Transportation Research Quarterly

Infrastructure Damage and Restoration

"I always think about one trucking industry stakeholder, at one of our roundtables, who reminded me, as he put it, that "infrastructure is our workplace." And for all of those whose workplace is the very infrastructure of roads, bridges, highways, interchanges, and more, that we're working on right now, we're working to make that a better workplace."

Pete Buttigieg, United States Secretary of Transportation
Remarks at American Trucking Association 2022 Management Conference

Restoration and Repair Projects

The collapse of a section of I-93 in Philadelphia, and the closing of Sumner Tunnel, over the last several months, highlight the importance of infrastructure damage assessment and restoration efforts to our transportation system. MassDOT is currently overseeing several studies that are looking into infrastructure damage assessment and restoration efforts.

INSIDE THIS ISSUE

According to the World Bank, roads "are among the most important public assets in any country." Among the multitude of research that MassDOT oversees, the following projects are related to restoration and repairs. This issue highlights two of these projects.

- Post Fire Damage Inspection of Concrete Structures Phase II completed and the Phase III In-situation Experimental Phase started.
- Development of Improved Inspection Techniques Using LiDAR for Deteriorated Steel Beam Ends
- Methods to Identify Problematic Carriers and Prevent Infrastructure Damage
- Construction & Materials Best Practices for Concrete Sidewalks: Phase II
- Revised Load Rating Procedures for Deteriorated Prestressed Beams
- Feasibility of 3D Printing Applications for Highway Infrastructure Construction and Maintenance - Phase II

Research Project Highlight

Post-Fire Damage Inspection of Concrete Structures

This study of post-fire damage inspection of concrete structures was undertaken as part of the Massachusetts Department of Transportation's (MassDOT) Research Program. Currently, there is insufficient inspection protocols for visual observations of nonstructural and structural fire damage tunnel components. The primary interest for structural engineers and stakeholders involved in decision making is the assessment of structure integrity after a damaging event. An inspector must be able to identify damage to structural components and any potential hazards post-fire. This can be especially difficult when addressing an intermediate temperature tunnel fire.

The purpose of this research was to understand how fire affects the residual strength capacity of tunnel structures and tunnel elements and to develop a post-fire inspection protocol that can be quickly and easily implemented. The primary goals of Phase II of the project included a thorough investigation of the visual changes and the mechanical behavior of components found in tunnel structures after heat exposure.

Structural reinforced concrete slab members were tested mechanically to investigate the residual capacity of members when exposed to various heating regimens. Slab specimens were heated to temperatures ranging from 300°C (572°F) to 500°C (932°F) for three hours to investigate the effects of intermediate tunnel fires. Test results suggest that the residual capacity of structural reinforced concrete slab specimens was not significantly influenced by the applied heating regimens.

The collection of visual data in conjunction with the results of mechanical testing may be used by MassDOT and other agencies to enhance post-fire inspection of tunnel structures. The data reported from this study can help better the judgment of fire intensity and duration during inspection and provide insight into the mechanical behavior of structural members. This project also aimed to study materials and components that may be common in tunnels in general, but with a specific focus on MassDOT-owned tunnels. The next phase of this research will continue to study fire and tunnel structures through on-site testing of tunnel components.

Research Project Highlight

Methods to Identify Problematic Carriers and Prevent Infrastructure Damage

In order to prevent further damage to Massachusetts' aging and evolving roadway infrastructure, the Commonwealth is interested in identifying and quantifying oversize/overweight trucking operations as well as violation types and rates. MassDOT currently uses a variety of datasets which cause difficulty in harmonizing them for effective analysis towards the prevention of infrastructure damage. This research is required to establish the current use and availability of datasets, methods of access and integration nuances related to oversize/overweight trucking operations, and violation types and rates for these vehicles in Massachusetts.

The project's objectives are to compile a comprehensive classification of relevant existing data sources, and their framework of interoperability from Massachusetts agencies and departments including but not limited to: MassDOT's Registry of Motor Vehicles (RMV) Divisions citations, licensed drivers, registered vehicles, and crashes as well as, Massachusetts State Police (MSP) SafetyNet Commercial Motor Vehicle (CMV) crash and inspection data. Furthermore, MassDOT datasets including overweight/size permits, freight restrictions, a roadway inventory, and toll records will be examined for potential inclusion.

This project will develop recommendations and procedures for the preferred utilization of shared datasets from multiple departments and agencies to enable MassDOT to identify and analyze height and/or weight restricted Massachusetts transportation infrastructure, and to prevent damage from problematic use by commercial carriers.

Upon completion of this project, MassDOT data users, analysts, and planners will be able to employ immediate use procedures to target problematic uses of the Commonwealth's vulnerable height and/or weight restricted transportation infrastructure. This project will help MassDOT to develop models and software systems that could run in real time with proactive analyses and identification.

A Look at Who We are – Team Highlights

Each MassDOT research project team is comprised of a Project Champion(s), a Principal Investigator(s) and a Project Manager. The Project Champion serves as the MassDOT technical representative, the Principal Investigator conducts research investigation and produces deliverables per project scope and schedule, and the Project Manager takes charge of the overall project administrative management and coordination. Highlighted below are the key members of "Methods to Identify Problematic Carriers and Prevent Infrastructure Damage" project team.

Project Champion – Makaela Niles

Makaela Niles is a transportation planner in the Office of Transportation Planning's Multimodal section. Since joining MassDOT in 2019, Makaela has been engaged in studies and initiatives that aim to improve access and multimodal mobility. In addition to her work on freight planning activities, Makaela is involved in a variety of efforts, including the Northern Tier Passenger Rail Study and the Wellington Circle Study. She holds a B.A. in English and an M.S. in Urban Planning and Community Development, both from the University of Massachusetts Boston.
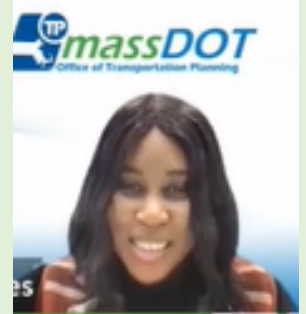
Principal Investigator – Robin Reisman

Robin Reisman is the Director of UMassSafe. She has been with UMassSafe since its inception in 2001, has been extremely instrumental in visualizing, strategizing and implementing the myriad of UMassSafe programs. She has worked in the field of highway safety for nearly 30 years including as the Associate and then Deputy Director of UMassSafe for 17 years. As the UMassSafe Deputy Director, and Principal Investigator for many research projects, she was responsible for the oversight of staff, projects, research, strategic planning, grant writing and management, and project evaluation. As Director, her role includes overall strategic and operational responsibilities for UMassSafe staff, programs, expansions and execution of its mission.
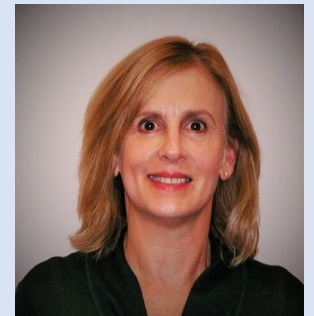
Performing Team – UMassSafe

UMassSafe is a multidisciplinary traffic safety research program housed in the University of Massachusetts Transportation Center in the College of Engineering at the University of Massachusetts Amherst. As part of the University they have access to unique resources. They are supported by state-of-the-art computer facilities including the Advanced Transportation Lab with full GIS capabilities and two full-scale driving simulators housed in the Human Performance Lab. UMassSafe seeks to reduce the frequency and severity of crashes through the rigorous examination of safety-related data – both traditional and nontraditional – to better understand crashes, driver behavior, and related factors.

Research Manager – Nicholas Zavolas

Nicholas Zavolas is a transportation planner with the Research Section in the Office of Transportation Planning. Prior to joining MassDOT in 2015, Nicholas worked with the MEPA Office as a staff member for the Secretary of Energy & Environmental Affairs. He holds a Master of Urban Planning & Environmental Design degree from MIT. Nicholas' research interests include electric and autonomous vehicles, and pre-fab and container architecture. He enjoys woodworking, kayaking, hiking. You may contact Nicholas at Nicholas.Zavolas@dot.state.ma.us.
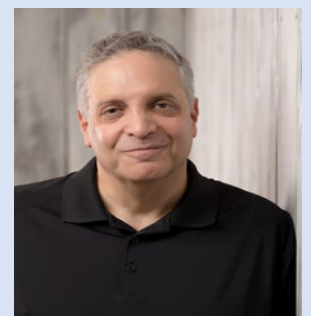
Events & Announcements

MassDOT's Moving Together Conference Early Bird Registration is Now Open

October 4, 2023
New Location!
Sheraton Boston Hotel
39 Dalton Street
Boston, MA • 7:45 am - 4:30 pm
with Limited Virtual Attendance Option

Register Here

- Attend workshops and panels that highlight current pedestrian, bicyclist and public transportation topics
- Network with colleagues representing diverse interests from the public, academic and private sectors
- All new site visits and mobile workshops led by engineers and bicyclist/pedestrian advocates.

Session topics will include:
- MassTrails - Investments in Trails Across the Commonwealth
- MassDOT Resources Available to Support Safe School Travel: Pop-Up and Quick Build Projects, Traffic Gardens, and Infrastructure Grants
- GeoDOT 2.0 – The Next Generation in Collaboration and Data Management
- SWAG: Quarterly GIS Meeting
- Corridor Spotlight: Southeastern MA

See full agenda here: https://www.umasstransportationcenter.org/assnfe/ev.asp?ID=5346

Problem Submittals for FY2025 National Cooperative Highway Research Program

Problem Statements Due by November 1, 2023

The AASHTO Special Committee on Research and Innovation (R&I) is soliciting candidate research problems for the fiscal year 2025 National Cooperative Highway Research Program (NCHRP).

Problem statements are to be submitted electronically via this link.

To be considered for the FY2025 program, problem submittals must arrive by midnight EST on **November 1, 2023**—this is a firm deadline.

No time to conduct a literature search yourself?
TRB Library Snap Searches can help

Snap Searches are designed for the busy professionals and researchers who would like to quickly get up to speed on complex research topics. They provide a succinct summary of current activities at TRB on a given topic. Follow the link below for the TRB snap search results for "Environment and Sustainability."

TRB Snap Search: Maintenance and Preservation

MassDOT Research Resources

In Progress MassDOT Research

	Start Date
• Massachusetts-Specific Trip Generation Rates	March 2021
• Revised Load Rating Procedures for Prestressed Concrete Beams	May 2021
• Outdoor Information Panels to Convey Real-time Travel Information for Ridership Recovery	May 2021
• Optimizing MassDOT's High Performance Asphalt Overlay Mixtures	July 2021
• Using Traffic Signals to Reduce Speeding Opportunities	July 2021
• Ultra High-Performance Concrete Reenforced with Multi-scale Hybrid Fibers	August 2021
• Development of Improved Inspection Techniques Using LIDAR for Deteriorated Steel Beam Ends	March 2022
• Smart Work Zone Safety Control and Performance Evaluation	April 2022
• Tree Preservation and Planting for Complete Streets Development	April 2022
• Development of a Salt Spreader Controller Program	April 2022
• Post-Fire Inspection of Concrete Structure Phase III - In-Situ Experiments	April 2022
• Building Information Model for Transit Infrastructure: Feasibility and Gap Analysis	April 2022
• Methods to Identify Problematic Carriers	May 2022
• 3D Printing Applications for Bridge Element Repair	June 2022
• Evaluating Safety Impacts of Two-stage Bike Boxes	June 2022
• Field Study to Determine Salt Usage Efficiency on Two Pavement Types	August 2022
• Implementing AASHTO Mechanistic-Empirical Pavement Design Guide Phase III	August 2022
• LIMMS Development Planning	November 2022
• Accessible Bus Stop Design in the Presence of Bike Lanes	March 2023
• Cross-Modal Assessment of Sustainable Transportation Networks	March 2023
• A Pavement Marking Inventory and Retroreflectivity Condition Assessment Method Phase II	March 2023
	March 2023

Recently Completed MassDOT Research

	Completion Date
• Massachusetts Depth to Bedrock	May 2023
• Discover the Root Causes for Truck Rollover at Highway Ramps	March 2023
• Measuring Food Access to Improve Public Health Phase I	July 2023
• Multisource Data Fusion for Traffic Incident Detection	May 2023
• Using Mycofiltration Treatment for Stormwater Management	March 2023
• Construction and Material Best Practices for Concrete Sidewalk Phase II – Hot Placement	March 2023
• Safety Impacts of Yellow Flashing Permissive Left-Turn Indications – Approach Analysis	March 2023
• Post-Fire Damage Inspection of Concrete Structures (Phase II) – Experimental Phase	February 2023
• Implementing AASHTO Mechanist-Empirical Pavement Design Guide Phase II	September 2022
• Understanding the Asset Management Systems Utilized by Municipalities in Massachusetts	September 2022
• Use of UAS for Surface Transportation Emergency Response	July 2022
• A Pavement Marking Inventory and Retroreflectivity Assessment Method Using Mobile LiDAR Phase I	June 2022

Additional Resources

Transportation Research and Information Database (TRID) is a comprehensive bibliographic database containing more than 1.3 million records of transportation research.

Research in Progress (RiP) Database contains information on more than 12,000 current or recently completed federally-funded transportation research projects.

AASHTO Publications include the most accepted technical guides, specifications, and manuals of the industry.

Contact Us

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