



ANNUAL REPORT FY21

Michigan Tech Transportation Institute
Director, Jacob Hiller



**Michigan
Technological
University**

Michigan Tech Transportation Institute

MISSION STATEMENT

The Michigan Tech Transportation Institute will provide the operating structure, resources, recognition and leadership, in a collaborative environment, that supports research, education and outreach leading to sustainable solutions for transportation.

The Michigan Tech Transportation Institute (MTTI) at Michigan Technological University (Michigan Tech) is a multidisciplinary affiliation of faculty and professional staff actively engaged in a wide range of transportation-related activities. MTTI has a singular charge; to leverage University resources for the purpose of increasing external funding of transportation-related activities including research, education, training, product development, outreach, and technology transfer to assist in development of transportation systems. To achieve this goal, MTTI provides an administrative structure and resources for programs, individuals, and initiatives. MTTI resources are necessarily distributed to support activities of the Institute.

SUMMARY OF ACTIVITIES AND HIGHLIGHTS

MTTI's mission and goals, as stated, are to support transportation research and education opportunities on campus. Although activities were limited in scope due to Covid19 and to a smaller funding budget, MTTI was able to meet these goals by providing cost share funding for proposals, sponsoring a summer youth program, funding membership for all campus research members to the National Road Research Alliance, and supporting travel for students.

Institute Governance Structure

MTTI is governed by a member-elected, and VPR-approved, Director and also by a member-elected Executive Committee.

The Director serves as the chief executive officer for the organization and is responsible for the overall operation of the Institute including supervision of MTTI employees. The Director is the main representative of the Institute to Michigan Tech, other universities, state and federal agencies and private organizations. The Director is installed, renewed, or removed in accordance with procedures outlined in the MTTI By-Laws. The Director reports to the Vice President of Research.

An elected Executive Committee guides MTTI. The Executive Committee consists of five members elected by and from the Institute's Principal and Affiliate Members. An elected term for an Executive Committee member is three (3) years and terms are staggered such that at least one (1) member is elected yearly. The Executive Committee also includes the MTTI Director serving as an ex officio (non-voting) member.

The Director and Executive Committee establish policies/procedures and recommend strategic financial decisions, including but not limited to an annual MTTI operating budget, project cost share commitments, staffing decisions to support the activities of the Institute, capital investments, and other strategic initiatives.

Membership

MTTI membership is available to all Michigan Tech faculty and staff involved in or pursuing MTTI Activities. Members are classified into two groups: Principal Members and Affiliate Members. All others are eligible to be a Friend of the Institute.

Principal Members - Those eligible for membership who in the last three years have served as the Principal Investigator (PI) or Co-Principal Investigator (Co-PI) on one or more MTTI Activities that result in combined average IDC recovery greater than or equal to \$5000/year over the three previous fiscal years.

Affiliate Members - Eligible PI or Co-PI (as defined previously) with successfully awarded project(s) that qualify as a MTTI Activity(-ies), but does not meet the combined minimum \$5,000/year IDC rule over the three previous fiscal years. Additionally, one may qualify as an Affiliate Member if he/she has submitted at least three proposals in the last three fiscal years through MTTI.

Friends of the Institute - All others who request to join MTTI as a friend.

During the previous fiscal year, MTTI has welcomed three new members to the Institute; Stephen Morse, Eugene Levin and Ricardo Eiris, all Civil, Environmental and Geospatial Engineering faculty members. Additionally, new MTTI researchers Kai Zhang (Mathematics) and Yongchao Yang from Mechanical Engineering have been involved in multiple proposals as Co-PIs with the intent of joining MTTI.

Membership Involvement

A goal of MTTI during the previous year was to meet individually with MTTI members to distribute embroidered MTTI polos to wear at conferences and meetings and to discuss how members feel MTTI can further help them to achieve their goals. As most members were not on campus during the past year, Director Hiller and Coordinator Pam Hannon will schedule visits this year.

Building Membership Capacity

MTTI typically holds an annual general meeting in which all faculty and staff on campus with interests in transportation research are invited to a membership luncheon and informational session. Due to the physical meeting restraints on campus during Covid19, no meeting was held this past year. This meeting is a way to showcase MTTI capabilities and to invite new members to join the institute and will be reinstated in 2022.

Additionally, as proposed in the previous annual report, Director Jake Hiller will be connecting with new members of the campus community who may have interests in transportation issues to inform them of opportunities MTTI can provide to researchers and educators as well.

Membership List

A list of current members is included in Appendix A.

BUDGET OVERVIEW

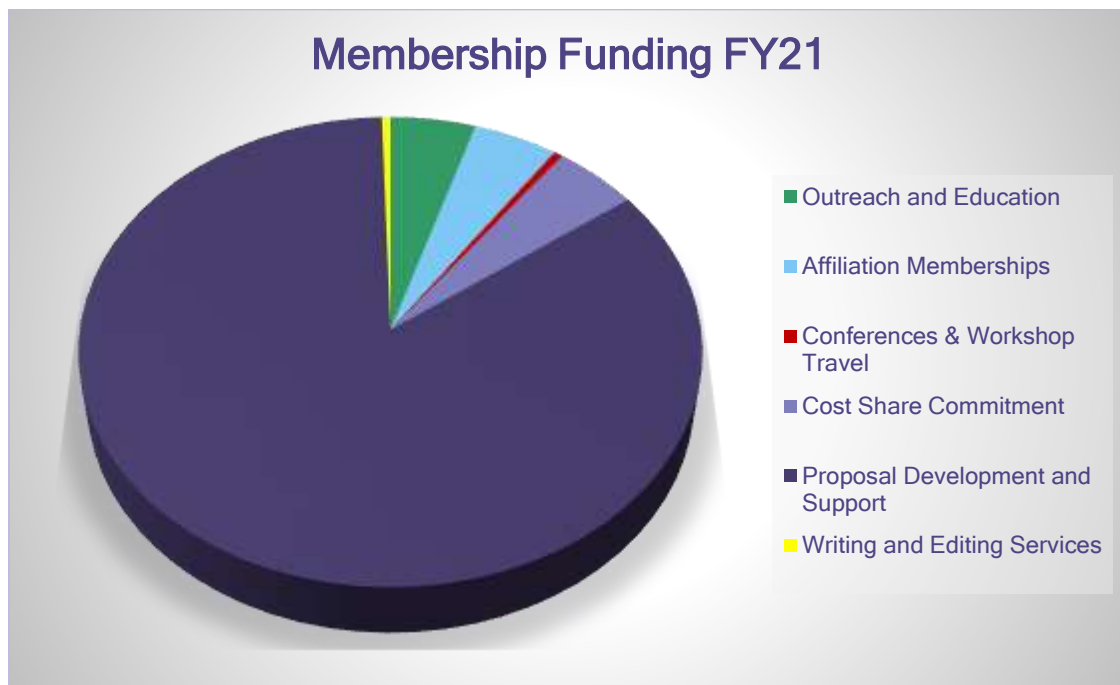
FY21 Budget

The MTTI Director and Executive Board set an annual budget for the Institute to guide IRAD expenditures available to support our members. The proposed and actual budgets for FY21 are included below.

Budget FY21	Proposed	Actual
Faculty Summer (Director)	\$0	\$0
Other - Pam Hannon	\$58,359	\$50,279
Other Technical - Velat/Bershing	\$4,000	\$896
Fringe Benefits	\$23,572	\$20,470
Equipment	\$0	
Travel	\$2,000	\$200
Supplies	\$2,000	\$1,885
Services (Fees)	\$0	\$2,000
Other - Education (SYP)	\$1,000	\$2,000
Other - Cost Share	\$2,000	\$2,000
	\$92,931	\$79,730

IRAD

Funding is allocated annually for items such as internal major and minor initiative research projects, data collection, proof-of-concept studies, equipment purchase, member travel, external speaker expenses and required cost share. Membership funding was allocated as seen below in FY21.



Proposal development and support continues to be the largest funded benefit to MTTI members and is a strength of the institute as many departments lack designated proposal development personnel. Proposal assistance is provided from the location of an RFP through submission of a proposal along with modifications, amendments, etc.

One of MTTI's most effective use of IRAD tends to be in providing cost share to Principal Investigators to increase the competitiveness of proposals submitted. This trend in required cost share by transportation-based funding sources seems to be increasing. MTTI provided cost share funding to Zhanping You's proposal "Ground Tire Rubber Asphalt for Durable Pavements for Heavy Traffic Road for Michigan's Wet-Freeze Environment" with the Kent County Road Commission. In the past five years, MTTI has transferred \$35,400 in cost share commitments to investigators.

As a university member of the Minnesota Department of Transportation and the National Road Research Alliance, MTTI has paid membership fees in the amount of \$2,000 annually for the past six years. Additionally, MTTI Director Jake Hiller and Executive Committee member Zhanping You are members of the NRRR Rigid and Flexible research teams, respectively.

A new agreement was reached recently for a five-year renewal of the partnership. Members from departments across campus provided data included in the renewal: *Biological Sciences*,

Civil, Environmental and Geospatial Engineering, Cognitive and Learning Sciences, College of Computing, Center for Rural and Tribal Community Resilience, Center for Science & Environmental Outreach, Center for Technology & Training, Electrical & Computing Engineering, Great Lakes Research Center, Geological & Mining Engineering & Sciences, Keweenaw Research Center, Mechanical Engineering-Engineering Mechanics, Michigan Tech Research Institute, Michigan Tech Transportation Institute, Physics, Rail Transportation Program, Social Sciences and Sustainable Futures Institute.

MTTI provides support to transportation related educational programs through financial sponsorship of youth programs. After a year off due to Covid 19 restrictions, the MTU Rail and Intermodal Summer Youth Program was once again held on campus. MTTI sponsored the annual program in the amount of \$2,000.

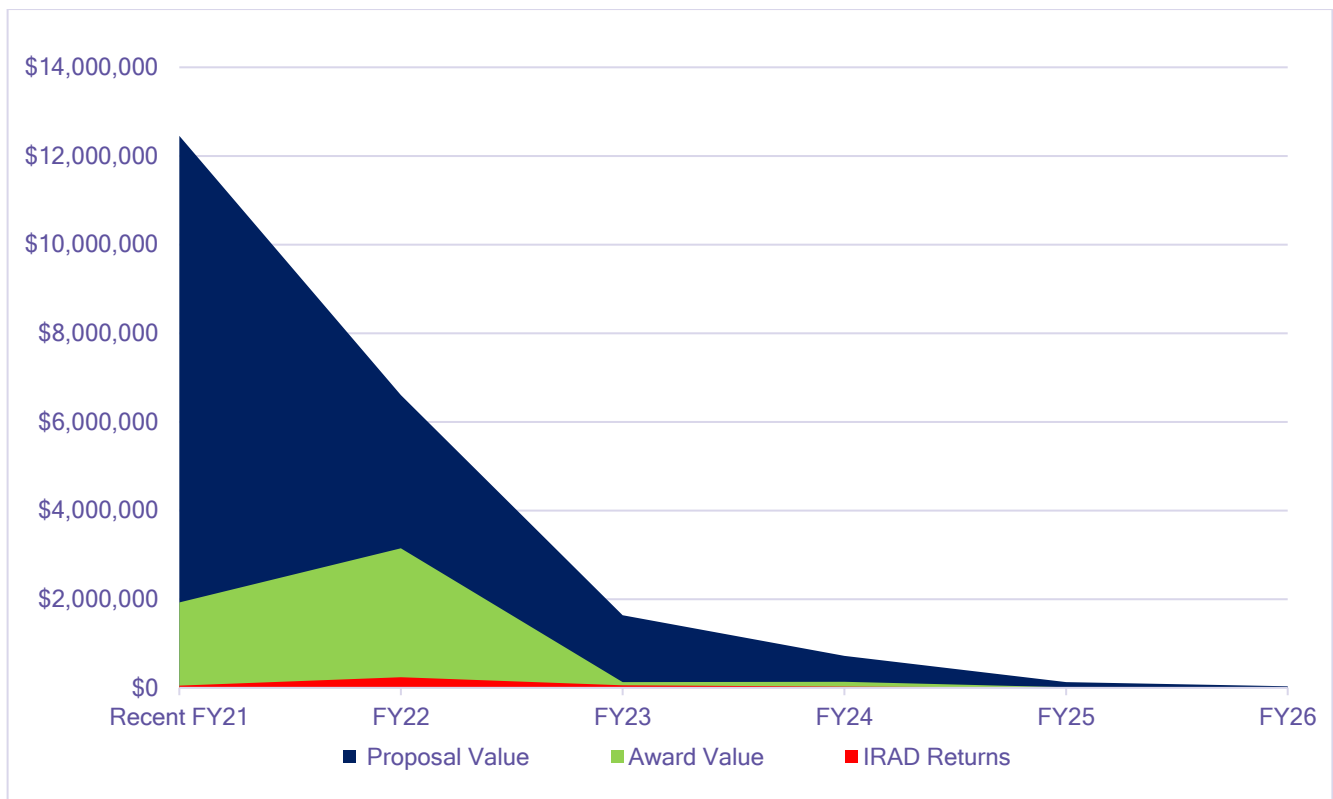
With travel being extremely limited this past year, MTTI received very few requests for travel support. CEGE students Dongdong Ge and Xiaodong Zhou attended the Transportation Research Board annual meeting in Washington, DC in January 2021. MTTI funded registration fees for the students. MTTI anticipates a return toward a normal travel funding request schedule as this pandemic subsides.

Proposal List

A list of proposals submitted during the fiscal year 2021 is provided in Appendix B.

Aspire Projections

Based on projections from Michigan Tech's Accounting for Space, People, Indexes, Research, and Equipment (ASPIRE) system, the figure below shows the proposal value, award value, and IRAD return projections for MTTI. The total proposal value for FY21 was increased from \$10.1M in FY20 to nearly \$12.5M in FY21, which should help the Institute financially in the coming years as noted in the increased projected award value for FY22 (\$3.1M versus \$1.9M in FY21 during Covid19).

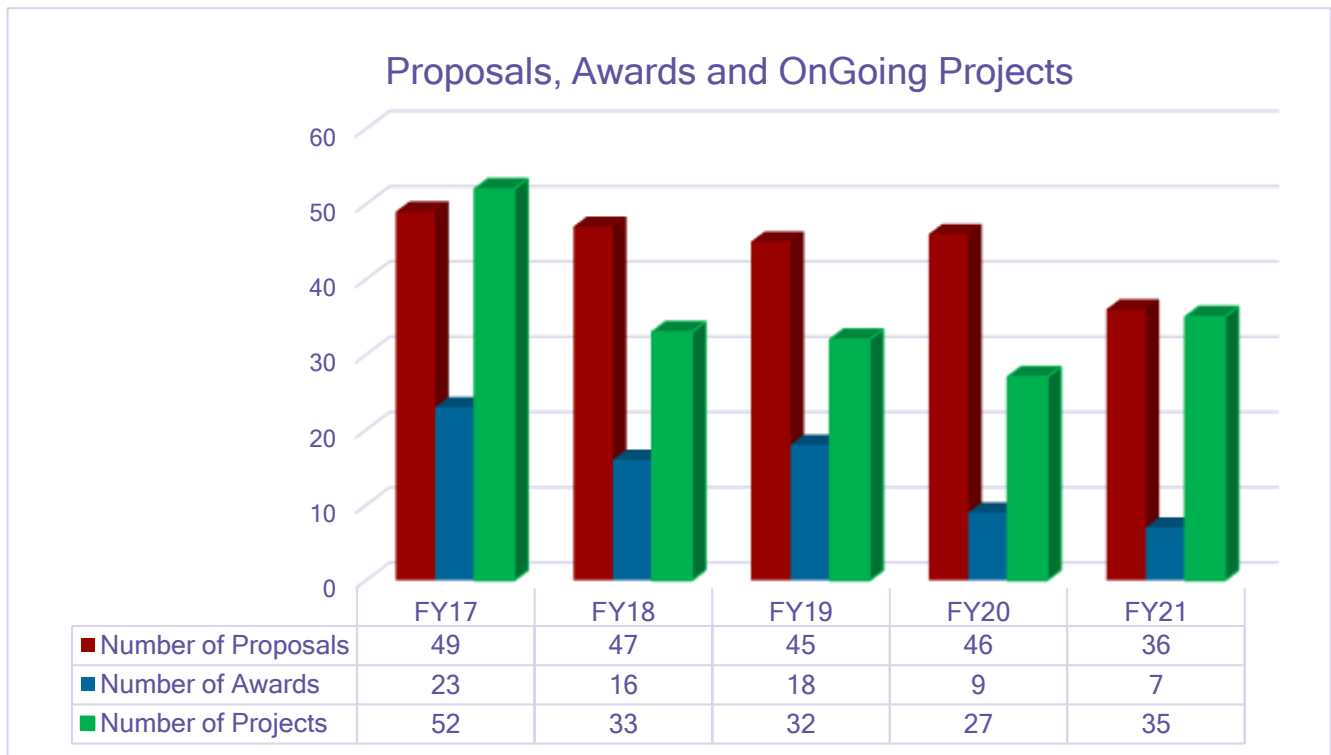


Projected from ASPIRE						
	Recent FY21	FY22	FY23	FY24	FY25	FY26
Proposal Value	\$12,453,630	\$6,602,104	\$1,636,743	\$723,910	\$128,701	\$33,638
Award Value	\$1,926,804	\$3,148,222	\$128,845	\$139,292	\$11,608	\$0
IRAD Returns	\$46,703	\$239,698	\$54,715	\$26,124	\$5,609	\$1,675

Proposals, Projects, and Awards

In fiscal year 2021, MTTI researchers submitted proposal requests to multiple funding sponsors totaling \$12,453,630. **36** proposals were submitted of which **7** were awarded in the amount of \$ 1,849,470. MTTI currently has **35** projects in progress.

The table provides a summary of proposals, awards, and on-going projects over the previous five fiscal years.



FUTURE PLANS AND GOALS

Overview of Strategic Goals

The Director and Executive Committee will develop a strategic plan for growth of MTTI in the next year and the future five years.

- The first concern for fiscal year 2022 is to increase both our financial base and our membership numbers after the down years of Covid19.
- Identify and expand research opportunities for MTTI members. The MTTI Director and EC will focus on developing relationships with other funding sponsors beyond our typical partners.
- Support large, interdisciplinary teams in finding funding for cross campus projects.
- Increase educational opportunities for our research students.
- Broaden our transportation research base beyond typical roads, bridges, and train transportation to include other areas of research; planning and design, safety, environment, pedestrians, big data, computing, and connected/automated vehicles. We may need to look at rebranding MTTI as a mobility center rather than narrowly focused transportation institute in the future.

Financial and Membership Goals to Enhance Member External Awards

- Continue to join forces with other centers and institutes on campus. MTTI has recently collaborated with MTRI, MTRI, INC., and HUI on proposal submissions. Our best chance to broaden our scope is to work with researchers from other institutes and centers who have similar research interests.
- Continue to work with MDOT to build a workforce pathway between Michigan Tech and MDOT in terms of research needs, and technical expertise, and workforce development.

Space and Facility Needs

MTTI members share research and lab space with collaborators in each member's individual departments. MTTI currently has ownership and use privileges in these rooms. No other space or facilities are required at this time for the Institute.

- 301J Dillman Hall (Conference room)
- 315 Dillman Hall (CN RTEC Media Room/CTT Webinar studio)
- 316 Dillman Hall (CN Rail Transportation Education Center), and
- 318a and 318b offices

Financial Deficit in Achieving Goals

MTTI's current budget is substantially reduced in comparison to five years ago due to various factors, including a lack of research billing and limited sponsor funding during Covid19.

Previously, the Center for Technology & Training research projects were included under the MTTI umbrella which included all MDOT LTAP projects. With the designation of CTT as its own entity, those projects and associated IRAD were transferred to CTT with a deficit occurring annually in MTTI's budget.

Additionally, the reducing of the IRAD return payable to institutes for billed research will increase the amount of time necessary to rebuild our surplus.

Strategies to Fill Deficit

Discussions have been held with both the Civil, Environmental, and Geospatial Engineering Department and the Railroad Program to share Pam Hannon's time to lessen the burden on MTTI's finances solely.

MTTI's focus will be to increase the number of researchers involved and to return to normal project submission numbers as well as increase the types of sponsor funding sought.

Seek large, interdisciplinary proposals to increase IRAD and cross campus research.

CHALLENGES AND BARRIERS

MTTI is primarily thought of in terms of typical roads, bridges, and train transportation research on campus rather than a broad encompassing unit. The potential to expand to many other departments is achievable but competition to join other centers and institutes is also a roadblock we need to overcome.

Currently, MTTI is dependent upon few researchers for the majority of the funding dollars brought in to the institute.

A challenge facing MTTI and possibly other institutes on campus is that we must compete against multiple other institutes for limited research dollars. We have had success in signing memorandums of understanding with other institutes in previous years but cooperation between institutes to share IRAD has been limited by the returns structure.

APPENDICES

Appendix A:

MTI Membership

Name	Department	College
Barkdoll, Brian	CEGE	Engineering
Billmire, Michael	MTRI	Engineering
Brooks, Colin	MTRI	Engineering
Chadde, Joan	CSEO	Engineering
Dai, Qingli	CEGE	Engineering
Dowden, Dan	CEGE	Engineering
Eiris, Ricardo	CEGE	Engineering
Gilbertson, Chris	CTT	Engineering
Handler, Robert	CHEM ENG	Engineering
Havens, Tim	EE	Engineering
Hiller, Jacob	CEGE	Engineering
Lautala, Pasi	CEGE	Engineering
Levin, Eugene	CEGE	Engineering
Liu, Zhen	CEGE	Engineering
Morse, Stephen	CEGE	Engineering
Mukherjee, Amlan	CEGE	Engineering
Nelson, Dave	CEGE	Engineering
Oommen, Thomas	GMES	Engineering
Swartz, Raymond	CEGE	Engineering
Velat, John	CRTCR	Engineering
Vitton, Stan	CEGE	Engineering
Watkins, David	CEGE	Engineering
Watkins, Melanie	CEGE	Engineering
Webster, Veronica	CEGE	Engineering
Veinott, Elizabeth	CLS	Sciences and Arts
Xue, Pengfei	CEGE	Engineering
Yongchao, Yang	MEEM	Engineering
You, Zhanping	CEGE	Engineering
Zhang, Kai	MATH	Sciences and Arts
Zhang, Kuilin	CEGE	Engineering

Appendix B:

Proposals Submitted FY21

Status	Funding Source	Principal Investigator	Sponsor	Amount Requested	Project Total	Title
Awarded	Other-Association/Society	Mukherjee, Amlan	National Asphalt Pavement Association	\$ 49,999	\$ 49,999	PCR for Asphalt Mixtures and the Emerald Eco-Label EPD Program
Declined	Federal	Watkins, Melanie J Kueber	US Dept of Transportation	\$ 375,480	\$ 387,310	Automated Assessment of Track Drainage with High-Resolution Aerial Remote Sensing
Pending	Federal	Levin, Eugene	National Aeronautics & Space Administration	\$ 900,000	\$ 900,000	Citizen-Science in geospatial AI knowledge discovery for decision support emergency situation (C-SAIR)
Pending	Other	Hiller, Jacob E	Minnesota Department of Transportation	\$ 149,419	\$ 149,419	Asphalt vs Concrete - Tool to Guide in Selection of Pavement Type
Awarded	FPT-Industry	Mukherjee, Amlan	Engineering and Software Consultants Inc	\$ 50,000	\$ 50,000	Identify Evaluate and Populate FHWA's Pavement LCA Benchmarking Tool with Industry Datasets
Pending	Other	You, Zhanping	Minnesota Department of Transportation	\$ 149,140	\$ 149,140	Cost Estimate of B vs C Grade Asphalt Binders
Awarded	Federal	Lautala, Pasi T	US Dept of Transportation	\$ 474,695	\$ 474,695	Expanding Summer Youth Programs in Rail through Virtual Learning and a National Campus Network
Declined	Federal	Levin, Eugene	National Science Foundation	\$ 598,490	\$ 598,490	RET Site: Global Env. Soc. Phenomena Understanding with Virtual Reality by Means of Opensource Geospatial Big Data Cloud Computing Machine Learning for K-12 Teachers
Awarded	State of MI pass through	You, Zhanping	Michigan State University	\$ 50,000	\$ 50,000	Evaluation of MDTs Methodologies for both Quantifying Pavement Distress and Modeling Pavement Performance for Life-Cost Cycle
Pending	FPT	Oommen, Thomas	University of Michigan	\$ 49,670	\$ 49,670	Remote Sensing Based Terrain Strength Characterization for the Next Generation NATO Reference Mobility Model Development
Pending	State of MI	Liu, Zhen	Michigan Dept of Transportation	\$ 356,080	\$ 356,080	Effective Bridge Deck Warning Weather Technologies
Declined	State of MI	Swartz, R. Andrew	Michigan Dept of Transportation	\$ 437,585	\$ 437,585	Electronic Water Level Sensors for Monitoring Scour Critical Structures
Awarded	State of MI	You, Zhanping	Michigan Dept of Transportation	\$ 231,343	\$ 231,343	Quantity the Impact of Super Single (Wide Base) Tires on Pavement Performance in Michigan
Pending	State of MI	Brooks, Colin N	Michigan Dept of Transportation	\$ 411,679	\$ 411,679	Research on Right of Way Mapping Conversion to GIS
Declined	FPT	Dai, Qingli	The REMADE Institute	\$ 330,948	\$ 663,182	Upcycling of Mixed Waste Plastic #3-#7 and Scrap Tire Rubber as Compound Particle Feedstock to Increase Crack-Resistance
Pending	State of MI	Liu, Zhen	Michigan Dept of Transportation	\$ 153,923	\$ 153,923	Infrastructure Protection and Rehabilitation to High Lake Levels
Declined	FPT	You, Zhanping	The REMADE Institute	\$ 999,286	\$ 1,998,572	Engineering Waste Tires to Low Cost Construction Materials for Durable Roads
Closed	Industry	Morse, Stephen M	Phoenix Foam Mfg	\$ 1,800	\$ 1,800	PFM - Initial Compression Testing
Pending	Federal	Oommen, Thomas	US Dept of Transportation	\$ 606,922	\$ 694,922	An Integrated and Automated Decision Support System for Ground Hazard Risk Mitigation for Railroad using Remote Sensing and Traditional Condition Monitoring Data
Declined	FPT	You, Zhanping	University of Texas	\$ 175,000	\$ 175,000	Capturing Durability of High Recycled Binder Ratio (RBR) Asphalt Mixtures
Pending	Federal	Lautala, Pasi T	US Dept of Transportation	\$ 380,705	\$ 380,705	Railroad Crossing Vehicle Warning (RCVW) Application Demonstrations with Connected Vehicles
Pending	Other	Brooks, Colin N	National Academies of Sciences Engineering and Medicine	\$ 339,918	\$ 339,918	Developing Proposed AASHTO Guidelines for Applications of Unmanned Aerial Systems Technologies for Element-Level Bridge Inspection
Withdrawn	Other	Mukherjee, Amlan	Auburn University	\$ 300,002	\$ 300,002	Design Guide and Standards for Infrastructure and Resilience
Pending	State of MI pass through	You, Zhanping	Michigan State University	\$ 35,000	\$ 35,000	Establish Policies and Procedures for Use of Subgrade Stabilization in Michigan
Pending	State of MI	Watkins, Melanie J Kueber	Michigan Dept of Environment Great Lakes and Energy	\$ 40,000	\$ 48,014	Huron Creek Watershed Management Plan
Pending	State of MI pass through-Industry	You, Zhanping	Entech Inc	\$ 149,254	\$ 298,508	R&D of Rubber Chip Seal Projects in Michigan
Pending	State of MI pass through	Dai, Qingli	City of Muskegon	\$ 95,002	\$ 190,005	Build Sustainable and Durable Rubber-Modified Concrete Pavement
Pending	State of MI pass through	Dai, Qingli	St Clair County Road Commission	\$ 95,002	\$ 190,005	Build Strong Pavement with Scrap Tire Rubber and Nylon Fiber
Pending	State of MI	Dai, Qingli	Michigan Dept of Transportation	\$ 307,740	\$ 307,740	Research on Repair of Bridge Deck Fascias
Awarded	State of MI pass through	You, Zhanping	Dickinson County Road Commission	\$ 100,000	\$ 200,000	Using Tire Rubber Modified Pellet Asphalt for Roadway Paving in Dickinson County
Awarded	State of MI	You, Zhanping	Michigan Dept of Environment Great Lakes and Energy	\$ 396,031	\$ 793,433	New Hot Rubber Overlays and Tire Derived Aggregates Construction in Bay County and Clare County
Pending	Federal	Eiris, Ricardo M	National Science Foundation	\$ 420,684	\$ 420,684	Collaborative Research: NRI: DroneStory - Students in Immersive Drone-based Stories
Pending	Federal	Dai, Qingli	National Science Foundation	\$ 329,400	\$ 329,400	pH-Responsive Nanosilica Hydrogels for Pore Chemistry Regulation and ASR Damage Mitigation in Concrete
Pending	Federal	Liu, Zhen	National Science Foundation	\$ 437,407	\$ 437,407	BRITE Pivot: Georobotics: Empowering Geosystems with Intelligent Mechanical Responses to Environment via Active Reinforcing and Deep Reinforcement Learning
Pending	State of MI	You, Zhanping	Michigan Dept of Environment Great Lakes and Energy	\$ 50,000	\$ 100,000	Marketing Development of Stamp Sands for Durable Roads
Pending	State of MI	You, Zhanping	Michigan Dept of Environment Great Lakes and Energy	\$ 50,000	\$ 100,000	Recycling E-Waste Plastics for Asphalt Pavement Construction
				\$ 10,077,604	\$ 12,453,630	