

# Rail Transportation News

The Michigan Tech Rail Transportation Program Newsletter

August 2013-April 2014

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## Michigan Tech Rail Transportation Program Supporters

RTP acknowledges and thanks the following industry partners for their support of the RTP.



**Michigan Tech**  
Transportation Institute

## 1st Annual Michigan Rail Conference

Michigan Tech's Rail Transportation Program, in conjunction with the Michigan Department of Transportation, organized the 1st Annual Michigan Rail Conference in Lansing, Michigan on August 27th, 2013. The theme of the event focused on economic development via rail transportation in Michigan, ranging from development of high-speed passenger rail to rural freight rail. The day-long conference featured several industry leaders, including MDOT employees, railroad company representatives, rail shippers, and other stakeholders interested in Michigan's rail system.

The keynote speaker was Tom Carper from Amtrak. The conference hosted over 150 attendees and included a wide range of presentations and a panel discussion. The conference held concurrent passenger and freight rail breakout sessions to highlight specific projects and plans happening within Michigan.

The conference was broadcast live to a web audience across the state and all presentations, discussions and sessions were recorded and placed onto Michigan Tech's online rail site



Presenters gather for a group photo at the 1st Annual Michigan Rail Conference.

([www.rail-learning.mtu.edu](http://www.rail-learning.mtu.edu)) for viewing by those who could not attend the event or wish to review the presentation in the future. The 2nd Annual Michigan Rail Conference is being planned and the tentative dates are August 27-28. The proposed location is Macomb Community College in Warren, Michigan. Stay tuned for more details.

## RTP Establishes Rail Transportation Advisory Board (RTAB)

After years of planning, RTP has established the Rail Transportation Advisory Board (RTAB). The Board will provide strategic guidance to the RTP and expert advice on program priorities and student activities. Ten individuals, including six Michigan Tech Alum, were appointed to the inaugural board. The first RTAB meeting was held in conjunction with the 9th Annual Railroad Night. Matt Glynn was elected as the Board chairman, Darryl Babbitt Vice Chair, and Kevin Kesler as Secretary/Treasurer. We thank the Board members for their commitment and look forward to working with them to improve the RTP over the coming years!

- **Tom Bartlett**, Union Pacific (*alum, EE, 08*)
- **Phil Danner**, Union Pacific
- **Matt Glynn**, CN (*alum, CE, 81*)
- **Martita Mullens**, CN
- **Darryl Babbitt**, Lake Superior and Ishpeming Railroad (LS&I) (*alum, CE, 08*)



Rail Transportation Advisory Board at Railroad Night.

- **Tim Hoeffner**, MDOT (*alum, CE 80*)
- **Dave Thomson**, Engineered Rail Solutions(ERS) (*alum, CE, 83*)
- **Jon Cool**, Michigan Railroad Association (MRA)
- **Kevin Kesler**, Federal Railroad Administration (FRA)
- **Tim McKay**, Dallas Area Rapid Transit (DART) (*alum, CE, 84*)



## Director's Message

Considering the temperatures and snowfall in Houghton this winter, I'm quite convinced that Michigan Tech should develop a "deep-freeze" rail research facility. At least this year, we would certainly have all the elements for successful operations. Joking aside, our Rail Transportation Program (RTP) has had plenty of things to do without such a laboratory, as you will find out from this newsletter.

The two highlighted projects illustrate how far we have come since we started our operations. With the addition of Dave Nelson to our staff and the victorious proposal by NURail to USDOT, we've been able to expedite our expansion of rail activities throughout the university. We now have a half a dozen faculty and more than a dozen graduate students working in rail related research....in six different departments. In addition, our alumni have become an irreplaceable resource for expertise and we have officially connected some of the greatest industry experts with our program by establishing the Rail Transportation Advisory Board (RTAB).

In the end, we're all about people and students. We've had an exciting stream of high-level visitors at Michigan Tech and the generosity of our sponsors allows our students to participate in some of the leading rail conferences in the U.S. The conferences may be a "bonus" for students who are involved in rail transportation at Tech, but they earn every trip through their hard work in student projects, graduate research, or Rail Engineering and Activities Club (REAC) activities. In the end, we require motivated students who understand what the industry needs and we need all their mental capacity for the industry to excel in the growing competition. With that in mind, enjoy reviewing the rail activities that take place at Michigan Tech today and I hope that you, or your company, decide to become an active participant in our program. Together we are able to thrive and attract the brightest minds of the next generation to our industry.

Pasi

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### Senior Research Engineer **Dave Nelson, M.S., P.E.** [dannelso@mtu.edu](mailto:dannelso@mtu.edu)

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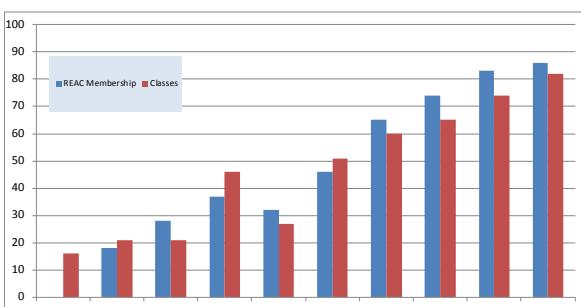
Rail Transportation Program at Michigan Tech

## Rail Engineering Activities Club (REAC) Update

The 2013-2014 school year may be quickly winding down, but REAC is still going strong. The club has had another successful year of exposing students to the railroad industry through events and activities. With the bar set high, plans are already being put into place to continue this tradition into next year.

REAC started off this past year by visiting the annual AREMA conference in Indianapolis, Indiana. The conference was followed by a series of other events including Rail Info Night, a visit to the Mineral Range Railroad near Marquette, and the 9th annual Railroad Night. The year's highlight was a recent field trip to Detroit where students had the opportunity to visit Norfolk Southern, Conrail, Amtrak, M1 Rail, and the SteelPro warehouse and transload facility. In addition to many large scale events, REAC members also found the time to have monthly meetings featuring various speakers with the common theme of Railroads in Michigan, volunteer locally, host community events, and participate in the Homecoming Cardboard Boat Race.

Recently, a new board of Officers was elected and plans are already underway to make next year even better. Look for many more events and activities to participate in with REAC, as we continue to increase the visibility of rail transportation on campus.



REAC membership and class enrollment.

*Nick Lanoue, Outgoing REAC President*

## Upper Peninsula Freight (Rail) Study

**Jan. 2013-Apr. 2014**

Study Team: Dr. Pasi Lautala, P.E., Ph.D.

Dr. Greg Graman, Dr. Frank Pentti, David Nelson,

Students: Irfan Rasul, Akalu Tafesse, Sean Pengelly

This project concentrates on identifying challenges faced by rural rail service providers and shippers along light-density lines and on developing tools and methods that facilitate the use of rail and multi-modal transportation alternatives in the Upper Peninsula of Michigan.

Michigan's Upper Peninsula has seen a reduction in railroad mileage and usage over the past several decades; shippers have discontinued their use of rail in favor of highly competitive trucking and some rail lines have been removed and abandoned. In coordination with the Michigan Department of Transportation, Michigan Tech has been developing an analysis of railroad operations in the Upper Peninsula to better understand the current operations, existing infrastructure, shipping patterns, and shipper/railroad concerns. Some of the outcomes of the study include an interactive map of the facilities and discussion of current freight flows. A parallel graduate student study is also underway to investigate the potential for establishing a transload facility in the U.P.



Interactive Rail Map of the Upper Peninsula.

## Independent Review of High Pressure Heat Exchanger Locomotive Test and Thermodynamic Simulation Data (HiP HEX)

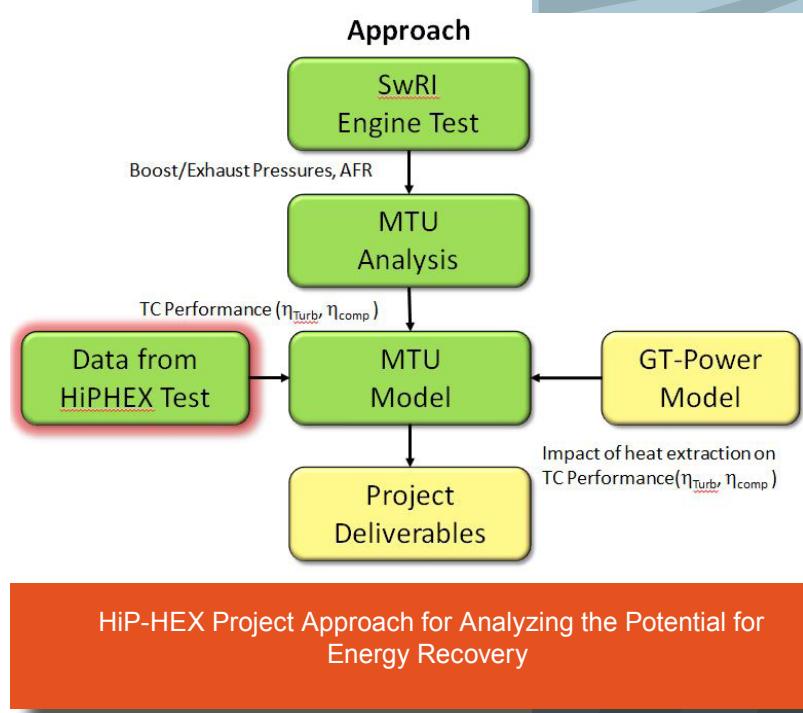
**June 2013-May 2014**

Study Team: Dr. Jeffrey D. Naber, Dr. Jaclyn Johnson

Students: Venkat Sai Raxit Karramreddy, Venkata Vedam, Venkata Krishna Teja Nagupalli

A team of students from the Mechanical Engineering department are working with the FRA to analyze the potential for energy recovery from the exhaust of diesel locomotive engines. The analysis is complicated by the interaction between the exhaust flow and the engine turbocharging system. The study objective is to validate an industry proposal for an energy recovery system.

The team is working with data acquired from a Southwest Research Institute's emissions research project and a variety of software tools to develop a model that shows the engine exhaust flows, and the energy available from the exhaust. It will also look at how energy removed from the flow interacts with the performance of the engine turbo charger with an ultimate goal of determining how much energy can be removed without impacting engine performance.





## REAC Honorary Members



Above: RTP Director Pasi Lautala with Tom Bartlett, 2014 Honorary Member, and Nick Lanoue, REAC President.

Below: James J. Scullion, 2013 REAC Honorary Member.

Each year at RTP's Annual Railroad Night we have the opportunity to recognize and acknowledge the work of outstanding supporters of our Rail Transportation Programming with a REAC Honorary Membership. This past year we recognized two supporters. Tom Bartlett and Jim Scullion. Thank you both!

### Tom Bartlett (EE 2008)- 2014 REAC Honorary Member

Manager of Special Projects Field Construction for Union Pacific Railroad

*"One of the greatest rewards for educators is to meet young prospects and to see them excel in the industry and it's been a pleasure to watch Tom Bartlett to advance and grow over these years,"* says RTP Director Pasi Lautala. *"Since his graduation in 2008, Tom Bartlett has been a regular figure on campus and a relentless visitor in classrooms to talk about railroads and railroad careers. More than once he's stepped up to give a presentation to REAC with short warning and more recently, he's become a great advocate to initiate more active project collaboration between his company and Michigan Tech."*

In Tom's words: "My first involvement in rail was through Michigan Tech's "Summer in Finland" rail education study abroad program. At the time, my professional interests lied elsewhere, but I welcomed the opportunity to travel abroad. During the program, I found the course material to be very interesting, and was particularly excited about the opportunities inside the railroad industry for EE's. Following the program, I received job offers into a co-op program from three railroad companies. I picked Union Pacific because they already had projects lined up for me, all of which had a high "cool-factor": remote-control locomotives and classification yard automation. When I returned to school, I became an officer in Michigan Tech's Railroad Engineering and Activities club, which allowed industry involvement while still in school. Following graduation, job offers came easy since there was a high demand for EE's in the railroad industry, and there were very few candidates with railroad-specific experience. I again chose Union Pacific because of my positive experience during the co-op, and advancement opportunities within the organization."

### James J. Scullion- 2013 REAC Honorary Member

Railroad, Cliffs Energy, Area Manager of Transportation Management, Retired

*"Jim's phone rang many times each year with requests for visits, projects, information, etc. and we've never been turned away. Jim and our alum Darryl Babbitt (who is continuing Jim's work at LS&I) have always opened their arms to our troops and made it available for our students and faculty to observe a revenue-serving railroad from within. Jim's continuous support, has made it possible for us to be where we are today." - RTP Director Pasi Lautala.*

In Jim's words: "I began my railroad career in 1972 as a track laborer during the summer months while attending college. In the summer of 1973 I moved into the shops as a machinist helper. In 1975 I was transferred to the electrical dept. where I went through an apprenticeship and began work as an electrician in the locomotive department. I was later promoted to an electrical foreman's position before being given a position in management as a shop superintendent in 1985.

Over the course of my career I have held positions as Signals and Scales Superintendent, Purchasing Manager, Chief Mechanical Officer, and Chief Engineer. In 2002 The Lake Superior and Ishpeming Railroad was consolidated into Cleveland Cliffs Iron Co. and I was given the title of Section Manager Maintenance, Transportation at the LS&I Division of Cliffs Michigan Operations. I went on to hold the position of Acting Area Manager Transportation before retiring in 2013 as the Area Manager of Transportation Maintenance for Cliffs Michigan Operations.

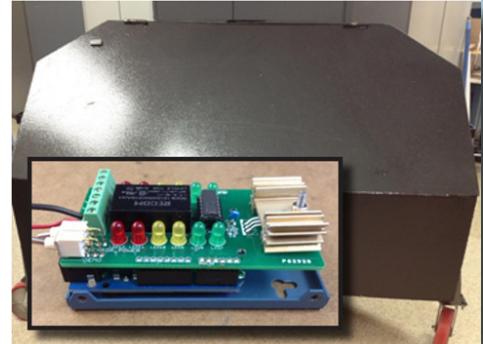
I am a third generation railroader whose father and both grandfathers worked in the railroad industry on now long defunct railroads such as the Erie and B&O. I grew up with a love of the rails which continues to this day. My time spent working on projects with the Michigan Tech's group was a very enjoyable chapter in my career. I hope the program at Tech continues to flourish and supply eager young minds to what I believe is an exciting future career in railroading."

## Undergraduate Student Projects

Undergraduate research is an important part of the RTP. Student projects are a great way to introduce the industry to the next generation while harnessing their skills toward technology development. In this newsletter we feature two of these projects. With assistance from a NURail grant and industry RTP has been able to fund a total of seven projects in 2012-2014, involving over 30 undergraduate students from various departments.

### **Locomotive Sand Tank Level Sensor (September, 2012 – May, 2013), sponsored by Union Pacific Railroad**

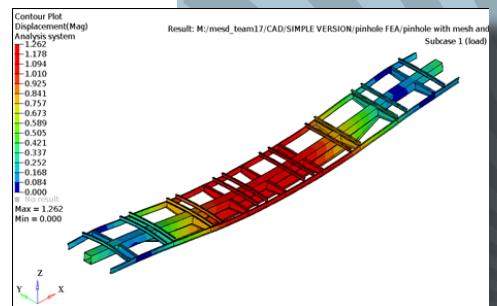
Locomotives currently have no automated system in place to safely and accurately measure the level of sand in the on-board sanding containers which are used to improve traction during acceleration. Working with Union Pacific, a Senior Design Group of Electrical Engineering students designed a sensor system that remotely monitors the sand levels and displays the information to personnel in a safe, accurate and easy-to-read format. The group identified several different technologies to solve the challenge. The research and testing results suggested that an ultrasonic sensor is the most suitable device for detecting sand levels. The final solution was an ultrasonic sensor that was placed in a perforated PVC pipe to provide an ultrasonic waveguide, together with led display board designed on Arduino protoshield platform. The team built a full scale sand tank for testing in the laboratory, based on GE 4400 AC locomotive. The team recommended that locomotive manufacturers integrate sand level sensing systems into new production units and provide a visual readout in the locomotive cab.



Replica tank from GE AC4400 Locomotive and LED Display.

### **Centerbeam Car Conversion Project (September, 2013 – May, 2014), sponsored by NURail.**

Six undergraduate students from the Mechanical Engineering department embarked on a project to find a re-use for a centerbeam rail car. There is an abundance of such cars, but the demand is expected to remain low, making them a prime candidate for a conversion to other car types in higher demand. After meetings with the RTP staff at Michigan Tech, and with representatives from the Escanaba and Lake Superior (E&LS) railroad car shop, the students decided to tackle converting the car to hauling frac-sand in “pods”. The project required removing the old centerbeam spine and replacing the lost load capacity with structural members under the deck. Due to challenges in securing the design details of the original car, conceptual sketches, hand calculations, and finite element analysis were required to develop the conversion plan. Under advice from E&LS, the team researched AAR standards to find the structural and construction requirements and used 3D cad design and FEA modeling to develop the new design for the car. Finally, a scale prototype beam section was constructed in a local fabrication shop and tested in a Michigan Tech lab to verify their FEA results. The team is finalizing their analysis and completing cost estimates for the conversion process. The result of their efforts? A completed car conversion plan that can (and probably will!) be used to convert these underused cars to a new life in today’s oil field business. An AAR car modification submittal package will be completed over the summer in collaboration with E&LS by one of the students who will remain as an intern for the RTP.



Students use FEA modeling to develop new design for centerbeam cars.

## RTP Congratulates 2014 Scholarship Recipients!

This year \$12,000 in designated railroad scholarships were awarded and made possible via generous donations of Michigan Tech Alum, CN Railroad, and Union Pacific Railroad. Michigan Tech undergraduate or graduate students with an interest in railroad transportation have the ability to compete for internal and AREMA scholarships each year (those applying for AREMA scholarships were eligible to compete for \$61,000 in awards from the organization).

### **Chris Blessing**

Union Pacific Scholarship & AREMA Presidential Scholarship

### **Nicholas R. Lanoue**

Union Pacific Scholarship & AREMA Committee 27 – Maintenance-of-Way Work Equipment Scholarship

### **Tanja S. Mattonen**

CN Scholarship & AREMA Union Pacific William E. Wimmer Scholarship

### **Renee C. Oats**

AREMA Michigan Tech Alumni Scholarship

### **Antonio Passariello**

CN Scholarship & AREMA Committee 1 - Roadway & Ballast Scholarship

### **Sean P. Pengelly**

Union Pacific Scholarship & AREMA Committee 27 – Maintenance-of-Way Work Equipment Scholarship

### **Hamed Pourousef**

AREMA Michigan Tech Alumni Scholarship

### **Irfan Rasul**

CN Scholarship

### **Akalu Tafesse**

CN Scholarship



## Conferences and Presentations



Students and Michigan Tech NURail project presenters at the Joint Rail Conference.

RTP students, staff, and faculty participated/presented in numerous conferences and events from Fall 2013-Spring 2014.

Lautala, P. & Hoeffner, T. (MDOT), Northern Michigan Rail Studies, *Michigan Rail Conference*, Lansing, Michigan, August, 27th, 2013.

Pouryousef, H., Review of Applying Hybrid Approach of Capacity Simulation on a Shared-use Rail Corridor, *2013 INFORMS Annual Meeting*, Minneapolis, MN, October 6-9, 2013.

Jeon, M., & Lautala, P. Necessity of vehicle to rail infrastructure communication for grade crossing warning & safety, *Adjunct Proceedings of the 5th International Conference on Automotive User Interfaces and Vehicular Applications (AutomotiveUI'13)*, Eindhoven, The Netherlands, October 27 - 30, 2013.

Lautala, P., Freight (Rail) Transportation in the State of Michigan, *Invited Presentation to House Standing Committee Meeting for Transportation and Infrastructure*, Lansing, Michigan, October 29th, 2013.

Lautala, P., panel on the topic of Strategic Initiatives in a Bi-National Transportation Corridor, *National Twin Sault's Regional Conference*, Sault Ste. Marie, October 31, 2013.

Lautala, P., Freight (Rail) Transportation Challenges and Brief Update on UP Michigan Rail Study, *Northwoods Rail Transit Commission Meeting*, Rhinelander, WI, November 22, 2013.

Pouryousef H., & Lautala, P., Cost of Railway Congestion: Congestion, Railway Capacity and Operational Performance, *Transportation Research Board 93rd Annual Meeting*, Washington D.C., January 12-16, 2014.

Pouryousef H., & Lautala, P., Evaluating Two Capacity Simulation Tools on Shared-Use U.S. Rail Corridor (Case Study: Northeast Corridor), *Transportation Research Board 93rd Annual Meeting*, Washington D.C., January 12-16, 2014.

Rasul, I., Synthesis of Multimodal Freight Transport and Emissions Cost and Application in the Upper Peninsula (UP) of Michigan, *Logistics, Trade and Transportation Symposium*, Gulfport, Mississippi, February 26-27, 2014.

Lautala, P. & Haas, P., HIGH SPEED RAIL LEARNING SYSTEM (HSRLS) – Taking Advantage of Online Technologies in Railway Education, *55th Annual Transportation Research Forum*, San Jose, California, March 14-16, 2014.

Sproule, W., Detroit People Mover, *Historical Society of Michigan's Local History Conference*, Sterling Heights, Michigan, March 29th, 2014.

## Events and Activities

### AREMA Conference, Indianapolis, IN, September 28-October 1, 2013

16 students and RTP Director Pasi Lautala traveled to the AREMA Annual Conference. Students were able to interact with rail industry representative, meet with Michigan Tech alum in industry, take in presentations and visit exhibits.

### REAC Volunteers at Quincy Mine and Hoist, Hancock, MI, October 12, 2013

REAC adviser Dave Nelson and student members volunteered at the Quincy Mine and Hoist with Ron Whiton and others to lay about 100 feet of track next to the old Quincy Mine round house. With nothing but muscles, spike mauls, claw bars, shovels, and some good story telling, the group was able to get the track all spiked and lined.



### REAC Volunteers for Haunted House and Train Ride, Houghton County Historical Museum, Lake Linden, MI, October 19, 2013

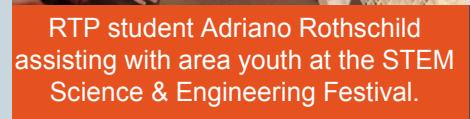
Members of REAC volunteered at the annual Lake Linden Halloween Train which featured food, train rides, and a haunted house in the ground floor of the Houghton County Museum.

### STEM Festival - October 24, 2013

Science & Engineering Festival, or Grades 3-5. RTP students collaborated with the Western UP Center for Science, Math & Environmental Education and Michigan Tech.

### REAC Fall Field Trip: Mineral Range Railroad in Humboldt, MI, November 10, 2013

The field trip included a visit to Mineral Range Railroad, Humboldt Mill, and a guided tour of the Humboldt Junction. The group also toured a wooden bridge, and the M-95 junction.



### REAC Spring trip to Detroit, Michigan, March 27-30, 2014

David Nelson and a group of students took a trip to Detroit with site visits and presentations including M-1 Rail, Norfolk Southern, Conrail, Michigan Accelerated Rail, Continental Gateway, New Dearborn Train Station, and SteelPro's warehouse.

*continued on page 7*

## Events and Activities continued....

### Joint Rail Conference, Colorado Springs, Colorado, April 2-4, 2014

10 undergraduate and graduate students led by Dr. Lautala attended and presented research and projects at the 2014 Joint Rail Conference sponsored jointly by ASME, ASCE, and IEEE.

Lautala, P., REES 2014 Update, NURail Education and Research Session.

Lautala, P., High Speed Rail Learning System (HSRLS) – Taking Advantage Of Online Technologies In Railway Education

Pouryousef H., Capacity Implications of Applying Directional Operations along North-East Corridor

Warsinski, K., Austempered Ductile Iron Performance at Rail Wheel Operating Conditions

Tervo J., Bolthouse, A., Peterson, R., & Scheetz, N., Center Beam to Frac Sand Rail Car Conversion, NURail Education and Research Session, Student Research.

Dallmann, R., Campbell, R., Mandalari, M., & Fobbs, C. Intelligent Railroad Crossing Signal Maintainer & Railroad Crossing Surface Material Evaluation, NURail Education and Research Session, Student Research.

Havens, T., presentation by P. Lautala on behalf of Havens, Computer Vision and Machine Learning for Detection of Wheel Anomalies from Thermal Cameras, NURail Education and Research Session.

## REAC & RTP Guest Presenters, Lecturers and Visitors

Allen Brown, President & CEO of Railmark Holdings, Inc., October 8, 2013, "Rail Transloading Facilities: Development, Promotion and Operation" (web presentation)

Carmen Garozzo, Bergmann Associates, November 12, 2013, "Farm Lane - An example of the emerging trends in the rail industry"

William Sproule, Professor at Michigan Tech, November 14, 2013, "Copper Country Streetcars: presentation and book signing"

Heather Carmona, Chief Administrative Officer of M-1 Rail, December 2, 2013, "M-1 Rail and the Woodward Avenue Street Car project in Detroit" (web presentation)

Irfan Rasul, and Akalu Tafesse, graduate students at Michigan Tech, January 21, 2014, "Upper Peninsula Rail Study Project"

Phil Pasterak, PB's Central Regional Manager for Rail and Transit, February 11, 2014, "HSR Track Design" and "Passenger Rail Outlook in the US"

Ulrich Leister, Manager of Business Development, SMA Switzerland, February 13, 2014, "Characteristics of Railway Operation and System Design"

Ed Burkhardt, President of Rail World, Inc., April, 8, 2014, "The Effects of Government Policy and Regulations on Railroads" and "A Look Back at the Wisconsin Central Railroad"



Ed Burkhardt (center) with RTP Director Pasi Lautala and Dave Nelson.

## 9th Annual Railroad Night and Rail Day

The Rail Transportation Program (RTP) and the Rail Engineering and Activities Club (REAC) organized the 9th Annual Railroad Night and related Rail Day activities on February 18th, 2014. The event brought together a diverse range of participants including rail industry, students, the community, and Michigan Tech faculty, staff, and administration. Railroad Night's over 150 participants made for a full house and an exciting evening. The event drew in fifteen industry company sponsors including RTP program partners Norfolk Southern, Union Pacific and CN.

The Rail Transportation Program has been founded on a multi-disciplinary approach and this year's Railroad Night demonstrated the interest across the university. Faculty and students from ten departments were represented, as well as administration, including Provost and Vice President for Academic Affairs Max Seel, Board of Control member Paul Ollila, and Vice President for Governmental Relations, Dale Tahtinen.

The keynote speaker was Lisa Stabler, the President of the Transportation Technology Center Inc. (TTCI) of Pueblo, CO, and one of the leading female executives in the industry. Ms. Stabler gave a presentation on rail industry research and outlook from TTCI. Railroad Night also included poster presentations of rail related faculty and student research, and table top exhibits by industry sponsors. This year Tom Bartlett (EE, 2008) from Union Pacific was awarded an Honorary REAC membership for his contributions to advance the RTP and REAC. Over 80 students participated in the event and were provided the opportunity to socialize, network, and dine with industry and faculty. The event this year is considered a great success and yet another step to strengthen ties between faculty researchers, rail industry representatives, local technology companies, and students from Michigan Tech.



Women students, alumni, and industry gather for a group photo with Lisa Stabler, keynote speaker.



# Summer Youth Program

## 5th Annual Rail and Intermodal Transportation Program, July 27th-August 2nd, 2014

This program is a weeklong investigation designed to create awareness and stimulate interest in the area of rail and intermodal transportation. The program is a collaborative effort by Michigan Tech's Rail Transportation Program and the Transportation and Logistics Management Program at University of Wisconsin—Superior.

### Scholarships are available for successful applicants.

Students participate in field trips and class room activities. Participants will:

- Learn about and ride trains—the “green transportation alternative.”
- Learn about new advances in Railroad Technology—alternative fuels, advanced train control systems, and much more!
- Enjoy technical tours to rail and intermodal facilities in Marquette and Duluth.
- Find out why trucks, ships, and trains are so important to today’s economy.
- Work in teams to complete group projects.
- Experience college life on two college campuses—stay in a residence hall, explore campus, and meet others with similar backgrounds and interests.
- Enjoy Michigan’s beautiful Keweenaw Peninsula and the shores of Lake Superior.



Summer Youth Field Trip

<http://www.syp.mtu.edu/> or [www.rail.mtu.edu](http://www.rail.mtu.edu) ; or contact Dave Nelson at [dannelso@mtu.edu](mailto:dannelso@mtu.edu) for more information.

### Rail Transportation Program Vision

The vision of the Rail Transportation Program is to expand its service to the rail industry by offering an interdisciplinary program in railroad engineering and urban rail transit that will provide opportunities for our students and faculty to participate in the development and operation of rail transportation for the 21st Century.

### About Michigan Technological University

Michigan Technological University is a leading public research university, conducting research, developing new technologies, and preparing students to create the future for a prosperous and sustainable world. Michigan Tech offers more than 120 undergraduate and graduate degree programs in engineering, forestry and environmental sciences, computer sciences, technology, business and economics, natural and physical sciences, arts, humanities and social sciences.



# **Michigan Tech**

Create the Future

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Michigan Technological University is an equal opportunity educational institution/equal opportunity employer.

### About the Michigan Tech Transportation Institute

Transportation related activities at Michigan Technological University (Michigan Tech) including research, education and training, outreach, product development or technology transfer, are organized under the umbrella of the Michigan Tech Transportation Institute (MTTI). MTTI brings together principle investigators across all disciplines at Michigan Tech for collaborative research in six areas of transportation to address national and global needs:

- **Structures** research focuses on the built environment including bridges, pavements, geotechnical applications, construction and nanotechnology related to sensors. Research is also conducted on monitoring strategies to extend the service life of aging transportation infrastructure.
- **Materials** used in transportation infrastructure including concrete, asphalt, steel, wood and aggregates are being investigated as well as the use of industrial byproducts and recycled materials including fly ash, slag and cement kiln dust.
- **Systems** groups focus on the planning, design, construction, operations and management of transportation infrastructure and systems including highway networks, railroads, airports, public transit, and waterways.
- **Environmental** studies include the transportation issues of energy, carbon dioxide and other pollutants, flora, fauna and wildlife, and the impact of the environment.
- **Societal** research explores historical developments in transportation, archeological studies of transportation features, human factors, and the interaction of transportation and society through policy, planning, and regulation.
- **Technology transfer** “bridges the gap between research and practice” by providing outreach, management systems, and workforce development programs as well as develops management tools for the transportation industry including GIS, asset management, and project estimating software.