massDOT
Massachusetts Department of Transportation

Transportation Research Quarterly

Providing highlights of MassDOT's transportation research activities and other helpful information **2022 Q1**

Focused on Research

MassDOT and MBTA are responsible for owning, managing and operating the most important transportation assets and services that are crucial to the Commonwealth's prosperity. This issue of Transportation Research Quarterly showcases several MassDOT research projects focusing on designing, constructing, and maintaining high-quality and long-lasting transportation infrastructure through innovative and cost-saving technologies and processes. I would also like to call your attention to the open registration for the upcoming hybrid MassDOT Innovation Conference on May 24 and 25, 2022 which has a special focus on MassDOT's investment in infrastructure.

Steve Woelfel, Deputy Executive Director, Office of Transportation Planning

INSIDE THIS ISSUE

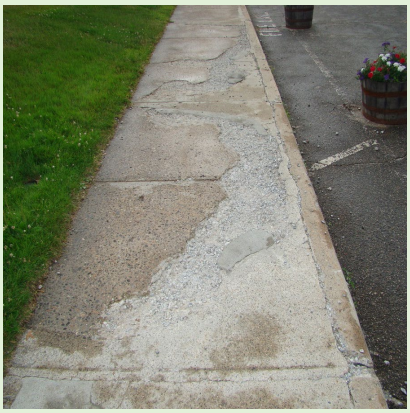
Six MassDOT Research Projects Were Presented at the 2022 TRB Annual Meeting

MassDOT's research projects aim to address our agency's needs and provide practical solutions to the most salient transportation problems that we face. These problems are oftentimes not unique to MassDOT, and thus the scientific investigation approaches and the findings are relevant to stakeholders inside and outside of MassDOT. We encourage our research project champions and principal investigators to disseminate our joint research efforts through various transportation professional channels, including TRB meetings and publications. This year, six presentations originating from our research projects were chosen by TRB committees as part of the TRB 2022 Annual Meeting poster sessions. The table below lists the titles and associated MassDOT/MBTA project champions.

Presentation Title	Project Champion
Best Practices for Cost Recovery in State DOT Highway Construction Projects	Jerrell Riggins Tom DiPaolo
Best Practices of Knowledge Management for State DOTs: Developing Actionable Objectives	Jenny Zeng Steve Woelfel
Bicyclist and Motorist Behavior at Bike Boxes	Andrew Wilkins
Characterization of Reclaimed Asphalt Pavement for Hot Mix Asphalt Surface Courses in Massachusetts (AASHTO 2021 HVR Award Winner)	Ed Naras
Curb Management Policy Insights and Recommendations for Communities of All Sizes	Derek Shooster
Modeling System-wide Urban Rail Transit Energy Consumption: A Case Study of MBTA	Sean Donaghy

Ongoing Research Highlights

Construction & Materials Best Practices for Concrete Sidewalk



Deterioration, such as scaling of concrete sidewalks, is one of the most urgent and common challenges that need to be tackled by construction QA/QC. Through this two-phased research, MassDOT seeks to improve the durability of concrete sidewalks under extreme winter weather conditions to reduce the maintenance and reconstruction costs. A variety of experimental testing of in-situ concrete sidewalk panels, fresh concrete, and hardened concrete are being conducted on many samples with varying mixed design, curing methods, deicing and sealing treatments to determine key factors impacting concrete performance. Read Phase I summary and Phase II cut sheet for details.

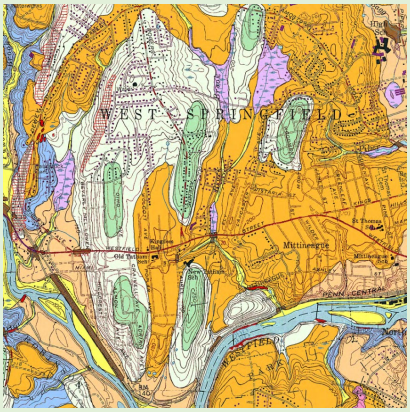
Principal Investigators: Dr. Kara Peterman & Dr. Sergio Breña, UMass Amherst
Project Champion: Richard Mulcahy, MassDOT Highway
Project Manager: Lily Oliver, MassDOT OTP

Ultra-High Performance Concrete Reinforced with Multi-Scale Hybrid Fibers

There are critical gaps in the understanding of the efficiency of mixture design and fibers on concrete performance, especially the mechanical and durability-related properties. This project aims to develop novel, non-proprietary, fiber reinforced concrete (FRC) and Ultra-High Performance Concrete (UHPC) mixtures for transportation infrastructure applications and maximize the roles of fibers and additives in enhancing mechanical and durability-related properties. The results will advance the wider use of FRC and UHPC in transportation and inform standard Specification development for concrete construction materials. Read the UHPC project cut sheet for further information.

Principal Investigators: Dr. Jianqiang Wei, UMass Lowell; Dr. Sergio Breña, UMass Amherst
Project Champion: Richard Mulcahy, MassDOT Highway
Project Manager: Drew Pflaumer, MassDOT OTP

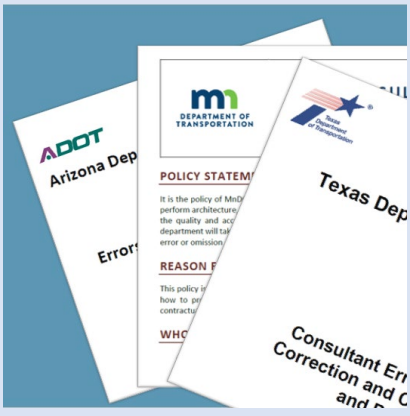
Massachusetts Depth to Bedrock Project



Knowing the overburden thickness influences not only construction project costs but also the selection of the appropriate foundation system for a particular structure and the selection of a suitable subsurface investigation method. This project will clarify overburden thickness across the Commonwealth by collecting and synchronizing several hundred thousands of borehole and geophysical records from various sources, combining them with topographic LiDAR data and statewide surficial materials map, and creating a high-resolution, continuous data layer of the varying thickness of the overburden across Massachusetts. Read the Depth of Bedrock project cut sheet for further information.

Principal Investigators: Steve Mabee & Bill Clement, UMass Amherst
Project Champion: Jennifer Rauch, MassDOT Highway
Project Manager: Drew Pflaumer, MassDOT OTP

Best Practices for Cost Recovery



MassDOT seeks to improve its cost recovery procedures for construction projects which can help to hold designers accountable for their mistakes, improve overall design quality, and save resources. This project gathered and analyzed information on best cost recovery practices used by state DOTs across the nation and offered a set of recommendations to modify and enhance as appropriate the 2017 MassDOT Cost Recovery Procedures. It also provided a set of modified flowchart guides designed to assist in preventing or minimizing potential design errors and omissions during the early stages of project development. Read the Cost Recovery Project Summary for further information.

Principal Investigator(s): Dr. Michael Plotnikov, UMass Amherst
Project Champion: Jerrell Riggins & Tom DiPaolo, MassDOT Highway
Project Manager: Lily Oliver, MassDOT OTP

A Look at Who We are – Team Highlights

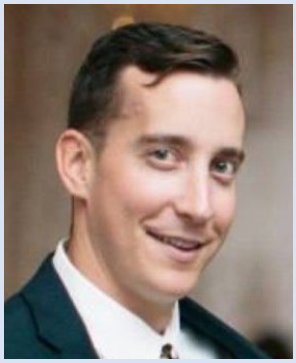
Each MassDOT research project is supported by a team comprised of a Project Champion, a Principal Investigator and a Project Manager. Often, the research project team will also include staff from the UMass Transportation Center (UMTC) who provide general support services to the Principal Investigator. Highlighted below are the key members of the "Construction and Materials Best Practices for Concrete Sidewalks" project team.

Project Manager – Lily Oliver

A MassDOT Research Project Manager (PM) is responsible for the administrative management and overall coordination of an assigned research project.

Lily (Hongyan) Oliver leads the Research Section at the Office of Transportation Planning and oversees all research and technology transfer activities supported by the FHWA State Planning and Research Part II funds. Prior to managing the Research Section, she managed MassDOT energy and climate resiliency initiatives. Lily holds a doctoral degree in Civil and Environmental Engineering from Stanford University and a master's degree in Environmental Science and Economics from Peking University. She enjoys hiking and jogging while listening to Freakonomics Radio podcasts.

Project Champion – Richard Mulcahy



A Project Champion (PC) is a MassDOT subject matter expert, the proponent of a funded research project, and the technical advisor for project development, completion and implementation.

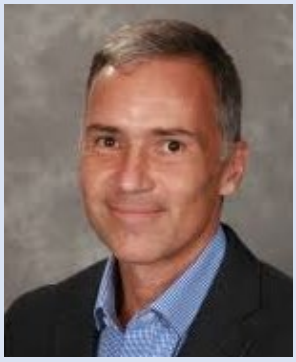
Richie Mulcahy is the current Materials Field Control Engineer at MassDOT Highway Division Research and Materials Section. He leads a team of civil engineers, oversees many of the state's sampling, testing, inspection, and materials approval programs, authors standard specifications and special provisions, and conducts research on highway construction materials. Richie holds a bachelor's degree in Civil and Environmental Engineering from Northeastern University and has been recognized multiple times by MassDOT for his dedication and contributions in recent years.

Principal Investigator – Kara Peterman

The Principal Investigators (PI) are responsible for submitting an interest statement, developing a detailed research scope if selected, and conducting research activities per project scope.

Dr. Kara Peterman is an Assistant Professor of Civil and Environmental Engineering at the University of Massachusetts Amherst. Kara investigates the sustainability and performance of basic infrastructure focusing on residential construction, infrastructure materials, and structural stability. She is a member of the American Iron and Steel Institute Committee on Specifications (where she chairs the Test-Based Design subcommittee) and Committee on Framing Standards. Kara holds a doctoral degree in Civil Engineering from John Hopkins University.

Principal Investigator – Sergio Breña



Dr. Sergio F. Breña is a Professor of Civil and Environmental Engineering at the University of Massachusetts Amherst. He has over 23 years of experience in laboratory and field testing of structures and structural systems and over six years of structural design experience. He is a member of several professional organizations including the American Concrete Institute (ACI) and the Precast/Prestressed Concrete Institute (PCI). He currently serves as a voting member of ACI Building Code subcommittees ACI 318-C - Safety, Serviceability, and Analysis and ACI 318-H – Seismic Provisions, technical committees ACI 369 - Seismic Repair and Rehabilitation (chair of ACI 369F – Retrofit), and ACI 374 - Performance Based Seismic Design of Concrete Buildings. He is the immediate past-chair of the PCI Student Education Committee and voting member of the PCI Design Handbook Committee and the PCI Design Standards Committee.

News and Events

The 2022 Innovation Conference is In-Person with Virtual Option

Sessions & Exhibits: May 24-25, 2022 7:30 am – 4:00 pm
Visit the 2022 Innovation Conference Webpage to Register

The annual MassDOT Transportation Innovation Conference provides a forum for innovative transportation systems, management ideas, and initiatives. The conference is an important opportunity for transportation practitioners to share knowledge, sponsor peer-to-peer learning, and collaborate on issues of mutual interest. A specific focus of this year's conference will be on MassDOT's investment in infrastructure.

The 2022 Conference focuses on the following themes:

A. Innovations in Construction Methods
B. Promoting a Safe and Equitable Transportation Culture
C. Streamlining the Project Delivery Process to Improve Infrastructure
D. Best Practices in Municipal and Regional Transportation
E. New Techniques in Design and Materials
F. Implementing New Technologies

State DOTs are the sole sponsors of the AASHTO National Cooperative Highway Research Program (NCHRP) and continue to be the driving force behind NCHRP research. MassDOT contributes 5.5% of its available FHWA SPR funds to NCHRP; and our subject matter experts (SMEs) presently serve on over 40 NCHRP project panels.

Each year, the Research Section coordinates and submits our agency's review of candidate NCHRP problem statements, and the results from all 50 states serve as the basis for the AASHTO Research & Innovation Committee's funding decisions on the following years' new research projects.

FFY 2023 NCHRP Problem Statements Review is open and due by March 25, 2022.

If you are interested in nominating yourself or your staff to review future NCHRP problem statements, please contact research staff Nicholas Zavolas.

Visit NCHRP website to learn more about NCHRP, how their projects are generated, and ongoing and completed research.

FY23 Research Solicitation Opens Soon

Be on the lookout for Secretary Tesler's email announcement on the Office of Transportation Planning (OTP) FFY23 planning and research solicitation! Starting this year, OTP annual planning work solicitations for planning studies and research ideas will be combined under one umbrella. Research will offer a Lunch & Learn session and three roundtables to help you start on your research need submission.

Register for Research Lunch & Learn by March 29

Register for Research Roundtables by April 5

Research Resources

In Progress MassDOT Research

	Start Date
Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam End	February 2020
A Pavement Marking Inventory and Condition Assessment Method Using Mobile Lidar	March 2020
Understanding the Asset Management Systems Utilized by Municipalities in Massachusetts	April 2020
Impact of Advanced Driver Assistance System on Road Safety	June 2020
3D Printing Application for Transportation Infrastructure and Maintenance	June 2020
Automated Guardrail Inventory and Condition Assessment	January 2021
A UAS Network for Transportation Emergency Response	March 2021
Discover the Root Causes for Truck Rollover at Highway Ramps	March 2021
Massachusetts Depth to Bedrock	March 2021
Massachusetts-Specific Trip Generation Rates	March 2021
Multisource Data Fusion for Traffic Incident Detection	April 2021
Accessibility to Public Health	May 2021
Revised Load Rating Procedures for Prestressed Concrete Beams	May 2021
Post-Fire Damage Inspection of Concrete Structures (Phase II) – Experimental Phase	June 2021
Using Traffic Signals to Reduce Speeding Opportunities	July 2021
Optimizing MassDOT's High Performance Asphalt Overlay Mixtures	July 2021
Construction and Material Best Practices for Concrete Sidewalk Phase II – Hot Placement	July 2021
Implementing AASHTO Mechanist-Empirical Pavement Design Guide Phase II	July 2021
Mycofiltration Design and Treatment Option	August 2021
Ultra High-Performance Concrete Reenforced with Multi-scale Hybrid Fibers	August 2021
Safety Impacts of Yellow Flashing Permissive Left-Turn Indications – Approach Analysis	October 2021

Completed MassDOT Research

	Completion Date
Detecting Subsurface Voids using UAS Infrared Thermal Imaging	February 2022
Best Practices for Cost Recovery	October 2021
Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking in Southeastern MA	September 2021
Improving Load Rating Procedures for Steel Beam Ends with Deteriorated Stiffeners	September 2021
Effectiveness of Bike Boxes in Massachusetts	September 2021
Energy Consumption, Cost and Emissions of MBTA Rapid Transit Vehicles	August 2021
Flexible Transit Services in Rural Areas	August 2021
Future of Commonwealth's Curb	June 2021
Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide (Phase I)	June 2021
Translating Data Generated by the Transit App into Insights on Transportation Use	May 2021
Post-fire Damage Inspection of Concrete Structure (Phase I)	April 2021
Construction and Materials Best Practices for Concrete Sidewalks (Phase I)	March 2021
Impacts of Flashing Yellow Permissive Left-Turn Indications in Massachusetts	March 2021
Characterization of Reclaimed Asphalt Pavement for HMA Surface Courses in Massachusetts	August 2020
Compost Blankets for Erosion Control and Vegetation Establishment	May 2020

Additional Resources

Transportation Research and Information Database (TRID) is a comprehensive bibliographic database containing more than 1.2 million records of transportation research.

Research in Progress (RiP) Database contains information on more than 13,000 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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