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Michigan Tech Transportation Institute 2019 Annual Report

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Michigan
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Michigan Tech Transportation Institute



2019

ANNUAL REPORT

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BY THE NUMBERS

35

faculty and staff members were involved in active research through MTI

\$2,589,713

in research funding was awarded to MTI investigators

MTI supported over **70** students in STEM related activities

proposals submitted

45

40%

of proposals submitted were awarded

2019 research partners

- City of Munising
- Federal Highway Administration
- Keweenaw Bay Indian Community
- Mashantucket Pequot Tribal Nation
- Michigan Depart of Environment, Great Lakes & Energy
- Michigan Department of Transportation
- Minnesota Department of Transportation
- Montana Department of Transportation
- MTRI, Inc.
- National Academies of Science, Engineering, and Medicine
- National Science Foundation
- Texas Tech University
- The World Bank
- University of Illinois
- University of Michigan
- University of Tennessee Knoxville
- US Department of Agriculture
- US Department of Energy
- US Department of Transportation
- Wisconsin Department of Transportation

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.

The Year in Review

With the yearlong sabbatical of Director **PASI LAUTALA** (CEE), **JAKE HILLER** (CEE) was chosen as Interim Director of MTI to provide continued leadership to the membership during **LAUTALA'S** absence. Executive Committee (EC) members serving MTI during FY19 include the following:

PRINCIPAL MEMBERS – **COLIN BROOKS** (MTRI), **THOMAS OOMMEN** (GMES), **ZHANPING YOU** (CEE)

AFFILIATE MEMBERS – **CHRIS GILBERTSON** (CTT), **JAKE HILLER** (CEE)

An election for a new Director and two Executive Committee members was held in spring 2019. **JAKE HILLER** was elected as MTI Director with **PASI LAUTALA** serving as a principal member and **ROBERT HANDLER** (SFI) elected as an affiliate member. The Associate Vice President of Research Development Office (AVPRD) approved **HILLER** as the next MTI Director in accordance with the MTI bylaws. Each of the newly elected members will serve a three-year term beginning July 1, 2019.

MTI's previous five-year authorization as a research institute with the university expired on December 31, 2018. After meetings and a presentation with the Vice President of Research Office by Interim Director **HILLER**, MTI was reauthorized to serve the transportation research community at Michigan Tech with a five-year term expiring 12/31/2023.

During FY18, the Director and Executive Committee formulated a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis for MTI as an organization which precipitated the development of a TOWS plan as an extension of the SWOT. Combining the SWOT analysis with TOWS strategies gives MTI a basis to work from to continue growth of the institute.

Based on the analyses, plans developed for MTI in FY19 and beyond included nine broad initiatives. The specific initiatives as well as work to support these plans in FY are listed as follows:

1. Provide a support mechanism for creating larger center proposals (staff coordination and seed funding) including writing and editing services and funding of major and minor initiatives.
 - J. HILLER met with AVPRD J. CARTER and other center/institute members to develop a tentative mechanism to share IRAD between collaborating research centers.
 - Budgeted IRAD funds for writing and editing services are available to MTI members provided by J. VELAT (TTAP) and S. BERSHING (CTT).
2. Facilitate connections with potential sponsors (travel and networking events) for MTI informational sessions and for invited guest speakers
 - Continual efforts are being expended on providing networking opportunities for MTI members. MDOT research administration members visited the campus at the invitation of Director HILLER.
3. Add research staff to increase support. Must be billable.
 - This is a continual goal. Currently MTI provides funding to non-MTI staff to provide writing and editing services.
4. Establish post-award support.
 - After discussion at a monthly Executive Committee meeting, MTI leadership decided that IRAD funds earned are better spent on initiatives and growth of the institute at this time. It was decided that PI's are capable of maintaining most projects scopes themselves.
5. Encourage use of initiatives on equipment.
 - The Executive Committee is currently developing a funding matrix for equipment initiatives. A limit will be set for the number of initiatives funded each year, cost share will be required and upgrades of equipment will have preference. In the past year, MTI awarded two equipment initiatives to members to help facilitate research on campus.
6. Create close coordination with the Center for Technology & Training to maximize and secure ROI from joint projects.
 - MTI continues to work closely with the CTT on projects. A current, joint project is the EPA's Environmental Finance Center for the Great Lakes Region.
7. Use student activities such as the Enterprise program to increase industry collaboration. Coordinate with CEE to support potential Transportation Enterprise.
 - Advancements are being made in the development of a Transportation Enterprise team over the next few years.
8. Identify strategic university and external entities for collaboration.
 - This is a continual goal set by the EC. Currently, a meeting in Lansing with MDOT is being scheduled for visits by Director HILLER, EC member P. LAUTALA, and CEE Chair AUDRA MORSE to better connect MTI research, outreach, and workforce development goals to a key in-state partner.

9. Facilitate research connections with MTI faculty and other MTU centers to partner with other centers and institutes.
 - MTI member **L. SUTTER** served as the PI on a proposal to the USDOT for a University Transportation Center titled “The National Center for Durability and Extended Life for Local Transportation Agencies (DELLTA)” which included multiple campus departments/centers/institutes and numerous off campus partners. MTI was key to initiating this proposal process and providing required cost share resources for the proposed project to meet its intended goals and impact.
 - MTI has several collaborative projects with the Michigan Tech Research Institute (MTRI) and has submitted proposals with the Sustainable Futures Institute (SFI).

Use of IRAD Funds

MTI is allocated Institutional Research and Development (IRAD) funds by the Vice President of Research Office, used for operating expenses and for investment in membership to encourage growth of the institute. MTI IRAD returns (Figure 1), expenditures (Figure 2), and IRAD balances (Figure 3) are depicted for a five-year period from FY15 – FY19. At the direction of the VPR office, MTI was tasked with spending down a large institute balance in FY16. MTI has also undergone a major change in its scope with the CTT becoming a standalone center in the past few years.

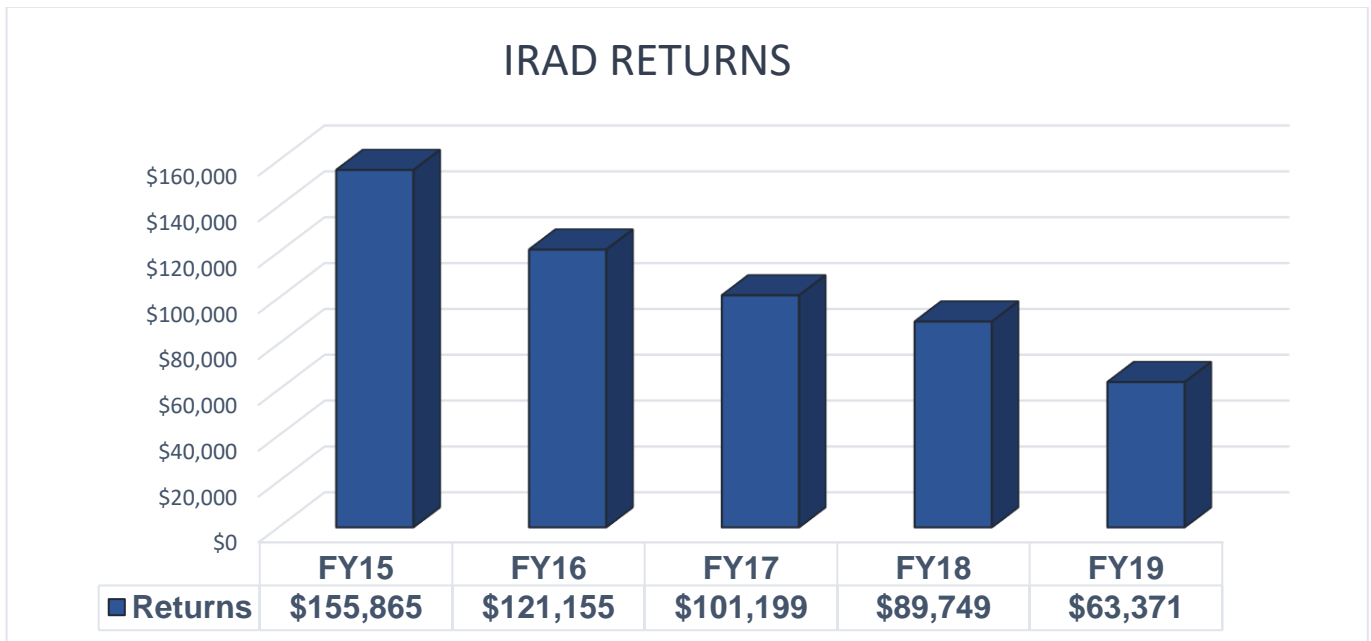


FIGURE 1 MTI IRAD RETURNS

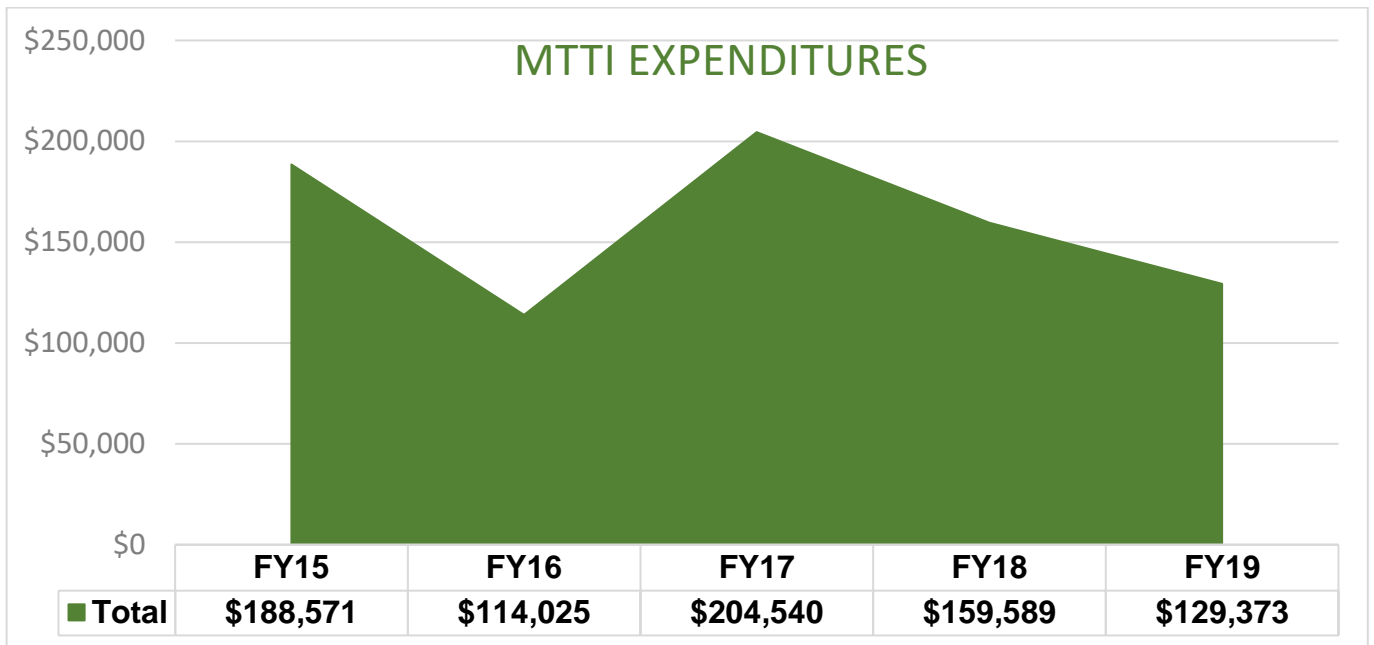


FIGURE 2 MTTI EXPENDITURES

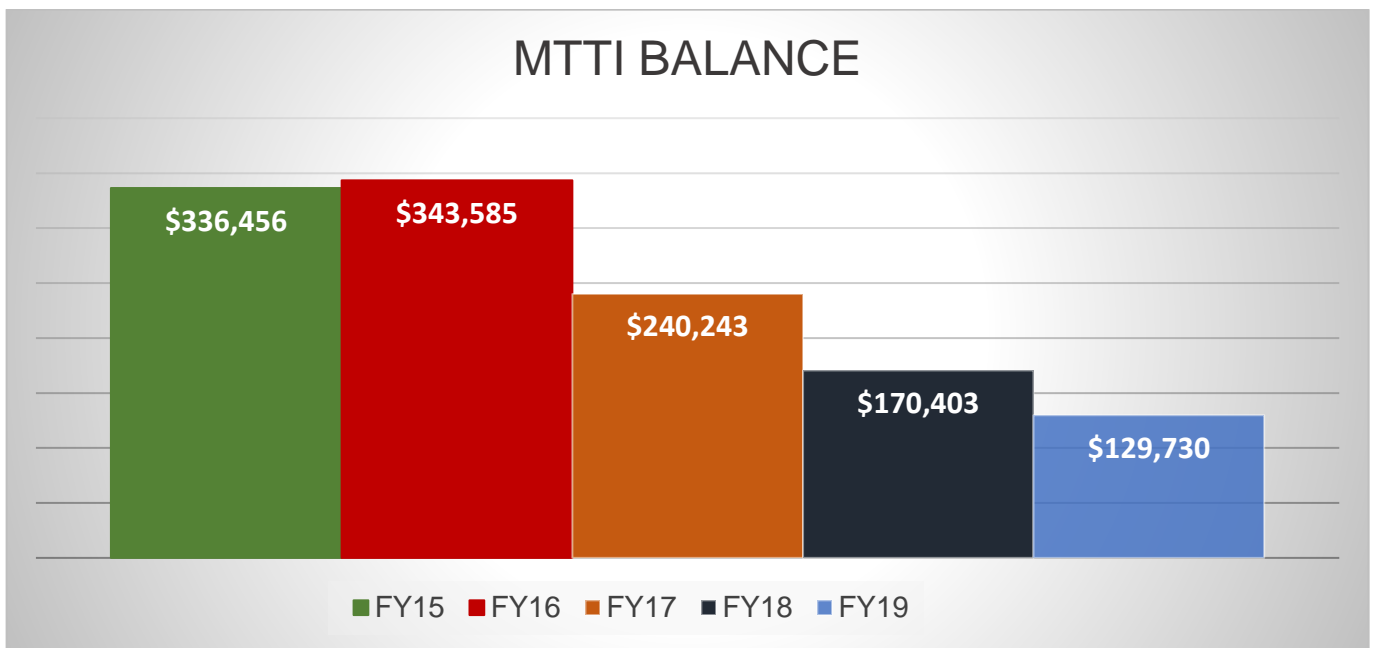


FIGURE 3 MTTI IRAD BALANCE

RETURN ON INVESTMENT

MTTI is allocated Institutional Research and Development (IRAD) funds by the Vice President of Research Office, which MTTI uses in support of membership. Typical expenses include major and minor initiatives, equipment upgrade funding, proposal preparation costs, cost share funding, educational activities, sponsored speakers and membership travel. MTTI membership funding is depicted in Figure 4 for fiscal year 2019.

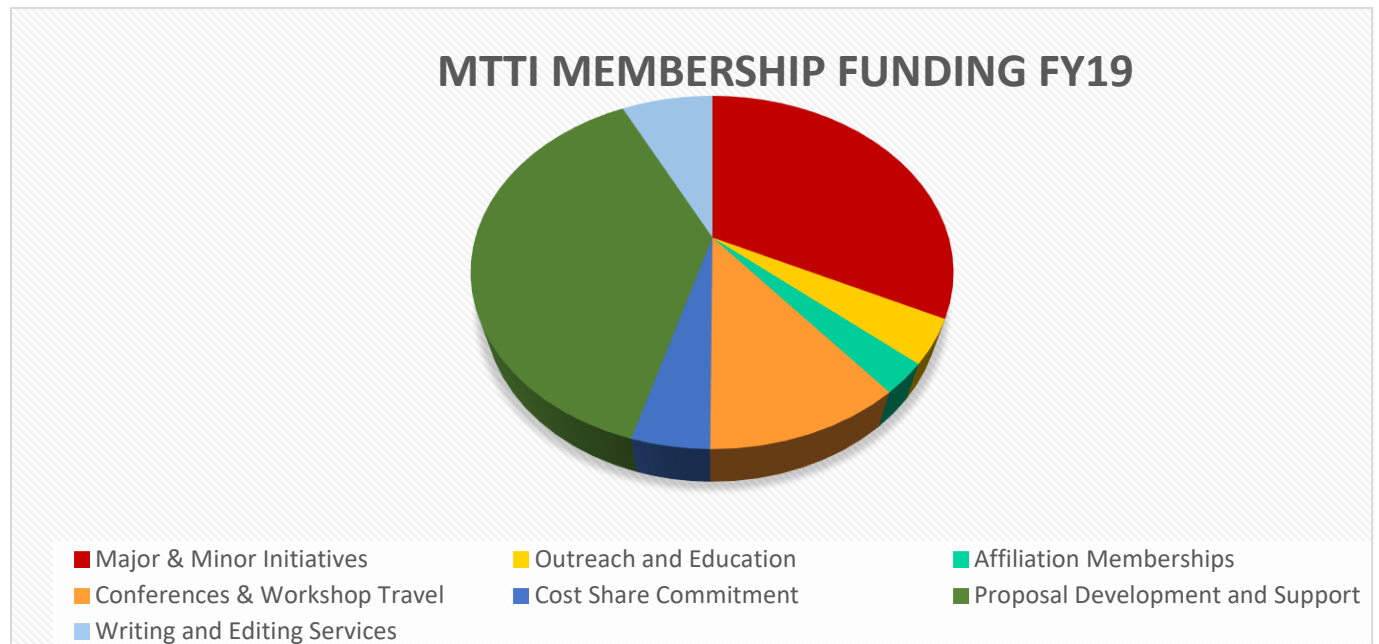


FIGURE 4 MTTI MEMBERSHIP FUNDING

MTTI supported members through the following funding activities in FY19:

INITIATIVES

Two initiatives were submitted to the Executive Committee for equipment upgrade or purchase. Both initiatives were approved for funding.

Equipment Upgrade: **ZHANPING YOU** (CEE) requested funding in the amount of \$15,000 for upgrades to the Universal Testing Machine (UTM). The UTM was over 20 years old and hadn't functioned due to a failed controller. The total cost to repair the equipment was \$47,000.

Equipment Purchase: **THOMAS OOMMEN** (GMES) received \$10,000 from MTTI IRAD funds for the purchase of a hyperspectral camera that can be placed on an Unmanned Aerial Vehicle (UAV) platform. Cost of the new camera was \$42,174.

In addition, cost share funding was committed by MTTI to **ZHANPING YOU'S** project, "Tire Rubber Modified Asphalt Emulsion for Effective Pavement Preservation" with the Michigan Department of Environmental Quality in the amount of \$4,000.

OUTREACH

MTTI provides financial support of affiliation fees to external organizations in order to provide an additional platform for members to network and to encourage future collaborations. MTTI funded membership dues to the American Public Transit Association (APTA) and the National Road Research Alliance (NRRRA) to help facilitate relationships between national organizations and MTTI.

As a member of the APTA Research Committee and Marketing & Communications Committee, **PAM HANNON** (MTTI) participated in the APTA Marketing & Communications annual workshop and meeting in New Orleans, Louisiana.

JAKE HILLER (CEE) represented MTTI at the National Road Research Association (NRRRA) Pavement Conference in Minneapolis and St. Paul, Minnesota. **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. Activities in FY19 included:

Rail and Intermodal Transportation Summer Youth Program

MTTI collaborated with the Rail Transportation Program to provide financial support to participants of the 10th annual Rail and Intermodal Summer Youth Program held on Michigan Tech and the University of Wisconsin Superior's campuses as both an educational as well as recruitment tool for future students at Michigan Tech.

The week-long exploration includes field visits to rail roads, rail yards, an intermodal facility, and to rail museums. Along with the field visits, students are also active in building model train sections, using a computer based locomotive simulator, constructing mag-lev cars, and seeing an active railroad-highway grade crossing. MTTI supported the program financially.

Western UP Science Fair & STEM Festival

Over 130 students in grades 4-8, representing eight different schools, submitted projects to the 21st Annual Western UP Science Fair this year. Following the event, 300 science fair participants and families took part in the STEM Festival which offers over 30 hands-on activities for participants. **JOAN CHADDE** (CSEO) is an organizer of the events which MTTI sponsored financially.

KBIC Explorations Camp

The Great Lakes Exploration Summer Camp for 20 Keweenaw Bay students in grades 6-8 was held on the MTU campus again this past summer. Students of the camp took part in

activities involving watersheds, wetlands, stream monitoring, modeling and engineering culverts, and a shipwreck discovery. MTI supported the camp financially.

Houghton County Road Commission – Upper Peninsula Road Builders Association (UPRBA)

MTI again offered in-kind donations to the Houghton County Road Commission for their annual UPRBA fundraising initiative. Items are auctioned at the fundraising event with the funds raised being awarded to MTU students in Civil & Environmental Engineering. The Road Commission was able to offer eight \$1000 scholarships and six \$500 scholarships to deserving students for the academic year through the proceeds of the auction.

GET WISE

GET WISE is a program offered to seventh and eighth grade girls from the Western Upper Peninsula for a day of exploration. The students participate in three to four challenges designed to connect them to the world of engineering. The girls then have the opportunity to meet with female role models involved with STEM education at Michigan Tech. MTI supports the program annually through in-kind contributions.

CAMPUS SUPPORT

Collaborations between campus partners is crucial to the growth of the institute. In FY19, MTI took the lead in events to increase the visibility and to explore new opportunities in transportation.

- **UTC DELTA Proposal – LARRY SUTTER** (MSE) served as PI on a proposal through MTI to the USDOT University Transportation Center Program titled ““The National Center for Durability and Extended Life for Local Transportation Agencies (DELLTA)”. Co-PIs involved were from the Center for Technology and Training, Civil and Environmental Department, and the Department of Geological and Mining Engineering and Sciences. External university partners included the University of Delaware, University of Kansas, University of Virginia, University of Louisiana at Lafayette, University of New Mexico and the South Dakota School of Mines and Technology. In addition, over 100 senators endorsed the project to the USDOT. MTI provided administrative support in development of the proposal plus committed \$192,868 in cost share match to meet the sponsor requirements.
- **INVITED SPEAKERS** – At the invitation of Director **HILLER**, MDOT's Carol Aldrich (Director of Research Administration), Michael Townley (Supervisor, Project Admin under Research Admin) and Andre Clover (Project Manager under Research Admin) toured MTI facilities, held conversations with researchers, attended a luncheon with 45 MTI members and provided an update on the future of transportation research at their company. MTI also held their annual general membership meeting for updates on the future plans of the institute.

- MTI financially sponsored the annual **CLEAN SNOWMOBILE CHALLENGE**, organized and led by the Keweenaw Research Center (KRC), for the 9th consecutive year.
- **CEE SCHOLARSHIPS** – Each year, the UP Road Builders Association raises funds through an auction of items provided by MTI and others. Students in the CEE Department are recipients of scholarships funded by the auction. With funds raised through the 2018 auction, nine Michigan Tech students were awarded scholarship funding totaling \$8,000.
- **RAIL DAY EXPO/RAIL NIGHT** – The Rail Transportation Program hosted their annual Rail Day/Expo and Rail Night in the fall, allowing students, faculty, and industry partners to learn about the latest in rail technology improvements. Multiple invited speakers provided over 100 students and guests with an update on the rail industry today. MTI provided in-kind sponsorship of the event.

CONFERENCES AND WORKSHOP TRAVEL

MTI researchers and students are allotted funding annually for conference and workshop travel for their contributions to the growth of the transportation profession by participation in local, state, regional, and national workshops and conferences.

- A highly attended event in the transportation community is the Transportation Research Board's (TRB) annual meeting, held in Washington, DC. More than 13,000 professionals attended the 2019 meeting, covering all transportation modes and addressing topics of interest to policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. Attending from MTI were: **ZHEN LIU** (CEE), **LARRY SUTTER** (MSE), **THOMAS OOMMEN** (GMES), and students **SIYU CHEN** (CEE) AND **MIAO YU** (CEE).
- **DAVE NELSON** (CEE/RTP) helped with planning of the Railway Engineering Education Symposium while at the AREMA Committee 24 winter meeting in McDonough, GA.
- **LARRY SUTTER** (MSE) attended the ACI Conference in Quebec City, Canada.

Accomplishments

RESEARCH

MTTI researchers submitted proposal requests to multiple funding sponsors totaling **\$13,680,161** in fiscal year 2019. **45** proposals were submitted of which **18** were awarded funding for an approval rate of **40%**. Research awards amounted to **\$2,589,713**. MTTI currently has **32** 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.

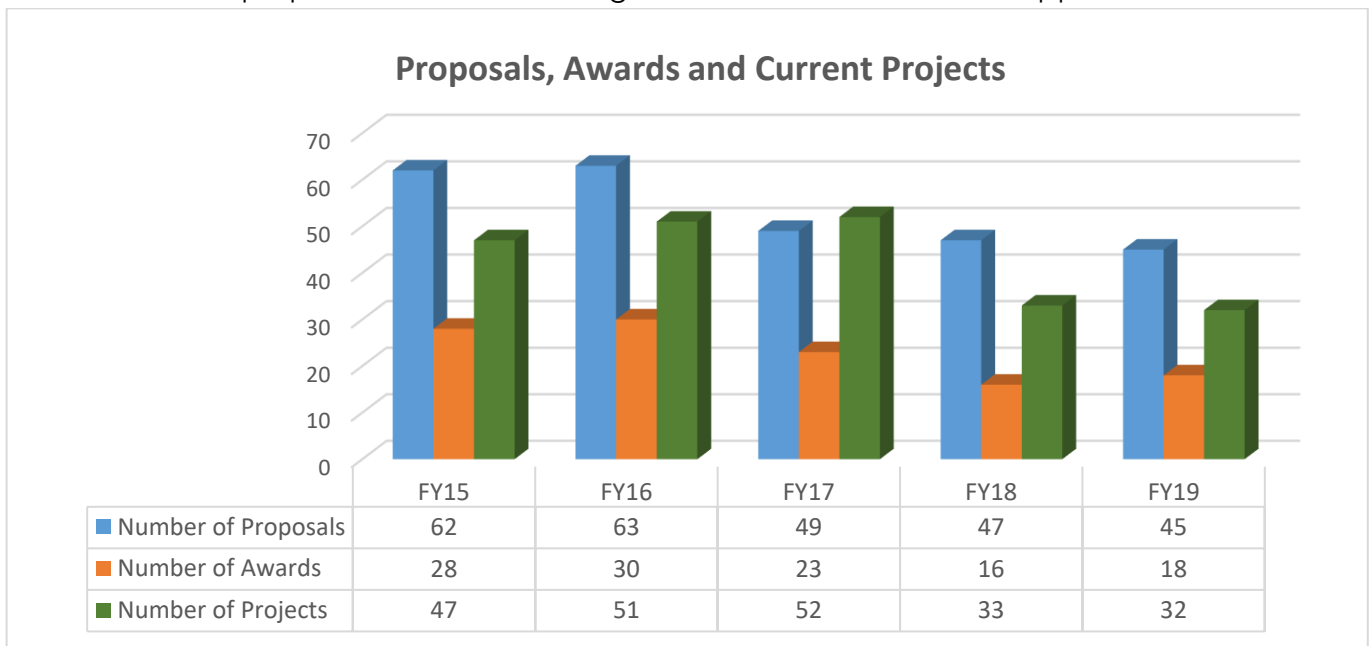


FIGURE 5 PROPOSALS, AWARDS, AND CURRENT PROJECTS

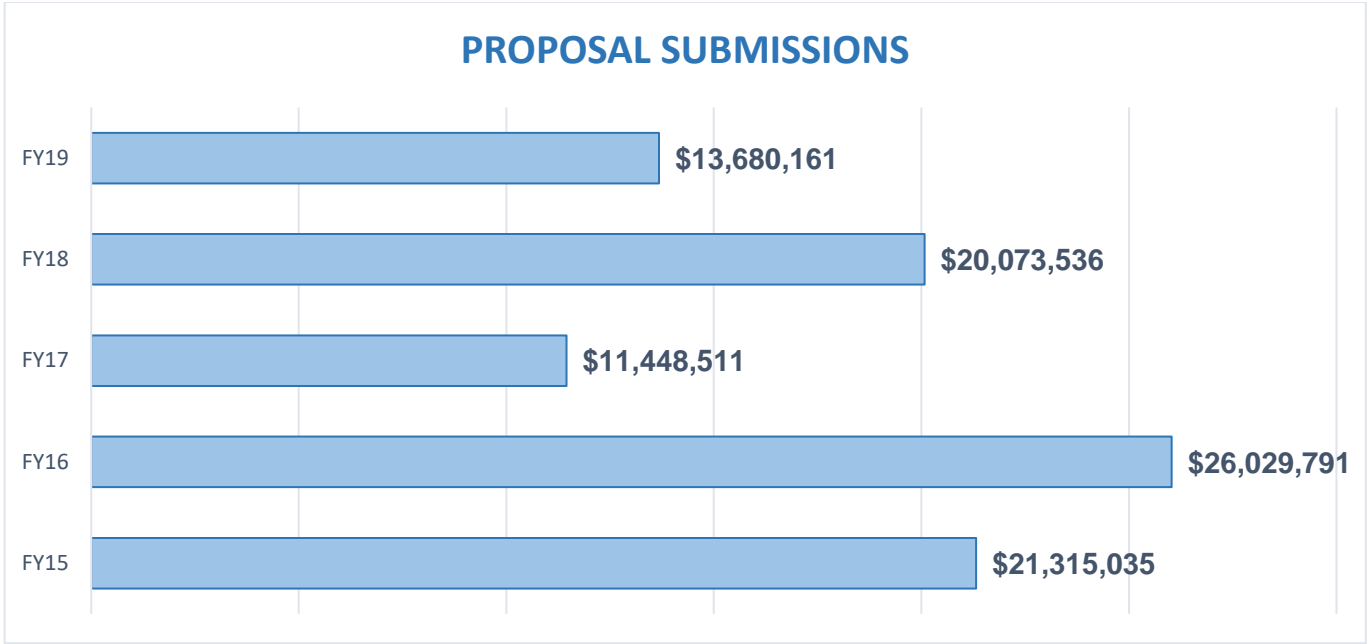


FIGURE 6 PROPOSAL SUBMISSIONS

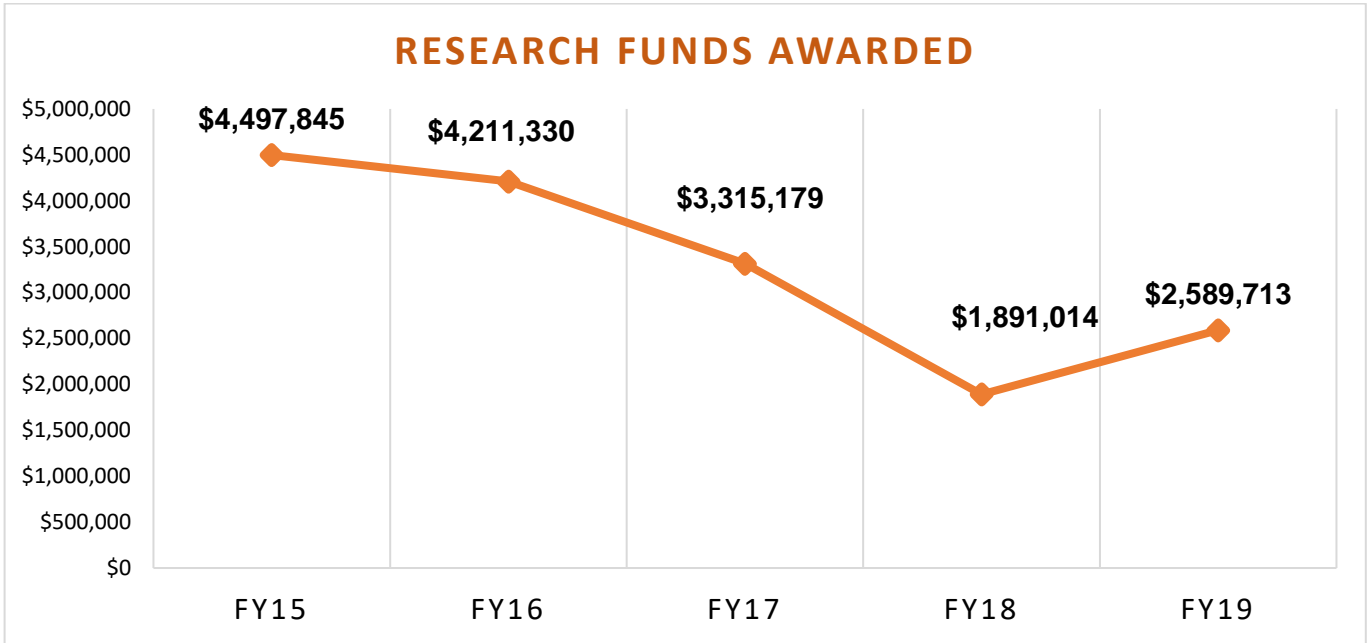


FIGURE 7 RESEARCH FUNDS AWARDED

Institute Membership

MTI members participating in research and educational activities during FY19 include:

CENTERS, INSTITUTES, AND PROGRAMS

CENTER FOR SCIENCE AND ENVIRONMENTAL OUTREACH (CSEO)

Joan Chadde, Director

Gary Schlaff, Senior Project Manager
Peter Torola, Research Engineer II

CENTER FOR RURAL AND TRIBAL RESILIENCE

John Velat, Director

KEWEENAW RESEARCH CENTER (KRC)

Jay Meldrum, Director

CENTER FOR TECHNOLOGY AND TRAINING (CTT)

Scott Bershing, Technical Specialist
Chris Codere, Senior Project Manager
Tim Colling, Director
Chris Gilbertson, Associate Director
John Kiefer, Research Engineer II
Nick Koszykowski, Principal Programmer
Dale Lighthizer, Training Development Specialist
Luke Peterson, Principal Programmer

MICHIGAN TECH RESEARCH INSTITUTE (MTRI)

Colin Brooks, Senior 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

DEPARTMENTS AND SCHOOLS

BIOMEDICAL ENGINEERING (BME)

Bruce Lee, Associate Professor

Eric Seagren, Professor
Stan Vitton, Professor
Pengfei Xue, Associate Professor
Zhanping You, Professor
Kuilin Zhang, Associate Professor

CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

Tess Ahlborn, Professor
Jennifer Becker, Associate Professor
Qingli Dai, Professor
Jake Hiller, Associate Professor
Zhen Liu, Associate Professor
Amlan Mukherjee, Associate Professor

ELECTRICAL AND COMPUTER ENGINEERING (ECE)

Tim Havens, Associate Professor

GEOLOGICAL AND MINING ENGINEERING AND SCIENCES (GMES)

Snehamoy Chatterjee, Assistant
Professor
Thomas Oommen, Associate Professor

HUMANITIES (HU)

Erin Smith, Principal Lecturer

MATERIALS SCIENCE AND ENGINEERING (MSE)

Larry Sutter, Professor

SCHOOL OF BUSINESS AND ECONOMIC (SBES)

Jon Leinonen, Mentor in Residence

Space and Facilities Requirements

No additional space or facilities for MTI activities are requested at this point. Current usage and/or ownership of the following locations are allocated to MTI.

- 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

The Director and Executive Committee hold monthly meetings to discuss opportunities, strategic planning, and financial oversight of MTI. Over FY20, MTI is planning on enacting some of the following initiatives to meet strategic goals and help support our mission:

- 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 representative of the Michigan Department of Transportation 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.
- One of the largest impediments to conducting research among MTI members is due to 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.
- 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.

- 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.
- 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.
- 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.

Appendix A: MTTI Proposal Submissions FY19

Principle Investigator	Co-Principle Investigator	Sponsor	Project Title	Budget	Status
K. Zhang					Pending
T. Oommen		The World Bank	Proactive Monitoring and Assessment of Critical Slopes Using Remote Sensing in the Transport Sector, South Asia	\$50,000	Awarded
A. Mukherjee	A. Swartz, T. Ahlborn, C. Brooks	MDOT	Element Based 3D Bridge Deterioration Frameworks	\$145,237	Pending
J. Velat	Q. Dai, K. Kitalong, A. Oliveira	MDOT	Mobility as a Service Pilot for Rural Communities	\$83,434	Declined
K. Zhang		NSF	CAREER: Tackling Congestion in Smart Cities via Data-driven Optimization-based Control of Connected and Automated Vehicles	\$580,980	Awarded
Q. Dai	B. Lee, D. Shonnard	USDA	Bioprocessing of Waste Kraft Ligin as Cathecolic Primer & Cathecolate Complex Heaving Flexing Materials for Sustainable Infrastructure Applications	\$500,000	Declined
K. Zhang	P. Lautala	FRA	Developing Safe & Efficient Driving and Routing Strategies at Railroad Grade Crossings based on Highway-Railway Connectivity	\$567,230	Awarded

T. Oommen	C. Brooks, S. Vitton	National Academies	Recent Advances in Unstable Slope Instrumentation and Monitoring	\$45,000	Declined
Z. You		National Academies	Practices for the Fabrication of Hot Mix Asphalt Samples for Testing in Laboratories	\$45,000	Declined
Z. You		National Academies	Performance Based Pavement Warranty Specifications	\$45,000	Declined
P. Lautala		FRA	Implementation of Online Training Modules to Rail Learning System	\$8,164	Additional Funding
Z. You	M. Watkins, L. You	National Academies	Development of a Practical Chip Seal Measurement Device to Improve Durability	\$150,000	Pending
J. Velat		Mashantucket Pequot Tribal Nation	Mashantucket Pequot Tribal Nation's Long-Range Transportation Plan Update	\$24,000	Awarded
P. Lautala	E. Veinott, D. Nelson	University of TN Knoxville	National Institute for Rail Safety Improvement	\$345,573	Pending
E. Vega	C. Brooks, P. Lautala	FRA	Railroad Artificial Intelligence Learning System (RAILS)	\$103,808	Awarded
T. Colling	J. Velat, J. Leinonen, D. Johnson, R. Handler, E. Seagren	EPA	EPA Environmental Finance Center for the Great Lakes Region (EPAS)	\$60,000	Additional Funding
Q. Dai	Z. You	St. Clair Road Commission	Optimized Rubber-Modified Epoxy Polymer Concrete Overlay for Bridge Deck Protection	\$126,454	Pending
Q. Dai	Z. You	City of Muskegon	Tire Rubber Modified Asphalt Pavements to Resist Freeze-Thaw Damage and High Traffic Volume	\$157,898	Pending
Q. Dai	Z. You, M. Kueber Watkins	City of Munising	Using Rubberized Asphalt to Reconstruct High Volume Roads in the City of Munising	\$128,256	Pending

					Pending
Z. You	Q. Dai	Kent County Road Commission	Ground Tire Rubber Asphalt for Durable Pavements for Heavy Traffic Road to Meet Michigan's Wet Freeze Environment`	\$197,742	Pending
Z. You	Q. Dai	MIDEQ	Improved Tire Rubber Based Chip Seal Technologies for Highways	\$482,528	Pending
T. Colling	J. Velat, J. Leinonen, D. Johnson, R. Handler, E. Seagren	EPA	EPA Environmental Finance Center for the Great Lakes Region (EPAS)	\$29,000	Additional Funding
A. Mukherjee		Engineering & Software Consultants	Mapping of Unit/Product Processes for Pavement Life Cycle Assessment and Demonstration Case Studies	\$162,256	Awarded
M. Kueber Watkins		The National Academies	Letter of Intent for NCHRP: Highway Hydraulic Engineering State of Practice	\$68,850	Awarded
Q. Dai		University of Michigan	Design and Test of Martin Geopolymer for 3D Printing and Construction in Mars	\$3,000	Pending
A. Swartz	A. Mukherjee	MDOT	Element Based 3D Bridge Deterioration Frameworks	\$147,665	Pending
C. Brooks	A. Mukherjee, K. Zhang, T. Oommen, R. Dobson, R. Branch	MDOT	Integration of Unmanned Aerial Systems Data Collection into Day-to-Day Usage for Transportation Infrastructure	\$871,002	Awarded
Z. Liu	B. Barkdoll, S. Vitton	MDOT	Improved Calculation of Scour Potential in Cohesive Soils and Scour Susceptible Rock	\$90,418	Awarded

					Declined
T. Colling	M. Crane	MDOT	2018 TAMC Technical Assistance Activities Program	\$22,100	Additional Funding
J. Velat		Keweenaw Bay Indian Community	2019 KBIC SHSP	\$12,000	Awarded
Q. Dai	Z. You, D. Dowden, Z. Liu	WISDOT	Analytical and Testing Methods for Rating Longitudinal Laminated Timber Bridge Slabs	\$260,815	Pending
Z. You		WISDOT	Expansion of AASHTOWare ME Design Inputs	\$247,208	Pending
A. Morse	A. Mukherjee, D. Watkins, L. Brown, A. Carter, L. Gauchia, J. Pearce, M. Raber	NSF	NRT-HDR: Micropolitan Area Systems Sustainability (MASS): A Transdisciplinary Approach to Developing Resilience in Regional Communities	\$2,952,886	Declined
Z. You	S. Chen	Montana DOT	Evaluation of Thin Polymer Overlays for Bridge Decks	\$75,000	Pending
Q. Dai		US DOE	Design and Evaluation of Extremely Durable Low Cement Sulfate Activated Cementitious Materials	\$1,064,852	Declined
Q. Dai	Y. Dickinson, M. Rudnicki, X. Xue	US Department of Agriculture Forest Service	Measurement and Validation of In-plane Structural Properties for Diaphragm Design with ANSI/PRG320 Grade V1 and Beetle-killed Spruce CLT	\$361,451	Pending
M. Kueber Watkins	Q. Dai	MnDOT	Standard Test Procedures for Ice Melting Capacity of Deicers	\$74,997	Pending
P. Lautala		MTRI Inc.	Automated, Drone-based Grade Crossing Inspection	\$49,815	Pending

					Declined
A. Mukherjee		MDOT	Training Tools for Effective Advancement of Digital Technologies for Construction Field Operations	\$257,351	Declined
D. Dowden	Q. Dai, T. Ahlborn	MDOT	Development of Guidelines for the use of Intermediate Diaphragms on Precast Concrete Beam Superstructures	\$290,560	Pending
P. Lautala	D. Nelson, E. Veinott	MDOT	Safety Enhancements at Short-Storage-Space Railroad Crossings	\$105,640	Pending
Z. You	Q. Dai, J. Hiller, Z. Liu	MDOT	Evaluation of MDOT's Long-Life Pilot Projects	\$346,745	Declined
T. Oommen		University of Michigan	Remote Sensing Based Terrain Strength Characterization for the Next Generation NATO Reference Mobility Model	\$100,437	Awarded
Q. Dai	L. Sutter, D. Dowden, Q. Sha	MDOT	Concrete Deterioration of Prestressed Bridge Beams	\$202,153	Pending
P. Lautala	D. Nelson, E. Veinott	National Academies	Strategies for Deterring Trespassing on Rail Transit and Commuter Right-of-Ways	\$248,984	Pending