July 2013 - June 2014

ANNUAL REPORT

Rail Transportation Program

Michigan Tech Transportation Institute • Michigan Technological University

Michigan Tech
Transportation Institute

RAIL TRANSPORTATION PROGRAM VISION:

“Develop leaders and technologies for 21st century rail transportation.”

MISSION:

“The Mission of the Rail Transportation Program is to participate in the development of rail transportation and related engineering skills for the 21st century through an interdisciplinary and collaborative program that aligns Michigan Tech faculty and students with the demands of the industry.”

DIRECTOR'S MESSAGE

Another year has passed and Michigan Tech's Rail Transportation Program (RTP) rolls on its tracks toward new adventures. Some of the highlights of our 2013-2014 academic year included completion of our first research projects with Michigan Department of Transportation (MDOT) and the Federal Railroad Administration (FRA). On the educational side, we continued to attract new talent to the industry by conducting a "sold-out" Summer Youth Program in Rail and Intermodal Transportation.

The National University Rail Center (NURail) had an escalating impact on our program growth. This year, we started several new research projects and secured another cycle of funding with matching commitment from MDOT that extends our grant to late 2017. It's hard to overemphasize the impact of NURail on our program and we are certainly grateful to be part of the academic consortium leading the development of tomorrow's rail academia. NURail has also strengthened our already solid relationship with the rail industry, as most projects involve either supplementary funding, or other in-kind contribution from our partners.

We are continuing to improve our industry relations in other ways as well. One of the year's highlights was the establishment of the Rail Transportation Advisory Board (RTAB). The Board is still evolving, but we already have a great group of industry, government and academic experts who have taken the first step in directing the future of our program. Many of them are Michigan Tech alumni, demonstrating the growing impact of our graduates in the industry. We have continued to support our local technology companies who are interested in applying their expertise to the rail industry. This year brought some success to one of them in the form of a Small Business Innovation Research (SBIR) grant.

While research, industry connections, and the whole portfolio of other activities highlighted in this report are all important parts of our program, in the end it's all about students. Without them, this program wouldn't exist and it's the struggles and successes with students that define the program in the end. Our growing number of projects has allowed expanded undergraduate and graduate student involvement in rail topics. We've also been positively surprised by the increasing variety of rail industry stakeholders recruiting on campus. On the other hand, there are certainly plenty of challenges ahead. There has been an explosive growth in competition for students from other industries since the economic downturn. The rail industry is still not recognized like "Google"or one of the other companies / industries that everyone knows about. We have a long way to go in convincing the industry of the need for continuous and consistent project, internship and funding opportunities. While alignment with student expectations and industry demands has improved, we could certainly increase university / industry coordination to make the recruitment process as effective and robust as possible.

I hope you enjoy reviewing the report and all the good work completed by our students, staff, faculty and industry partners. If this report doesn't quench your thirst for curiosity, stop by at our web site **http://www.rail.mtu.edu** for more information. And make sure to get in touch with me, if you have any comments on our report….or if you want to get involved in Michigan Tech's Rail Transportation Program.

Pasi Lautala

RAIL TRANSPORTATION ADVISORY BOARD

In 2013 the Rail Transportation Program implemented a Rail Transportation Advisory Board. The first meeting was held on Feb 17, 2014. The Board selected Matt Glynn from CN to serve as Chairman, and Darryl Babbitt from Lake Superior and Ishpeming Railroad to serve as Vice Chair. Kevin Kesler from the FRA was elected Secretary/Treasurer, (position also supported by the RTP staff). The initial Board consisted of twelve members representing a broad cross section of the rail industry. Two additional members have been added, bringing the Board to a total of 14 members, seven of whom are Michigan Tech alumni. The RTAB will provide guidance in the following areas:

- Improving student recruitment, from both an industry and a student perspective
- Consistent and active participation from the industry in project and research opportunities as well as in engagement of students
- Visibility of the RTP as a leading rail university, capable of providing both students and research as future assets to the industry
- Consistent and sustained funding for the RTP

Matt Glynn – Chair – Chief Engineer, Signals and Communications, CN (CE, 1981)

Darryl Babbitt - Vice Chair - Section Manager, Maintenance, LS&I Railroad (CE, 2008)

Kevin Kesler - Secretary/ Treasurer – Chief of Rolling Stock R&D, Federal Railroad Administration

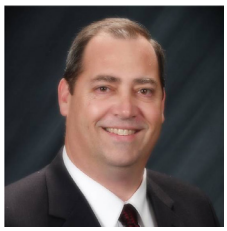
Tim McKay - Executive VP of Growth and Regional Development, DART (CE, 1984)

Tim Hoeffner - Director, Office of Rail, MDOT (CE, 1980)

Martita Mullen - System Manager-Track Standards, CN

Jon Cool - President, Michigan Railroads Association

Tom Bartlett - Mgr of Special Projects Field Const, Signal Engineering UPRR (EE, 2008)



David Thomson – President, Engineered Rail Solutions, LLC (CE, 1983)

Richard Stewart - Professor and Director Trans and Logistics Research Center, UW-Superior

Phil Danner - AVP Engineering – Track Programs, UPRR

Brian Sykes – Chief Engineer, C&S Engineering, NS Railroad

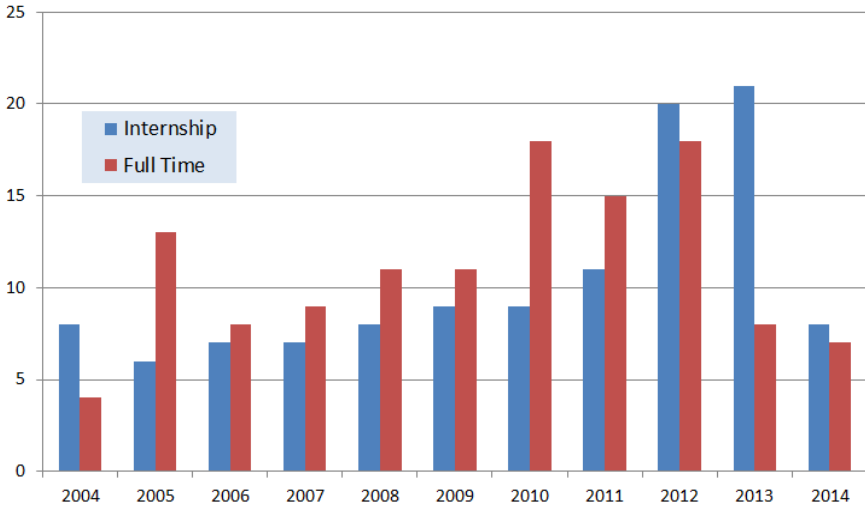
Pasi Lautala - Assistant Professor and Director, Rail Transportation Program, Mich Tech (CE, 1997, 2007)

Chris Blessing - REAC President (CE, 2015)

RAIL INDUSTRY PARTNERS

Our rail industry partners continue to provide support for the RTP. In addition to funding and other support by our partners, CN, Union Pacific, and Norfolk Southern Railroads, numerous other industry companies have supported student projects that provide rail industry visibility on campus, and ultimately industry recruitment efforts.

Thank you for your generous support in 2013-2014!



Rail Industry Recruitment by Calendar Year

The RTP actively works with all of our contacts in the rail industry to promote job opportunities within the industry. In addition to the work done by the Michigan Tech Career Services program, we fielded more than 20 job notifications from industry, and forwarded them on to our student population and our alumni list. We expect the final internship and full time hires to be higher for 2014 as we collect more information from the rail industry.

Recruitment numbers peaked in 2010-2012 when many industries were recovering from the recession. At that time railroads were still hiring, and competed very well with other industry recruitments. In the last couple of years, the U.S. economy has made a slow recovery and other industries have become much more active in the hiring process, with almost 300 firms attending the Career Fair events in 2013-2014. This has made recruitment of Michigan Tech graduates to the rail industry more challenging and will continue to be a challenge for us and our industry partners.

RTP FACULTY AND STAFF

Dr. Pasi Lautala, P.E.

Dr. Lautala is the Director of the Rail Transportation Program and an Assistant Professor in the Civil and Environmental Engineering Department. For the past ten years, Dr. Lautala has been one of the leaders in re-establishing rail transportation education and related research in North American universities. He's an Associate Director of Education for the NURail Consortium, one of the seven members of the State of Michigan Commission for Logistics and Supply Chain Collaboration and Vice Chair of TRB Freight Rail Committee and ASCE T&DI Rail Transportation Committee. He has created and teaches several courses in railroad engineering and is currently involved in numerous funded research projects related to railroads, multimodal transportation logistics and railway engineering education. Before his academic career, Dr. Lautala spent several years in the rail industry in the United States and Finland.

Dave Nelson, P.E.

David Nelson is our Senior Research Engineer and supports activities across the program. Dave has a BS in Civil Engineering and an MS in Mechanical Engineering which will help as we continue to push for multidisciplinary collaboration across the university. He also has an MS in teaching, including seven years of experience in primary and secondary schools. Dave's 20+ years of engineering and management experience with the US Air Force, including a tour teaching at the US Air Force Academy, and his experience from the rail related projects with Maine Department of Transportation bring a unique set of skills and experiences to our program.

Pam Hannon

Pam Hannon is the Coordinator of the Michigan Tech Transportation Institute and supports the Rail Transportation Program through proposal development and coordination, and research project management.

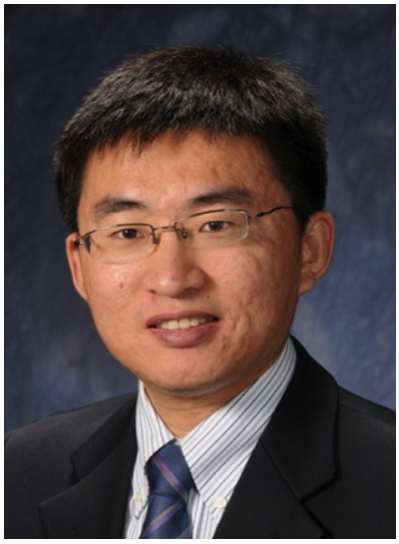
Dr. Bill Sproule, P.E.

Bill Sproule is a Professor in the Department of Civil and Environmental Engineering with over 40 years of service in government, consulting, and university research and teaching in Canada and the U.S. He assisted in the development of the current Rail Transportation Program at Michigan Tech and teaches various transportation courses. He has also recently authored a book, *Copper Country Streetcars*. Dr. Sproule's interests include transportation planning, traffic engineering, airport planning and design, public transit, automated people movers, and consulting engineering. Canadian born and a true ice hockey fan, Bill also teaches a class titled "Hockey History and Culture". Dr. Sproule has been recognized with several awards including a Michigan Tech Distinguished Teaching Award and the ASCE Horonjeff Award.

Jess Juntunen

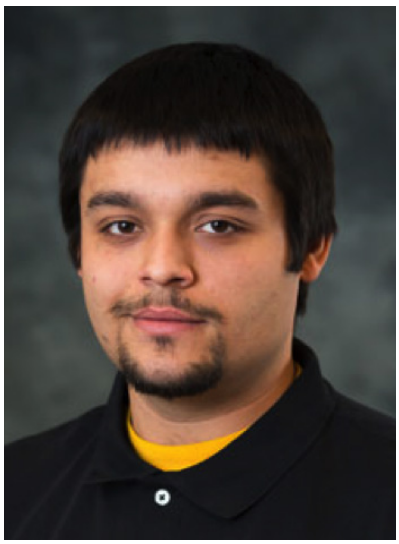
Jess Juntunen works as a technical communicator and as support staff with the Rail Transportation Program. She headed the development of RTP materials such as the annual report, newsletter, and promotional materials. She also developed web content, edited reports and papers, assisted in organization of RTP events, and offered support for the RTP Director, coordinator, and overall RTP program. Jess has an MS in Rhetoric and Technical Communication from Michigan Tech.

RTP WELCOMES NEW FACULTY AND STAFF



Dr. Kuilin Zhang, P.E.

Kuilin Zhang is Assistant Professor in the Department of Civil and Environmental Engineering at Michigan Tech. Dr. Zhang received his Ph.D. degree in Transportation Systems Analysis and Planning from the Department of Civil and Environmental Engineering at Northwestern University in December 2009. After working as a Postdoctoral Fellow in the Transportation Center at Northwestern, he joined the Energy Systems Division at Argonne National Laboratory as a Postdoctoral Appointee in November 2010. He is a member of Transportation Research Board (TRB) standing committees of Transportation Network Modeling (ADB30) and Freight Transportation Planning and Logistics (AT015). Dr. Zhang's research interests include dynamic network equilibrium and optimization, modeling and simulation of large-scale complex systems, multimodal transportation systems analysis, freight transportation and logistics systems, data-driven travel behavior analysis, impact of plug-in electric vehicles to smart grid and transportation network systems, and railway systems. He directs a high-performance computing Laboratory on Sustainable and Intelligent Transportations (SITS-Lab), and teaches transportation planning and transportation systems analysis.



Chris DelReal,

Chris DelReal is a 2010 graduate of Michigan Technological University's Computer Networking and System Administration program. He now works with Michigan Tech's Tribal Technical Assistance Program as a web designer, technical advisor and code writer. Chris had a key role in the technical development of the High Speed Rail Learning System (HSRLS).

ALUMNI HIGHLIGHTS

Darryl Babbitt,

Section Manager, Maintenance, LS&I Railroad

My first involvement with the rail industry came as a summer internship with CSX TraMy first involvement with the rail industry came as a summer internship with CSX Transportation in 2007. The experience got me interested in a rail career, so after my return to Michigan Tech, I tried to find a way to combine my two passions; railroads and the Upper Peninsula of Michigan. Fortunately, I was able to secure another internship with Lake Superior & Ishpeming Railroad (LS&I) in Negaunee, MI for the summer of 2008 and after getting some more experience through Dr. Lautala's CE 5409 Track Engineering and Design course, LS&I hired me full time as their Civil Engineer in 2009.

Since then, I've been able to work in multiple leadership positions in the organization, ranging from track maintenance to car and locomotive maintenance. Moving between positions, some of which have been a stretch to my civil engineering background, have really allowed me to learn new things on daily basis and my job has never turned into boring repetition. I've also been able to continue my collaboration with Michigan Tech's Rail Program through student projects that we've sponsored, annual field visits by the Railroad Club, and most recently as a member of the Rail Transportation Advisory Board (RTAB).

Since 2013, I've been in my current position as Section Manager Maintenance. Only five years after my graduation, I am responsible for the entire maintenance group at LS&I. This includes everything from railroad infrastructure to motive power. Under this wide range of assets I maintain include the Marquette Ore Dock, which is over 100 years old and has seen over 450 million tons since 1912. The majority of that tonnage was moved with railcars that were built in 1937, which we still maintain today. Similar to the overall rail industry I'm challenged on a daily basis to determine economical projects that will continue to extend the life of those assets

I feel extremely blessed that I've been able to move my career forward with LS&I. In a short line railroad, like us, one needs to be an extremely versatile "jack of all trades", but it also offers freedom to grow, both professionally and as a person. And the best of all, every day I get to spend time outdoors and enjoy the beauty of the Upper Peninsula.

Erik Czarnik

Senior Signals & Communications Standards Engineer, CN

At no point in my childhood and teen years did I ever think of "workin' on the railroad." It wasn't until a gentleman named Pasi Lautala helped set me on a different track, by talking about railroads in my Controls class at Michigan Tech. After going to an informational meeting, and talking to CN at the career fair, I was sold.

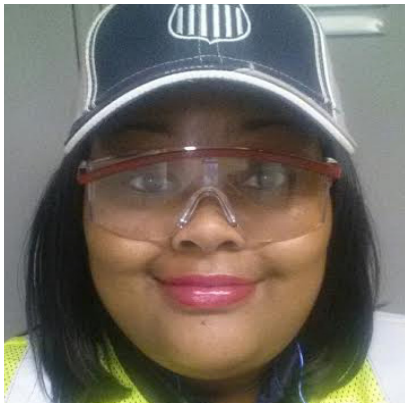
What amazed me was how much responsibility railroads entrusted young professionals right out of college. When I hired on in 2007 with CN, I was an assistant supervisor, with duties that ranged from helping draft budget requests to covering for vacationing supervisors.

In 2008, the Flint Signal Supervisor retired, and I was promoted to take his place. There, my responsibilities and challenges increased dramatically. I oversaw the signal system on 200 miles of track, with nearly 200 crossings and 30 control points. At 23 years old, I had a staff of 20 people working for me. Many of my decisions had immediate impact on railroad operations and the general safety of the public, so it definitely was a high-pressure job.

In 2013, I transferred to my current position as a Senior S&C Standards Engineer. I am in the group that writes all testing procedures for the signal systems at CN, and authorizes new equipment from vendors to be used on the railroad. This group and position has broad effect on our department, influencing all Signals & Communications employees at CN.

I've come across people that say that their profession is unique, and while that may be true, I'd argue that it doesn't compare to railroading; railroading is entirely in a world of its own. While challenging to the extreme at times, railroading is vastly rewarding and I certainly wouldn't have traded my experiences for anything else.

RECENT GRADUATES HIGHLIGHTS



Destine Clark,

Union Pacific

Destine is a 2014 graduate with a BS in Operations and Systems Management. In July, 2014, she began work for Union Pacific Railroad as an Operations Management Trainee (OMT) in the Chicago, IL area. Upon completion of the OMT program Destin`e will become a Manager of Yard Operations.

"Prior to taking the Logistics and Transportation course (OSM4700), I never considered working for the rail industry. The topic of railroads was one that I rarely heard about until this course. After classroom lectures and being assigned a project discussing the critical issues in rail transportation, I became fascinated. I started to research rail career opportunities and later attended the fall 2013 Career Fair where I met with Union Pacific Railroad (UP) representatives.

Since starting the OMT program my knowledge of the UP and the rail industry has grown vastly. The employees at UP are very well educated about the industry and willing to share their experiences as well as give advice to new employees. I have found this to be very valuable in increasing my understanding of railroad operations. In my short time with the company, I have already come to the conclusion that I chose a great company to start my career with. The possibilities at UP are boundless and I am looking forward to a future here."

Arthur Jones,

Electro-Motive Diesel

Arthur Jones is a graduate of the Michigan Technological University ECE department. After working for two summers (2012 and 2013) as an intern for Electro-Motive Diesel (EMD), a major locomotive manufacturer based in La Grange, IL, he joined their electrical traction systems department full time in June, 2014.

Arthur's work focuses on the design and test of systems related to the electric drives on locomotives. "There is never a dull day at EMD; there is always more to do and so much to learn". EMD has a long history of innovation including pioneering AC traction drives, and self-steering radial bogies. "The rail industry is a very interesting field to be involved in. Our customers, the railroads, expect a lot out of the machines we produce. Quality and reliability must be factored into every facet of design as these locomotives are expected to run well for decades."

Arthur became interested in electric machines and power electronics through the Michigan Tech's ECE lab courses on the topics. He pursued graduate studies in the field, enabling him to gain the expertise needed to be able to understand the electrical systems on locomotives. "During my time here I took classes specialized towards power generation and hybrid-electric vehicles. A locomotive combines both of these together; it is basically a series diesel-electric hybrid with grid size generation on board."

Chad Kohlhoff,

Engineered Rail Solutions, LLC

After working as an intern for HR Green, Inc. in the summer of 2012, Chad Kohlhoff graduated in December 2012 with a BS in Civil Engineering. He was hired by HR Green upon graduation and since August, 2013, Chad has been working for Engineered Rail Solutions, LLC (ERS) as a Staff Engineer.

"My interest in railroad engineering was sparked by getting involved in the RTP and REAC at Michigan Tech. Student trips and hands-on activities on campus provided valuable learning experiences about the railroad industry outside of the classroom, including networking opportunities that led to my internship and full time job.

As a Staff Engineer, I combine geometric design principles with railroad operation practices to develop an efficient design for industrial rail facilities. I develop operational models to validate the design and streamline the approval processes. I am actively involved in project management tasks to ensure that the projects are delivered at high quality, on schedule, and within the project budget."

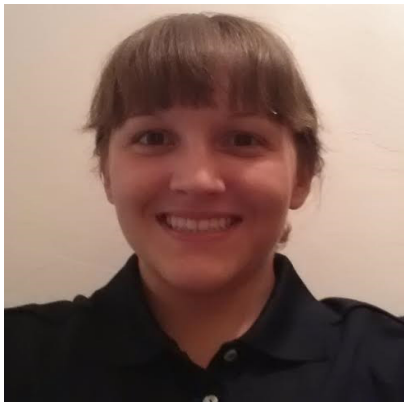
STUDENT INTERN/CO-OP HIGHLIGHTS

Aaron Lee (3rd year, Civil Engineering)

Transportation Technology Center, Inc

This summer I interned at the Transportation Technology Center, Inc. (TTCI) in Pueblo, Colorado. I worked primarily on research, about track structure and rail seat deterioration. In addition to research I also attended the International Cross Tie and Fastener Symposium at the University of Illinois Urbana-Champaign as well as tours of a concrete tie manufacturer and a steel mill which makes rail.

I have been a member of REAC since fall 2012 and will graduate in December 2014 with a Bachelors of Science in Civil Engineering. This internship has been a great learning experience and I'm hoping both TTCI and my prior summer working for Loram will put me on the fast track for a career in the railroad industry.



Alyssa Strebel (4th year, Civil Engineering)

Via Rail Logistics, LLC

I will begin my fifth year of Civil Engineering in the fall of 2014 and I worked as summer intern for Via Rail Logistics, LLC of Maribel, WI, in the summer of 2014. Via Rail Logistics is a site development company formed to provide the link between railroads and industry. Projects are located throughout the United States. As an intern at Via Rail Logistics, the majority of my work was done on the computer using Microstation. A great portion of work consisted of design work for modifications and expansions of industry track. Among other things, I designed yards, industrial parks, and more. Design included general geometry of tracks in order to maximize capacity within given area constraints, as well as developing horizontal and vertical alignments, stationing, and profiles. I did a few specific projects pertaining to rail yards that entailed designs to meet the size constraints while fitting space for as many cars as possible. I found these projects to be the most interesting too because it was a challenge, yet fun at the same time.

Will Dallman (4th year, Electrical Engineering)

Parsons Brinckerhoff

Prior to securing an internship with Parsons Brinckerhoff (PB) in Chicago, Illinois, I gained rail experience through my Senior Design project that focused on designing a solution that could improve grade crossing safety in the rail industry. As an intern at PB I was placed in the Signals group. I was able to learn what is involved in railroad signal design and placement on track. I also gained skills in using CAD software for drawing and correcting design submittals. Another important aspect of track signals is the codes they send through the track to determine which lights to display. I was able to delve into this area of signals as well, learning about the logic behind track codes. And finally, I worked a lot on quality control. Quality control is an important part of engineering and involves checking and double-checking documents, submittals, drawings, and more to make sure they are correct. Although office work was important to gain skills in engineering, some of my favorite experiences at PB were going out into the field and seeing design work come to life in the form of new signals, track, train stations, and more. Overall, interning at PB greatly expanded my understanding of engineering in the rail industry and was a very positive experience.

STUDENT ACTIVITIES AND SCHOLARSHIPS

REAC Field Trip to Detroit

REAC began in 2005 and became the first student chapter of the American Railway Engineering and Maintenance of Way Association (AREMA). The organization began with the goal of giving the community and students of Michigan Technological University an opportunity to explore the many opportunities within the rail industry. Since REAC's introduction, the multi-disciplinary organization has steadily grown and is looking to have record membership this coming year.

With the success of REAC, many opportunities are now available for everyone involved. The organization is highly active and hosts monthly meetings, trips, social gatherings, community outreach opportunities, and special events throughout the year. This past year included presentations by representatives of the M-1 Rail project in Detroit, design firms, and faculty and graduate student presentations on the feasibility of rail making a comeback in the Upper Peninsula of Michigan. Last fall, REAC members participated in the annual Homecoming Cardboard Boat Race (as a giant train) and successfully boarded and finished the race without taking on water. REAC members also had the opportunity to participate in a guided tour with the CEO of Mineral Range Railroad, Clint Jones, in Humboldt, MI. In the spring, members of REAC traveled down to Detroit to visit the M-1 Rail project, an NS classification yard, SteelPros Warehouse, and also got a chance to ride the AMTRAK line from Jackson to Dearborn. Our major event was the 9th Annual Railroad Night, which yet again had a great turnout and offered students another unique opportunity to interact and network with industry representatives following the Michigan Tech career fair.

As REAC looks forward to a new year, we hope to continue providing the great opportunities that have made the organization such a success. REAC is planning a fall field trip to the Empire Mine and Ore Docks in Ishpeming and Marquette, respectively and also a Spring field trip to Omaha, NE to visit Union Pacific rail facilities. Our 10th Annual Railroad Night will be moved to the fall as part of the 1st Annual Rail Day and Student Expo, a day filled with rail education for new and incoming students. Volunteer opportunities will continue to be extended to the Quincy Mine and Hoist as well as the Lake Linden train for the Houghton County Historical Society. REAC will continue to expand upon the foundation and looks forward to another year educating students on the benefits of working in the railroad industry.

Chris Blessing
REAC President

RAIL TRANSPORTATION PROGRAM CONGRATULATES ITS SCHOLARSHIP WINNERS

Each year the RTP offers internal scholarships funded by industry partners. External scholarships are offered through industry associations. Congratulations to the 2013 Scholarship Winners!

AREMA SCHOLARSHIPS ($7,500)

Dylan J. Anderson	Michigan Tech Alumni Scholarship
Chris Blessing	AREMA Committee 27 - Maintenance-of-Way Work Equipment Scholarship
Nicholas Lanoue	REMSA Scholarship
Antonio Passariello	Michigan Tech Alumni Scholarship
Sean Pengelly	AREMA Committee 18 - Light Density & Short Line Railways Scholarship
Hamed Pouryousef	AREMA Educational Foundation Scholarship
Irfan Rasul	AREMA Committee 30 - Ties Scholarship

LOCAL MICHIGAN TECH SCHOLARSHIPS ($10,000)

Irfan Rasul, Akalu Tafesse, Tanja S. Mattonen, Antonio A. Passariello	CN Scholarship
Nicholas R. Lanoue, Christopher L. Blessing, Sean P. Pengelly	Union Pacific Scholarship

ASME SCHOLARSHIPS TO JRC CONFERENCE ($7,650)

Nine students received $850 scholarships from the ASME Terrey Hawthorne Memorial Scholarship Fund to attend the Joint Rail Conference in Colorado Springs. Recipients:

Alec Bolthouse
Becky Schlak
Charles Fobbs
Jocelyn Tervo
Michael Mandalari
Nate Scheetz
Riley Peterson
Ron Campbell
Will Dallmann

Total Scholarships by Tech Students: $25,150

ASME Scholarship Recipients with Director Lautala

GRADUATE STUDENTS

2013-2014 Graduates

Adriano Rothschild

MS in Civil Engineering
Advisor: Dr Jeffery Lidicker,
Graduated; Spring, 2014

Adriano completed an MS in Civil Engineering with an emphasis on transportation. His course work revolved around transportation planning and modeling. Adriano's MS project title was *"Prospects and Issues for Fuel Cells with Freight Rail Transportation*". He is currently employed as a transportation analyst with Kimley-Horn and Associates in Fort Lauderdale, FL.

Irfan Rasul

MS in Civil Engineering
Advisor: Dr Pasi Lautala,
Graduated; Summer, 2014

IIrfan completed his MS in Civil Engineering, with an emphasis in transportation. His course work included rail, modeling and GIS related courses. Irfan was a graduate research assistant for the Upper Peninsula Freight Rail Study and his MS Project title was *"Evaluation of Potential Transload Facility Locations in the Upper Peninsula (UP) of Michigan"* (see Graduate Research Highlight, p. 15). As of May 2014, Irfan has been working as Staff Engineer - Intern for Engineered Rail Solutions, LLC (ERS) at McHenry, IL.

Continuing Graduate Students

Hamed Pouryousef
PhD Candidate,
Civil Engineering,
Advisor: Dr. Pasi Lautala

Hamed is working on *"Capacity Improvement Along the U.S. Shared-Use Corridors by Applying Timetable and Operational Management Techniques "*, funded by NURail. He is also a co-PI for a new project, Evaluating the Use of Operational Management Techniques for Capacity Improvements on Shared-Use Rail Corridors. The project starts in September, 2014, and is funded by the Center for Freight and Intermodal Research and Education (CFIRE). His Ph.D. thesis is closely aligned with project work and evaluates different U.S. and European simulation tools to examine shared-use corridors based on different scenarios of improving operational features by focusing on timetable management and rescheduling techniques, including hybrid simulation approach.

Karl Warsinski
PhD Candidate,
Materials Science and Engineering,
Advisor: Dr. Paul Sanders.

Karl is working on *"Austempered Ductile Iron (ADI) for Railroad Wheels"*, funded by NURail. His Ph.D. thesis concentrates on the ADI properties, investigating the potential effects of on-tread braking on the microstructure and properties of ADI railroad wheels.

New Graduate Students

Hanieh Deilamsalehy
PhD Candidate,
Electrical Engineering,
Advisor: Dr. Timothy Havens

Hanieh is currently working on a *"Computer Vision Method for Detecting Train Car Wheel Defects in Thermal Imagery"*, funded by NURail. The algorithm that she developed is able to detect a wheel defect named "hot-spotted wheel" and also a "hot bearing" from the given thermal image of the train wheel.

Maryam Fakhrhosseini
PhD Candidate,
Applied Cognitive Science and Human Factors,
Advisor: Dr. Myounghoon Philart Jeon

Maryam is working on "*Multimodal Warnings and Grade Crossing Behaviors"*. The focus is on the level of crossings for safety and efficiency of drivers' behavior depending on different types of visual warnings by means of analyzing eye movement pattern.

Sangpil Ko
PhD Candidate,
Civil Engineering,
Advisor: Dr. Pasi Lautala

Sangpil is currently working with a Biomass project, funded by BNSF, titled *"OISE-PIRE: Sustainability, Ecosystem Services, and Bioenergy Development across the Americas"*. The research is focusing on biomass transportation logistics modeling and the development of indicators to compare biomass transportation systems based on the availability of modal and multimodal transportation alternatives.

New Graduate Students Continued

Steven Landry,
PhD Candidate,
Applied Cognitive Science and Human Factors,
Advisor: Dr. Myounghoon Philart Jeon

Steven is working on *"Project Train Sounds"* to improve compliance and safety for drivers at railway crossings, funded by NURail. The project investigates driver behavior at railway crossings with and without the presence of audio cues. Questions of what type, when, and where the audio cures are presented and explored.

Priscilla Addison,
MS Candidate,
Geological Engineering,
Advisor: Dr. Thomas Oommen

Priscilla is working on the *Rail Embankment Stabilization Needs on the Hudson Bay Railway,* funded collaboratively by NURail and Omnitrax. The project seeks to evaluate the rail embankment stabilization needs on the Hudson Bay Railway, using field and remotely sensed data. The key objectives are to understand the condition of the underlying permafrost and the challenges it poses to the stability of the embankment; and also to develop a long-term solution for embankment stability.

Sumanth Kalluri,
MS Candidate,
Civil Engineering,
Advisor: Dr. Pasi Lautala

Sumanth worked on the final stages of the *Upper Peninsula Freight Rail Study*. In his MS project, he's planning to concentrate on comparative Life-Cycle Analysis (LCA) and Life-Cycle Cost Analysis (LCCA) for rail and road projects.

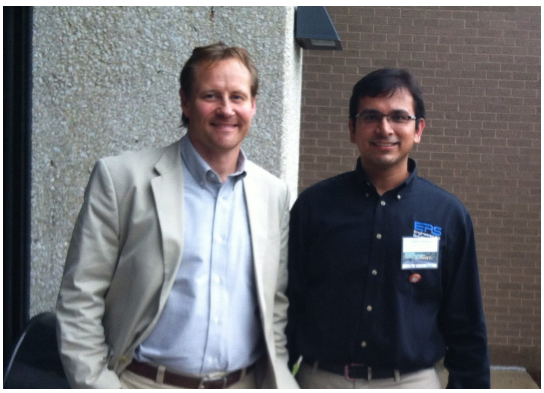
GRADUATE STUDENT RESEARCH HIGHLIGHT

Irfan Rasul, Transload Study in the U.P.

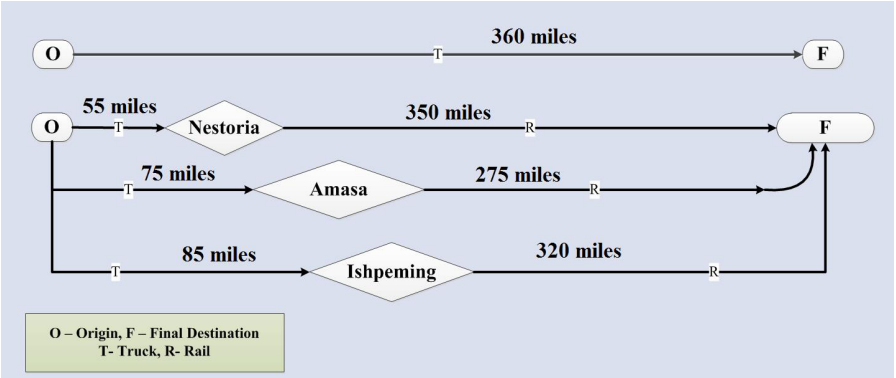
After studying light rail opportunities in Dhaka, Bangladesh as his undergraduate research, Irfan Rasul decided to continue rail related studies at Michigan Tech as a graduate student. At Tech, Irfan started studying multimodal freight transportation, eventually investigating the potential of establishing a transload facility in the U.P. of Michigan.

U.P. transportation faces constant challenges due to the distance from major markets and the absence of available truck/rail facilities reduces options further. This study reviewed three potential locations for a transload facility: Nestoria, Ishpeming, and Amasa; and evaluated transportation costs for shippers who currently use trucking as a single mode of transportation to Wisconsin, Chicago, Minneapolis, and Sault Ste. Marie. In addition to shipping costs, the study also evaluated the potential impact of future carbon emission penalties on the shipping cost and conducted fuel price sensitivity analysis on shipping cost.

The study developed a spreadsheet transport model to calculate the shipping and emission costs which were used to further analyze the percent cost savings that can be gained from using these facilities compared to the truck only movements. The study used case studies of two U.P. companies to evaluate the benefits for their movements. The study found the distant destinations; Chicago and Minneapolis would get the most benefits from using such a transload facility, especially at higher fuel prices. The effect of emissions on overall cost was minor, only 1-2 percent. The research is funded by Michigan Department of Transportation (MDOT) and National University Rail Center (NURail) as a part of the "U.P. Freight Rail Study" project.



Pasi Lautala and Iran Rasul



Truck Versus Multimodal Transportation Distances, Northern Hardwoods Case

YOUTH ACTIVITY HIGHLIGHTS

Attracting and educating K-12 students in rail (and other) transportation is a high priority. In 2013-2014, RTP led and contributed to the following activities to accomplish the mission.

October

October 24, 2013
STEM Festival
Science & Engineering Festival for Grades 3-5.RTP students collaborated with the Western UP Center for Science, Math & Environmental Education and Michigan Tech.

February

February 4, 2014 -
Visit to grades 2 - 5
CLK Elementary School in Calumet to teach kids "Packaging Bananas (fragile goods)".

February 25, 2014 -
Iran Rasul and Adriano Rothschild presented "Packaging Bananas" to students and families at Ocean Springs Upper Elementary School, Gulfport, MS. They were part of an event supported by eight universities, all presenting hands on activities, as part of the Logistics, Trade, and Transportation Symposium.

April

April 3, 2014
Spring Break Camp
RTP hosted 19 local youth in grades 1-3 for an afternoon session focused on railroad activities. The students were participating in the Spring Break Camp at Michigan Tech, this year's focus was Transportation.

June

June 13, 2014 -
RTP and the Center for Technology and Training (CTT) supported a visit by the Keweenaw Bay Indian Community Youth Program to Michigan Tech. The Tribal Technical Assistance Program helped arrange the visit.

June 25, 2014 -
WIE Expo
RTP and REAC manned a booth for the Women In Engineering Summer Youth Program Expo. This event gave us a chance to interact with 150 high school students and showcase the RTP and the rail industry in general.

July

July 9, 2014 -
ESP Expo
Similar to the WIE Expo, this event supported the Engineering Scholars Summer Youth Program. This program hosts some of the brightest high school students across the country. We again manned a booth showcasing RTP and the rail industry, and Dr. Lautala gave an invited presentation to the group.

Rail and Intermodal Transportation Summer Youth Program

July 27 - August 1, 2014

The 5th consecutive year of the Rail and Intermodal Transportation Summer Youth Program was organized in collaboration with the University of Wisconsin-Superior, and had a record-breaking 24 participants from high schools all over the country. Full scholarships were provided from the NURAil grant and industry gifts. Students were immersed into rail transportation education through class activities and on-site visits. The highlights of the program included a trip to Cliffs Mine and LS&I Railroad in Marquette, MI. The participants spent two days in Duluth, MN, visiting the BNSF rail yard and maintenance shop, Halvor Lines and CN ore docks. The students got to see all facets of rail transportation first hand and completed the trip in Duluth with a ride on the NorthShore Railway.

Summer Youth Group Attempting to Throw a Switch

Grade 3 – 5 Student's Activity "Packaging Bananas" in Calumet

Michigan Tech graduate students Irfan Rasul and Adriano Rothschild, working for the Rail Transportation Program, volunteered for a student activity organized in the CLK Elementary School in Calumet. The activity was open for both students and their parents. The activity demonstrated to the young students how fragile goods are packaged before being shipped a long distance. The students also learned the advantages and disadvantages of different modes of transportation. Students, along with their parents, were teamed up to come up with creative ideas for packaging bananas. During the activity, the students were very enthusiastic about learning something new.

Irfan and Adriano also traveled to Gulfport, MS, and presented the same activity at the Ocean Springs Upper Elementary School, Family Transportation Activity Night. This event, held on February 25, 2014, pulled college students from eight universities that were attending the Logistics, Trade, and Transportation Symposium, to present a variety of hands on activities to elementary school students and their families.

Summer Youth Program Group taking a tour in Duluth, MN

Rail Transportation Program graduate students, Irfan Rasul and Adriano Rotschild, demonstrating the activity "Packaging Bananas"

STEM Festival, Michigan Tech University

Every year the STEM (Science, Technology, Engineering and Mathematics) Festival is organized to stimulate learning skills of young students. In October 2013, the STEM Festival took place at Michigan Tech which attracted about 300 students from grades two to six. Irfan Rasul and Adriano Rothschild, volunteered at the festival to teach young students "Who Wins the Energy Efficiency Race: Trains or Trucks?" The students enjoyed the activity which explained to them how rail can show better efficiency over trucks. After the event, the students were able to better understand the role of a transportation engineer.

Rail Transportation Program graduate student, Irfan Rasul, demonstrating the activity "Who Wins the Energy Efficiency Race- Trains or Trucks?"

PROFESSIONAL DEVELOPMENT AT MICHIGAN TECH

PUBLICATIONS / CONFERENCES

Final Research Reports

Vitton, S., Brietenbucher, K., *Assessment of Aggregate Sources in Michigan for High Speed Railroad Ballast*, Jan 31, 2014, Prepared for Michigan Dept of Transportation, Contract 2010-0295

Blessing, C., Fobbs, C., Jurmu, N., Kleiber, J., Summers, A., Artman, L., *Highway-Rail Grade Crossing Surface Material Performance*, April 31, 2014, Prepared for Michigan Dept of Transportation, Contract 2010-0295

Lautala, P., Graman, G., Pentti, F., Nelson, D., Rasul, I., Tafesse, A., Pengelly, S., Kalluri, S., *Rural Freight Rail and Multimodal Transportation Improvements – the Upper Peninsula of Michigan*, July 18, 2014, Prepared for Michigan Dept of Transportation, Contract 2010-0295

Naber, J., Johnson, J., Lautala, P., Nelson, D., Vedam, V., Karramreddy, V., Nagupalli, V., *Independent Review of High Pressure Heat Exchanger Locomotive Test and Thermadynamic Simulation Data*, July 18, 2014, Prepared for Federal Railroad Administration

Journal Publications

Pouryousef, H, Lautala, P., White, T.; *Railroad Capacity Tools and Methodologies in the U.S. and Europe*; Journal of Modern Transportation-Springer, USA (Under Review, Submitted April 2014)

Lautala, Laitinen, Bittencourt, Valente, Hilliard, Webb, Busch, Handler, Hess, Roni, Hilbert; *Opportunities and Challenges in the Design and Analysis of Biomass Supply Chains*, Environmental Management (Under Review, Submitted June 2014).

Handler, R., Shonnard, D., Lautala, P., Abbas, D., Srivastava, A.: *Environmental Impacts of Roundwood Supply Chain Options in Michigan: Life-cycle Assessment of Harvest and Transport Stages,* Journal of Cleaner Production, Volume 76, p.64-73, August 1, 2014.

Conferences Papers / Presentations

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 (Automotive UI 13"), pp. 79-80. Eindhoven, The Netherlands, October 27-30, 2013

Pouryousef, H., Lautala, P.T., *Evaluating Two Capacity Simulation Tools on Shared-use U.S. Rail Corridor*, Transportation Research Board 93rd Annual Meeting of the National Academies, January 12-16, 2014.

Lautala, P.T., Hass, P., *High Speed Rail Learning System (HSRLS) – Taking Advantage of Online Technologies in Railway Education,* Proceedings of 55th Annual Transportation Research Forum, San Jose, CA, March 13-14, 2014.

Warsinski, K., P., and Sanders, P., *Austempered Ductile Iron Performance at Rail Wheels Operating Conditions*, Proceedings of the 2014 Joint Rail Conference, Colorado Springs, CO, April 2-4, 2014.

Hardy, A., Hill, J., Jeon, Myounghoon, and Lautala, Pasi, *Driver Response to Grade Crossings and the Effects of Different Warning Types,* 2014 Global Level Crossing Safety & Trespass Prevention Symposium, Urbana, IL, August 3-8, 2014.

Conference / Meeting Presentations

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

September 9, 2013 - Review of Applying Hybrid Approach of Capacity Simulation on a Shared-use Rail Corridor, 2013 *INFORMS Annual Meeting*, Minneapolis, MN

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

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

November 15, 2013 - Lautala, P., Univ. of WI-Madison, AREMA Student Chapter presentation: *Railroad Careers and Programs*

February 2, 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 in February, 2014

March 4, 2014 - Joint Rail Conf. Presentations (see highlight)

April 22, 2014 - Fakhr Hosseini, S. M., Hardy, A., Jeon, M., & Lautala, P. (2014). *Driver Behaviors With Various Visual Warnings at the Railroad Grade Crossings*. Proceedings of the Upper Peninsula Interdisciplinary Student Research Conference (UPISRC-2014), p.8, MI: Houghton. Available from: **https://sites.google.com/a/mtu.edu/upirs/**

Students at the 2013 AREMA Conference

Conferences Highlights

August 27, 2013 - Michigan Rail Conference

ConferenceMichigan 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 on Michigan Tech's online rail site (**www.rail-learning.mtu.edu**) for viewing by those who could not attend the event or wish to review the presentations in the future.

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

Ten 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.

Hobbs, C., *Highway-Rail Grade Crossing Surface Material Performance*

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.*

Dallman, 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

1st Annual Michigan Rail Conference (Left to Right: Joe Schwartz, Pasi Lautala, Nikkie Johnson, Anne Canby, Tammy Wagner, Tom Carper)

Other Professional Development

In addition to publications and conferences, RTP encourages various ways for professional development, such as hosting visitors and guest speakers. 2013-2014 saw an escalated number of experts visiting campus, or providing their expertise via web presentation. In addition, RTP also participated in numerous other events and meetings.

Guest Speakers / Visitors

October

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

November

November 12, 2013 -
Carmen Carozzo, Bergmann Associates
Farm Land – An Example of The Emerging Trends in the Rail Industry

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

December

December 12, 2013 -
Heather Carmona, Chief Administrative Officer of M-1 Rail
M-1 Rail and the Woodward Avenue Street Car Project in Detroit (web presentation)

January

January 21, 2014 -
Irfan Rasul and Akalu Tafesse,
Graduate Students at Michigan Tech
Upper Peninsula Rail Study Project

February

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

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

March

March 29, 2014 -
William Sproule
Keynote speaker at the Historical Society of Michigan's Local History Conference in Sterling Heights where he spoke of the *Detroit People Mover*

April

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


Phil Pasterak, PB


Dr. Lautala, Ed Burkhardt and Dave Nelson (right)

Professional Development / Workshops / Other Events

August

August 27, 2013 -
1st Annual MI Rail Conference
Lansing, MI
Michigan Tech organized the conference, in collaboration with MDOT

September

September 28 - October 1, 2013 -
AREMA Conference,
Indianapolis, IN
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, participate in technical presentations and visit exhibits.

October

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

October 15, 2013 -
Rail Info Night
Michigan Tech Campus
40 students and 10 companies participated in the REAC-organized evening pizza event for students and rail industry companies as part of fall Career Day activities.

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

November

November 13, 2013 -
Dr. Pasi Lautala was appointed by the Governor as one of seven members of the Commission for Supply Chain and Transportation Logistics Collaboration in the State of Michigan. The group is responsible of advising the state in the strategic direction related to the development of supply chain and logistics industry.

November 19 - 20, 2013 -
Fundamentals of Railway Train Control and Signaling, Including PTC Systems
Madison, WI
Dave Nelson participated in this UW-Madison Continuing Education Seminar.

January

January 10, 2014 -
CN Meeting
Homewood, IL
Dr. Lautala and Irfan Rasul visited the CN Homewood offices to discuss multimodal transportation issues and the Upper Peninsula Freight (Rail) Study.

February

February 11, 2014 -
Lansing, MI
Inaugural meeting of the Commission for Logistics and Supply Chain Collaboration
Dr. Lautala participated in the first meeting of the new commission.

February 18, 2014 -
9th Annual Railroad Night
Houghton, MI
RTP and REAC organized a full day of activities on campus. Keynote speaker for the 9th Annual Railroad Night was Lisa Stabler, President of Transportation Technology Center, Inc.

February 20, 2014 -
AREMA Committee 24, planning session for REES 2014
Jacksonville, FL
Dave Nelson participated in the meeting to lead the planning for Railway Engineering Education Symposium, 2014

February

February 26-27, 2014 -
Logistics, Trade, and Transportation Symposium,
Gulfport, MS
Irfan Rasul and Adriano Rothschild attended the two day symposium. While there, they presented "*Packaging Bananas*" (see Youth Activities on page 16) to elementary students at Ocean Springs Upper Elementary School, as part of an event sponsored by CFIRE.

June

June 4-5, 2014 –
Wisconsin Central Group (WCG) and Council for Supply Chain Management Professionals (CSCMP) Meetings
Green Bay, WI
Dr. Lautala participated in the CSCMP meeting. WCG Intermodal and Log Transportation committee meetings.

June 6-8, 2014 –
APTA Annual Rail Conference,
Dave Nelson participated in the annual APTA Rail Conference in Montreal. He also participated in a set of meetings introducing the topic of railroad engineering education within the APTA organization

June 16-17, 2014 -
Union Pacific Homeplate Event
Omaha, NE
Jim DesRochers from the Career Center participated in the Union Pacific Railroad's (UPRR) "Home Plate" event. In addition to presentations by the leadership team, Jim had meetings with Union Pacific's recruitment team and Michigan Tech alumni.

June 23-25, 2014 -
REES 2014
Overland Park, KS
Dave Nelson and Bill Sproule participated in REES 2014. Dave was a major player in organizing the academic presentations for the event and presented an abbreviated version of the REES 3 – Railway Engineering Design Case Studies module, when the scheduled presenter was not able to attend. Bill presented the REES 1 – Transit, Commuter and Intercity Passenger Rail Transportation module.

NURAIL

National University Transportation Center (NURail)

In 2012, the seven university consortium, including Michigan Tech, was awarded the first National University Rail Transportation Center (NURail) by the USDOT Research and Innovative Technology Administration (RITA). After the 2013 competition, NURail also became a Tier-1 University Transportation Center.

The primary objective of the NURail Center is to improve and expand rail education, research, workforce development, and technology transfer in the U.S. The grant has supported various educational and student activities and projects covered in this report, and there are five on-going NURail research projects. Many of the projects have received complimentary funding from non-federal sources.

Ongoing NURail Projects

Michigan Tech is expanding its research faculty involved in NURail activities. In addition to Dr. Pasi Lautala, who leads Michigan Tech activities and functions as Associate Director of Education for the NURail consortium, other Tech faculty involved include Dr. Paul Sanders, Assistant Professor, Material Science and Engineering; Tim Havens, Assistant Professor, Dept. of Electrical and Computer Engineering; Myounghoon "Philart" Jeon, Assistant Professor, Dept. of Cognitive and Learning Sciences; and Thomas Oommen, Assistant Professor, Dept. of Geological Engineering. The current portfolio of projects includes the following:

Computer Vision and Machine Learning Method for Detection and Assessment of Wheel Anomalies Using Sensor Fusion of Thermal and Visible Spectrum Cameras (by Dr. Tim Havens)

The collaborative project with Union Pacific Railroad investigates use of thermal imaging cameras and automated detection techniques to detect defective wheels and define how severe the defect is. To date, the project has developed an algorithm that identifies the wheel and bearing in the thermal image. In addition, the algorithm is able to detect and extract the hot spot (if there is any) and also the hot bearing.

The Effects of Auditory Warnings and Driver Distraction on Rail Crossing Safety (by Dr. "Philart" Jeon)

The project expands the driver behavior research to evaluate the effects of various auditory cues. The work to date has included collection of various sound samples, designed a series of experiments, and developed an experimental program.

Rail Embankment Stabilization for Cold Climate Railroads – Case of Hudson Bay Railway (by Dr. Thomas Oommen)

The project is a collaboration with Omnitrax. Work to date has included conducting literature review, building a GIS database with data and insights obtained from past engineering reports on the line, remote sensing analysis of temperature and vegetation data, and summer 2014 fieldwork (general site reconnaissance, route characterization and strength testing). Future work includes integration of various databases to an integrated geodatabase.

Rescheduling/ Timetable Optimization of Trains along the U.S. Shared-use Corridors (by Dr. Pasi Lautala)

The research investigates operational techniques to improve the capacity utilization of shared-use rail corridors. Work to date has concentrated on analysis of the Northeast Corridor (NEC) and establishing collaboration with MDOT for Michigan analysis. The research uses multiple simulation software, including Rail Traffic Controller (RTC), RailSys and OpenTrack. A complimentary research project was recently funded by the Center for Freight and Intermodal Research and Education (CFIRE).

Alloy Design and Testing of Austempered Ductile Iron for Rail Wheels (by Dr. Paul Sanders)

The project is investigating the potential use of ADI in railroad wheels. To date, the majority of work has concentrated on establishing the heat characteristics of the material. Forty-five ADI samples have been tested and the peak extrapolation and statistical analysis for the full data set is in progress.

Researchers

Tim Havens,
Assistant Professor,
Dept. of Electrical and
Computer Engineering

Thomas Oommen,
Assistant Professor,
Dept. of Geological
Engineering

Dr. Paul Sanders,
Assistant Professor,
Dept. of Material Science
and Engineering

Myounghoon Jeon,
Assistant Professor,
Dept. of Cognitive and
Learning Sciences

NURail Student Projects

RTP supported four undergraduate senior design and Enterprise projects with a combination of NURail and industry funding. These projects spanned the entire Michigan Tech academic community, with students from Civil, Computer, Electrical, and Mechanical Engineering, and Construction Management taking part. We also got students from the Business Department involved for the first time this year. The completed projects include the following:

Highway-Rail Grade Crossing Surface Evaluation (CE, CM, industry sponsor MDOT) –

A student group collected available data, conducted site inspections, and analyzed the information to define crossing surface performance. The group found that the current level of data available for analysis is lacking and developed a set of criteria for evaluation of crossing surfaces for Michigan DOT and a model for collecting grade crossing historical data for use in future evaluation of crossing surfaces.

Centerbeam Car Repurposing (ME, industry collaborator Escanaba & Lake Superior Railroad) –

There is an oversupply of centerbeam railcars, so a student group evaluated options for repurposing the car to other uses, eventually developing a plan for re-using this car type for frac-sand transportation. The plan included removing the existing centerbeam structure and replacing the lost structural capacity with a redesigned "fish-belly" beam. The group constructed a 3D model of the design and completed laboratory testing on a ¼-scale prototype of the beam. The cost estimate suggested conversion to be highly cost effective. The project will be continued by EL&S with development of conversion documents for approval by the Association of American Railroads (AAR).

Grade Crossing Jumper Cable (EE, industry sponsors UP and NS Railroad) –

This group investigated the potential to improve the safety of "jumper cables" used by maintenance crews to disable grade crossing signals. Occasionally the cables are forgotten at the end of maintenance work, leaving the signals and gates disabled when the next train arrives. The design solution uses voltage to distinguish between trains and maintenance vehicles and reactivates the crossing if a train is detected, while keeping the crossing disabled if maintenance vehicles are detected. The design has performed well under laboratory testing that has used actual train movement data collected, with the help of the industry sponsors.

Balise and Train Control System Market Study (EE, SBE, industry sponsor Tech Expert Network) –

A multidisciplinary team of students provided an overview of train control systems that use balise technology and the potential market opportunities in that technology area. The team also reviewed use of RFID tags in the rail industry and how those tags might be better used to improve product tracking. The research allows Tech Expert Network to better align their client interests with industry opportunities and demands.

RESEARCH HIGHLIGHTS

High Speed Rail (HSR) Workforce Development through Education and Training

Sponsor: Federal Railroad Administration

Study Team: Dr. Pasi Lautala, John Velat, Scott Bershing, Chris DelReal, Hamed Pouryousef, David Nelson (all Michigan Tech), Peter Haas, Stan Feinsod (Mineta Transportation Institute)

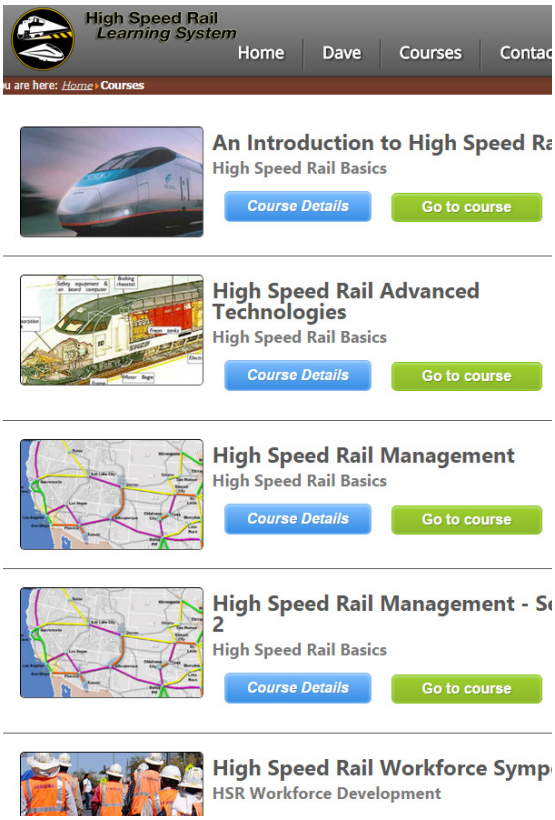
In October of 2011 the Rail Program teamed up with Mineta Transportation Institute, and set off to accomplish a task made possible by a grant from the Federal Railroad Administration under Broad Angency Announcement (BAA 2010-1) program.

The resulting High-Speed Rail Learning System (HSRLS) is designed to serve as a multi-purpose education web tool for higher education where students can study HSR topics and academia can share their expertise in collaborative environment. The proof-of-concept system with limited interactive HSR content was successfully launched in July, 2013. The project team developed three learning modules to demonstrate the capabilities of the on-line system.

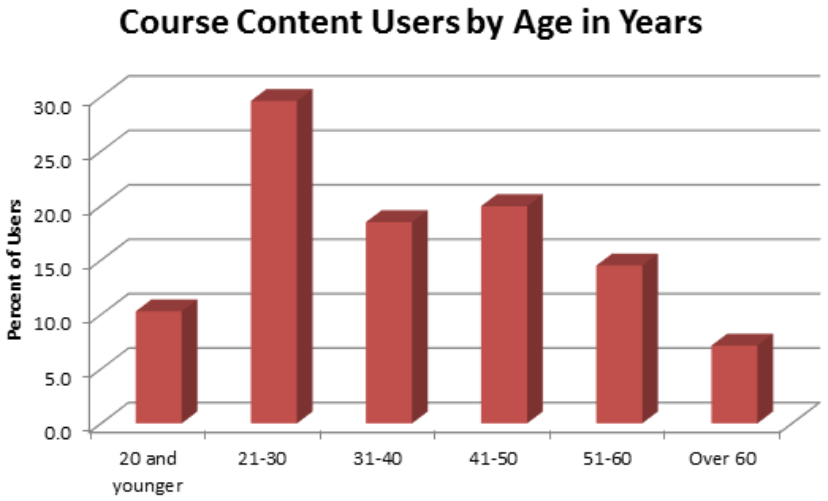
- **HSR 101 - An Introduction to High Speed Rail** is an interactive and asynchronous module designed to introduce a variety of HSR concepts.
- **HSR 102 - HSR Management** was designed as a synchronous course offering and presented in three live sessions. However, the presentations were also recorded and are now offered as an asynchronous module to new users.
- **HSR 103 - High Speed Rail Advanced Technologies** consists of a series of recorded video lectures, supplementary readings, and short quizzes.

In addition to HSR Modules, the system houses recorded presentations from 2013 Michigan Rail Conference, HSR Workforce Symposium, and AASHTO webinar on State Rail Workforce development.

The project was successfully completed in Fall 2013 and the Learning System has been since available at **http://www.rail-learning.mtu.edu/.** To date, the site has nearly 850 registered users and over 4,000 unique visitors from more than 40 countries around the world. The users come from all age groups and range from rail industry professionals to students and individuals from other industries. Despite absence of new materials or marketing, the visitor numbers have continued to climb slowly.



High Speed Rail Development Web Page

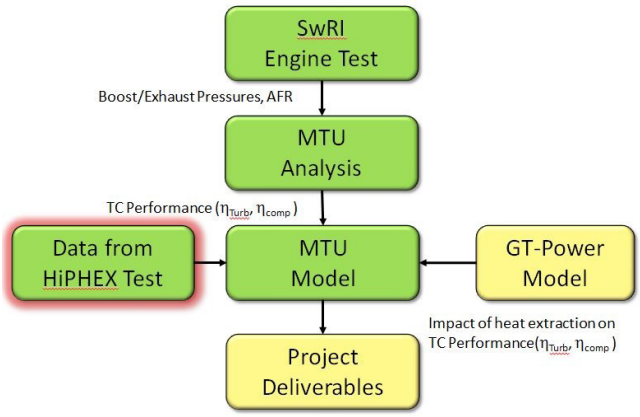


Independent Review of High Pressure Heat Exchanger Locomotive Test and Thermodynamic Simulation Data

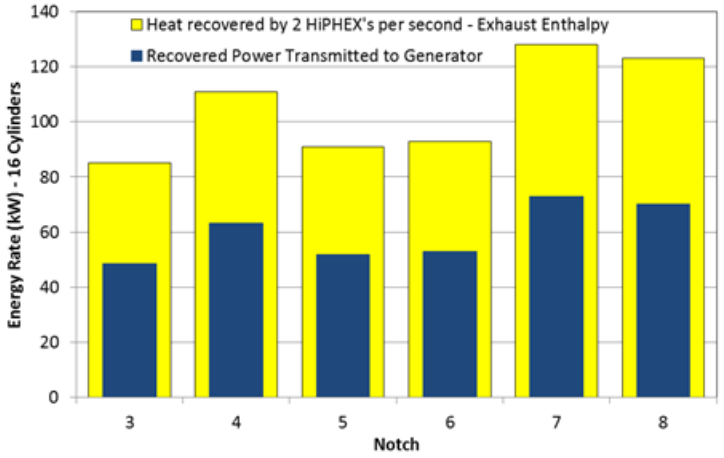
Project Goal: Analyze the potential for energy recovery from a locomotive engine using High Pressure Heat Exchangers (HiPHEX).
Sponsor: Federal Railroad Administration
Study Team: Dr. Jeffrey D. Naber, Dr. Jaclyn Johnson
Venkat Sai Raxit Karramreddy, Venkata S H K Vedam, Venkata Krishna Teja Nagupalli

A team of students from the Mechanical Engineering department worked with the FRA to validate the potential for energy recovery from the exhaust of diesel locomotive engines. The analysis was complicated by the interaction between the exhaust flow and the engine turbocharging system.

The team worked with data acquired from the developer of proposed technology and from the Southwest Research Institute's emissions research project. Analysis utilized a variety of software tools to develop a model that shows the engine exhaust flows and the energy available from the exhaust. It also looked 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 could be removed without impacting engine performance. While a more thorough data collection should be completed to provide a more thorough and accurate analysis, the work by Tech suggested that potential benefits may exist from the energy recovery technology.



HIPHEX Approach Model



Electrical Energy Recovered with HIPHEX

Local Companies as Part of Rail Technology Development

Over the past several years the Houghton/Hancock area has seen growth in technology companies, many of them small businesses with a high level of technical specialization and expertise. One of the long term objectives of RTP is to collaborate with companies such as GSLV, Inc.; Hawk Technologies; Thermoanalytics; and GS Engineering Inc. to expand the rail related development and research beyond the university perimeter. A great demonstration of the progress was the response from the community to a recent request for Small Business Innovative Research (SBIR) program proposals. The program, which is organized by the U.S. Department of Transportation, included two topics related to research in rail technologies. In total, there were three proposals submitted by the local companies to the program and RTP worked collaboratively in developing two of these proposals.

One of the proposals, submitted by GS Engineering, successfully received Phase I SBIR funding from the program. GS Engineering Inc., an innovative small business located in Houghton, MI, was awarded funds for the research topic of "Easy Access to Freight Locomotives". This project will leverage GS Engineering's team of engineers, as they work to reduce the effort for boarding and un-boarding freight locomotives. This SBIR effort will enable the staff of GS Engineering to demonstrate its ability to innovate while providing cost effective solutions to the rail industry. GS Engineering is focused on providing turn-key engineering services including program management, mechanical and electrical design, analysis and simulation, and laboratory and field test activities through the full product life cycle. It has been involved in over 750 contracts for all branches of the military, commercial and military vehicle Original Equipment Manufacturers (OEMs), as well as marine and aerospace markets. This SBIR contract offers GS Engineering a pathway toward becoming an active contributor to the rail industry, and we believe that the future will see similar success by other local companies with interest in the field.

FINANCES

RTP Funding

Financial support for the Rail Transportation Program is received internally at Michigan Tech from the Department of Civil and Environmental Engineering (CEE) and from the Provost. External funding consists of sponsored program research projects and contributions and gifts from industry partners and private individuals.

RTP Expenditures

Expenditures to support the rail transportation activities have been divided into several categories:

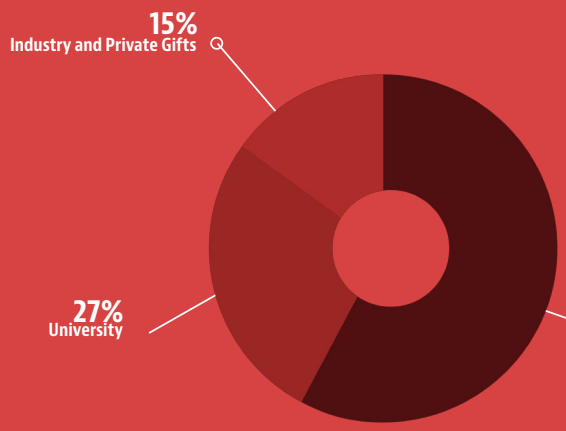
Faculty, Staff and Consultants (Research)- Research expenses are wages, salaries, and subcontracts plus overhead charges specific to sponsored research projects.

Director and Staff (RTP)- Rail program expenditures include director and staff salaries and other direct expenses used to support and continue development of the Rail Transportation Program.

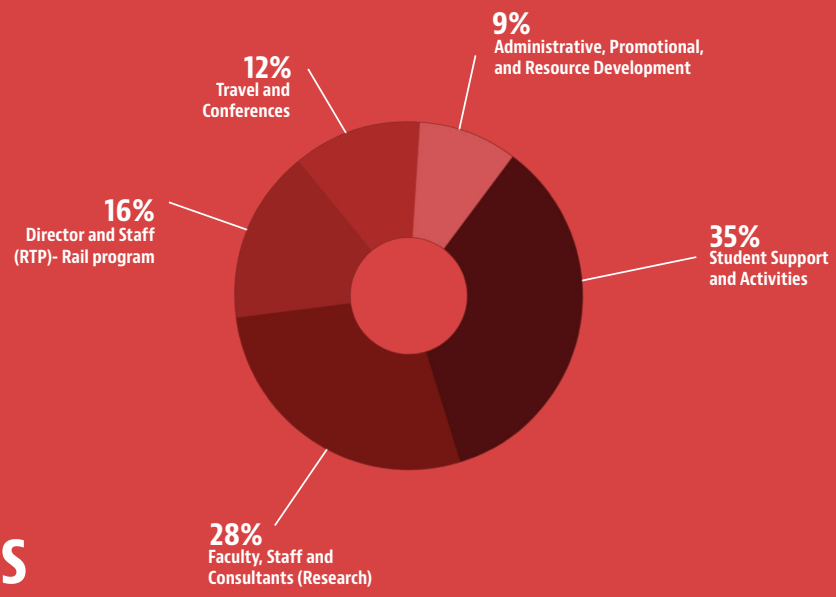
Student Support and Activities includes direct student expenses such as tuition and stipends, expenses for conference fees and field visits, travel, and sponsorship for student events and REAC activities.

Travel and Conferences includes all non-student support for travel and participation in rail and educational conferences and meetings to facilitate the development of the rail transportation program. This includes travel expenses incurred in sponsored research projects.

Administrative, Promotional, and Resource Development expenditures are expenses incurred in the operation and development of the rail program, such as marketing, material development, and purchase of program resources (software books, manuals, etc.)



RTP REVENUE



RTP EXPENDITURES

About the Michigan Tech Transportation Institute

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.

MTTI is an umbrella organization bringing together the cross-disciplinary centers and principle investigators conducting transportation related research and education initiatives that address national and global needs. Principal Investigators conduct transportation research under MTTI within six transportation focused areas:

- Transportation Structures including bridges and pavements. Other related areas include geo-technical, construction, and nanotechnology related to sensors.
- Transportation Materials including concrete, asphalt, steel, wood, and aggregates. Other related areas include construction, geo technical, and nanotechnology related to sensors and materials.
- Transportation Systems including waterways, traffic/safety, construction, rail, air, public transportation, freight, intelligent transportation systems, vehicle infrastructure integration, nanotechnology related to sensors, and radio frequency identification devices.
- Environmental Aspects of Transportation includes environmental impacts, energy, carbon dioxide and other pollutants, fugitive dust, wildlife, flora and fauna, and carbon credits.
- Social Aspects of Transportation includes policy, planning, human factors, history, economics, and archeology.
- Transportation Technology Transfer includes all outreach, management systems, and workforce development programs.

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Michigan Tech Transportation Institute

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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