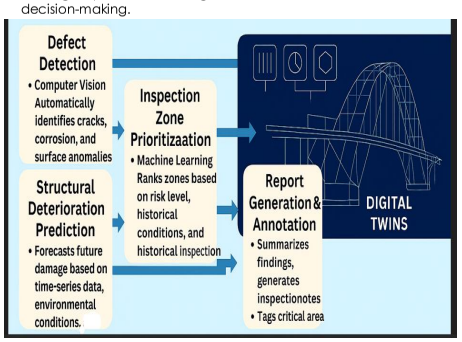
## Harnessing AI & Engineering Intelligence

Bridges are monitored using diverse data sources—from sensors and inspection reports to drone imagery and environmental records. AI-powered analytics and engineering intelligence transform this data into actionable insights that support risk mitigation, forecasting, and long-term planning. The result: smarter, more precise decisions that enhance safety, optimize maintenance, and strengthen infrastructure resilience.




## AI-Enabled Workflows for Bridge Maintenance

This section illustrates how AI transforms raw inspection data into actionable insights through a multi-step workflow. Each stage leverages specific technologies to automate and enhance decision-making.




## Human-AI Synergy

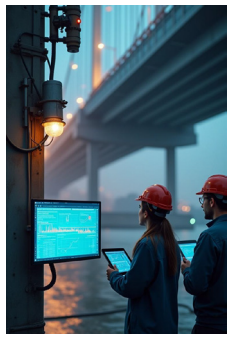
Effective human–AI collaboration is essential for optimizing bridge maintenance workflows. These models leverage the strengths of human judgment and AI capabilities through structured interaction frameworks that ensure informed, accurate decision-making. By integrating AI-driven insights with field expertise, organizations can enhance problem-solving efficiency, reduce errors, and foster an adaptive culture that embraces innovation and continuous improvement.

Focused training programs are key to equipping the workforce with essential AI competencies. Covering domains such as data analytics, machine learning, and intelligent system design, these programs combine hands-on experience, mentorship, and real-world applications. This investment cultivates continuous learning, strengthens individual capabilities, and drives organizational productivity in an increasingly competitive infrastructure landscape.

By combining advanced AI techniques with deep engineering insight, infrastructure monitoring evolves from reactive maintenance to proactive intelligence. This synergy enables predictive modeling, risk prioritization, and scenario planning—turning multi-source data into precision decisions that safeguard bridge health and resilience.

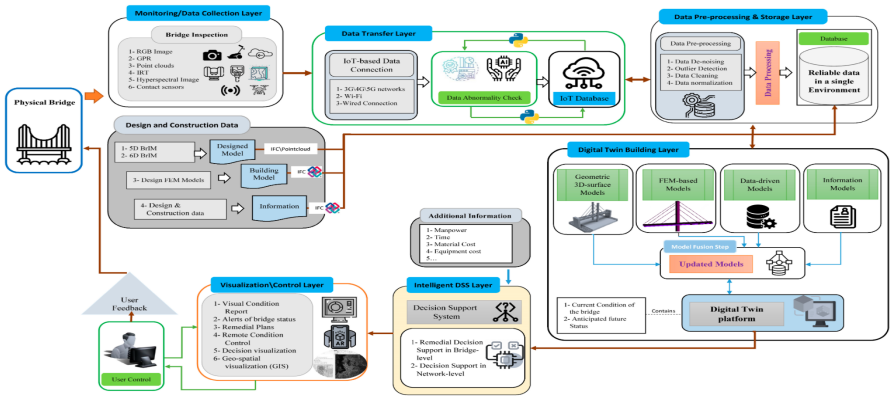
## Data Collection and Sensor Integration

Utilizing **advanced sensors** and IoT devices allows for comprehensive and continuous monitoring of bridge conditions. These systems provide real-time data on structural integrity, traffic loads, and environmental factors, which are critical for assessing the health of infrastructure. By enabling proactive maintenance strategies, organizations can identify potential issues early, reducing repair costs and extending the lifespan of bridges. This shift towards *smart infrastructure* enhances not only safety but also operational efficiency in bridge management.



## Transformative Innovations in Bridge Inspection

**Digital Twin Integration**: Synchronizes real-time inspection data with virtual bridge models to simulate deterioration, plan interventions, and optimize maintenance strategies. By mirroring physical bridge conditions in a virtual environment, digital twins support proactive planning and resource optimization.




## Empowering the Inspection Workforce

AI tools are only as effective as the teams that use them. Focused training in data interpretation, digital twin systems, and intelligent workflows equips inspectors to act confidently on AI-generated insights. Hands-on experience, mentorship, and real-world applications foster continuous learning and strengthen individual capabilities. This human-centered approach ensures sustainable technology adoption, enhances decision-making, and drives productivity across bridge maintenance operations.

**AI-Enabled Innovations in Bridge Maintenance**

## Human-AI Collaboration in Bridge Inspection

**Toward Scalable Intelligence Across Civil Infrastructure Systems**

From field notes to predictive models, bridge inspection is evolving into a collaborative dialogue-where human judgment and AI-powered systems converge to safeguard our infrastructure with clarity and care.

| Capability | Human Expertise | AI Systems | Collaborative Outcome |
|---|---|---|---|
| Visual Interpretation | Context-rich judgment, nuanced perception | Consistent image analysis, anomaly detection | Enhanced defect recognition with contextual insight |
| Risk Prioritization | Experience-based decision-making | Predictive modeling from historical data | Balanced urgency and data-driven foresight |
| Planning & Adaptation | Responsive to site conditions | Pattern-based optimization | Agile, efficient workflows |
| Communication & Reporting | Narrative clarity, Stakeholder engagement | Auto-generated summaries, annotation tools | Clear, timely documentation |
| Learning & Evolution | Tacit knowledge, mentorship | Continuous model updates | Mutual growth and system improvement |

## Looking Ahead

As bridge maintenance evolves into a data-driven discipline, the integration of AI tools demands not only technical precision but also thoughtful collaboration— where engineering intelligence guides innovation toward scalable, trustworthy outcomes. These tools are increasingly embedded across the maintenance lifecycle, and their responsible use requires recognizing key challenges, applying mitigation strategies, and focusing on outcomes that reinforce engineering judgment and public trust.

| Lifecycle Phase | AI Tools | Challenges | Mitigation Strategies | Outcome |
|---|---|---|---|---|
| Data Collection | Computer Vision, IoT Sensors | Inconsistent data quality, environmental noise | Sensor calibration, multi-modal capture | Rich, real-time data for early issue detection |
| Data Integration | Data Fusion, Cloud Platforms | Format mismatch, siloed systems | Standardized schemas, API bridges | Unified datasets enabling holistic analysis |
| Analysis & Prediction | ML Models, Predictive Modeling | Overfitting, lack of interpretability | Expert-guided tuning, explainable AI | Accurate forecasts and risk prioritization |
| Decision Support | Optimization Algorithms, Risk Scoring Tools | Misaligned priorities, opaque logic | Transparent criteria, stakeholder input | Informed, balanced maintenance planning |
| Reporting | NLP, Auto-summarization Tools | Loss of nuance, generic language | Human editing, narrative enrichment | Clear, timely communication with stakeholders |

# Developing a Sensor-Based Mapping System for Soil Characterization

Ayodeji Aderibigbe*, Oladoyin Kolawole

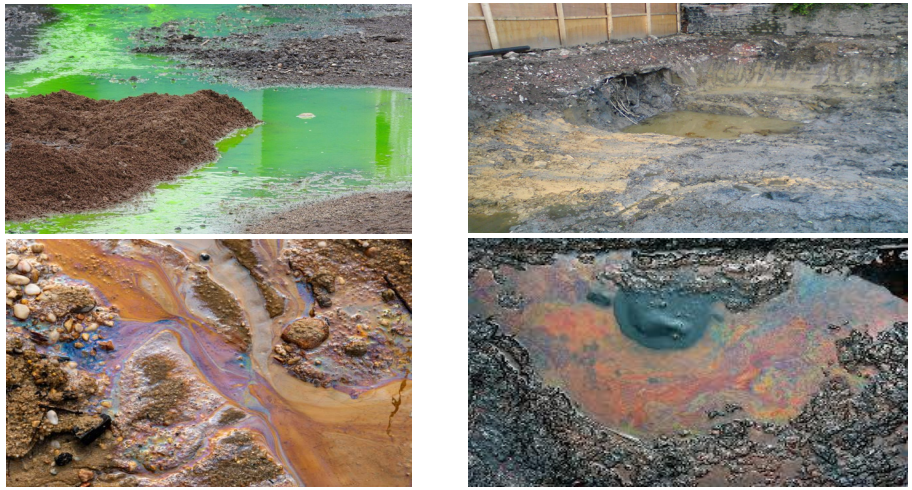
*ada49@njit.edu

*Department of Civil and Environmental Engineering, New Jersey Institute of Technology (NJIT)*

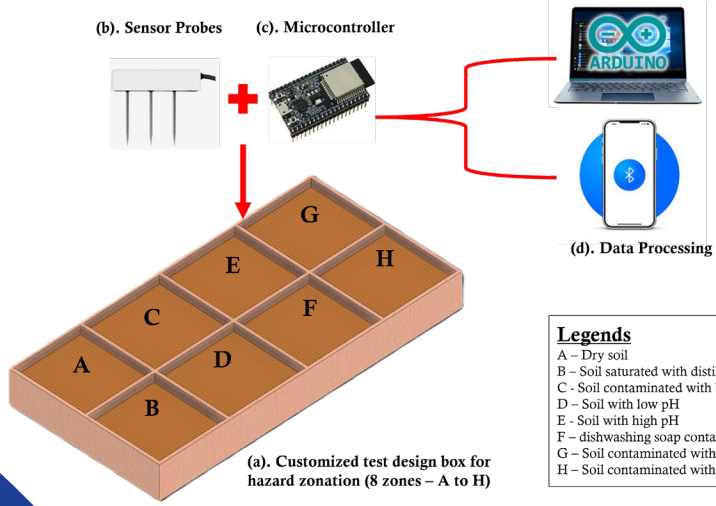
POSTERS

## BACKGROUND & MOTIVATION

Polluted Soils



## METHOD



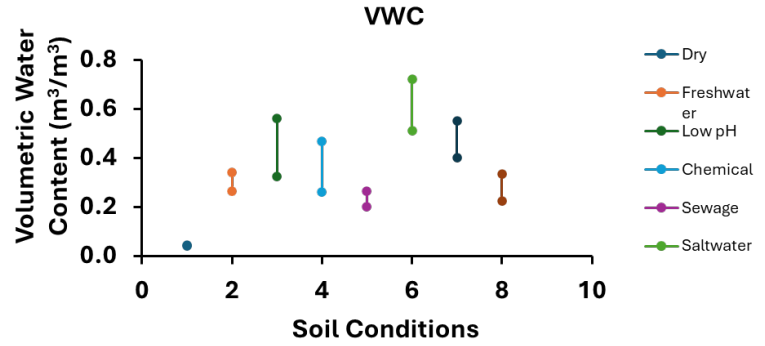

(a). Customized test design box for hazard zonation (8 zones – A to H)

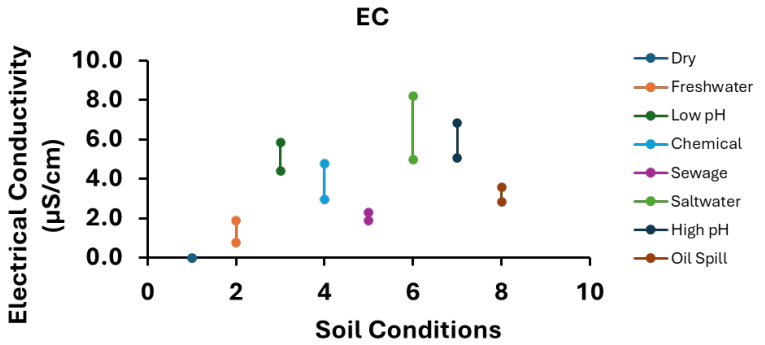
- Customized soil test box divided into 8 contamination zones.
- Contaminants: dry soil, freshwater, saltwater, high pH, low pH, oil, sewage, & chemical solution.

**Legends**

A – Dry soil
B – Soil saturated with distilled water
C - Soil contaminated with brine
D – Soil with low pH
E - Soil with high pH
F – dishwashing soap contaminated Soil
G – Soil contaminated with oil spill
H – Soil contaminated with sewage

## RESULTS




## CONCLUSIONS

- The sensor-based proofing system effectively detects and differentiates soil contaminants.
- It generates accurate contaminant maps with geotechnical relevance and demonstrates potential for real-world soil geohazard mapping.

## ACKNOWLEDGMENT

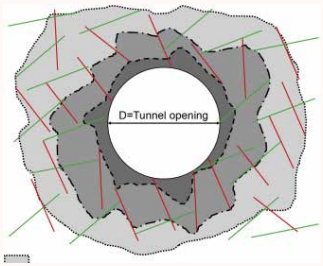
We would like to thank the Collaborative Early Research Translation (CERT) and the New Jersey Institute of Technology (NJIT) Collaborative Research and Innovation Strategic Partnership (CRISP) for their support for this work.

# Rock Mass Grouting for Coastal Infrastructure

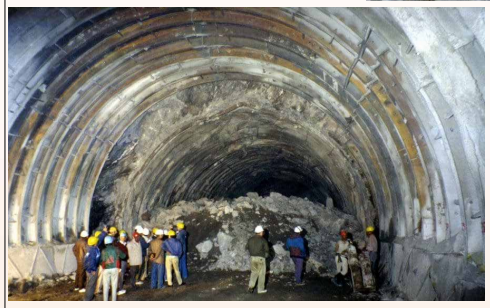
**Matthew O. Sonibare, Oladoyin Kolawole**

*John A. Reif Jr. Department of Civil and Environmental Engineering, New Jersey Institute of Technology, (NJIT)*

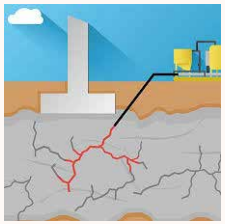
## BACKGROUND AND MOTIVATION



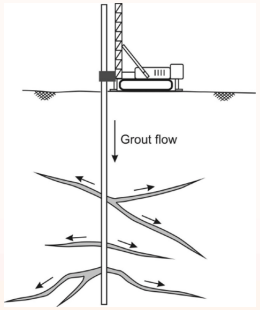
Problem ??



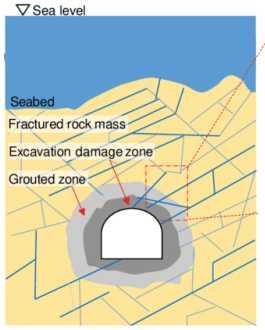
Rock grouting to fill cracks in rocks

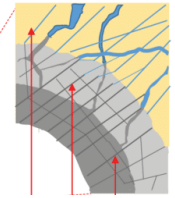


*Interaction with saline water in coastal areas may have an impact on the efficiency of the grouting process*

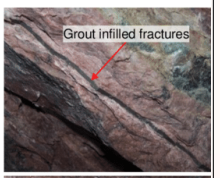


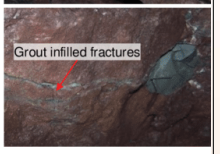

fluid is injected to fill cracks in rocks



Grouting of rocks improves the strength and reduces the permeability of rocks



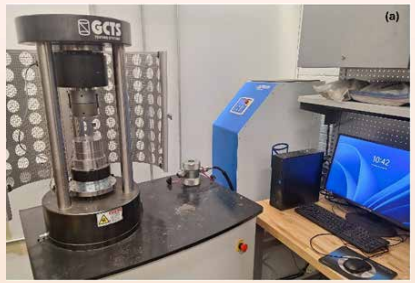




## TESTING PROCEDURE

Fractures were induced on the transverse section of the rock core specimens

The fractured rocks were grouted

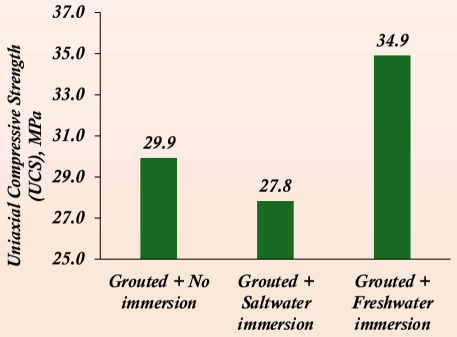
Grouted rocks were immersed in saltwater and freshwater for 45 days

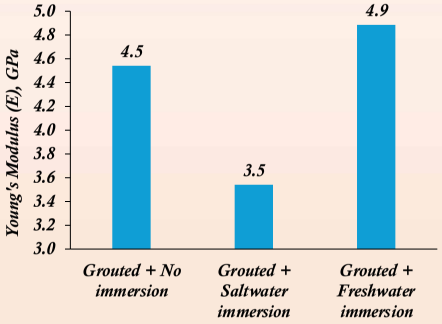



Uniaxial compression test is carried out to determine the rock properties

***The mechanical properties of grouted rocks with interaction with saltwater and freshwater were determnied***

## RESULTS AND CONCLUSIONS




- Interaction with saltwater reduces grouting efficiency in fractured rocks
- Interaction with freshwater increases grouting efficiency in fractured rocks

# Electric Curing of Concrete: Methodology, Validation, and Field Scale-Up

RowanUniversity
CENTER FOR RESEARCH & EDUCATION IN ADVANCED TRANSPORTATION ENGINEERING SYSTEMS

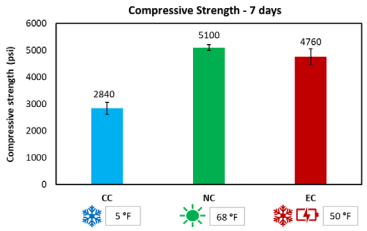
Rim Najmeddine[1], Mohamed Masbouba[1], Shahriar Abubakri[1], William Riddell[1], Islam Mantawy[1], Benjamin Watts[2], Seth Wagner[2]

[1]Rowan University, [2]US Army Corps of Engineers

CRREL ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

## INTRODUCTION

- Curing concrete in subzero temperatures slows hydration, reducing strength by up to 50% and increasing microcracking risk. Electric curing offers an efficient alternative by generating internal heat through the Joule effect, but its field use remains limited by cost, safety, and scalability challenges.

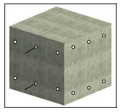


Freeze-Induced Damage in Concrete

Coupal, J. (2015, January 22). Practical advice for pouring concrete walls in cold weather – Boston, MA. A-1 Foundation Crack Repair, Inc.

## OBJECTIVES

This research introduces an Electrically Controlled Reinforced Concrete (ECRC) system that:



- Uses reinforcement steel as embedded electrodes for uniform heating.
- Employs a low-voltage thermostat-based controller for self-regulating temperature.
- Develops a scalable energy-balance theoretical model that enables prediction of the electrical power demand for curing concrete elements of any size or geometry under real field conditions.

## THEORETICAL FRAMEWORK

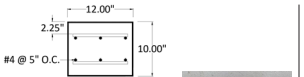
The ECRC model is based on energy exchange principle between generated heat and heat losses.

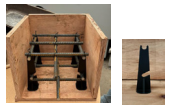
- Joule Heating: $W_E = \frac{U^2 t}{R}$
- Heat Loss: $W_c = Ah(T - T_r)t$
- Required Heat: $Q = mc(T_f - T_0)$

$$\rho WLDc\frac{dT_c}{dt} = \frac{V^2}{rL} + \dot{q}_{HoH}WLD - WLh\Delta T_{conv}$$

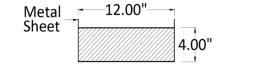
## EXPERIMENTAL SETUP

- Concrete slabs (12″ × 12″ × 10″) were cast and instrumented to evaluate the heating performance of the ECRC system.



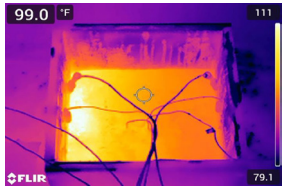
10″ THK. Slab
Rebar mesh used as electrodes

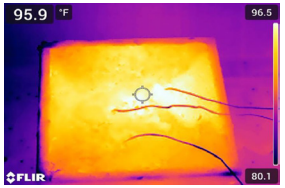


4″ THK. Slab
Metal sheet used as electrodes

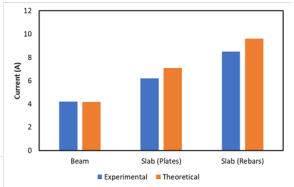
## RESULTS

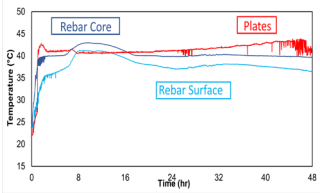
- Both electrode setups increased concrete temperature—plates produced side-dominant heating, while rebars achieved uniform heating throughout the slab.




- The theoretical model accurately predicted the current required for heating, with experimental values within ±1 A of predictions.




- Rebars provided uniform heating even without carbon fiber (0% CF), whereas plate electrodes required 0.5% CF to reach similar temperatures.

## RESEARCH OVERVIEW

**Phase I – Beam Experiment Data**

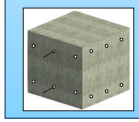
- Laboratory-scale beam specimens.
- Conducted in cold chamber (–15 °C).
- Studied temperature and electrical behavior under realistic cold-curing conditions.
- Output → foundational data for model development

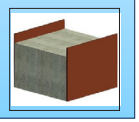
**Theoretical Model**

- Developed an energy-balance model linking electrical input and thermal response.
- Parameters include Joule heat generation, conductive/convective losses, and time-varying resistivity
- Output → predicted current required for stable curing

**Scale-Up Application (Slab)**

- Concrete slabs (12″×12″×10″) tested in lab from 20–40 °C.
- Two configurations: plate vs. rebar electrodes.
- Rebar system achieved 40 °C even at 0 % CF, plates required CF.
- Output → validated model under scaled-up, practical geometry.





**Model Validation**

- Compared predicted vs. experimental currents (± 1 A agreement)
- Verified performance using Phase I beam (cold chamber) and Phase II slab data
- Output → model confirmed scalable and accurate for field-scale implementation

## CONCLUSION AND ONGOING WORK

**Conclusion:**

The ECRC system provides an efficient and low-cost solution for cold-weather concrete curing. By using existing reinforcement as embedded electrodes, it removes the need for conductive additives like carbon fiber or complex heating setups. This simple integration reduces material and installation costs while ensuring uniform heat distribution. The scalable energy-balance model further allows accurate prediction of the required current or power for any structural size, making the system practical and field-ready.

**Ongoing work:**

- Conduct microstructural studies to assess effects of electric curing on concrete structure.
- Examine rebar durability and conductivity after heating.
- Perform numerical simulations to examine heat and temperature distributions within Large-Scale slabs and complex structural elements.

## Acknowledgement

This material is based upon work supported by the Broad Agency Announcement Program and the U.S. Army Engineer Research and Development Center (ERDC) under Contract No. W913E523C0007. Any opinions, findings and conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Broad Agency Announcement Program and the U.S. Army Engineer Research and Development Center (ERDC).

# Electric Curing of Concrete at Subfreezing Temperature (Lab Scale)

Mohamed Masbouba[1], Rim Najmeddine[1], Shahriar Abubakri, Ph.D.[1], Islam Mantawy, Ph.D., P.E.[1], Danielle Kennedy[2], Benjamin Watts Ph.D.[2]
[1]Rowan University, [2]US Army Corps of Engineers

RowanUniversity
CENTER FOR RESEARCH & EDUCATION IN ADVANCED TRANSPORTATION ENGINEERING SYSTEMS

CRREL ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

## Background & Objectives

♦Making concrete in cold climates is challenging, as low temperatures negatively affect hydration and strength development, while admixtures alone fail to prevent freezing.

♦The study evaluates the effectiveness of electric curing of concrete beams under subfreezing conditions.

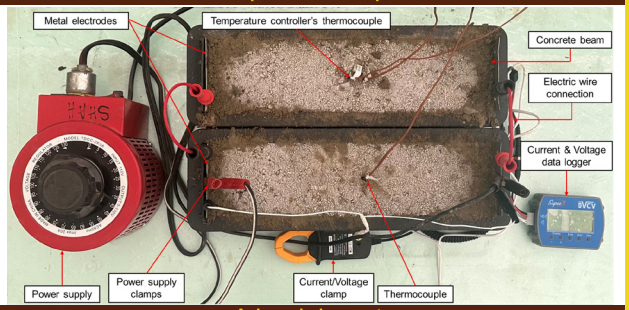
♦It investigates the influence of cold-weather admixtures and conductive fillers on the electrical and thermal performance of concrete.

♦The economic feasibility of the lab-scale setup is assessed and the process is scaled up to field application to evaluate its practical implementation.

## Mix Design Proportions

| Mix label | Cement (lb/yd³) | Fly ash (lb/yd³) | Water (lb/yd³) | Sand (lb/yd³) | Coarse Aggregate (lb/yd³) | CF (% by volume) | SF (% by volume) | HRWR (oZ/cwt) | AEA (oZ/cwt) | CI 30 (gal/yd³) | FP 20 \ (oZ/cwt) | Air Content (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | 356 | 356 | 340 | 1445 | 857 | 0.5 | - | 6.54 | 0.37 | - | - | 5 |
| II | 356 | 356 | 340 | 1445 | 857 | 0.5 | 0.5 | 6.54 | 0.62 | - | - | 8 |
| III | 356 | 356 | 263 | 1445 | 857 | 0.5 | - | 6.54 | 0.15 | 3.53 | 75 | 6 |
| IV | 356 | 356 | 263 | 1445 | 857 | 0.5 | 0.5 | 6.54 | 0.15 | 3.53 | 75 | 5.6 |

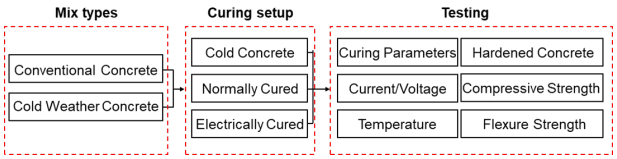
## Experimental Setup




## Acknowledgement

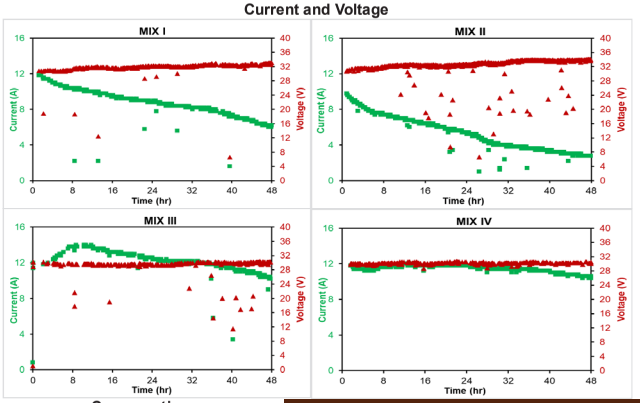
This material is based upon work supported by the Broad Agency Announcement Program and the U.S. Army Engineer Research and Development Center (ERDC) under Contract No. W913E523C0007. Any opinions, findings and conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Broad Agency Announcement Program and the U.S. Army Engineer Research and Development Center (ERDC).

## Methodology

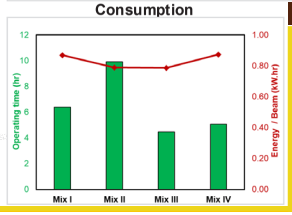



## Results

### Current and Voltage




### Consumption

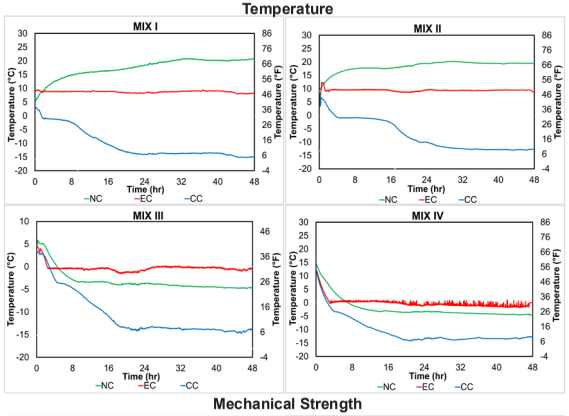



## Conclusion

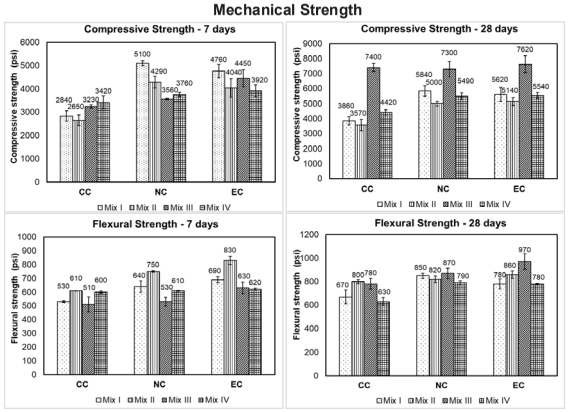
- Electric curing effectively enhances early-age strength of concrete in subfreezing conditions, achieving up to **41% higher compressive strength** than cold cured samples.
- **Cold-weather admixtures** stabilized resistivity and prevented frost damage.
- Steel fibers improved flexural performance.
- With an average energy use of **211 kW·hr/m³**, electric curing offers a **practical, efficient, and scalable solution** for durable concrete in cold climates.

## Results

### Temperature




### Mechanical Strength



POSTERS

# Microwave Heating for Concrete Demolition: Experimental and Empirical Study


RowanUniversity
CENTER FOR RESEARCH & EDUCATION IN ADVANCED TRANSPORTATION ENGINEERING SYSTEMS

CRREL ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

Mehdi Roshanbin[1], Shahriar Abubakri[1], Gilson Lomboy[1], Benjamin Watts[2], Seth Wagner[2]

[1]Rowan University, [2]US Army Corps of Engineers


## RESEARCH FRAMEWORK

### BACKGROUND

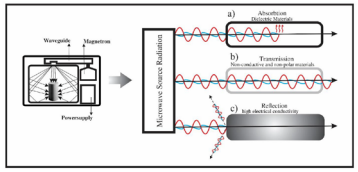
•Traditional demolition (breaking, blasting, chemicals) causes noise, dust, safety risks, and high costs.
•Need for safer, eco-friendly, and efficient methods has led to microwave-based demolition.
•Microwaves create hot spots, cracks, and aggregate separation, enabling selective demolition and recycling.
•Unlike traditional methods, microwaves reduce explosives, dust, and energy use, while improving safety and recycling.
•This study examines key factors (w/c ratio, sample size, power) and develops a predictive model for controlled microwave demolition.

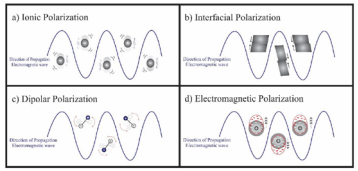
### OBJECTIVES

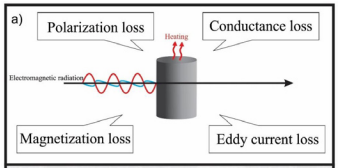
•Establish dataset on microwave–concrete interactions (w/c, size, power).
•Measure penetration depth under moisture and boundary conditions.
•Calibrate thermal imaging with MATLAB correction.
•Develop predictive equation with machine-learning absorption factor ($I_m$).
•Validate model ($R^2 > 0.94$) across mixes and sizes.
•Provide guidance for selective demolition and recycling

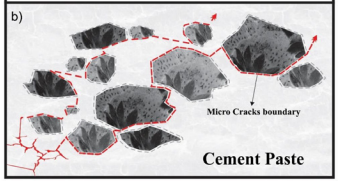
### METHODS

•Prepared concrete mixes with w/c = 0.36, 0.43, 0.50.
•Cast cylindrical samples (2×4, 3×6, 4×8 in.) and cured 28 days.
•Exposed specimens to microwaves at 300, 600, 1000 W.
•Recorded temperatures with thermocouples and thermal camera.
•Improve data using MATLAB code for accuracy.
•Developed and validated a predictive equation for heating behavior.



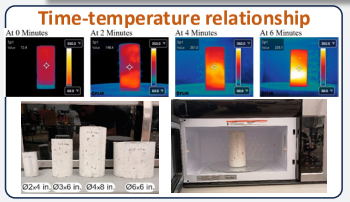



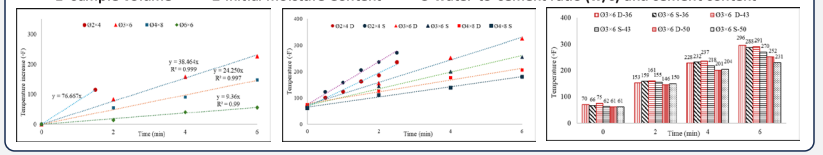

## RESULTS

### Time-temperature relationship

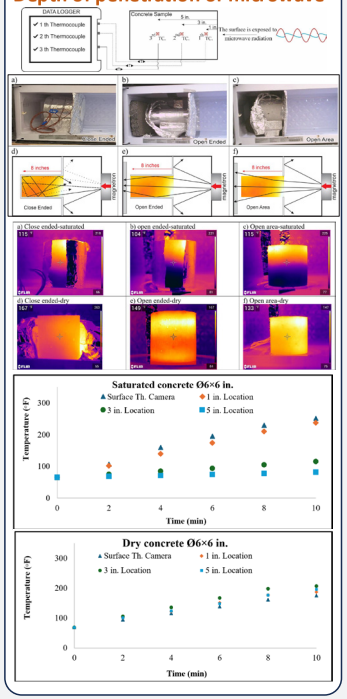



### Effect of microwave heating on

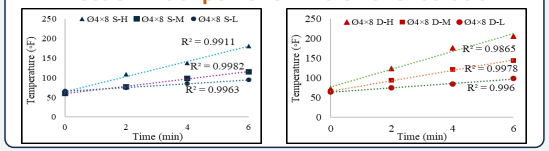
1- sample volume | 2-initial moisture Content | 3-water-to-cement ratio (w/c) and cement content




### Depth of penetration of microwave




### Effect of initial power of microwave radiation

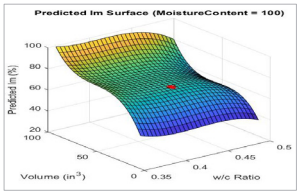



| Mix ID | Cement (lb/yd³) | water (lb/yd³) | Sand (lb/yd³) | Gravel (lb/yd³) | w/c ratio | ΔLA 90 (lf. oz) | Slump (in) | Air (%) | Compressive Strength (psi) |
|---|---|---|---|---|---|---|---|---|---|
| I36 | 871.6 | 313.8 | 1325.2 | 1291.0 | 0.36 | 8.5 | 4.5 | 7.6 | 6090 |
| I43 | 656.7 | 282.4 | 1587.1 | 1291.0 | 0.43 | 5.6 | 3.3 | 8.9 | 4510 |
| I50 | 575.1 | 287.6 | 1641.9 | 1291.0 | 0.50 | 3.8 | 5.1 | 8.5 | 3940 |

### Temperature Prediction Model and Validation

$$T_2 = T_1 + \frac{P \times t \times I_m}{mc_{concrete} + mc_{water}}$$

•The developed equation predicts the temperature rise in concrete under microwave exposure by combining microwave power, heating time, material mass, and a newly introduced absorption coefficient ($I_m$). This coefficient captures the effects of w/c ratio, sample size, and moisture, making the model adaptable to different conditions. Validation against experiments ($R^2 > 0.94$) confirmed its accuracy, offering a reliable tool for controlled demolition and recycling applications.




The microwave absorption coefficient ($I_m$) captures the combined effects of w/c ratio, size, and moisture on heating efficiency. It enables accurate prediction of concrete temperature under microwave exposure.

### CONCLUSION

Microwave heating of concrete is influenced by specimen size, w/c ratio, moisture, and power level. Dry samples allowed deeper penetration, while saturated small ones often cracked due to steam pressure. Lower w/c mixes heated faster. A new absorption coefficient ($I_m$) captured these combined effects, and the model achieved high accuracy ($R^2 > 0.94$) with MATLAB corrections, showing strong potential for selective demolition.


### Acknowledgement

This material is based upon work supported by the Broad Agency Announcement Program and the U.S. Army Engineer Research and Development Center (ERDC) under Contract No. W913E523C0007. Any opinions, findings and conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Broad Agency Announcement Program and the U.S. Army Engineer Research and Development Center (ERDC).

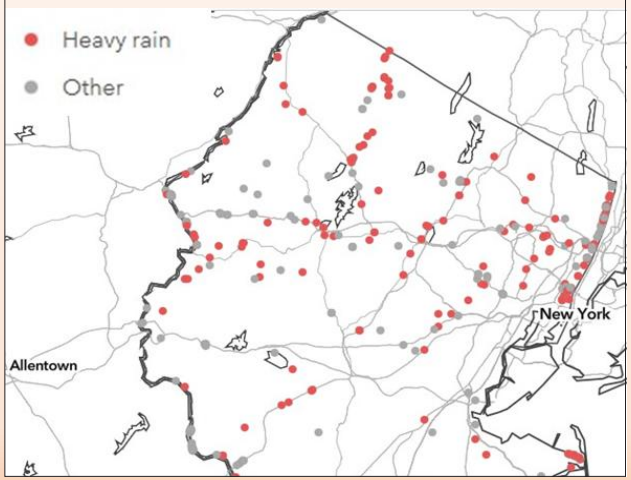
# Protecting Critical Infrastructure: Combined Seismic-Rainfall Landslide Assessment and Advanced Stabilization Technologies for New Jersey Transportation Corridors

Prabhakar Khadka* and Oladoyin Kolawole
*pk734@njit.edu
*Department of Civil and Environmental Engineering, New Jersey Institute of Technology (NJIT)*

POSTERS

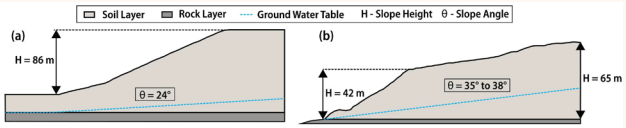
## BACKGROUND AND MOTIVATION

- Landslides threaten lives and critical infrastructures.
- Transportation networks face heightened vulnerability to slope failures.
- Climate change intensifies extreme rainfall events in coastal regions like New Jersey.
- New Jersey sits in a moderate seismic zone, often overlooked in slope analysis.
- Combined rainfall-seismic effects on slope stability remain understudied using New Jersey as case study.




*Slope Failures in New Jersey due to Rainfall*

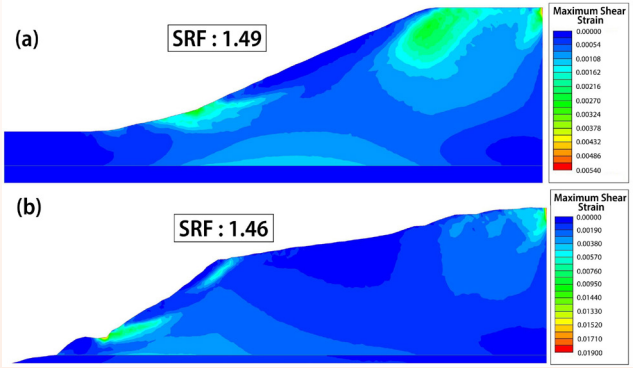
## MATERIALS AND METHODS



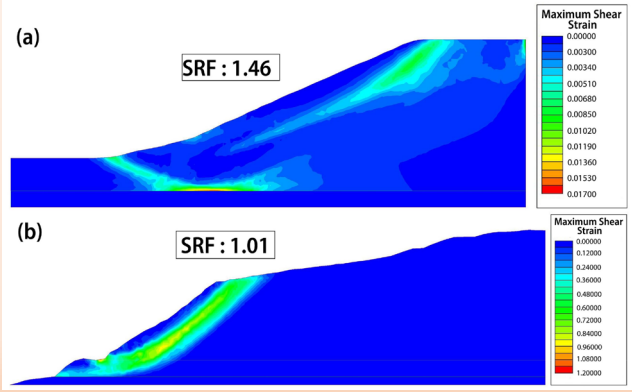

*Geometry of studied slope*

- Slope stability analysis of two unique slopes in New Jersey area
- Effect of Rainfall and Seismicity on these slopes using Finite Element Modeling (FEM).

## RESULTS & DISCUSSION

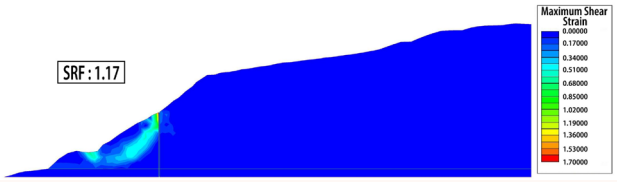



*Maximum shear strain developed (Before)*




*Maximum shear strain developed (After)*

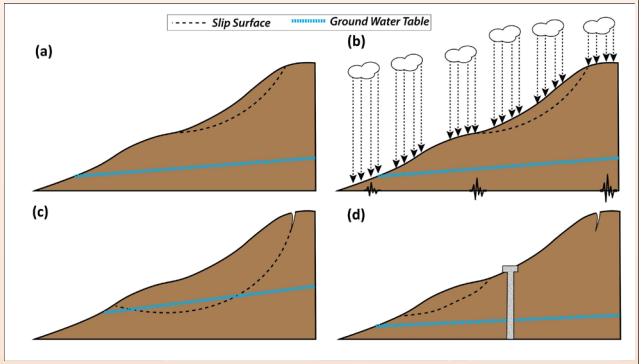
- Higher saturation of soil mass due to water infiltration leading to reduced soil strength
- Combined earthquake and rainfall can accelerate the slope failure process.




*Maximum shear strain developed (After installing Pervious Concrete Pile)*

## CONCLUSION

- Proposed method for slope protection works yielded an improvement in safety factor of up to +16% along critical New Jersey transportation networks.
- For the weaker slope adjacent to major highways and rail lines, change in safety factor can be substantial (up to -31%) under extreme weather conditions, threatening transportation network reliability.
- Combined seismic-rainfall landslide assessment should be adopted to mitigate hazards that can disrupt and destroy the transportation network.




*Schematic representation of the proposed slope stabilization method*

# Integrated Evaluation of Distracted Driving and Seatbelt Non-Use Among Truck Drivers in New Jersey: Insights from Field Observations and Crash Data Analytics

RowanUniversity
CENTER FOR RESEARCH & EDUCATION IN ADVANCED TRANSPORTATION ENGINEERING SYSTEMS

Md Sadman Islam[1], Ahmed Imtiaz Zamee[2], and Mohammad Jalayer (Ph.D.)[1]

[1]Department of Civil and Environmental Engineering, Rowan University, Glassboro, NJ

RowanUniversity
CENTER FOR RESEARCH & EDUCATION IN ADVANCED TRANSPORTATION ENGINEERING SYSTEMS

## Background

- The trucking industry plays a vital role in supporting the U.S. economy by moving over 70% of the cargo volume
- However, due to the large size and operational demands, crashes involving trucks often lead to fatalities
- Distracted driving and seatbelt non-compliance are two major contributing factors to crash severity
- According to NHTSA, in 2022, 3,308 deaths and 289,310 injuries were recorded due to driver distraction, with FMCSA reporting that 7–8% of these fatal crashes involved large trucks
- Fatality rates for seatbelt non-use for truck drivers are more than 5 times higher compared to all other drivers
- Around 51% fatal crashes for all vehicles could have been prevented if the driver had been wearing seatbelts

## Objectives

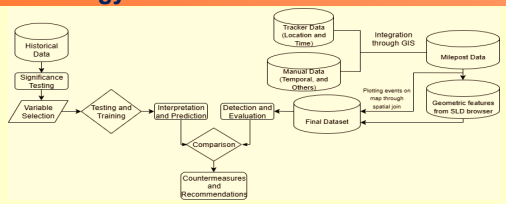
- Identify distracted driving and seatbelt non-use incidents for truck drivers using innovative methods
- Determine the influencing factors for truck-involved crashes based on temporal and geometric features, roadway and vehicle types, weather conditions, and driver behavior

## Data Collection

- More than 315 hours of video data were recorded across 22 high-risk corridors in New Jersey using the floating car method
- More than 111 hours of video data were recorded using the static camera method
- Historical crash data (2016-2022) for 3,071 large truck crashes were obtained from the NJ CAT database

Figure 1: Data collection using floating car (Left), and static camera (Right)

## Methodology




## Results

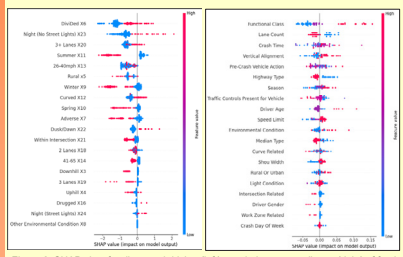


Figure 2: SHAP plots for distracted driving (left); seatbelt non-compliance (right) of fatal crashes for large trucks

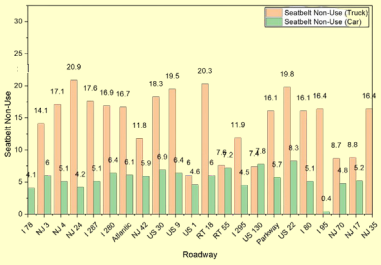



Figure 3: Route-based comparison for the seatbelt non-use

Table 2: Seatbelt non-compliance rate for instate and out of state

| Type | State | Seat Belt Compliant | Seat Belt Noncompliant | Total | Noncompliance (%) |
|---|---|---|---|---|---|
| Truck | In State | 1829 | 632 | 2461 | 25.6 |
| Truck | Out State | 1464 | 383 | 1847 | 20.7 |
| Car | In State | 39134 | 2284 | 41418 | 5.5 |
| Car | Out State | 3923 | 347 | 4270 | 8.1 |

Table 1: Distraction Rates of various classes for temporal and geometric variation

| Temporal/ Roadway Feature | Non-Dist. | Handheld Cellphone | Eating/ Drinking/ Smoking | Receiving Calls | Talking to Passengers | Drowsy | Radio/ Reaching Object | Fidgeting/ Grooming | Distraction Rate |
|---|---|---|---|---|---|---|---|---|---|
| Distraction Rates (%) (T=Truck, NT= Non-Truck) | | | | | | | | | |
| **Day of Week** | | | | | | | | | |
| Weekday (T) | 82.7 | 5.0 | 4.6 | 1.4 | 0.3 | 0.2 | 2.4 | 3.4 | 17.3 |
| Weekday (NT) | 77.8 | 7.3 | 3.8 | 1.7 | 0.6 | 0.5 | 2.2 | 6.1 | 22.2 |
| Weekend (T) | 80.3 | 4.5 | 4.9 | 1.6 | 0.6 | 1.3 | 2.9 | 3.9 | 19.7 |
| Weekend (NT) | 79.1 | 6.4 | 3.5 | 1.3 | 1.8 | 0.5 | 1.8 | 5.6 | 20.9 |
| **Hour of Day** | | | | | | | | | |
| Congestion (T) | 81.3 | 4.9 | 5.1 | 2.1 | 0.5 | 0.5 | 1.9 | 3.7 | 18.7 |
| Congestion (NT) | 77.3 | 7.2 | 4.3 | 1.5 | 1.0 | 0.6 | 2.1 | 6.0 | 22.7 |
| No-Cong. (T) | 82.6 | 4.9 | 4.5 | 1.3 | 0.3 | 0.4 | 2.6 | 3.4 | 17.4 |
| No-Cong. (NT) | 78.5 | 6.9 | 3.5 | 1.6 | 1.0 | 0.5 | 2.1 | 5.9 | 21.5 |
| **Presence of Signal** | | | | | | | | | |
| Signal (T) | 82.3 | 4.5 | 4.8 | 1.0 | 0.3 | 0.3 | 2.9 | 3.9 | 17.7 |
| Signal (NT) | 76.1 | 7.6 | 4.3 | 1.5 | 1.0 | 0.4 | 2.5 | 6.6 | 23.9 |
| No-Signal (T) | 82.4 | 5.1 | 4.5 | 1.7 | 0.3 | 0.5 | 2.2 | 3.3 | 17.6 |
| No-Signal (NT) | 79.8 | 6.5 | 3.3 | 1.6 | 1.0 | 0.5 | 1.8 | 5.5 | 20.2 |
| **Toll** | | | | | | | | | |
| Toll (T) | 81.2 | 5.5 | 4.2 | 1.8 | 0.5 | 0.2 | 2.3 | 4.3 | 18.8 |
| Toll (NT) | 79.8 | 6.3 | 3.4 | 1.6 | 1.1 | 0.5 | 1.7 | 5.6 | 20.2 |
| No-Toll (T) | 82.8 | 4.7 | 4.8 | 1.3 | 0.3 | 0.5 | 2.5 | 3.1 | 17.2 |
| No-Toll (NT) | 77.4 | 7.4 | 3.9 | 1.4 | 1.0 | 0.4 | 2.3 | 6.2 | 22.6 |
| **Season** | | | | | | | | | |
| Winter (T) | 79.6 | 4.5 | 5.7 | 1.6 | 1.2 | 0.5 | 3.1 | 3.8 | 20.4 |
| Winter (NT) | 76.4 | 8.2 | 3.7 | 1.3 | 1.5 | 0.4 | 2.8 | 5.7 | 23.6 |
| Spring (T) | 80.4 | 4.3 | 5.5 | 0.9 | 0.2 | 0.5 | 3.4 | 4.8 | 19.6 |
| Spring (NT) | 76.6 | 6.7 | 4.0 | 1.6 | 1.0 | 0.8 | 2.3 | 7.2 | 23.4 |
| Summer (T) | 84.1 | 5.3 | 3.9 | 1.7 | 0.1 | 0.3 | 1.8 | 2.8 | 15.9 |
| Summer (NT) | 79.9 | 6.7 | 3.6 | 1.5 | 0.8 | 0.5 | 1.6 | 5.4 | 20.1 |
| **Type of Median** | | | | | | | | | |
| Unprotected (T) | 83.9 | 4.1 | 4.7 | 1.1 | 0.3 | 0.3 | 1.6 | 4.1 | 16.1 |
| Unprotected (NT) | 76.3 | 6.9 | 4.4 | 1.6 | 1.0 | 0.4 | 2.8 | 6.6 | 23.7 |
| Curbed (T) | 81.4 | 4.6 | 5.4 | 0.0 | 0.0 | 1.6 | 4.7 | 2.3 | 18.6 |
| Curbed (NT) | 77.2 | 7.8 | 4.0 | 1.5 | 1.0 | 0.3 | 2.5 | 5.7 | 22.8 |
| Positive (T) | 82.0 | 5.1 | 4.6 | 1.7 | 0.4 | 0.3 | 2.5 | 3.4 | 18.0 |
| Positive (NT) | 78.7 | 7.0 | 3.6 | 1.5 | 1.0 | 0.5 | 1.9 | 5.8 | 21.3 |
| **No. of Lanes** | | | | | | | | | |
| 2 (T) | 82.6 | 4.7 | 4.6 | 0.7 | 0.7 | 0.2 | 2.5 | 4.0 | 17.4 |
| 2 (NT) | 77.6 | 7.1 | 3.9 | 1.5 | 1.0 | 0.4 | 2.2 | 6.3 | 22.4 |
| 3 (T) | 80.9 | 6.3 | 4.5 | 1.9 | 0.1 | 0.5 | 2.7 | 3.1 | 19.1 |
| 3 (NT) | 79.1 | 6.8 | 3.5 | 1.6 | 1.0 | 0.5 | 1.9 | 5.6 | 20.9 |
| 4 or more (T) | 84.0 | 3.3 | 4.9 | 1.5 | 0.3 | 0.4 | 2.0 | 3.6 | 16.0 |
| 4 or more (NT) | 77.7 | 7.1 | 3.9 | 1.5 | 0.9 | 0.6 | 2.2 | 6.1 | 22.3 |
| **Posted Speed Limit (mph)** | | | | | | | | | |
| 25-35 (T) | 89.3 | 7.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.6 | 10.7 |
| 25-35 (NT) | 77.7 | 6.0 | 4.2 | 1.6 | 0.8 | 0.2 | 3.7 | 5.8 | 22.3 |
| 36-45 (T) | 84.0 | 3.6 | 5.5 | 0.5 | 0.0 | 0.0 | 1.4 | 5.0 | 16 |
| 36-45 (NT) | 76.1 | 7.2 | 4.6 | 1.6 | 0.9 | 0.4 | 2.4 | 6.8 | 23.9 |
| 46-55 (T) | 81.4 | 5.2 | 4.3 | 1.2 | 0.5 | 0.3 | 3.3 | 3.8 | 18.6 |
| 46-55 (NT) | 77.0 | 7.7 | 3.7 | 1.6 | 1.2 | 0.5 | 2.2 | 5.9 | 23.0 |
| 56-65 (T) | 82.4 | 4.9 | 4.8 | 1.8 | 0.3 | 0.6 | 2.2 | 3.0 | 17.6 |
| 56-65 (NT) | 80.1 | 6.4 | 3.5 | 1.4 | 0.9 | 0.5 | 1.5 | 5.7 | 19.9 |

## Findings

- Truck drivers had higher seatbelt non-use (22%) than car drivers (8%), especially on interstates, in winter, and among older drivers
- RT-18 (20.3%) and NJ-24 (20.9%) had the highest percentage of seatbelt non-compliance for the truck drivers
- Truck drivers are significantly less distracted (17.3%) than other drivers (22.2%); distraction is higher on weekends (19.7%) than on weekdays (17.3%)
- Positive median, higher speed limits (56-65 mph), 3+ lanes, summer, higher median width, and higher shoulder width had experienced a significant increase in distraction rates

## Recommendations

- **Engineering:** Install cameras, in-vehicle alerts, and enhanced seatbelt systems (reminders, interlocks) with better design and sign visibility
- **Enforcement:** Enforce phone bans, increase patrols, checkpoints, and fines, supported by high-visibility campaigns (U Drive, U Text, U Pay / Click It or Ticket)
- **Education:** Promote driver-focused training and public campaigns using social media, road signs, and outreach programs that highlight risks of distraction and consistent seatbelt non-use, with special attention to older drivers and high-risk routes

## Acknowledgement

- We express our gratitude to the New Jersey Division of Highway Traffic Safety (NJDHTS) for supporting this study

# Evaluating State DOT Practices and Priorities in Pavement Marking Implementation and Maintenance: Insights from Multi-State Interviews and Comparative Analysis

Md Sadman Islam[1], Ahmed Imtiaz Zamee[1], Salma Afia Ratri[1], and Mohammad Jalayer (Ph.D.)[1]
[1]Department of Civil and Environmental Engineering, Rowan University, Glassboro, NJ

RowanUniversity
CENTER FOR RESEARCH & EDUCATION IN ADVANCED TRANSPORTATION ENGINEERING SYSTEMS

## Introduction

- Crashes can occur due to improperly placed, faded, inadequate, or poorly designed pavement markings
- Temporary markings and those obscured by snow or ice reduce visibility, increasing crash risks
- Well-maintained, high-visibility markings help reduce crash frequency and severity
- Clear markings improve roadway visibility and driver awareness, enhancing safety

## Objectives

- Analysis factors like cost, durability, and safety in pavement marking choices
- Compares state priorities on retro reflectivity, durability, and cost
- Suggests strategies to optimize pavement markings based on local needs
- Sharing best practices to improve pavement marking systems

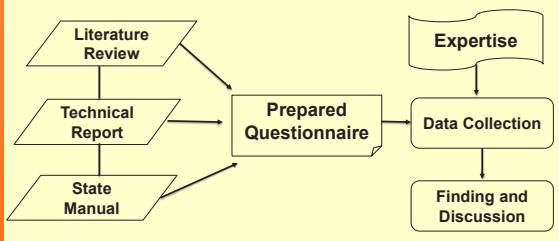
## Data Collection

- 23 states invited, 9 states participated: AZ, AR, IL, IA, KS, MN, MO, NH, WI
- Conducted **structured interviews** with DOT officials (37 questions)

## Factors Influencing Interview Questions

| Extensive Literature Review | Comprehensive Insights | Targeted Expertise |
|---|---|---|
| Reviewing Studies | Material Selection | DOT personnel involved in pavement marking programs |
| | Application Techniques | |
| Technical Reports | Maintenance | |
| | Quality Control | |
| Pavement Marking Practices | Environmental factors | |
| | The Impact of External Factors Like COVID-19 | |

## Methodology




## Findings

- From the analysis of Data following results have been found.

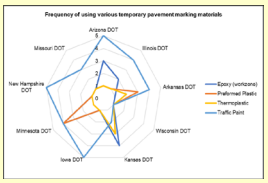


Figure 1: Frequency of using Epoxy, thermoplastic, traffic paints, and preformed

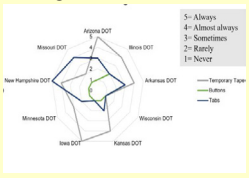


Figure 2. Frequency of using temporary tapes, buttons, and tabs for long duration work zones

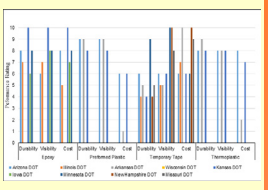


Figure 5: Rated performance of temporary pavement marking material

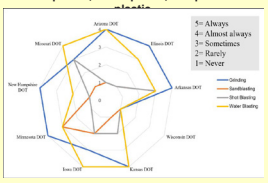


Figure 3. Frequency of using various temporary pavement marking removal methods (grinding, sandblasting, shot blasting, water blasting)

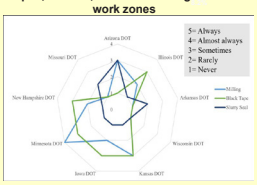


Figure 4. Frequency of using various temporary pavement marking removal methods (Milling, Black Tape, Slurry Seal)

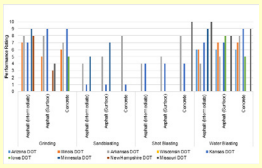


Figure 6: Rated performance of temporary pavement marking removal methods

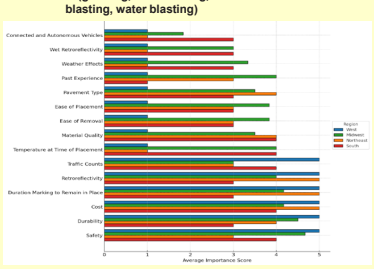


Figure 7: Region-based comparison for influencing factors for marking material selection

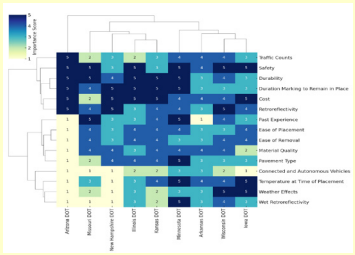


Figure 8: Clustered heatmap for different factors considered for pavement marking material selection by states

Table 1: Frequency of Factors Considered for the Selection of the Type of Pavement Markings

| Factor | Arizona DOT | Illinois DOT | Arkansas DOT | Wisconsin DOT | Kansas DOT | Iowa DOT | Minnesota DOT | New Hampshire DOT | Missouri DOT |
|---|---|---|---|---|---|---|---|---|---|
| Cost | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 2 |
| Durability | 5 | 5 | 3 | 4 | 5 | 3 | 5 | 4 | 5 |
| Duration Marking to Remain in Place | 5 | 5 | 3 | 3 | 5 | 3 | 5 | 5 | 4 |
| Ease of Placement | 1 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 4 |
| Ease of Removal | 1 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 |
| Material Quality | 1 | 3 | 4 | 4 | 4 | 2 | 4 | 4 | 4 |
| Past Experience | 1 | 3 | 1 | 4 | 4 | 3 | 5 | 3 | 5 |
| Pavement Type | 1 | 4 | 3 | 3 | 4 | 3 | 5 | 4 | 2 |
| Retroreflectivity | 5 | 3 | 3 | 5 | 4 | 4 | 4 | 5 | 4 |
| Safety | 5 | 5 | 4 | 5 | 3 | 5 | 5 | 3 | 5 |
| Temperature at Time of Placement | 1 | 3 | 4 | 4 | 4 | 5 | 5 | 1 | 3 |
| Traffic Counts | 5 | 2 | 4 | 4 | 3 | 3 | 4 | 3 | 2 |
| Weather Effects | 1 | 3 | 3 | 5 | 2 | 5 | 3 | 1 | 2 |
| Wet Retroreflectivity | 1 | 3 | 3 | 4 | 2 | 3 | 5 | 1 | 1 |
| Connected and Autonomous Vehicles | 1 | 2 | 3 | 2 | 2 | 1 | 3 | 1 | 1 |

## Conclusion

- Pavement marking practices vary widely across states
- Durability, cost, safety, and retro reflectivity are top priorities everywhere
- Need for consistent, performance-based specifications
- Findings can guide policy updates, DOT practices, and safer roadway designs

## Acknowledgement

- We express our gratitude to the New Jersey Department of Transportation (NJDOT) for supporting this study

# Harsh Braking as a Surrogate for Crash Risk: A Segment-Level Analysis with Connected Vehicle Telematics

Md Tufajjal Hossain, Ph.D. Candidate, Joyoung Lee, Ph.D., Dejan Besenski, Ph.D., Lazar Spasovic, Ph.D.
John A. Reif, Jr. Department of Civil & Environmental Engineering, New Jersey Institute of Technology
mh684@njit.edu, jo.y.lee@njit.edu, besenski@njit.edu, spasovic@njit.edu

NJIT New Jersey Institute of Technology | ITSRC Intelligent Transportation Systems Resource Center

POSTERS

## Introduction

- Harsh Braking (HB) events refer to sudden and forceful stops captured by connected vehicle (CV) telematics.
- NJ highways have heavy traffic, toll plazas, and complex interchanges that result in higher crash risk and conditions for sudden stops.
- If HB patterns can reliably identify crash-prone segments, action can be taken before crashes happen (proactive approach).
- **Goal:** to determine whether HB pattern associated with crash frequency.

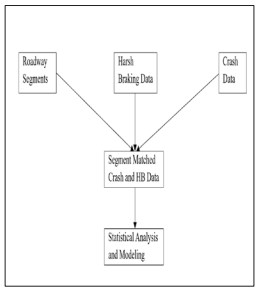
## Methodology

### Data

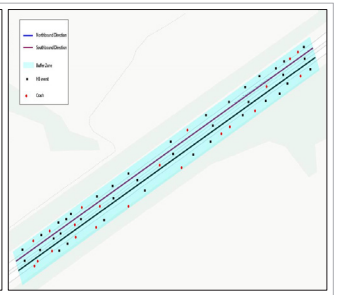
- About 8.5 million Drivewyze truck telemetry records (July–Dec 2024).
  - ✓ Define HB if deceleration >= 6 $fts^{(-2)}$ (approximately 0.2g).
- 45,000 NJ police crash reports, known as NJTR-1 reports, (same period)

### Framework

- **Segmentation:** NJ interstate highways split into 1-mile segments. Identified 1,023 segments.
- **Matching:** Crashes and HB events linked to the same segments using GIS buffers.
- **Modeling:** Statistical models, Negative Binomial (NB) and Zero-Inflated Negative Binomial (ZINB) tested if more HB results in more crashes.



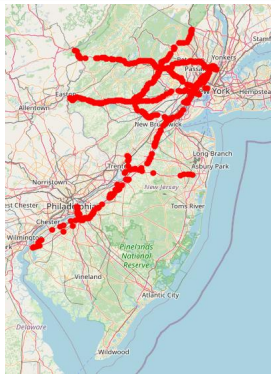

Methodological Framework



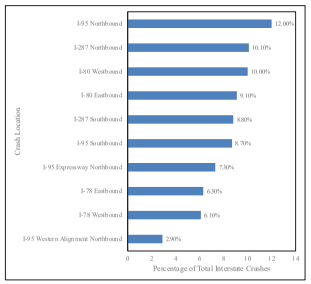
Crash and HB Matching Using Buffer

## Descriptive Analysis

Harsh Braking (HB) Locations

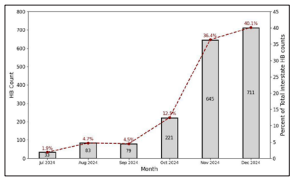


August-2024 Crash Locations

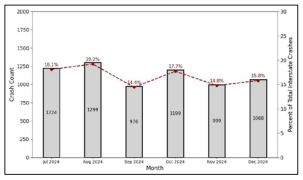



Top 10 Interstate Crash Locations in NJ

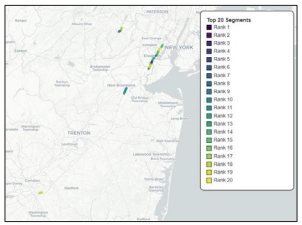
Segments with both HB & Crashes



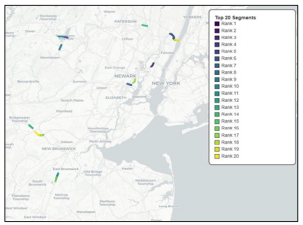

Interstate HB counts by Month




Interstate Crashes by Month



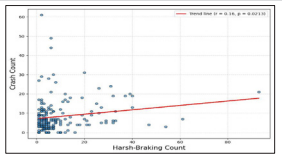

Top 20 Segments for HB events



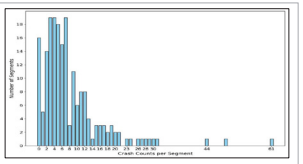

Top 20 Segments for crash events

## Model Result

- Zero-Inflated Negative Binomial (ZINB) model fits best.
- Each extra HB event contributes to a 1% increase in expected crashes per segment.
- Example: An increase of 10 HB events corresponds to an expected crash frequency of about 10 % higher.
- The result confirms that HB can events can serve as an early warning indicator of potential crashes.



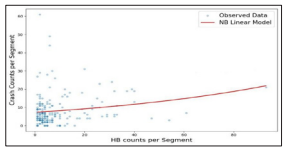

Correlation Between HB and Crashes

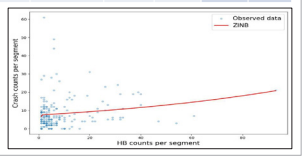



Segment-wise Distribution of Crashes

**Table:** NB and ZINB Regression of Crash Counts on HB Counts

| Model | Variables | Coefficient | Std. Error | Z | P>\|Z\| | AIC | Alpha |
|---|---|---|---|---|---|---|---|
| NB | Intercept/Constant | 1.99 | 0.10 | 20.98 | 0.00 | 1234.49 | 1.00 |
| | HB Counts | 0.01 | 0.01 | 1.92 | 0.06 | | |
| ZINB | Inflated constant | 12.77 | 1097.32 | 0.01 | 0.99 | 1228.63 | 0.65 |
| | Inflated HB counts | -15.03 | 1097.32 | -0.01 | 0.99 | | |
| | Constant | 2.01 | 0.08 | 24.88 | 0.00 | | |
| | HB Counts | 0.01 | 0.01 | 2.12 | 0.03 | | |




## Conclusion & Recommendations

- This study demonstrates that harsh braking (HB) activity, derived from connected-vehicle telematics, provides a meaningful surrogate for identifying crash risk on large-scale interstate highway systems.

### Recommendations

- Agencies should integrate HB monitoring into safety dashboards to identify danger zones in real time.
- Segments with frequent HB events should be prioritized for countermeasures such as better signage, enforcement, lane guidance, and ramp metering.
- Combining HB data with crash, weather, and traffic information enables faster, proactive crash prevention.

BUREAU OF RESEARCH, INNOVATION & INFORMATION TRANSFER

# 27th ANNUAL NJDOT RESEARCH PARTNERS

Greenman-Pedersen, Inc. (GPI)
New Jersey Institute of Technology
Thomas Edison State University
Stockton University
Rutgers, The State University of New Jersey
Rowan University
The College of New Jersey
Kean University

Please visit the NJDOT Technology Transfer website and the New Jersey State Transportation Innovation Council page.

https://www.njdottechtransfer.net/
https://www.njdottechtransfer.net/nj-stic/

NEW JERSEY STIC State Transportation Innovation Council

The 27th Annual NJDOT Research Showcase is organized and sponsored by the NJDOT Bureau of Research, Innovation & Information Transfer in partnership with New Jersey Local Technical Assistance Program (NJ LTAP) at Rutgers Center for Advanced Infrastructure and Transportation (CAIT) and co-sponsored by the Federal Highway Administration.

New Jersey Local Technical Assistance Program

U.S. Department of Transportation Federal Highway Administration

** To confirm the acceptance of these PDHs for continuing professional competency for licensed professional engineers, please consult the licensure board of that state.