

RAC – Highways Program & Project Development

Bridges & Structures

Goal 1: Develop a better understanding of how to preserve key structural steel bridge components.

Research Needs:

1. Pack rust removal best practices.
 - a. Identify condition triggers for cost effective removal of pack rust.
 - b. Evaluating the effectiveness of various pack rust removal techniques.
2. Laser paint removal costs and benefits.
 - a. Rust formation is reported to be delayed or impeded after laser paint removal. Initiate research to validate this claim.
 - b. Comparative analysis of various rust removal techniques including documenting environmental impacts.
3. Validation of pin and hanger fatigue life on previously retrofitted bridges.
 - a. Study of Michigan's Link Plate and Pin Assemblies (Previous MDOT Research SPR-1358).
 - b. Analysis of Stress Distribution in Link Plates Used for Suspending Bridge Beams (Previous MDOT Research SPR-1517).

Goal 2: Leveraging data and technological advances in bridge design to address complex field and construction conditions.

Research Needs:

1. Evaluating Michigan cohesive soils for applicability to the 2012 HEC manual methods for determining erodibility of cohesive soils and rock, and application of equations for scour depth.
2. Technology transfer of 3D hydraulic analysis methods in accordance with FHWA everyday counts methods. Investigate using new technologies such as LIDAR mapping, sonar and Unmanned Aerial Systems (UAS) to map river channels at structures.
3. Collecting and utilizing as-constructed slab & screed data to understand design and construction correlations as they relate to prestressed concrete long term multipliers and steel girder camber rebound for deck replacements.

Goal 3: Development of New Technology and Modernization of MDOTs Bridge Program.

Research Needs:

1. Standardizing Bridge Plans for Precast Bridge Systems.
2. Developing and Implementing 3D bridge models and plans.

Environment & Water Resources

Goal: Provide easier access to environmental information.

Research Needs:

1. Develop an Environmental Information Management System that provides easy access to

information relating to the environmental permit and design phases of project development. Endangered species, wetlands, and archaeological site surveys are examples of the type of available information.

2. Identify invasive species management strategies and mapping locations within the MDOT right-of-way.
3. Identify sensitive water resources and alternative snow/ice management techniques to protect water quality.
4. Identify pollinator corridors within the MDOT right-of-way along various state trunklines.

Innovative Contracting

Goal: Improve the consistency of contracting approaches used for maintenance and operations.

Research Needs:

1. Develop a Guidebook for Standard Contracting Practices for Maintenance and Operations. The guidebook will recommend standards for contract language, performance, evaluation and acceptance. Standard deductions and incentives for various situations will also be recommended.

Real Estate & Permits

Goal: Provide easier access to real estate and permit information to internal and external customers.

Research Needs:

1. Assess available technology to provide electronic real estate transactions and permit requests/issuance.
2. Identify the legal barriers, technology trends, and benefit/cost to developing and implementing new tools that support digital access to property acquisition/easement information, trucking permits, right-of-way permits and driveway permits.
3. Develop a risk-based tool that assists in determining if identified right-of-way can be classified as excess and sold to private entities.

Transportation Safety

Goal: Continue to progress toward zero highway deaths by further preventing or reducing the severity of crashes through the implementation of cost effective crash reduction strategies.

Research Needs:

1. Identify new crash countermeasures that leverage emerging transportation technologies related to vehicle to vehicle communication and vehicle to infrastructure communication.
2. Review safety related best practices, resulting from past research, and recommend implementation, training and communication strategies.
3. Develop tools that assist in balancing competing priorities and quantify safety impacts in the annual call for projects.
4. Study the safety related impacts of past speed limit increases on Michigan State Trunklines.

Rest Areas, Utilities & Landscaping

Goal: Develop metrics, materials, and specifications to improve landscape element performance within various contexts.

Research Needs:

1. Develop metrics for Complete Streets and Context Sensitive Solutions including seeking stakeholder input.
2. Update the Roadside Plant List (last updated in the 1970s). Develop updated guidelines that account for new planting options and varying roadside environments including difficult urban freeway slopes and degraded soils.
3. Update the Roadside Planting Details (last updated in the 1970's). Develop updated guidelines that account for new plant strains, planting techniques and plant maintenance strategies.

Surveys & Automated Design

Goal: Proper translation of survey and design data from design to construction to operations/maintenance.

Research Needs:

1. How to translate a 3D model to individual assets for construction (MDOT & Contractor) inspection and installation activities?
2. How to capture As-Built asset information during inspection activities and add the necessary asset attributes?
3. How to convert construction assets to the Enterprise Asset Management System for use in operations and maintenance?

Work Force Development

Goal 1: Recruit high quality employees.

Research Needs:

1. Identify recruitment best practices (public and private sector) including funding strategies and recruitment initiatives.

Goal 2: Retain and maintain a high performing workforce

Research Needs:

1. Develop a Workforce Development Strategy that includes curriculum development and training delivery approaches. Curriculum will include skill development opportunities in technical areas, communication, interpersonal and emotional intelligence. Training delivery will include identifying best practices for training employees at remote and field locations.

2. Identify strategies that will assist Leadership in encouraging organizational “buy in” to workforce development at all levels of the organization. Also, recommend strategies that will encourage employee engagement, participation and “organizational buy-in”.

Goal 3: Prepare employees to assume future leadership roles.

Research Needs:

1. Identify or develop training tools and approaches that will prepare younger employees for future leadership roles. (ex. - Harvard Business Review, Franklin Covey, Thomas-Kilmann assessments)

RAC – Highways Delivery & Operations

Construction

Goal: Effectively oversee and manage construction projects utilizing Three Dimensional (3D) design technologies.

Research Needs:

1. Develop and provide staff training on construction management of 3D modeled projects.
2. Identify technology that will assist construction field staff to effectively utilize a 3D plan set.
3. Identify methods to capture inspection data and adjust 3D models to accurately produce as-built plans and to allow for easy data migration to an enterprise asset management system. Develop data standards and contract acceptance language for asset data.

Geotechnical & Foundation Design

Goal 1: Improve roadway support during thaw periods

Research Needs:

1. Quantify the benefit of improved drainage treatments.
2. Quantify the benefit of improved work platforms.
3. Quantify the benefit of increased construction inspection (underdrains).
4. Use remote sensing (i.e. InSAR Radar or Aerial LIDAR) to identify poor drainage.
5. Use Aerial LIDAR to quantify drainage freeboard of trunk line roadbeds.

Goal 2: Develop a GIS based online repository for geotechnical data

Research Needs:

1. IT support for geospatial referencing and archival of geotechnical data
2. Transfer of data by utilizing the “Miss Dig” data transfer standard
3. Develop GIS strip maps from archived soil surveys conducted by region soil engineers

Goal 3: Improve identification and characterization of potential geo-hazard sites

Research Needs:

1. Develop GIS map of known underground abandoned mines and karst geology

Intelligent Transportation Systems

Goal: Develop a network level asset management strategy for ITS infrastructure.

Research Needs:

1. Develop a decision making tool that will assist in network level evaluation of the effectiveness of both new and existing ITS assets. The tool will analyze the cost effectiveness of various maintenance, replacement and relocation strategies.
2. Assess the use of Digital Message Signs (DMS) devices and to quantify the effectiveness/impact of these installations on traffic.
3. Assess the use of Traffic Detector devices and Traffic Count Information and to quantify the effectiveness/impact of their locations on traffic.
4. Assess the use of Closed-Circuit Television Cameras for Traffic and Incident Management and to quantify the effectiveness/impact of these installations on traffic.

Fleet/Facility Management & Operations

Goal: Improve/increase lifespan of MDOT facilities

Research Needs:

1. Quantify the life cycle cost of available roofing materials and roof types to improve the cost effectiveness of roofing systems.
2. Quantify the life cycle cost of available interior building materials to improve the cost effectiveness of interior building construction and maintenance.

Maintenance

Goal: Improve the effectiveness of MDOT's winter maintenance operations.

Research Needs:

1. Assess best practices for identifying and measuring the level of service (LOS) associated with winter maintenance operations.
2. Develop new roadway LOS performance measures for winter maintenance operations.
3. Determine the impact that winter operations LOS has on the Michigan economy.
4. Assess the feasibility of utilizing connected vehicles technologies in winter maintenance operations.

Mobility, Systems, & Signal Operations

Goal: Assess System Operations, Safety, and Travel Time Reliability practices and identify potential areas for improvement.

Research Needs:

1. Evaluate the feasibility of utilizing Collision Avoidance & Mitigation Systems (CAMS) on winter maintenance trucks.
2. Identify best practices and protocols used to submit VISSIM Traffic Simulation Model and Outputs.
3. Continue to identify further opportunities to utilize Unmanned Aerial Systems (UAS) technology to further improve systems operations and maintenance.

Pavements & Materials

Goal: Reduce the life cycle cost of pavement designs.

Research Needs:

1. Continue to improve the accuracy of Mechanistic-Empirical Pavement Design Guide (MEPDG) performance models relative to Michigan pavement performance.
2. Evaluate the impact of various Hot Mix Asphalt (HMA) longitudinal joint treatments on pavement performance.
3. Further evaluate the impact of crushed concrete aggregate base on underdrain effectiveness.
4. Evaluate the impact of available concrete additives on concrete permeability.
5. Identify minimum pavement base/subbase thicknesses necessary to provide adequate frost-heave protection to the pavement structure.
6. Compare the performance of pavement structures utilizing the “Metro 16 inch aggregate on 8 inch sand ” base design versus the more typical; “Out state 6” aggregate base over 18” subbase design”
7. Assess the effect of “Globalization” on Michigan’s Transportation Materials Acceptance Program.
8. Assess the impact of “Mobility Policies” on Long-Term Pavement Performance.
9. Evaluate the impact of super-single (wide-base) tires on pavement performance.
10. Compare the performance of pavement structures utilizing a Gap-Graded Super Pave (GGSP) top course mix versus a 5E30 or 5E50 top course mix.
11. Improve performance testing/balanced mix designs for HMA Pavements.
12. Identify Michigan's Natural Aggregate Resources Using Scientific Geologic Mapping Technology

Worker/Facility Safety and Security Emergency Management

Goal 1: Develop Michigan Re-Entry Plans for declared disaster zones.

Research Needs:

1. Perform a synthesis of re-entry plans from other states including non-hurricane states.
2. Determine best practices from each of the re-entry plans studied.
3. Provide a compilation summary of key ideas (in a report format) or approaches taken from the plans; especially non-hurricane and no-notice states.

Goal 2: To determine the best practices of flood mitigation techniques used at highway pump stations.

Research Needs:

1. Synthesis of flood mitigation techniques from other states using highway pump stations.

2. Review best practices from each of the plans provided.
3. Summarize key ideas (in a report format) from the information collected.

Goal 3: Electronic tracking of Safety Topics or related Safety Training

Research Needs:

1. Determine a methodology to create easily recordable safety training via electronic tracking.
2. Assess best practices for assessing the effectiveness of e-training for comprehension and application by employees to meet the requirements by MIOSHA.
3. Create a monthly report of e-training by individual and business areas.

RAC – Multi-Modal Transportation

Aviation

No Priorities

Freight & Logistics and Freight Rail

Goal 1: Initiate investments that improve economic development.

Research Needs:

1. Identify and/or develop investment models that can quantify the impact of transportation investments on economic growth.
2. Identify and/or develop models that can compare the benefits of multiple transportation modes on economic growth.

Goal 2: Improve safety at highway-railroad at-grade crossings.

Research Needs:

1. Evaluate available crossing technologies that can address crossings with short storage space.

Intercity Bus, Local Transit and Passenger Rail

Goal 1: Preparing for the Future of Public Transportation

Research Needs:

1. Develop strategies for future local and long distance passenger transportation system that account for changing demographics, changing customer needs/preferences, emerging vehicle technologies including automated vehicles, emerging private sector passenger transportation services (Uber, Lyft, etc.) and shared use mobility services.
2. Develop future federal and state funding strategies, related to technical assistance and regulatory programs, that will account for future passenger transportation changes.

Goal 2: Measuring the Value of Passenger Transportation investment

Research Needs:

1. Update the existing model used to measure the benefits of transit investment. Existing model - http://www.michigan.gov/documents/mdot/MDOT_HDR_Economic_Community_Benefits_Local_Bus_Transit_Service_288060_7.pdf

Maritime

No Priorities

Private/For Hire Passenger Carriers

No Priorities

RAC – Planning and Finance

Asset Management

No Priorities

Contract Administration

No Priorities

Finance

No Priorities

Non-Motorized Planning and Development

Goal: Improve Access to Non-Motorized Facilities

Research Needs:

1. Develop scoping and design guidance to improve direct access to non-motorized facilities. Review and recommend signing techniques, signal crossing technologies and improved visibility strategies to improve facility access.
2. Identify strategies that enhance the connectivity of non-motorized facilities to transit, rail and highway facilities.
3. Develop an evaluation tool that will quantify the benefits of operating a more integrated and connected transportation system (non-motorized, transit, rail and highway).

Program Development

Goal: Develop a network level asset management strategy for urban freeway network.

1. Assess the capacity of existing sewer systems.
2. Quantify existing drainage capacity needs.
3. Develop maintenance strategies to ensure that existing sewer system capacities are fully utilized.
4. Develop flood prediction, management and mitigation strategies.



FY 2019/2020/2021 Research Priorities
SPR II/UTC/COE Funded Research Program
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Transportation Policy

No Priorities

Travel Demand Processing

No Priorities