2026 MassDOT Research Project Portfolio Analysis Report

Research and Technology Transfer
Office of Transportation Planning
Massachusetts Department of Transportation

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Executive Summary

The Massachusetts Department of Transportation (MassDOT) Research, Development, and Technology Transfer (RD&T) Program plays a central role in advancing innovation, improving system performance, and supporting evidence-based decision-making across the Commonwealth's transportation network. The program serves multiple MassDOT divisions, including Highway, Rail and Transit, Aeronautics, the Registry of Motor Vehicles (RMV), and the Massachusetts Bay Transportation Authority (MBTA), ensuring that research investments address both operational needs and long-term strategic priorities.

RD&T activities are funded through State Planning and Research (SPR) Part II funds provided by the Federal Highway Administration (FHWA), as authorized under Title 23, United States Code Section 505, and implemented in accordance with Title 23 of the Code of Federal Regulations (CFR), Part 420. This funding structure emphasizes accountability, applied research, and the practical deployment of findings to improve transportation systems.

During Federal Fiscal Year 2026 (FFY 2026), the RD&T Program undertook a comprehensive initiative to inventory completed research projects and evaluate overall program performance. This effort represents a significant step toward strengthening program transparency, improving internal decision-making, and aligning future transportation research investments with demonstrated needs and outcomes.

The analysis focused on key dimensions of program performance, including:

- Research funding distribution and scale
- Research focus areas and alignment with agency priorities
- Researcher participation and concentration
- Research project duration and delivery characteristics

The findings indicate a research project portfolio, characterized by:

- Consistent project sizing and duration
- A strong emphasis on infrastructure and materials research
- Heavy reliance on a core group of academic researchers
- Frequent use of schedule extensions as a delivery mechanism

The RD&T Program continues to demonstrate effective execution and strong alignment and support for MassDOT's mission. The analysis also highlights opportunities to enhance the program's performance through:

- Increased vendor diversification
- Improved schedule realism and forecasting
- More systematic performance tracking and outcome evaluation

Taken together, these findings position the RD&T Program as a mature and effective platform for applied research, with clear opportunities for refinement and continued growth.

1. Introduction

Since the late 2000s, the MassDOT RD&T Program has supported a broad portfolio of applied research projects designed to address critical transportation challenges. These projects have contributed to improvements in infrastructure durability and maintenance, operational efficiency, safety, environmental sustainability, and the integration of emerging technologies.

MassDOT's applied research projects are intended to produce actionable outcomes that can inform policy, guide engineering practices, and support operational decision-making across MassDOT divisions.

This report analyses 73 research projects completed within the past two decades. These projects provide a representative sample of the program's activities and allow for a structured assessment of funding patterns, delivery performance, and strategic alignment. While a small number of earlier projects were excluded due to incomplete data, the overall dataset is sufficient to support meaningful conclusions.

The analysis is guided by four primary objectives:

- To understand how transportation research funding has been allocated across subject matter, and project types
- To identify patterns in research project execution, including project duration and project findings
- To evaluate the structure and composition of project researchers
- To identify opportunities to improve the research program's efficiency, accountability, and long-term impact

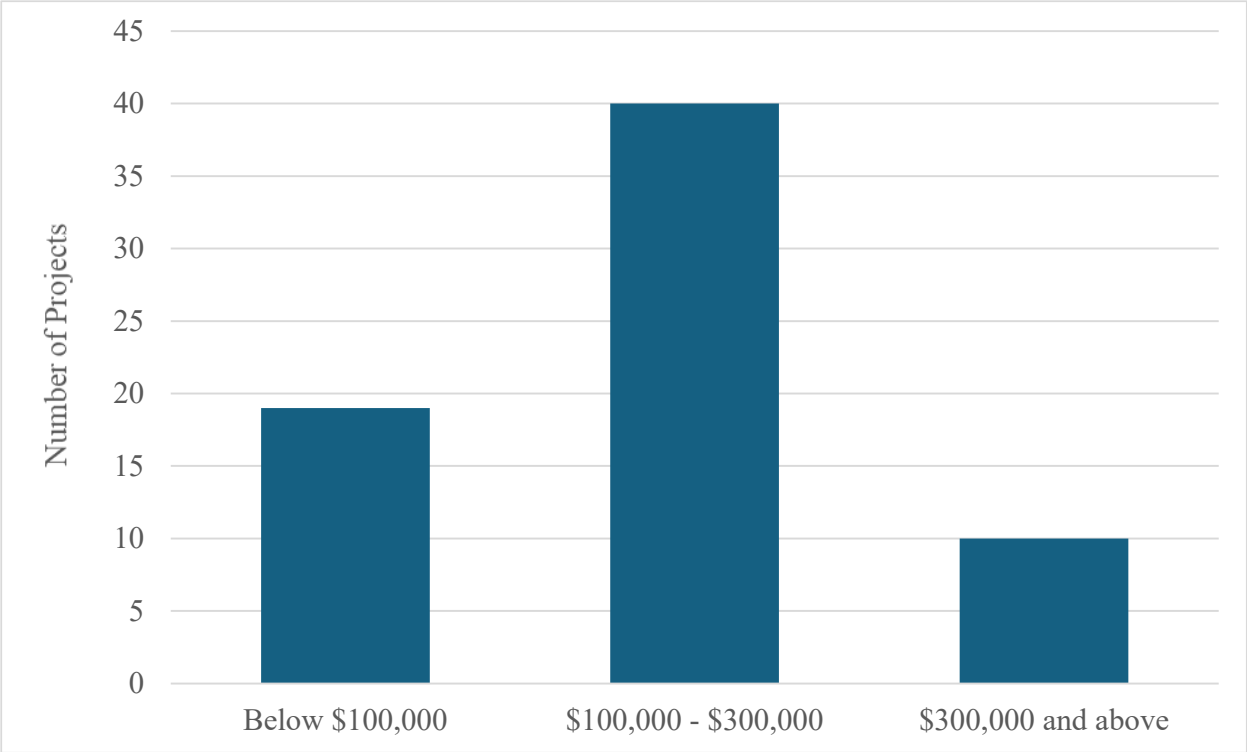
2. Portfolio Overview

2.1 Funding Scale

The RD&T Program invested approximately $13.5 million to fund the 73 analyzed research during the FFY 2009-2026 period. This investment represents a distributed commitment to transportation research.

A clear pattern emerges in the distribution of transportation research project funding:

- Average research project funding of projects falls within the $100,000 to $300,000 range, indicating a focus on targeted research efforts.
- While more complex investigations or multi-phase studies have higher overall budgets, annual breakdown averages them out on par with shorter projects.
- The largest project (~$783,000) reflects the high cost of advanced materials research, including laboratory testing and long-term performance evaluation. The smallest project (~$36,000) represents a narrowly scoped administrative or process-focused effort



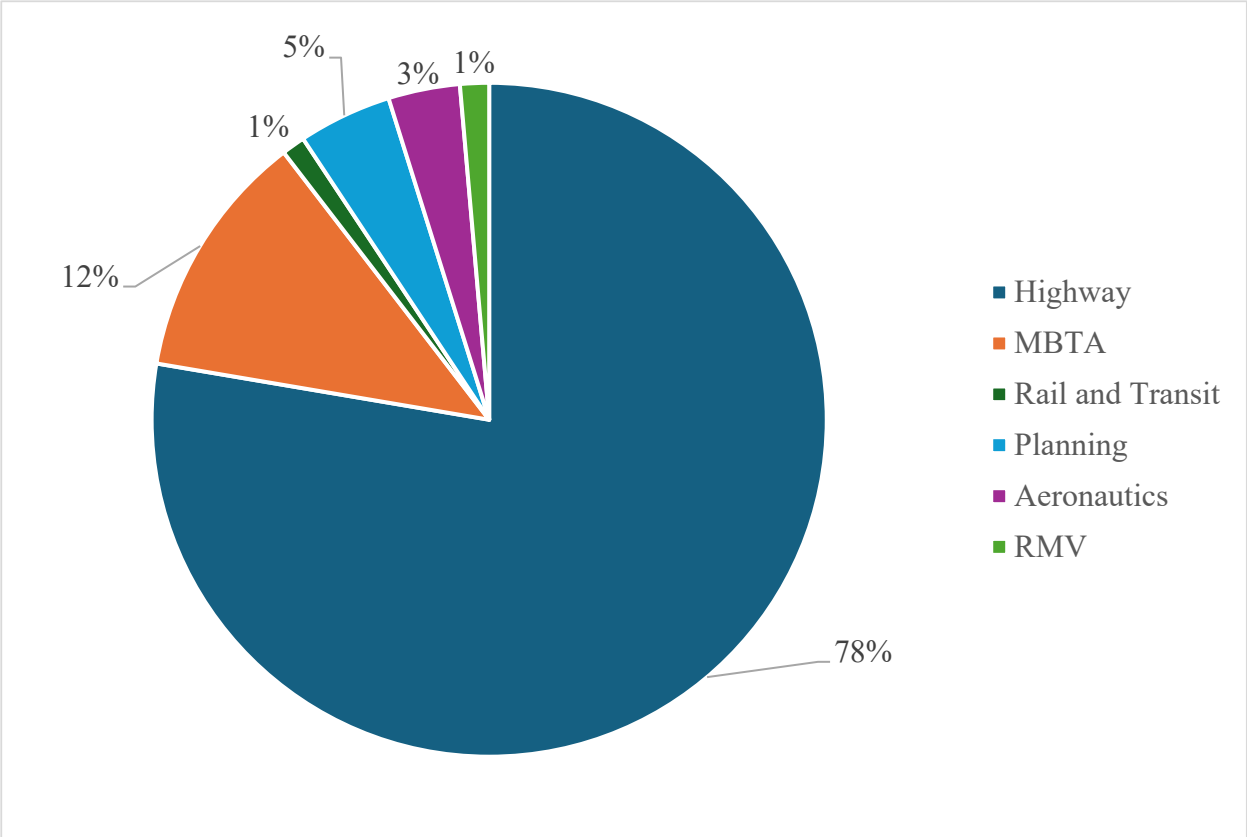
2.2 Research Area Funding

The allocation of funding across research areas reflects MassDOT's operational priorities and long-term infrastructure needs. Research areas spread across six major areas. The largest share of funding is directed toward Highway research needs and accounts for approximately 80% of total funding. Research projects in this category include:

- Asphalt and concrete performance
- Pavement lifecycle and durability
- Material innovations for sustainability and resilience
- Traffic, Safety, and Operations, focusing on congestion management, signal optimization, and data-driven tools
- Structures, addressing bridge performance, deterioration, and inspection technologies

Secondary areas, while smaller in scale, play important roles in supporting system-wide outcomes:

- Transit and MBTA initiatives
- Environmental sustainability
- Planning and administration
- Aeronautics and RMV-requested studies



2.3 Project Budget

The distribution of project budgets provides insight into how the program prioritizes different types of research.

High-cost projects are concentrated on areas that require:

- Extensive field data collection
- Laboratory testing and validation
- Long-term monitoring and performance analysis

Lower-cost projects are typically:

- Exploratory in nature
- Limited in scope
- Shorter project completion timelines

2.4 Project Completion Timelines

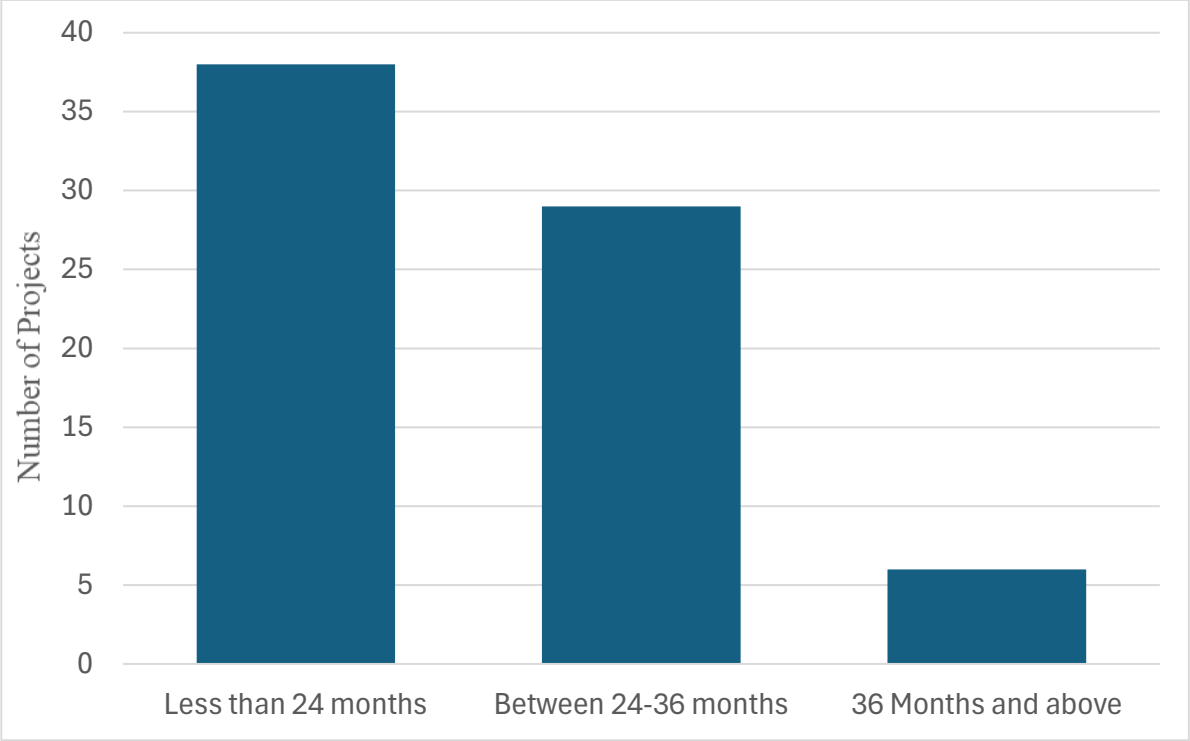
Project completion timelines provide important insight into both research complexity and program efficiency.

The analysis shows the project completion timelines for most projects fall within a range of 18 to 36 months. Over 90% of the projects are completed in less than 36 months. Project completion timelines can be extended to accommodate unanticipated delays. A No Cost Time Extension (NCTE) is utilized to realize project term extensions. Most timeline

extensions are between 12 to 24 months. Few projects have required more than a 40-month extension. The longest project duration was 60 months and the shortest project lasted 6 months.

A clear trend is evident over time:

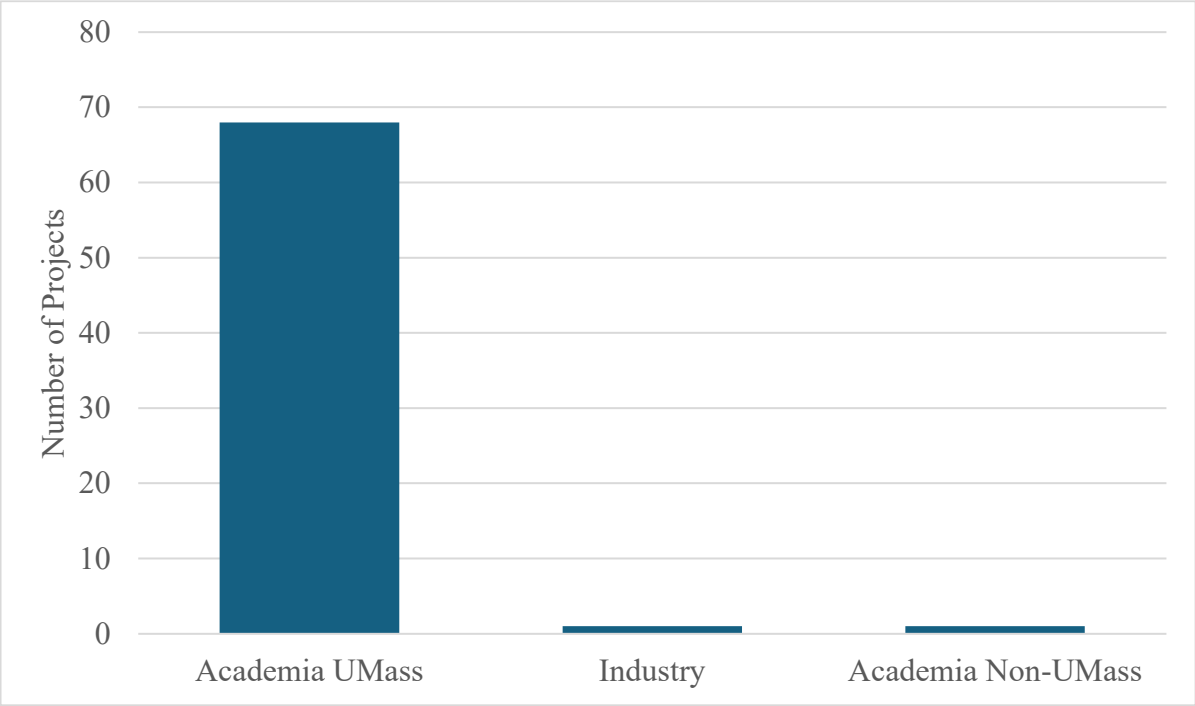
- Earlier projects tended to have longer timelines and less segmented
- More recent projects are shorter, more focused, and modular
- Approximately 10% of projects are broken down to multiple phases spreading them out the different fiscal years.



2.5 Researcher Participation

The MassDOT RD&T Program has contracted with researchers to conduct its transportation research projects. UMass Amherst serves as the primary research consultants, participating in most projects. UMass Dartmouth contributes significantly to asphalt materials and pavement research.

This concentration of researcher consultants provides strong continuity. However, it also introduces potential risks related to limited competition and reduced diversity of ideas. Expanding the research consultant base from UMass College System only to include private vendors, and others, could enhance innovation while maintaining existing strengths.



3. Analysis and Observations

3.1 Vendor Participation

The program's reliance on a relatively small group of research consultants is one of its most defining characteristics. While this approach offers benefits in terms of familiarity with MassDOT processes, it also introduces potential risks. A limited research consultant pool may reduce competitive pressure, potentially affecting cost efficiency and innovation. The challenge moving forward is to balance program continuity with an expanded network of research consultants, to ensure that MassDOT's transportation research program continues to benefit from established expertise while also encouraging new perspectives.

3.2 Project Budget

Most transportation research projects are scaled to their objectives; however, the relatively narrow range of project sizes may indicate an opportunity to explore more transformative initiatives that address system-wide challenges.

3.3 Project Completion Timelines

Project completion timelines have aligned closely with academic research cycles and can inadvertently extend project timelines and affect research delivery performance. Without tracking deviations from planned timelines, it is difficult to assess efficiency or identify recurring delays. This highlights the need for more robust performance metrics.

3.4 No-Cost Time Extensions

The prevalent use of No-Cost Time Extensions (NCTE) indicates that schedule flexibility is a standard feature of project delivery. Over 50% of the projects received a NCTE. While

flexibility is necessary in research environments, its consistent use may indicate that initial timelines are overly optimistic or that projects encounter recurring external constraints. Without standardized tracking, it is difficult to distinguish between justified extensions and avoidable delays.

3.5 Cost and Time Extensions

The use of Cost and Time Extensions (CTE) suggests that both cost and schedule evolve during execution. While this is not uncommon in research, it underscores the importance of improving initial scoping and contract structuring.

3.6 Recommendations

Opportunities to improve and maintain project completion timelines involve improving transparency, measurement, and accountability:

- Improve duration forecasting
- Standardize extension tracking and reporting
- Develop vendor performance metrics
- Expand vendor participation
- Transition toward outcome-based evaluation frameworks

4. Concluding Remarks

The MassDOT Research, Development, and Technology Transfer (RD&T) Program represents a mission-aligned research portfolio that consistently delivers applied value to the Commonwealth's transportation system.

The emphasis on infrastructure, particularly in pavement materials, structural performance, and system operations, reflects a necessary focus on maintaining and improving the Commonwealth's critical transportation assets. The increasing presence of technology-driven projects signals a gradual but important shift toward modernization and innovation. This trend positions the RD&T Program to play a key role in supporting future-ready transportation systems, where data, automation, and predictive tools become increasingly central to decision-making. Automated and predictive tools have already shown improvements in productivity but require increased planning and investment during this transition.

Despite these strengths, the analysis also highlights several structural patterns that warrant attention. The program's reliance on a concentrated group of research consultants—while beneficial for continuity introduces potential issues related to limited competition and reduced diversity of perspectives. Expanding the research consultants' network even incrementally would help strengthen innovation, improve resilience, and enhance overall program competitiveness.

Similarly, the prevalent use of schedule extensions, including both No-Cost Time Extensions (NCTEs) and Cost and Time Extensions (CTEs), suggests that flexibility is deeply embedded in project delivery. While this flexibility is often necessary in research environments, its regular use may indicate that initial project scoping and timeline

assumptions are not fully aligned with actual execution conditions. Without systematic tracking and analysis, these schedule extensions can obscure performance trends and limit the program's ability to refine future planning. The RD&T Program will periodically update this report when new data points become available.

Addressing these challenges presents an opportunity to build on existing strengths by introducing more robust performance management practices. Enhancing visibility into schedule adherence and extension tracking and incorporating outcome-based implementation evaluation metrics would improve program performance and support evidence-based decision-making across the Commonwealth's transportation network.

Looking ahead, the RD&T Program is committed to delivering high-impact research while adapting to emerging transportation challenges. Key areas of opportunity include:

- Expanding partnerships beyond traditional academic institutions
- Strengthening the connection between research outcomes and implementation
- Increasing focus on cross-disciplinary and system-level innovations
- Continuing to modernize research approaches through technology integration

Ultimately, the program's success lies in its ability to translate research into timely and practicable and implementable improvements. MassDOT Research Implementation Survey Report indicates that many of the research conducted is being implemented or used in practice. By refining its approach to vendor engagement, project planning, and performance tracking, the RD&T Program can further enhance its role as a strategic asset for MassDOT.

In conclusion, the RD&T Program not only supports current operational needs but also lays the groundwork for a more resilient, efficient, and innovative transportation system. Transportation research findings influence design standards, specifications, and operational decision-making within MassDOT. With targeted improvements and continued strategic alignment, it is well positioned to deliver even greater value in the years ahead.

Appendix: List of Completed Projects

Artificial intelligence framework for crosswalk detection across Massachusetts
Speed Management and Emergency Response – A Synthesis Study
Improving the Long-Term Condition of Pavements in Massachusetts and Determining Return on Investment: Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide - PHASE I
Methods to Identify Problematic Carriers and Prevent Infrastructure Damage
Data-Driven Approaches for Transit Capital Planning
Safe Waves: Signal Timing Guide, Analysis Tool, and Case Studies
Robust decision-making framework for sustainable operations and planning of MBTA rapid transit vehicles (RDMM)
Accessible Bus Stop Design in the Presence of Bike Lanes
Development of a Salt Spreader Controller Program Using Machine-Sensed Roadway Weather Parameters
Cross-Modal Impact Assessment for Sustainable Transportation Networks
Laboratory Information Materials Management System (LIMMS) Development Planning
Smart Work Zone Control and Performance Evaluation Based on Trajectory Data
Post-fire damage inspection of concrete structures Phase III – in-situ experimental phase
Effectiveness of Two-stage Turn Queue Boxes in Massachusetts: A Comparison with Bike Boxes
Tree Protection for Street Corridor Development in Massachusetts
Feasibility of 3D printing applications for highway infrastructure construction and maintenance
Development of improved inspection techniques using LiDAR for deteriorated steel beam ends
A Pavement Marking Inventory and Retroreflectivity Condition Assessment Method Using Mobile LiDAR – Phase 2
Measuring Fare Payment Compliance on MBTA Buses and Light Rail
Effect of Asphalt Binder Source on Asphalt Mixture Performance
Field Study to Determine Salt Usage Efficiency and Transport to the Surrounding Environment on Two Pavement Types
Development of a Visualization, Sharing, and Processing Platform for Large-Scale Highway Point Cloud Data
Evaluating the Effectiveness of Drivers' Education Modules on Safety
3D-Printed Lattice-Based Structures for Next Generation Bridge Bearings and Bridge Isolation Bearings (Phase III)
Measuring Food Access to Improve Public Health Phase II
Recycled Ground-Glass Pozzolan (RGGP) for Use in Cement Concrete
Cracks of Low-P Rapid Set Concrete in Deck Repairs: Analysis, Prevention, and Alternatives
Evaluation & Mitigation Methods for the Prevention of Cement Concrete Deterioration Due to Pyrrhotite Part 1
Developing Massachusetts-Specific Trip Generation Models for Land Use Projects

Outdoor Information Panels to Convey Real-Time Travel Information for Ridership Recovery
Massachusetts Depth to Bedrock Project
Measuring Food Access to Improve Public Health
Construction and Materials Best Practices for Concrete Sidewalks: Phase II – Long-Term Performance and Hot-Weather Placement Effects
Evaluating the Safety Impacts of Flashing Yellow Permissive Left-Turn Indications in Massachusetts: Approach Level Analysis
Using Mycofiltration Treatment for Stormwater Management
Uncovering the Root Causes to Truck Rollover Crashes on Ramps
Multisource Data Fusion for Real-Time and Accurate Traffic Incident Detection via Predictive Analytics
Post-Fire Damage Inspection of Concrete Structures Phase II - Experimental Phase
BIM for Transit Infrastructure: A Feasibility and Gap Assessment with Current Practices and Systems at the MBTA
Optimizing of MassDOT's High Performance Asphalt Overlay (HPOL) Mixtures
Revised Load Rating Procedures for Deteriorated Prestressed Concrete Beams
Ultra-High Performance Concrete Reinforced with Multi-Scale Hybrid Fibers and Its Durability-Related Properties
Understanding Asset Management Systems Utilized by Municipalities in Massachusetts
Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide (Phase II)
Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam Ends
Use of UAS For Surface Transportation Emergency Response
Impact of Advanced Driver Assistance Systems (ADAS) on Road Safety and Implications for Education, Licensing, Registration, and Enforcement
A Pavement Marking Inventory and Retroreflectivity Condition Assessment Method Using Mobile LiDAR
Automated Guardrail Inventory and Condition Evaluation
Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking in Southeastern MA
Feasibility of 3D Printing Applications for Highway Infrastructure Construction and Maintenance
Best Practices for Cost Recovery
Improved Load Rating Procedures for Deteriorated Steel Beam Ends with Deteriorated Stiffeners
Improving Future of the Commonwealth's Curb
PERCEPT Indoor Navigation System for Visually Impaired: Beta Study
Flexible Transit Services
Effectiveness of Bike Boxes in Massachusetts
Translating Data Generated by the Transit App into Insights on Transportation Use in Greater Boston
Evaluating the Safety Impacts of Flashing Yellow Permissive Left-Turn Indications in Massachusetts
Construction and Materials Best Practice for Concrete Sidewalks
Post-Fire Damage Inspection of Concrete Structures

Characterization of Reclaimed Asphalt Pavement for HMA Surface Courses in Massachusetts
Compost Blankets for Erosion Control and Vegetation Establishment
Public Health Assessment for Transportation Projects
The Application of Unmanned Aerial Systems in Surface Transportation Report
Tunnel and Fencing Options for Reducing Road Mortalities of Freshwater Turtles
Improved Highway Lane Reflectorized Markers
Coping with the Aging Driving Population
Evaluation of Specialized Hot Mix Asphalt Mixes for Massachusetts
Better Bridge Joint Technology
Automated Detection and Counting of Pedestrians and Bicyclists Along an Urban Roadway
Evaluating the Effect of Advance Yield Marking and Symbolic Signs on Vehicle-Pedestrian Conflicts at Marked Midblock Crosswalks across Multilane Roads
Calibration of Safety Performance Functions for Massachusetts Urban and Suburban Intersections
Determination of the Binder Grade and Performance RAP-HMA Mixes
Mitigation Techniques to Modify Driver Performane to Improve Fuel Economy, Reduce Emissions and Improve Safety
Evaluation of Portable Road Weather Information Systems
Current Counter-Drone Technology Solutions to Shield Airports and Approach and Departure Corridors
The State of the Practice of UAS Systems in Transportation
Developing a Metric for the Cost of Green House Gas Abatement
Field Monitoring of Experimental Hot Mix Asphalt Projects Placed in Massachusetts
Performance of Adhesive and Cementitious Anchoring Systems
Zero-Emission Transit Bus and Refueling Technologies and Deployment Status
Electric Vehicle: Impacts on Transportation Infrastructure - A Review of Other States
Commuter Bus Demand, Incentives for Modal Shift, and Impact on GHG
Measuring Left-Behind on Subway
The Role of Street Trees for Pedestrian Safety
Strategic Planning for Connected and Automated Vehicles in Massachusetts
Estimating Future Changes in 100-year Floods on the Connecticut and Merrimack Rivers
Commuter Bus Demand, Incentives for Modal Shift, and Impact on GHG (Part II)
Risk Factors for Older Pedestrian Injuries and Fatalities in Massachusetts
Evaluation and Enhancement of MassDOT Traveler Information Programs
Traffic Flow Improvements: Quantifying the Influential Regions and Long-Term Benefits
Optimizing ADA Paratransit Operations with Taxi and Ride Share Programs
Improving Pedestrian Infrastructure Inventory in Massachusetts Using Mobile LiDAR
Environmental Scan of Community Transit Needs Among Older Adults in Massachusetts
MassDOT Speed Regulations Editing Support
Detecting Subsurface Voids in Roadways using UAS with Infrared Thermal Imaging