massDOT
Massachusetts Department of Transportation

Transportation Research Quarterly

Being inquisitive

Research means that you don't know, but are willing to find out.

– Charles F. Kettering, American inventor, engineer, and holder of 186 patents

Thirteen New MassDOT Research Projects to be Initiated in FFY 2023

FFY 2023 Research Project solicitation received 23 submissions, of which 13 were selected for State Planning and Research Part II funding, with a total amount of $2.97 million. FFY23 projects are expected to identify most qualified researchers in the coming weeks and begin drafting formal scopes of work and contracts before research begins in early calendar year 2023. See page 2 for a description of FFY23 new research projects.

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Championed by	Proposed Project Title	Estimated Cost ($)
MBTA	Cross-Modal Impact Assessment for Sustainable Transportation Networks	100,000
MBTA	Energy-Focused Decision-Making Framework for MBTA Operations and Planning	125,000
MBTA	Measuring Fare Payment Compliance on MBTA Buses and Light Rail	150,000
MBTA	Accessible Bus Stop Design in the Presence of Bike Lanes	200,000
Highway Research & Materials	LIMMS Development Planning	300,000
Highway Research & Materials	Effect of Asphalt Binder Source in Asphalt Mixture Performance	400,000
Highway Research & Materials	Recycled Ground-Glass Pozzolan (RGGP) for Use in Cement Concrete	250,000
Highway Traffic & Safety	A Method for Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile LiDAR - Phase 2	200,000
Highway & IT	Development of a Visualization, Sharing and Processing Platform for Large-Scale Highway Point Cloud Data	175,000
Highway Bridge & Structure	3D Printed Lattice-Based Structures for Next Generation Bridge Bearings and Bridge Isolation Bearings	200,000
Secretary's Office & Highway	Speed Management and Emergency Personnel	300,000
Planning	Measuring Accessibility to Improve Public Health: Phase II	200,000
RMV	Evaluating the Effectiveness of Driver's Education Modules on Safety	370,000

MassDOT FFY2023 New Research Projects

Cross-Modal Impact Assessment for Sustainable Transportation Networks

Champion: MBTA   Estimated Cost: $100,000   Estimated Duration: 18 Months

When investing in a multi-mode transportation system, the following are crucial for defining the sustainability of the system: 1) What is the best way to quantify complex impacts across multiple domains (i.e., social, economic, and environmental)? 2) How does an agency quantify the impact of taking different transportation modes? 3) How can policy decisions about mode choice be evaluated through an equity lens? This project aims to address these questions by 1) introducing normalized metrics that can be used for cross-modal comparisons; 2) quantifying impacts in social, economic, and environmental dimensions; and 3) analyzing investment decisions with respect to equity.

Energy-Focused Decision-making Framework for MBTA Operations and Planning

Champion: MBTA   Estimated Cost: $125,000   Estimated Duration: 18 Months

The MBTA is the single largest user of electricity in the Commonwealth, majority of which is used by its rapid transit system. This project aims to develop an enhanced system-wide energy model for MBTA urban rail transit, building on prior efforts and harnessing network-specific substation energy data. It will calibrate train-specific energy models for all lines of the MBTA to evaluate high-resolution trajectory and ridership impacts on energy consumption. Eventually, it will build a decision-support tool to provide system-wide energy and cost predictions for different operational strategies to enable robust and sustainable planning by the MBTA.

Measuring Fare Payment Compliance on MBTA Buses and Light Rail

Champion: MBTA   Estimated Cost: $150,000   Estimated Duration: 21 Months

Fare collection is a critical revenue stream for transit agencies, and evasion or underpayment reduces these needed revenues. Fare gates in MBTA heavy rail stations provide reliable measures of fare non-payment but it is more difficult to understand fare evasion and occurrence frequency on buses and light rail vehicles without direct manual observations. As the MBTA implements new fare and proof of payment policies, it is important to track any changes in fare-evasion over time. This project will use existing data from infrequent manual observations and from continuous AFC and APC devices to estimate rates of fare evasion on buses and light rail vehicles and will develop a method to identify when and where manual spot checks of fare payment/evasion behaviors are most valuable.

Accessible Bus Stop Design in the Presence of Bike Lanes

Champion: MBTA   Estimated Cost: $200,000   Estimated Duration: 18 Months

The MBTA continues to upgrade bus stops for better accessibility. While these accessible bus stops are integrated with Complete Street designs and other multi-modal accommodations, the impact of other modes and related infrastructure on transit user safety (e.g., conflicts between bicycles traveling on adjacent bike lanes and transit riders), has not been fully investigated. This project will develop a better understanding of the impacts of bicycle infrastructure on bus stop accessibility and explore mitigation plans, ensuring an accessible, equitable, and safe travel experience for all travelers.

LIMMS Gap Analysis and Development Plan

Champion: Highway R&M   Estimated Cost: $200,000   Estimated Duration: 18 Months

The Laboratory Information Materials Management System (LIMMS) was designed as a secure platform to streamline and centralize materials data collection and provide tools to analyze patterns and trends statewide. The current design of LIMMS limits the expected benefits of the system. This project will conduct a gap analysis and investigate alternative software that can meet or exceed MassDOT's technical and design requirements. Findings will be used to inform the technical requirements and criteria for selecting future LIMMS software vendors.

MassDOT FFY2023 New Research Projects

Effect of Asphalt Binder Source in Asphalt Mixture Performance

Champion: Highway R&M   Estimated Cost: $400,000   Estimated Duration: 24 Months

There is a need to understand how asphalt binder source affects the asphalt mixture's overall performance between laboratory and paving settings. The research will investigate how binder source affects mixture performance by determining properties with significant variation; determining the mixture changes that significantly affect performance; analyzing the lifecycle cost based on binder properties; establishing specifications for allowable tolerances; and providing guidance on updating MassDOT pavement specifications to include new testing protocols.

Recycled Ground-Glass Pozzolan (RGGP) for Use in Cement Concrete

Champion: Highway R&M   Estimated Cost: $250,000   Estimated Duration: 22 Months

Hydraulic cement, the key ingredient of cement concrete, produces an immense amount of heat and carbon dioxide during the manufacturing process. RGGP has the potential to greatly reduce the amount of hydraulic cement (up to 50% reduction) needed in the mix design formulation. Other hydraulic cement replacement materials used in today's cement concrete, such as fly ash and slag, are becoming scarce, resulting in a supply shortage and cost increases. The objectives of this research project include validation of the efficacy of RGGP and development of new mix design formulations with RGGP, decreasing our carbon footprint while increasing the quality and durability of MassDOT projects.

Developing a Visualization, Sharing and Processing Platform for Large-Scale Highway Asset Point Cloud Data

Champion: Highway & IT   Estimated Cost: $175,000   Estimated Duration: 21 Months

Building upon results and confidence gained from previous research projects using mobile LiDAR, MassDOT procured a mobile LiDAR unit this year. However, utilization of the valuable point cloud LiDAR data can be challenging due to large file sizes and the complex formats. This project will: 1) develop a platform to enable visualization, sharing, and processing of large point cloud datasets; 2) integrate the platform with existing data sources and analysis tools at MassDOT; and 3) customize processing pipelines using the platform for critical applications and demonstrate the feasibility and benefits of the platform.
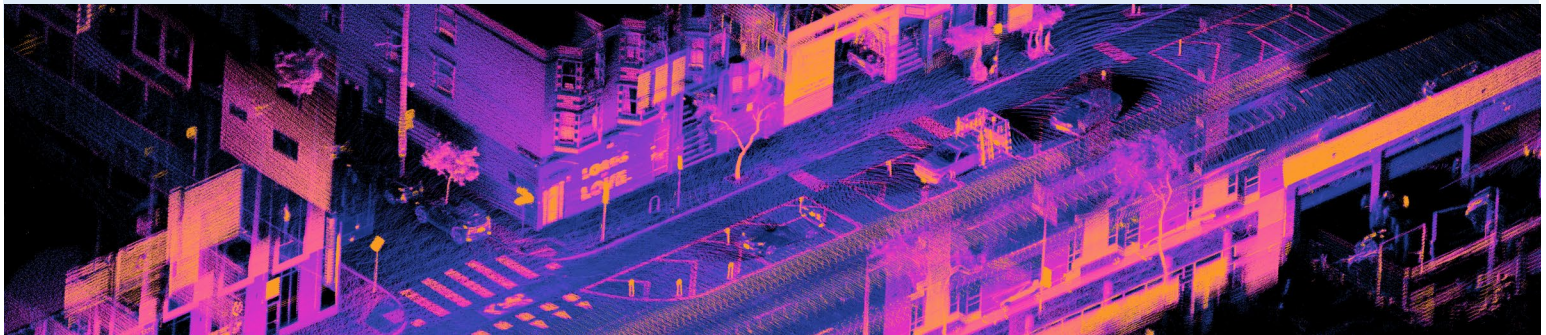

3D-Printed Lattice-Based Structures for Next Gen Bridge Bearings

Champion: Highway Bridge   Estimated Cost: $200,000
Estimated Duration: 24 Months

Recent progress in 3D printing applications through the MassDOT research program examined promising customizable designs for typical bridge and isolation bearings. This project will develop a prototype bearing system and manufacture and test the 3D printing bearing systems and will involve the design of lattices serving as the reinforcement of the rubber elastomer intended to replace the undesirable lead core in traditional isolation bearings. The main research efforts including the manufacturing of the prototype and testing of the composite bearings for a variety of loading conditions.
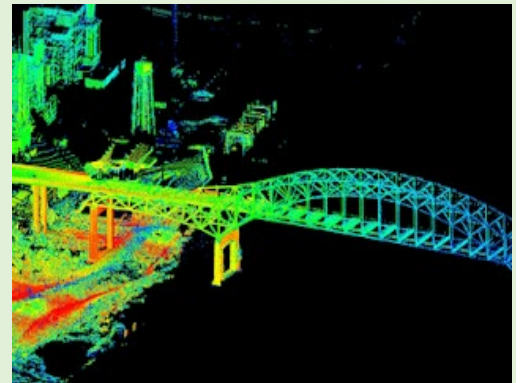
MassDOT FFY2023 New Research Projects

Pavement Marking Inventory and Retroreflectivity Condition Assessment Using Mobile Lidar (Phase II)

Champion: Highway Traffic & Safety   Estimated Cost: $200,000   Estimated Duration: 24 Months

Minimum pavement marking retroreflectivity requirements in the forthcoming MUTCD creates a need for MassDOT to implement an effective and efficient pavement marking inventory and means of retroreflectivity assessment. Phase 1 of this project developed an automated methodology for identifying markings and evaluating retroreflectivity and surface conditions. Phase 2 of this project will continue monitoring existing testing sections, monitor additional sections with waterborne and preformed tape, and investigate the effects of wet marking, recessed marking and skip sections on the retroreflectivity. It will also explore the feasibility of using a LiDAR-based methodology for QA/QC processes.

Measuring Accessibility to Improve Public Health (Phase II)

Champion: Office of Transportation Planning   Estimated Cost: $200,000   Estimated Duration: 24 Months

Phase I worked to quantify community access to opportunities like jobs, food, healthcare, and education. It accounted for different modes but did not consider the built environment and transportation infrastructure's impact on accessibility. Phase II expands on current work to focus on the data and metrics needed to account for access by bicycling, walking, microtransit, and ridesharing services. This research has two objectives: 1) develop measures of accessibility for alternative modes that account for relevant characteristics of infrastructure, built environment, and hours and area of service, and 2) identify gaps and inequities in accessibility that can be addressed by improving access.

Evaluating Driver Education Modules on Safety

Champion: Register of Motor Vehicles   Estimated Cost: $370,000   Estimated Duration: 24 Months

This project will conduct a comprehensive examination of the contents of current Massachusetts driver's education modules and their delivery methods to determine which, if any, modules of the program positively influence novice driver behavior and improve roadway safety. Additionally, there are numerous new technologies affecting drivers that are not yet covered under any drivers' education modules. The project will yield data and an associated report detailing the effectiveness of drivers' education on improving safety and reducing drivers' citations, guidelines and standards for driver's education components, and delivery methods that lead to optimal effectiveness. It will also provide guidance on the creation and implementation of new modules covering emerging technologies.

Speed Management and Emergency Personnel

Champion: Secretary's Office & Highway   Estimated Cost: $370,000   Estimated Duration: 21 Months

Emergency personnel are frequently cited as reason not to implement speed management roadway treatments. The objective of this research is to learn more about specific concerns; how communities have overcome them; and share exemplary case studies from Massachusetts as well as other states for our new mass.gov/safe-speeds site. Additionally, research could include pilot and testing of treatments. The resulting data will be used to inform standards and specifications on speed management treatments that are workable for emergency personnel while still controlling speed.
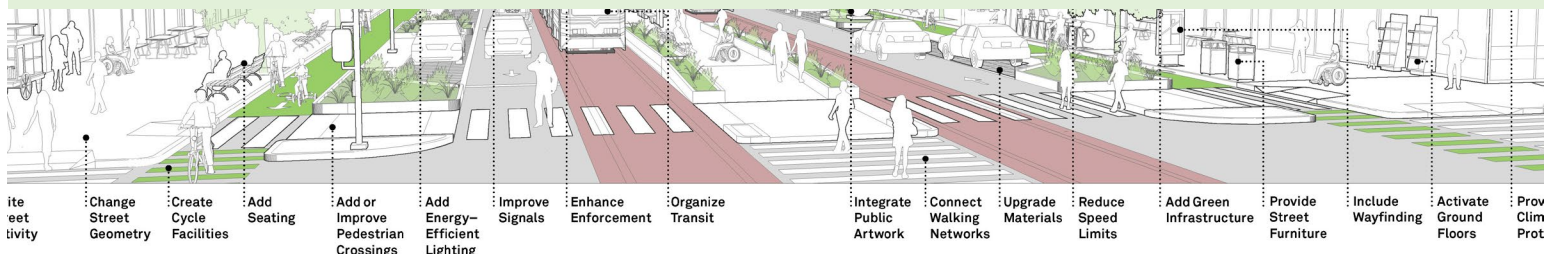
News and Events

In-person 2022 MassDOT Moving Together Conference with Virtual Attendance Option
Date: November 1, 2022, 7:30am-4:00pm
Location: Boston Park Plaza Hotel

The annual MassDOT Moving Together Conference will be in-person (virtual attendance is also available) for the first time since 2019 on **Tuesday, November 1, 2022** at the Park Plaza Hotel in downtown Boston (immediately adjacent to the State Transportation Building at 10 Park Plaza).

Moving Together brings together public and private transportation professionals, educators, and advocates with expertise and interest in bicycle, pedestrian, and transit improvements and features panels, workshops, and site visits around Boston. The League of American Bicyclists will be giving this year's keynote and there will be a special session dedicated to MassDOT's 2050 long-range transportation plan Beyond Mobility.

Other topics include:
- Complete Streets
- Shared Streets & Spaces
- MassTrails Projects
- Bus Network Redesign
- Microtransit
- Special Safety Mega Session

NCHRP FY2024 Problem Statement Solicitation Due by Nov 1, 2022

The AASHTO Special Committee on Research and Innovation (R&I) is soliciting candidate research problems for the fiscal year 2024 National Cooperative Highway Research Program (NCHRP). **Problem statements are to be submitted electronically via this link.**

Visit the **2021 Innovation Conference** website to view the conference program and to register

The problem statement template and the instructions for preparing a problem statement are two separate documents:
- The problem statement template is here
- The problem statement instructions are here

Please direct any questions you may have to Waseem Dekelbab, Acting NCHRP Manager (wdekelbab@nas.edu).

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

Snap Searches are designed for the busy researchers or professionals 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 including:
- A list of recent reports from TRB and the National Academies
- Current and upcoming projects related to the topic
- Names of Committees working on relevant issues
- Upcoming events such as conferences and webinars

Research Resources

In Progress MassDOT Research

	Start Date
• 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 Phase I	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
• 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	May 2022
• Methods to Identify Problematic Carriers	June 2022
• 3D Printing Applications for Bridge Element Repair	June 2022
• Evaluating Safety Impacts of Two-stage Bike Boxes*	August 2022

Recently Completed MassDOT Research

	Completion Date
• 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	June 2022
• 3D Printing Application for Transportation Infrastructure and Maintenance	May 2022
• Automated Guardrail Inventory and Condition Assessment	May 2022
• Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam End	March 2022
• Impact of Advanced Driver Assistance System on Road Safety	March 2022
• 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
• Flexible Transit Services	July 2021

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.

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* Project documents are being edited for accessibility and will be posted shortly.