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2021

## Michigan Tech Transportation Institute 2020 Annual Report

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Michigan  
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Michigan Tech Transportation Institute

2020  
ANNUAL REPORT

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## By the Numbers

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### 2020 research partners

- Center for Tribal Transportation
- City of Munising
- Engineering Software and Consultants, Inc.
- Federal Highway Administration
- Federal Railroad Administration
- Kent County Road Commission
- Keweenaw Bay Indian Community
- Michigan Department of Environment, Great Lakes & Energy
- Michigan Department of Transportation
- Minnesota Department of Transportation
- MTRI, Inc.
- National Cooperative Highway Research Program
- National Science Foundation
- Texas Tech University
- University of Illinois Urbana Champaign
- University of Michigan
- US Department of Energy
- US Department of Transportation
- Wisconsin Department of Transportation

Proposals submitted

46

37

members  
were  
active in  
MTI  
activities

\$10,098,659

In proposal submissions through MTTI in FY20

## MISSION:

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.

## Fiscal Year in Review

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**JAKE HILLER** (CEE) serves as Director of MTI, working with the member elected Executive Committee to promote MTI's mission, provide guidance, and to shape the future of the institute. The current team is comprised of:

**PRINCIPAL MEMBERS** – **COLIN BROOKS** (MTRI), **PASI LAUTALA** (CEE), **ZHANPING YOU** (CEE)

**AFFILIATE MEMBERS** – **CHRIS GILBERTSON** (CTT), **ROBERT HANDLER** (SFI)

Each year, the leadership team develops a plan for the upcoming fiscal year. The goals set by the Direct and EC for FY 20 included:

1. In order to cultivate a better long-term relationship with a key partner, Director **HILLER**, EC member **P. LAUTALA**, and CEE Chair **AUDRA MORSE** will be meeting with high-level representatives of the Michigan Department of Transportation (MDOT) this fall in a series of meeting in Houghton and Lansing. The intent is to help understand the needs of both organizations and better align programs to serve those needs going forward. This includes research, technology transfer, and workforce development.
  - **P. Lautala held meetings in Lansing with MDOT's Tim Hoeffner, Nikkie Johnson, and Amber Thelen for discussions about establishing an MOU between MDOT and MTU/MTI. A spring meeting was to be set up with hopes that an MOU would be finalized before MDOT Director Ajegba's visit to Houghton in June 2020 for the Bridge Fest event. Both the MDOT meeting and Bridge Fest were cancelled due to Covid19. It is the intention of the Institute to arrange for these meetings again in Summer 2021.**
2. One of the largest impediments to conducting research among MTI members is that of outdated and malfunctioning equipment in our members' laboratories.

The MTI EC will be developing a decision matrix to help promote cost sharing for equipment purchases and/or servicing.

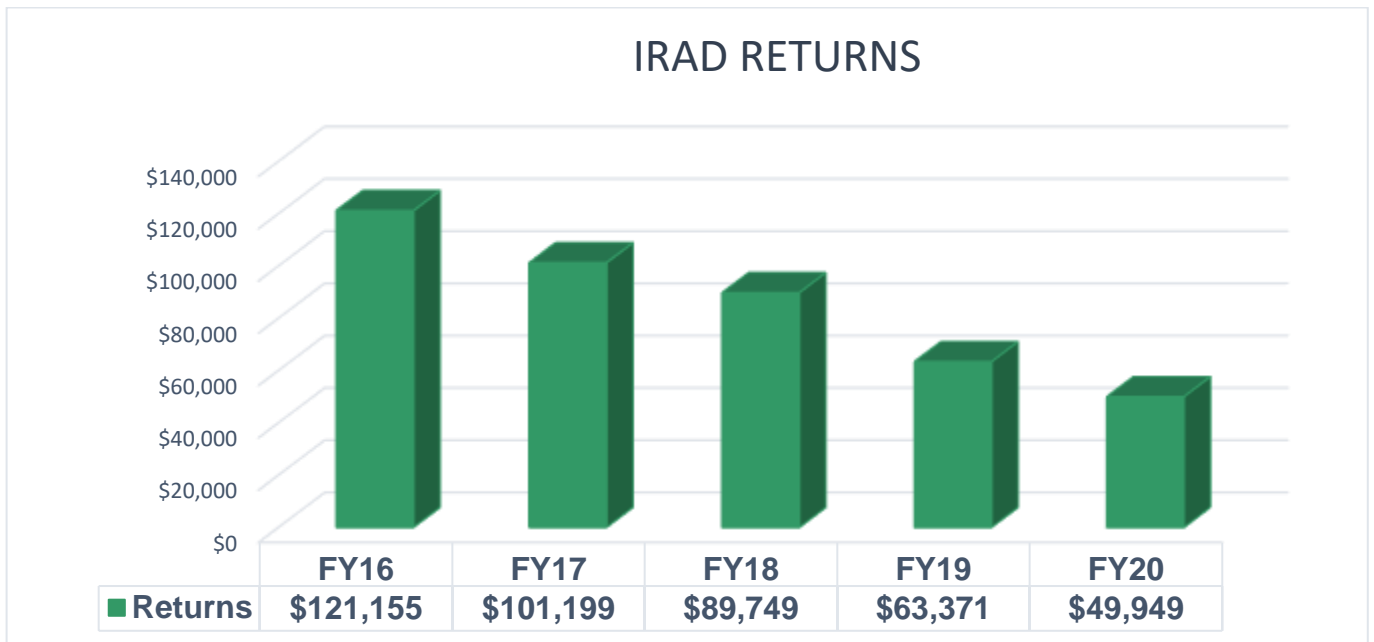
- Updates were made to initiative funding matrix for better clarification on equipment funding (repairs can be funded but annual maintenance costs cannot). Initiative requires a 1:1 match and is limited to \$5,000.
3. As many of MTI initiatives have a rolling deadline, it is difficult for the EC to utilize limited resources to make the best decisions for investment in its members' programs. The MTI EC plans to enact two yearly deadlines for initiatives to be submitted to allow for discussions of the most promising initiatives to meet its mission and strategic goals. A small budget may be set aside for funding requests that require immediate attention outside the set deadlines.
    - Deadlines were established as the end of the fourth week of each semester.
  4. As part of MTI's marketing strategy, the Institute will distribute embroidered polos to wear at conferences, meetings, etc. with the new MTI logo to MTI members. Director **JAKE HILLER** and Coordinator **PAM HANNON** will also visit with members to initiate discussions on future with MTI and how the Institute can help its members achieve their program goals.
    - Polo shirts were ordered and received for distribution to members but with the campus closure in spring, not all members have yet to receive their shirts.
  5. One on-going goal of MTI is to increase participation across campus in transportation-related research. Director **HILLER** will be contacting new members of the campus community that have research interests that may intersect with transportation issues to connect and inform them of opportunities MTI can provide to researchers and educators alike.
    - This is an annual goal of MTI and new members will continue to be vetted. MTI continues to reach out to new campus members to partner in transportation-related activities.
  6. As part of a MTI-funded major initiative on "Exploring the Science of Sustainability: Robustness and Resilience of Coupled Infrastructure and Natural Networks", member **AMLAN MUKHERJEE** has proposed an online course in "Infrastructure Life Cycle Engineering" to increase program offerings at Michigan Tech as well as connect MTI program development initiatives with practicing engineers across the world. The MTI EC will also be discussing plans for a larger impact on

transportation course development at Michigan Tech and how MTI can best support such measures.

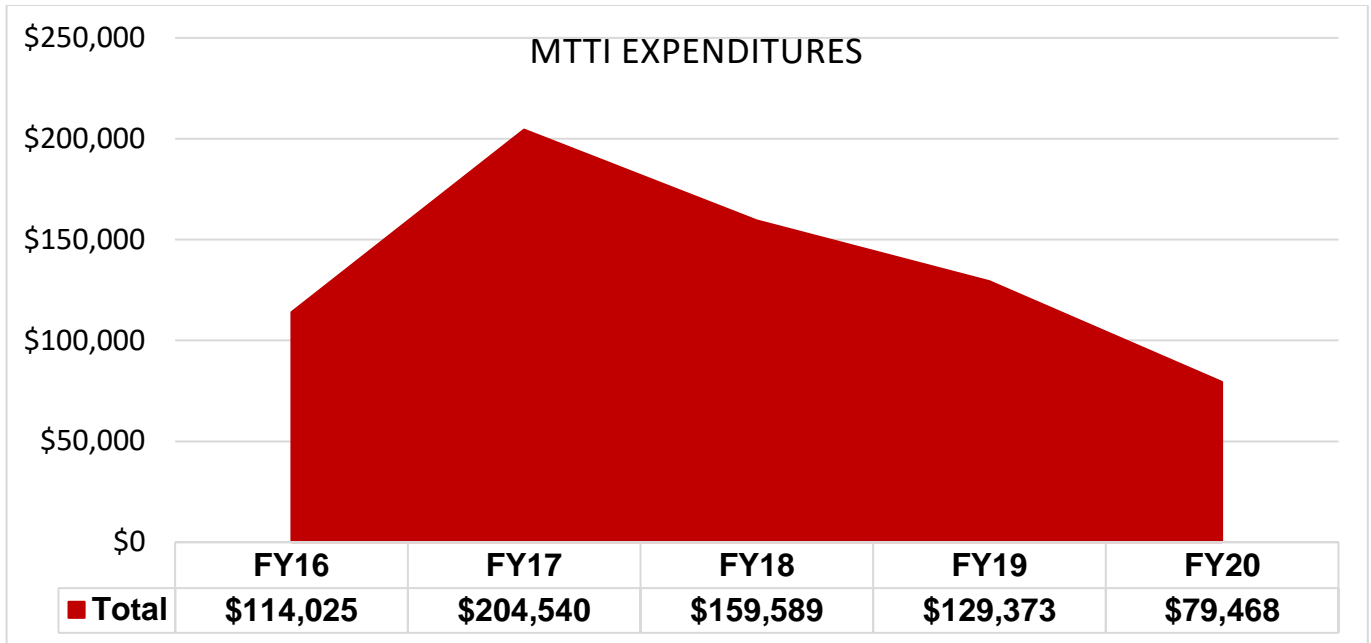
- Amlan Mukherjee, along with Jake Hiller and Zhanping You submitted a proposal for the Establishment of a New Graduate Certificate in Sustainable Pavement Design & Construction to the University Senate. The graduate certificate will introduce students to best practices in pavement design and construction with a strong emphasis on recent advances in sustainability. The course is still in the process of being approved as a certificate degree.

## Use of IRAD Funds

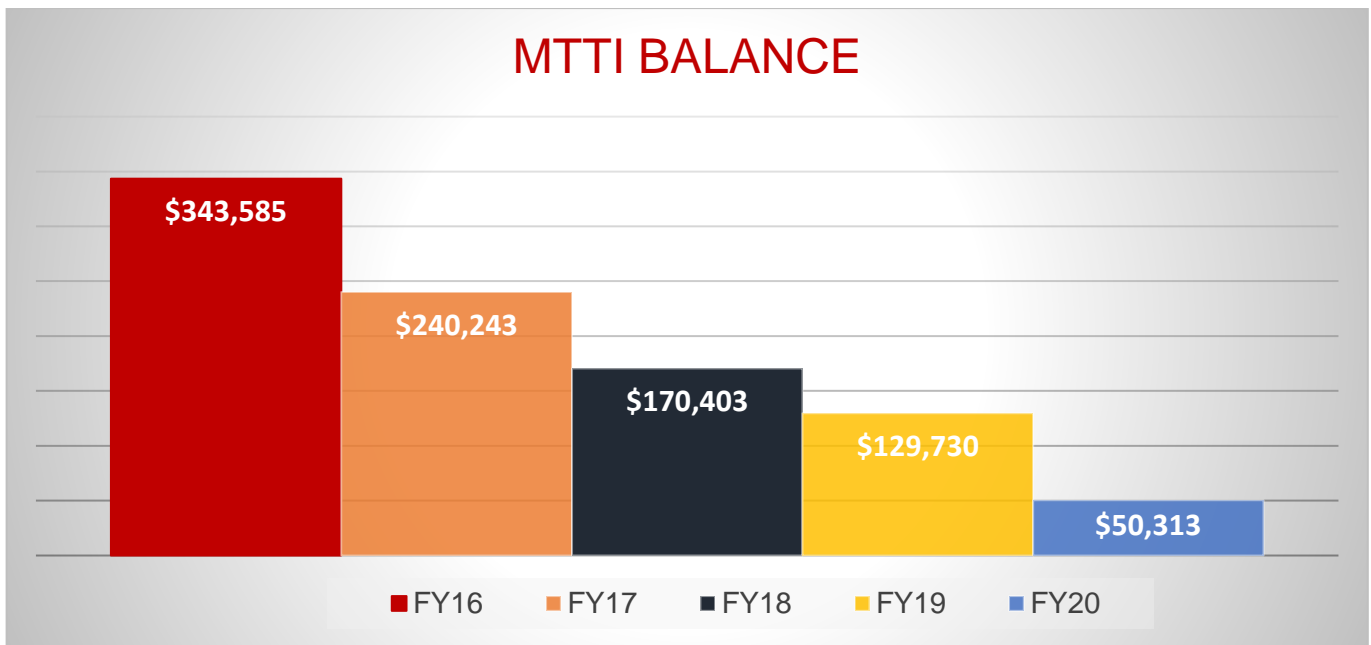
Institutional Research and Development Funds (IRAD), allocated by the Office of the Vice President for Research, is used by MTI for operating expenses and for strategic investment in membership activities. MTI IRAD returns (Figure 1), expenditures (Figure 2), and IRAD balances (Figure 3) are depicted for a five-year period from FY16 – FY20.



**FIGURE 1 MTI IRAD RETURNS**



**FIGURE 2 MTTI EXPENDITURES**



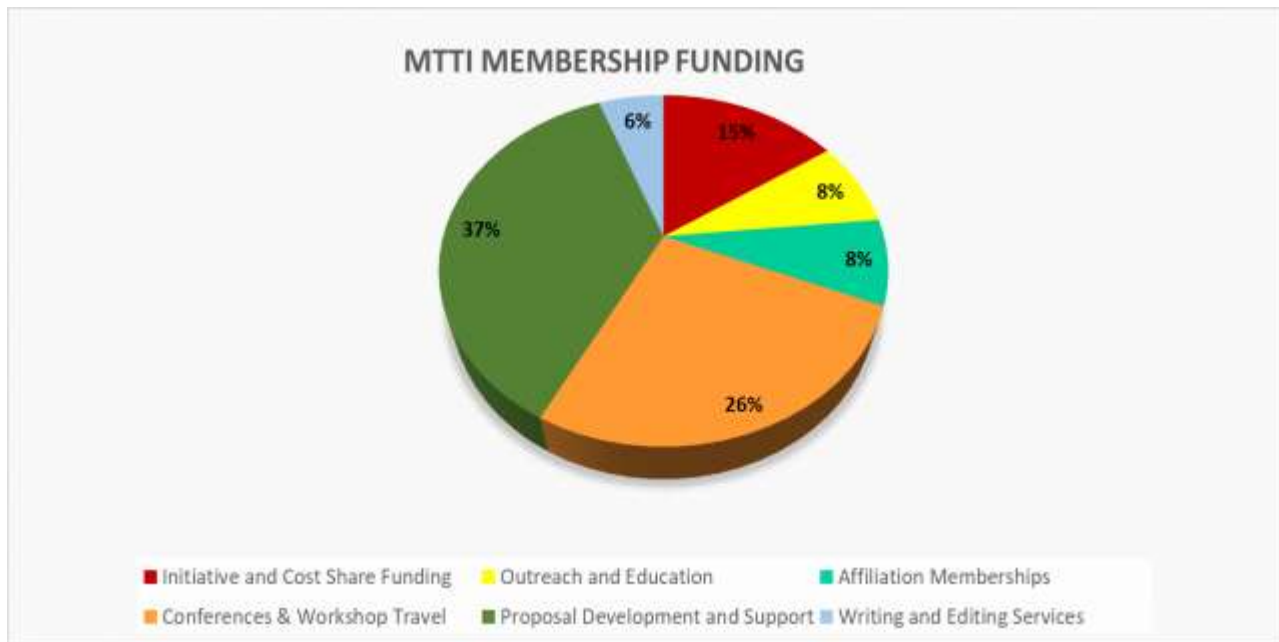
**FIGURE 3 MTTI IRAD BALANCE**

### RETURN ON INVESTMENT

MTTI uses IRAD earned in support of membership activities. 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. MTTI membership funding is depicted in Figure 4 for fiscal year 2020.



**FIGURE 4 MTTI MEMBERSHIP FUNDING**

MTTI supported members through the following funding activities in FY20.

### INITIATIVES

Cost share funding in the amount of \$5,000 was provided to **THOMAS OOMMEN** (GMES) for his project to the University of Michigan's Advanced Research Computing titled "Remote Sensing Based Terrain Strength Characterization for the Next Generation NATO Reference Mobility Model Development".

**JOHN VELAT** (CEE) attended the Transportation Innovation Education Stakeholders (TIES) Working Group meeting held in Washington, DC. **VELAT** is a member of the group which plans to develop education aids that would introduce the next generation of transportation practitioners to our Every Day Counts (EDC) innovations. This provides an opportunity to bridge the state of the art and state of the practice with a focus on EDC to ensure the emerging workforce is knowledgeable of innovations they will soon encounter in their careers. MTTI provided wage support for **VELAT** while attending the meeting.

MTTI provides proposal and report writing and editing services to members with funds earned through IRAD. **JOHN VELAT** provided editing services for the proposals listed below to:

**ZHANPING YOU** (CEE), "Have Minnesota's Warmer Winters Increased the Number of Freeze Thaw Cycles?", "Benefit/Cost of applying a higher Asphalt Film Thickness (AFT) vs. doing a Chip Seal at 1 year", and "Department of Environmental Quality (DEQ) Michigan Scrap Tire Program Market Study".

**QINGLI DAI** (CEE) "Measurement and Validation of In-Plane Structural Design Properties for Diaphragm Design with ANSI/PRG 320 Grade V1 CLT and Beetle-Killed Spruce CLT" and "U.S. Forest Service Wood Innovations Application".

**AMLAN MUKHERJEE** (CEE), "Innovative Contracting Risk Management Best Practices".

## OUTREACH

MTTI funded membership dues to the American Public Transit Association (APTA) and the National Road Research Alliance (NRRRA) to help facilitate relationships between national transportation organizations and MTTI members.

As a member of the APTA Research Committee and Marketing & Communications Committee, **PAM HANNON** (MTTI) attended the APTA Marketing & Communications annual workshop and meeting in Orlando, Florida.

**JAKE HILLER** (CEE) would normally represent MTTI at the National Road Research Association (NRRRA) Pavement Conference in Minneapolis and St. Paul, Minnesota but the meeting was held virtually this year instead. HILLER and EC member ZHANPING YOU are also members of the NRRRA Rigid and Flexible research teams, respectively.

## EDUCATION

Each year, MTTI provides support to transportation related programs through financial sponsorship of educational youth programs. Typically, MTTI provides funding for the Rail and Intermodal Transportation Summer Youth Program, Western UP Science Fair & STEM Festival, KBIC Explorations Camp, and Get WISE. Because these activities were cancelled due to Covid19 this spring and summer, we look forward to sponsoring these educational initiatives in the future.

## CAMPUS SUPPORT

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Collaborations between campus partners is crucial to the growth of the institute. MTTI lead events in order to increase visibility of the institute and to explore new opportunities in transportation with our campus colleagues.

- **Rural Roads Activities** – A meeting was held with **LARRY SUTTER** (MSE), **TIM COLLING** (CTT), **BRENT BURNS**, **JAKE HILLER** (CEE) and **BILL KORDENBROCK** for discussions on a continuing push for rural road research activities at MTU, based on the University Transportation Center proposal submitted by **SUTTER**. Discussions will continue on how best to bring a center, similar to MN's Local Road Research Board (funded with SPR money) to MTU. **SUTTER** and **COLLING** are leading this effort.
  
- **INVITED SPEAKERS – Portage Lake Lift Bridge Certification as National Landmark -** **TESS AHLBORN** (CEE) and CEE students submitted a proposal to designate Portage Lake Lift bridge as a national historic landmark. The designation was awarded and a ceremony was planned during BridgeFest 2020. MDOT Director Ajegba had accepted an invitation by **JAKE HILLER** to attend. Save the Date emails were sent and MTTI had planned to have campus visits by Director Ajegba and other MDOT representatives. The ceremony, BridgeFest 2020, and the campus visits were cancelled due to Covid19.
  
- **MnDOT Academic Research Program Proposal** – MTTI lead the submission of a five-year master contract proposal with the Minnesota DOT Academic Research Program for all campus researchers. **41** researchers participated in the renewal process from these campus entities: Biological Sciences, Civil & Environmental 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, the Rail Transportation Program, Social Sciences, Sustainable Futures Institute, and the School of Forest Resources & Environmental Science. The proposal was accepted by MnDOT.
  
- **Clean Snowmobile Challenge** – For the 10<sup>th</sup> consecutive year, MTTI provided funding the Clean Snowmobile Challenge, sponsored by the Keweenaw Research Center.
  
- **Houghton County Road Commission/UP Road Builders Association CEE Scholarship Fund** – The UP Road Builders Association seeks in-kind donations each year for their scholarship auction which provides funding to CEE students. MTTI has participated in the event for the past 8 years. Although donations were provided, the auction was postponed this year due to Covid 19.

- **MTTI Marketing** – MTTI ordered polo shirts for all members for use when traveling to conferences, meetings, and workshops. In addition, 500 MTU conference logos for name tags were also ordered for members and those interested in MTTI activities.

## CONFERENCES AND WORKSHOP TRAVEL

MTTI provides travel funding to researchers and students to attend conferences and workshops with the intent to increase MTTI and Michigan Tech exposure and to continue researcher contributions to the transportation industry.

In FY 20, MTTI funded travel for 15 members in the amount \$8,927.

# Accomplishments

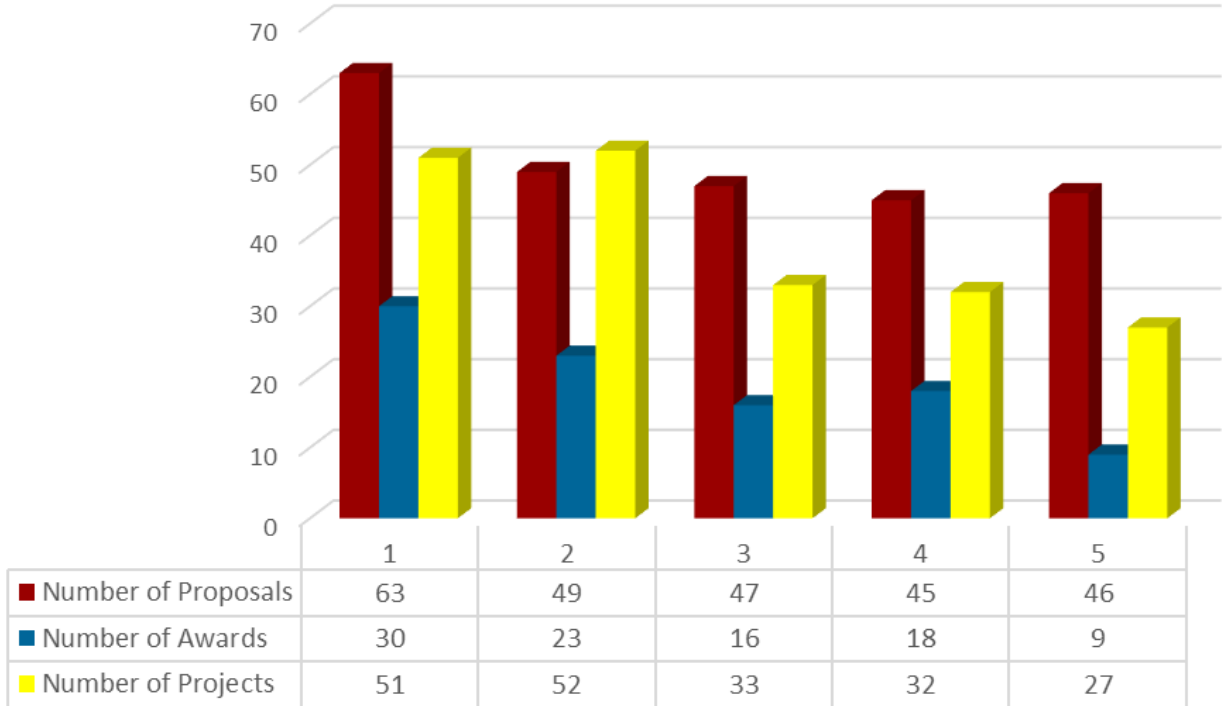
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## RESEARCH

In fiscal year 2020, MTTI researchers submitted proposal requests to multiple funding sponsors totaling **\$10,098,659**. **46** proposals were submitted of which **9** were awarded in the amount of **\$ 1,151,758**. MTTI currently has **27** projects in progress.

Figure 5 provides a summary of proposals, awards, and on-going projects over the previous five fiscal years. Annual proposal submission values are depicted in Figure 6 with total research funding awarded to MTU through MTTI sponsored projects is shown in Figure 7. A list of all proposals submitted through MTTI in FY19 is included in Appendix A.

### Proposals, Awards and OnGoing Projects



**FIGURE 5 PROPOSALS, AWARDS, AND CURRENT PROJECTS**

### PROPOSAL SUBMISSIONS

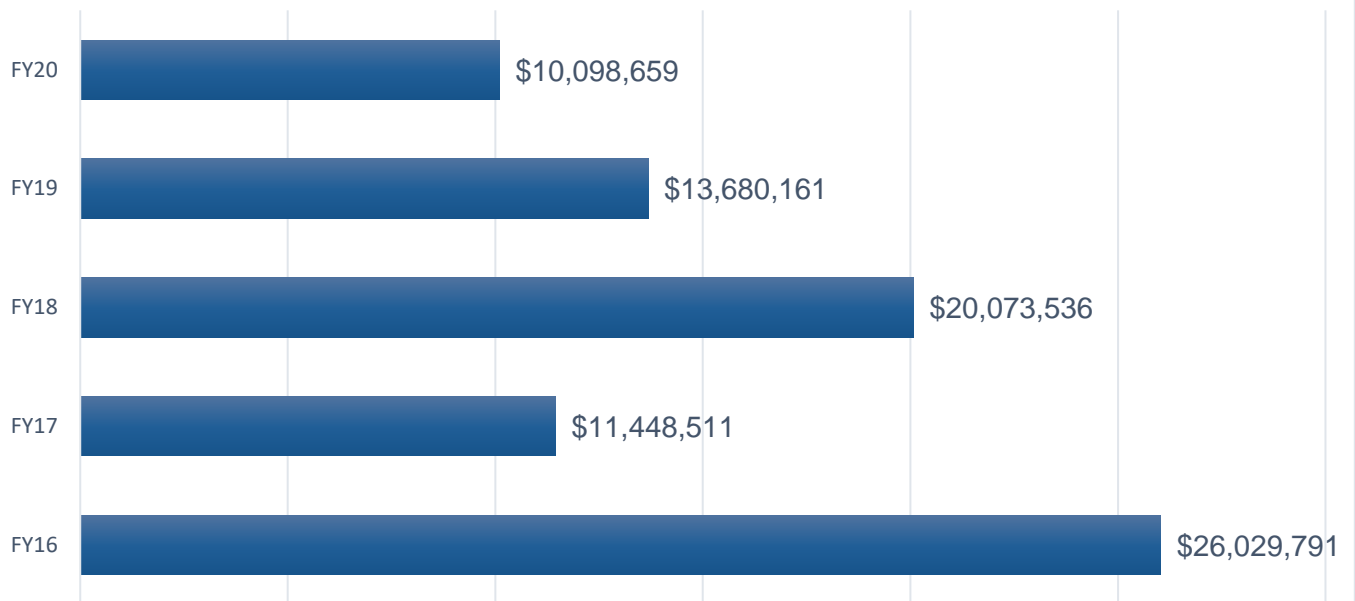


FIGURE 6 PROPOSAL SUBMISSIONS

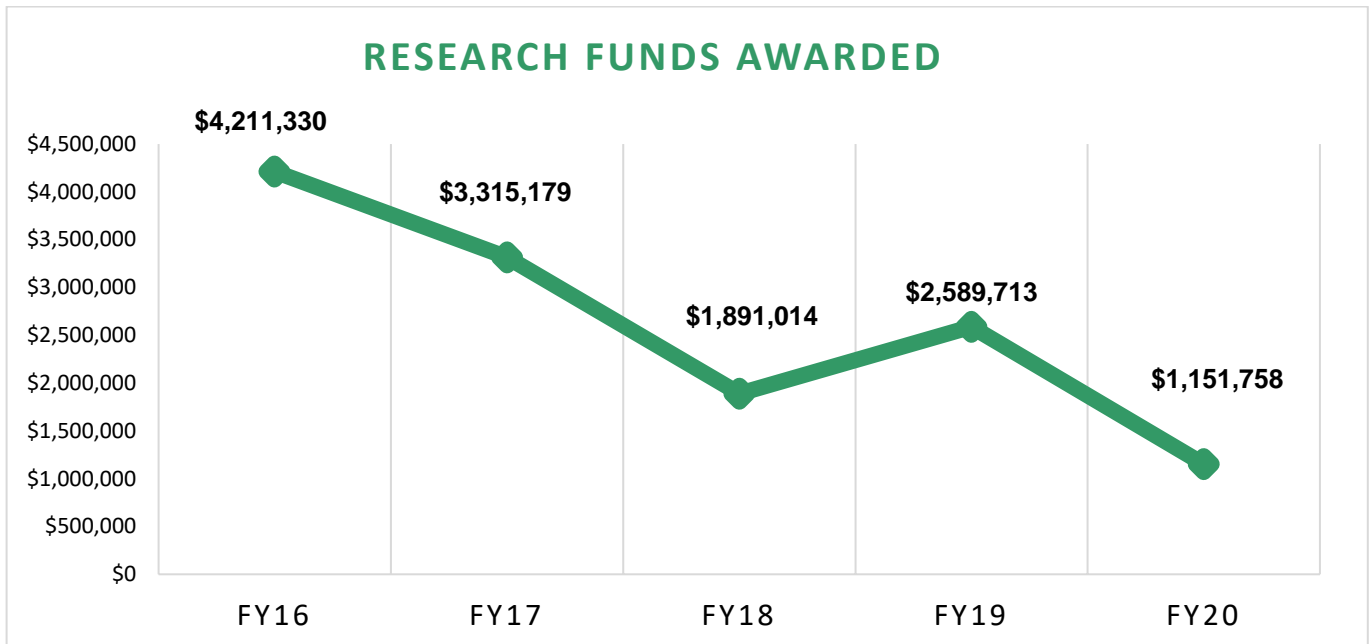


FIGURE 7 RESEARCH FUNDS AWARDED

## Institute Membership

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MTTI members who participated in research and educational activities during FY20 include:

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### CENTERS, INSTITUTES, AND PROGRAMS

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#### **CENTER FOR SCIENCE AND ENVIRONMENTAL OUTREACH (CSEO)**

Joan Chadde, Director

#### **CENTER FOR RURAL AND TRIBAL RESILIENCE**

John Velat, Director

#### **CENTER FOR TECHNOLOGY AND TRAINING (CTT)**

Scott Bershing, Technical Specialist

Tim Colling, Director

Chris Gilbertson, Associate Director

#### **GREAT LAKES RESEARCH CENTER (GLRC)**

Guy Meadows, Professor

### **KEWEENAW RESEARCH CENTER (KRC)**

Jay Meldrum, Director  
Russ Alger, Director Snow Institute

### **MICHIGAN TECH RESEARCH INSTITUTE (MTRI)**

Colin Brooks, Senior Research Scientist  
Richard Dobson, Research Scientist

### **RAIL TRANSPORTATION PROGRAM (RTP)**

Pasi Lautala, Director RTP/Assistant Professor (CEE)  
Dave Nelson, Senior Research Engineer

### **SUSTAINABLE FUTURES INSTITUTE (SFI)**

Robert Handler, Operations Manager

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## **DEPARTMENTS AND SCHOOLS**

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### **CHEMICAL ENGINEERING (CE)**

Dave Shonnard, Professor & Robbins Chair

### **CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)**

Tess Ahlborn, Professor  
Brian Barkdoll, Professor  
Siyu Chen, Post-Doctoral Researcher  
Qingli Dai, Professor  
Jake Hiller, Associate Professor  
Eugene Levin, Associate Professor  
Zhen Liu, Associate Professor  
Amlan Mukherjee, Associate Professor  
Andrew Swartz, Associate Professor  
Stan Vitton, Professor  
Melanie Kueber Watkins, Associate Research Professor  
Dave Watkins, Professor  
Zhanping You, Professor  
Kuilin Zhang, Associate Professor

### **COGNITIVE AND LEARNING SCIENCES (CLS)**

Elizabeth Veinott, Associate Professor

### **COLLEGE OF COMPUTING (COC)**

Jinshan Tang, Professor

### **ELECTRICAL AND COMPUTER ENGINEERING (ECE)**

Tim Havens, Associate Professor  
Ye Sun, Associate Professor

### **GEOLOGICAL AND MINING ENGINEERING AND SCIENCES (GMES)**

Snehamoy Chatterjee, Assistant Professor  
Thomas Oommen, Associate Professor  
Roger Turpening, Research Professor

### **MATERIALS SCIENCE AND ENGINEERING (MSE)**

Larry Sutter, Professor

### **PHYSICS (PHY)**

Claudio Mazzoleni, Professor

# Space and Facilities Requirements

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Although the facilities of our members are extensive, MTI 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 and 318 cubicles

## Future Plans and Goals

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The MTI Director and Executive Committee hold monthly meetings for discussions on opportunities available, strategic planning, and financial oversight of MTI. Future plans and goals are listed below.

Strategic plans for MTI in FY21 include:

- **Increase MTI's financial base after a shortened research year due to Covid19.**

While FY 20 plans were disrupted, in FY21, members have already submitted 15 proposals through the Institute and have pending awards of \$2,471,000. This enhanced effort will be critical to changing the funding trends that the Institute has experienced the past few years.

**ZHEN LIU** (CEE) was recently awarded a project from the Federal Highway Administration titled "Autonomous Winter Road Maintenance Decision Making Enabled by Boosting Existing Transportation Data Infrastructure with Deep and Reinforcement Learning", in the amount of **\$689,239**. Co-PIs are **ZHANPING YOU** (CEE) AND **TIM COLLING** (CTT).

Four campus researchers have been invited to submit proposals to the Federal Railroad Administration in response to their Broad Agency Announcement. In the past, when invited to submit a proposal, all projects have been successfully funded. These include the following:

**1. PASI LAUTALA**(CEE): Expanding Summer Youth Programs in Rail through Virtual Learning and a National Campus Network, **\$474,695**. Co-PIs is **DAVE NELSON** (CEE) with external partners University of Illinois-Urbana Champaign, Penn State Altoona,



University of South Carolina, University of New Mexico, Fresno State and four yet to be determined additional universities.

**2. PASI LAUTALA** (CEE): Railroad Crossing Vehicle Warning (RCVW) Application Demonstrations with Connected Vehicles, **\$332,000**. Co-PI is **KUILIN ZHANG** (CEE) with external partner Battelle.

**3. THOMAS OOMMEN** (GMES): An Integrated and Automated Decision Support System for Ground Hazard Risk Mitigation for Railway using Remote Sensing and Traditional Condition Monitoring Data, **\$600,000**. Co-PIs include

**4. MELANIE KUEBER WATKINS** (CEE): Automated Assessment of Track Drainage with High-Resolution Aerial Remote Sensing, **\$375,480**. Co-PIs are **PASI LAUTALA** (CEE), **THOMAS OOMMEN** (GMES) and **COLIN BROOKS** (MTRI).

- **Continue to join forces with other centers and institutes on campus. MTTI has recently collaborated with SFI, MTRI, MTRI, INC., HUI, and the GLRC on proposal submissions.**

As multi-disciplinary work is becoming the norm for academic-level research, institutes and centers across campus will be critical for helping bridge these gaps and making connections between researchers. MTTI is committed to a broad-based approach for finding transportation solutions, so this effort falls squarely within its mission.

- **Continue to work with MDOT to build a workforce pathway between Michigan Tech and MDOT.**

MTTI will continue its efforts to find solutions that benefit the Institute as well as its key partners like MDOT. In this instance, both organizations provide key resources that provide a mutually-beneficial partnership in terms of research needs, technical expertise, workforce development, and continued development of the next generation of the state's transportation network.

- **Identify and expand research opportunities for MTTI members**

As Covid19 effects will be felt throughout our society, government transportation agencies are taking a hard hit as revenues fall from reduced gasoline sales. This provides a challenge to the industry and the Institute as mounting transportation issues must be resolved. The MTTI Director and EC will be strategically planning to develop relationships outside our typical partners to help supplement members' research programs and outreach efforts. The multi-disciplinary approach to transportation efforts may provide to be beneficial in this instance.

# Appendix A: MTTI Proposal Submissions FY20

PI	CoPI	Sponsor	Title	Budget
Q. Dai		ACI Foundation	Fiber-Reinforced High-Performance Concrete with Recycled Organic Components	\$68,617
Z. You	S. Chen D. Ge	Baraga County Road Commission	Using Rubber Technology to Construct High Volume Traffic Road in Baraga County	\$194,662
Z. You		BASF	The Implementation of B2last for Asphalt Pavement in Michigan	\$60,000
Q. Dai		City of Davison	Development of sustainable rubber modified concrete pavement placed over recycled concrete aggregate base	\$143,340
Q. Dai	Z. You R. Si	City of Muskegon	Design Low-Cost and Durable Concrete Pavement with Tire Rubber Aggregates and Blended Cement	\$170,000
T. Oommen		Colorado DOT	Multi- and Hyper-spectral Remote Sensing and Data Processing for Colorado Slope and Embankment Assets	\$120,267
Z. Liu		DARPA	Unlocking and Merging the Secrets of Roman Concrete from Ancient Rome and China: Roman Concrete Enhanced with Organics	\$828,668
Z. You	S. Chen D. Ge	Dickinson County Road Commission	Using Warm Mix Tire Rubber Modified Asphalt for Roadway Paving in Dickinson County	\$194,662
Z. You	Q. Dai L. Liu	Dickinson County Road Commission	Using Tire Rubber Modified Pellet Asphalt for Roadway Paving in Dickinson County	\$194,662
M. Watkins	D. Watkins	EGLE	Huron Creek Watershed Management Plan	\$67,377
Z. You	Q. Dai L. Liu	EGLE	Research and Development of Advanced Rubber Technology for Asphalt Pavement	\$975,090
Z. You	Q. Dai	EGLE	Development of Novel Liquid-phase Waste Plastics Technology to Improve Mechanical Properties of Asphalt Pavement	\$1,179,563
Z. Liu	Z. You T. Colling	FHWA	Autonomous Winter Road Maintenance Decision Making Enabled by Boosting Existing Transportation Data Infrastructure with Deep and Reinforcement Learning	\$689,239
Z. Liu		MDOT	Develop and Implement a Freeze Thaw Model Based Seasonal Load Restriction Decision Support Tool	\$15,052
A. Mukherjee	J. Velat	MDOT	Innovative Contracting Risk Management Best Practices User Manual and Tools	\$140,248
J. Velat		MDOT	Research Program Services	\$652,657
Z. You	S. Chen D. Jin	Michigan State University	Testing protocol data storage and recalibration for Pavement ME Design	\$95,653
Z. You		Michigan State University	Field Evaluation of Promising Crumb Rubber Modified Technologies in Northern Climates	\$48,000
Q. Dai	Z. You	Midland County Road Commission	New techniques for producing durable fiber-reinforced rubber concrete used in structure applications	\$170,000

S. Chen	Z. You	MnDOT	A Rapid Treatment Technology for Pavement Surface Distresses Using Asphalt Patching Material	\$74,095
Q. Dai	Z. You	MnDOT	High-Strength and Low-Cost Rubber-Modified Epoxy Polymer Concrete Overlay for Concrete Substrates Protection	\$79,251
Q. Dai	R. Si, J. Wang	MnDOT	Taconite as a lower cost alternative High Friction Surface Treatment to Calcined Bauxite for low volume local roads in Minnesota	\$127,564
Z. You		MnDOT	Ground Tire Rubber Asphalt for Durable Pavements for Minnesota Roads	\$287,101
Z. You	L. Liu	MnDOT	Benefit/Cost of applying a higher Asphalt Film Thickness (AFT) vs. doing a Chip Seal at 1 year	\$171,637
Z. You	S. Chen	MnDOT	Have Minnesota's Warmer Winter Increased the Number of Freeze Thaw Cycles?	\$148,652
M. Watkins	B. Barkdoll C. Brooks	MODOT	Scour Analysis at Missouri Bridges	\$50,000
Z. You	Q. Dai S. Chen	Montana DOT	Evaluation of Thin Polymer Overlays for Bridge Decks	\$75,000
P. Lautala		MTRI, Inc.	Platform Edge Proximity Detection to Prevent Inadvertent Passenger Car Door Opening	\$40,357
Z. You	S. Chen D. Ge	Muskegon County Road Commission	New Rubber Asphalt for Heavy Traffic Road in Muskegon County	\$194,662
B. Barkdoll	D. Watkins M. Watkins	NCHRP	Guidelines for Selection and Application of Manning's Roughness Values in Two-Dimensional Hydraulic Models	\$497,354
M. Watkins	D. Watkins B. Barkdoll	NCHRP	NCHRP Synthesis 20-05/Topic 51-10: Flood Resiliency and Adaption Through Integrated Storm Prediction and Response Systems	\$45,000
Z. You	D. Ge M. Watkins	NCHRP	NCHRP Synthesis 20-05/Topic 510-0814: Practice and Performance of Cold In-Place Recycling and Cold Central Plant Recycling	\$45,000
Z. You	M. Watkins	NCHRP	NCHRP Synthesis 20-05/Topic 51-07 Practices for Assessing and Mitigating the Moisture Susceptibility of Asphalt Pavements	\$45,000
Z. You	M. Watkins	NCHRP	NCHRP Synthesis 20-05/Topic 51-16: Proper Maintenance Before Pavement Infrastructure Preservation	\$45,000
Q. Dai	D. Dowden D. Shonnard D. Watkins X. Xie	NSF	LEAP HI: Hardwood Cross-Laminated Timber for Enhanced Infrastructure Resilience Economic Prosperity and Environmental Sustainability	\$1,699,627
Z. Liu		NSF	Reinterpreting Stresses in Multiphase Porous Materials with Hybrid Statistical Mechanics Simulations	\$286,423
Z. Liu		NSF	ECR: Track III: Level I: Affirming subjective values of students through an open-loop learning platform to meet evolving workforce needs	\$299,870
J. Velat		NTICC	2019 NTICC Technical Assistance	\$3,500

<b>P. Lautala</b>	<b>D. Nelson</b>	UIUC	Center for Rail Infrastructure Safety	\$777,794
<b>T. Oommen</b>		University of Michigan	Remote Sensing Based Terrain Strength Characterization for the Next Generation NATO Reference Mobility Model Development	\$120,473
<b>P. Lautala</b>	<b>E. Veinott</b>	University of TN Kn	NIESI-National Institute for Rail Safety Improvements	\$507,157
<b>Q. Dai</b>		USDA	Establishing Baseline Allowable Design Values for Mixed Species Hardwood CLT with PRG 320 for Large-Scale Manufacturing	\$300,414
<b>K. Zhang</b>		Washington State University	Automated and Connected Transportation for Equitable Services: ACTES	\$300,000
<b>T. Oommen</b>		WHRP	Geotechnical Asset Management for Slopes	\$150,000