![massDOT - Massachusetts Department of Transportation]

Transportation Research Quarterly

Focused on Research

In order to be a forward looking and innovative agency, we must constantly be on the lookout for emerging industry trends and new technologies with the potential to change how we operate and serve our customers. We must be prepared to adapt to these changes and be willing to identify, explore, and adopt new technologies and solutions. Research can be instrumental to this effort. Through forward looking research, we can systematically explore potential solutions and examine how new technologies and approaches can help us operate more safely, equitably, efficiently and sustainably.

Johnathan Gulliver, Administrator, MassDOT Highway Division

INSIDE THIS ISSUE

Annual MassDOT Research Problem Statement Solicitation Remains Open until May 24

The Commonwealth strives to be a national leader in transportation research and practice. This research is driven by agency needs and our staff's innovative ideas to continually improve and transform the work we do at MassDOT and the MBTA. As shown in the chart below, our research projects cover many areas of surface transportation.
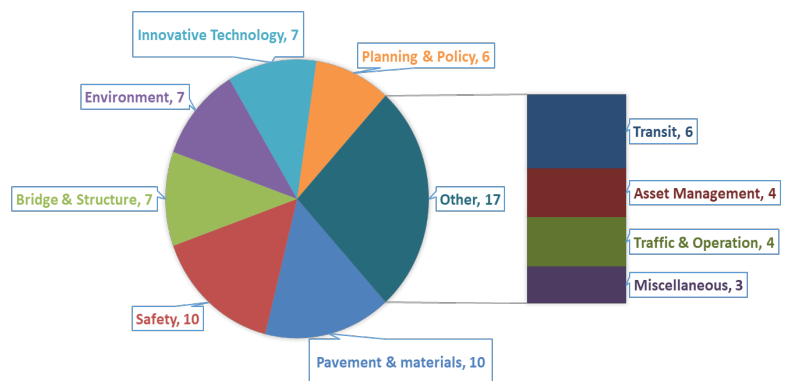
To participate you do not need to know the answers, just clearly define the problem that MassDOT needs to solve and how the results would be implemented. Should your project be selected, you will serve as the Project Champion. Working alongside the contracted researchers and Research Section staff, you will ensure that the results of the research address the most pressing issues facing us as an agency and that the recommendations are readily implementable.

To submit a research project idea, please complete a research problem statement submission form. The submission form and accompanying guide sheet provide detailed directions to help you create a strong proposal.

Ongoing Research Highlights

A UAS Network for Transportation Emergency Response

Unmanned Aerial Systems (UAS) have demonstrated great potential for surface transportation applications, including Transportation Systems Management and Operation (TSMO). Built upon a conceptual framework developed through a pervious MassDOT research project "Application of Unmanned Aerial Systems in Surface Transportation," this new project will investigate how UAS can be integrated into the surface transportation emergency response network by evaluating their practical utility, operational constraints, and integration steps. It will identify the types of highway incidents most suitable for using UAS, the key UAS operational parameters, and the standard operating procedure for highway emergency response applications.

Principal Investigators: Dr. Danjue Chen & Dr. Yuanchang Xie, UMass Lowell
Project Champions: Dr. Jeffrey DeCarlo, MassDOT Aeronautics & Chet Osborne, MassDOT Highway
Project Manager: Nicholas Zavolas, MassDOT OTP

Impact of Advanced Driver Assistance Systems on Road Safety and Implications

Advanced driver assistance systems (ADAS) are technologically complex and may elicit various unintended negative driving behaviors due to drivers' lack of understanding of the systems. This research creates a better understanding of the distribution and prevalence of ADAS-equipped vehicles in Massachusetts, how drivers use different ADAS functions, and the associated challenges for drivers to use them safely. The research findings may support future consideration for the implementation of new ADAS-related driver training standards or practices, licensing, and vehicle registration and inspection. The findings may also have relevance for transportation infrastructure owners and operators, local and state law enforcement officers and other first responders, and ADAS technology developers.

Principal Investigators: Dr. Anuj K. Pradhan, UMass Amherst
Project Champion: Dan Sullivan, MassDOT Secretary's Office
Project Manager: Nicholas Zavolas, MassDOT OTP

Feasibility of 3D Printing Applications for Highway Infrastructure and Maintenance

The project explores Additive Manufacturing (AM, or 3D Printing) technologies as a potential future resource to assist in the rehabilitation of highway infrastructure and classic recurring maintenance activities. The project connects the AM research community with Highway staff to explore AM repair techniques and to demonstrate AM technology capabilities by manufacturing selected rare components for Highway maintenance. The project will also develop recommendations for the necessary business processes to support AM procurements and related quality assurance reviews. The 3D Printing research team hosted a two-day workshop including introductions to AM technologies, industry overviews on infrastructure applications, and MIT and UMass AM lab capabilities.

Principal Investigators: Dr. Simos Gerasimidis & Dr. Wen Chen, UMass Amherst; Dr. John Hart, MIT
Project Champions: Paul Tykodi, MassDOT IT & Catherine Chen, MassDOT Highway
Project Manager: Michael Flanary, MassDOT OTP
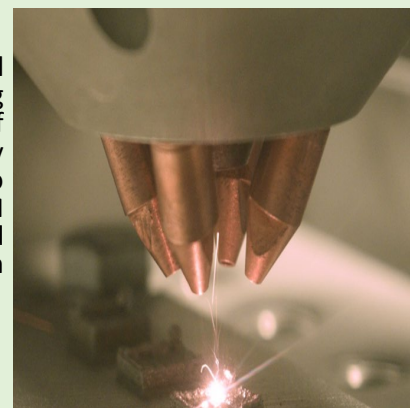
Detecting Subsurface Voids in Roadways using UAS with Infrared Thermal Imaging

The opening of soil voids below pavement caused by the failure of culverts and drainage piping creates a safety hazard. This study focuses on the experimental validation of rapid aerial infrared (IR) thermography and unmanned aerial systems (UAS) for detecting soil voids and assessing the conditions of culverts and drainage piping underneath public roadways. More specifically, it will determine the accuracy of IR imaging for field inspections to detect soil voids and underground structures and characterize the minimal size and severity of defects that can be detected with IR thermography. It will also define operational challenges associated with its field deployment and recommend procedures to optimize the use of IR imaging on UAS platforms.

Principal Investigators: Dr. Alessandro Sabato & Dr. Tzuyang Yu, UMass Lowell
Project Champions: Dr. Jeffrey DeCarlo, MassDOT Aeronautics & Jason Benoit, MassDOT Highway
Project Manager: Patrick McMahon, MassDOT OTP
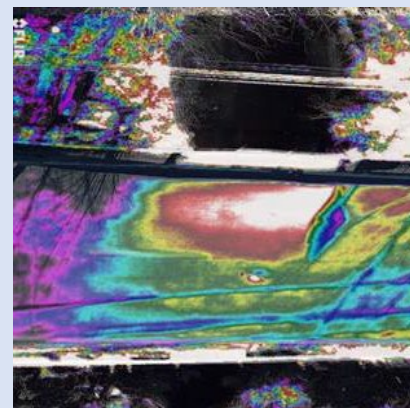
A Look at Who We are – Team Highlights

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 lead and project sponsor, 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 "A UAS Network for Transportation Emergency Response" project team.

Project 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, and watching his son pitch in Minor League Baseball. You may contact Nicholas at Nicholas.Zavolas@dot.state.ma.us.


Project Champion – Dr. Jeffrey DeCarlo

Dr. Jeffrey DeCarlo is the MassDOT Aeronautics Division Administrator tasked with providing statutory and regulatory oversight for all aviation matters in Massachusetts, including safety, security, airport development, and UAS programs. He leads the Commonwealth UAS Integration Program, an industry, academia, and government collaborative focused on enabling UAS and Counter-UAS systems. A former U.S. Air Force and airline pilot with over 10,000 hours in fighter and commercial aircraft, Dr DeCarlo has more than 30-years of aviation operations and consulting experience with the military, industry, academia and government. Dr DeCarlo sits on the Board of Directors of MassAutonomy (as Chair), the Northeast UAS Airspace Integration Research Alliance (NUAIR), the Association for Unmanned Vehicle Systems International (AUVSI) New England, and the National Association of State Aviation Officials (NASAO) and is the former Chair for the NASAO Center for Aviation Research and Education.
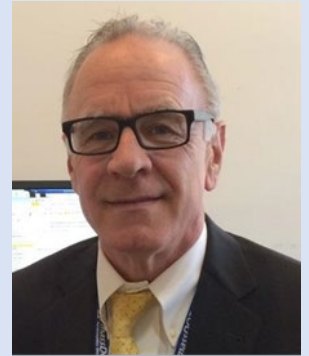
Principal Investigator – Dr. Danjue Chen

Dr. Danjue Chen is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Massachusetts Lowell. She is the recipient of the prestigious National Science Foundation (NSF) CAREER award. Dr. Chen's research interests include modeling and control of connected and autonomous vehicles, traffic flow theory, and interaction between human and machines such as smart vehicles. She holds a doctoral degree from Georgia Institute of Technology and worked as a postdoctoral researcher at UC Berkeley and University of Wisconsin Madison prior to joining UMass Lowell. You may contact Danjue at Danjue_Chen@uml.edu.
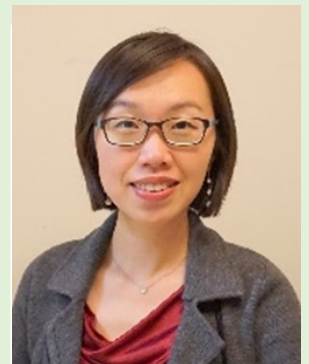
Principal Investigator – Dr. Yuanchang Xie

Dr. Yuanchang Xie is an Associate Professor in the Dept. of Civil and Environmental Engineering at the University of Massachusetts Lowell. His research focuses on Intelligent Transportation Systems (ITS), transportation safety, traffic control and simulation, and data analytics. He has published over 60 peer-reviewed journal and conference articles in these areas and received two Transportation Research Board (TRB) best paper awards. He is currently a member of the TRB Artificial Intelligence and Advanced Computing Applications Committee. You may contact Yuanchang at Yuanchang_Xie@uml.edu.

News and Events

The 2021 MassDOT Innovation Conference is Virtual

Sessions & Exhibits: May 25-27, 2021   8:00 am – 1:00 pm Daily
Visit the Conference Website to View Program Details and 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. This year's conference features three keynote lunch sessions by **MassDOT Acting Secretary Jamey Tesler, Louisiana DOTD (Department of Transportation and Development) Secretary Dr. Shawn Wilson, and Maryland DOT Secretary Gregory Slater**.

The 2021 Conference includes five tracks:
- A. Practices in Municipal and Regional Transportation
- B. Mobility, Accessibility, and Transportation Equity
- C. Techniques in Design, Materials, and Construction
- D. Promoting a Culture of Safe Transportation
- E. Shaping the Transportation Landscape for a Post Covid world

Register and Attend Upcoming TRB Webinars

Start by Creating a Complimentary MyTRB Account

The Transportation Research Board (TRB) provides leadership in transportation improvements and innovation through trusted, timely, impartial, and evidence-based information exchange, research, and advice regarding all modes of transportation. The TRB webinar program produces around 100 webinars per year on topics across the entire transportation industry. Like TRB itself, the webinar program is multimodal. These webinars provide opportunities to learn the latest research and practices by and for transportation professionals. If you have a MyTRB account created using your MassDOT email address, you can register and attend these webinars without additional costs.

New England Transportation Consortium (NETC)

Recordings of Recently Completed NETC Project Webinars are Available for Viewing

The New England Transportation Consortium (NETC) has hosted a series of webinars on completed NETC projects. In each webinar, the investigator outlined the project need, the research methodology, the study results, and the expected benefit and value of the project. The project topics include the following: Integration of UAS into State DOT Operations, Asphalt Balanced Mixture Design, MASH Computer Simulated Steel Bridge Rail and Transition Details, Optimizing QA Process for Asphalt Pavement Construction, Using SHARP2 Naturalist Driving Databases for Examining Safety Concerns for Older Drivers, Moisture Susceptibility Testing for Hot Mix Asphalt Pavements in New England, and the New England Connective and Automated Vehicle Collaborative Efforts.

Visit NETC Research Projects website for in progress and completed research efforts.

Research Resources

In Progress MassDOT Research

	Start Date
• Translating Data Generated by the Transit App into Insights on Transportation Use	November 2018
• Improving Load Rating Procedures for Steel Beam Ends with Deteriorated Stiffeners	June 2019
• Development of Comprehensive Inspection Protocols for Deteriorated Steel Beam End	February 2020
• Flexible Transit Services in Rural Areas	February 2020
• Effectiveness of Bike Boxes in Massachusetts	March 2020
• A Pavement Marking Inventory and Condition Assessment Method Using Mobile Lidar	March 2020
• Implementing the AASHTO Mechanistic-Empirical Pavement Design Guide (Phase I)	April 2020
• Understanding the Asset Management Systems Utilized by Municipalities in Massachusetts	April 2020
• Energy Consumption, Cost and Emissions of MBTA Rapid Transit Vehicles	May 2020
• Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking in Southeastern, MA	May 2020
• Impact of Advanced Driver Assistance System on Road Safety	June 2020
• 3D Printing Application for Transportation Infrastructure and Maintenance	June 2020
• Future of Commonwealth's Curb	July 2020
• Detecting Subsurface Voids using UAS Infrared Thermal Imaging	November 2020
• Automated Guardrail Inventory and Condition Assessment	January 2021
• Best Practices for Cost Recovery	February 2021
• A UAS Network for Transportation Emergency Response	March 2021
• Uncovering the Root Causes to Truck Rollover Crashes on Ramps	March 2021
• Massachusetts Depth to Bedrock	March 2021
• Developing Massachusetts-Specific Trip Generation Models for Land Use Projects	March 2021
• Multisource Data Fusion for Real-time and Accurate Traffic Incident Detection	April 2021
• Measuring Accessibility to Improve Public Health	May 2021
• Post-Fire Damage Inspection of Concrete Structures (Phase II) *	May 2021
• Revised Load Rating Procedures for Prestressed Concrete Beams *	May 2021

Recently Completed MassDOT Research

	Completion Date
• 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
• Public Health Assessment for Transportation Projects	March 2020
• Applications of Unmanned Aerial Systems in Surface Transportation	December 2019
• Commuter Bus Demand, Incentives for Modal Shift, and Impact on GHG Emissions (Part II)	December 2019
• Estimating Future Changes in 100-year Floods on the Connecticut and Merrimack Rivers	November 2019
• Improving Pedestrian Infrastructure Inventory in Massachusetts Using Mobile LiDAR	September 2019
• Risk Factors for Older Pedestrian Injuries and Fatalities in MA	August 2019
• Optimizing ADA Paratransit Operations with Taxi and Ride Share Programs	May 2019

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.

University of Massachusetts Transportation Center (UMTC) provides research and training services to MassDOT under an Interdepartmental Service Agreement.

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

Contact Us

Research & Technology Transfer Section
Email for General Questions

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Research Project Managers
Drew Pflaumer   Email Drew
Michael Flanary   Email Mike
Nicholas Zavolas   Email Nicholas
Patrick McMahon   Email Patrick

Note: * The 508-compliant research summary or final report will be posted on the Research web site by the end of May.