National University Rail Center

2014 Annual Report

NURail Center







University of Illinois at Urbana-Champaign
University of Illinois at Chicago
Massachusetts Institute of Technology
Michigan Technological University
University of Kentucky
University of Tennessee, Knoxville
Rose-Hulman Institute of Technology

Rail Focused US DOT OST-R Tier 1 University Transportation Center

Contents

This publication is a report of the NURail Center's transportation research, education and workforce development, and technology transfer activities for January 1, 2014 – December 31, 2014.

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NURail Center

The National University Rail (NURail) Center is a Tier-1 University Transportation Center (UTC) focused on rail transportation and funded by the U.S. Department of Transportation (US DOT) Office of the Assistant Secretary for Research and Technology (OST-R) UTC program. The NURail Center is a seven-university consortium led by the Rail Transportation and Engineering Center (RailTEC) at the University of Illinois at Urbana-Champaign (UIUC) and hosted by the Department of Civil and Environmental Engineering at UIUC.

U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

Building a Railway Academic Community

As the National University Rail Center concludes its third year, we find this is an exciting time to be engaged in railway research within academia. Shifting freight traffic patterns, record intermodal volume and continued development of passenger service are increasing the need for expanded infrastructure and well-educated personnel to plan, design, build, operate, maintain, and manage the system. Rail infrastructure, rolling stock, and train control technology is at a dynamic stage. Accommodating new demands for safety, service, capacity, sustainability, and energy efficiency will require innovative research. New talent is needed to apply new ideas and technologies within the industry.

The solutions that will help railway transportation fulfill its potential in the future are inherently multi-disciplinary. Expertise is needed in civil, mechanical, and electrical engineering; logistics, urban planning, material science, operations research, and computer science. Collaborative partnerships must be formed between subject matter experts to research, develop, and transfer new technology to the rail industry. Such linkages are best accomplished within an "academic community" described as *"Groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis. . . . Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices, and approaches."*

Prior to the formation of NURail, the railway academic community could best be described as a loose-knit group of "lone wolves": individual faculty at various campuses investigating specific railway applications within their area of expertise or with a general interest in rail. NURail brought seven leading railway programs together to facilitate increased collaboration and establish the foundation of a railway academic community. Joint research activities, peer review, and exchange of knowledge and ideas within this community are all essential to the academic growth and maturation of both faculty and students at the partner institutions. The coordinated NURail research, education, technology transfer and workforce development programs are greater than the sum of their individual component parts. Although, as illustrated on the following pages, much has been accomplished by NURail, the challenges and opportunities ahead for the rail mode are vast and disparate enough to require insight from a broader academic community. To formally recognize existing and developing research and education collaborations with academic institutions outside the center, the NURail Affiliates program was officially launched in 2014 (page 16).

The NURail Affiliates program recognizes institutions that have taken steps to develop their own railway research and education programs, and become active members of the railway academic community. By providing faculty with a group of rail-focused peers and opportunities for collaboration with more established rail programs, their interest in rail can flourish to the benefit of all NURail partners and rail practitioners. Relationships are also developed at the student level where research approaches and techniques can be shared. Student groups at partner and affiliate institutions have also engaged in joint field visits to rail facilities and other group activities, enriching their educational experience.

The growth of the railway academic community was best observed at the 2014 Railway Engineering Education Symposium where NURail partners and affiliates gathered to discuss railway curriculum and research program development. Many faculty who attended earlier REES events with little exposure to rail returned in 2014 to share their successes in establishing rail education and research activities. With each successful project, the railway academic community grows larger and stronger, and moves another step closer to ensuring the role of railways in providing safe, efficient and economically competitive freight and passenger transportation into the future.

Faculty from NURail partner and affiliate institutions gather at the 2014 Railway Engineering Education Symposium

NURail Center Leaders

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NURail Student of the Year

James O'Shea

University of Illinois at Chicago student James O'Shea is the 2014 NURail Center Student of the Year. James is currently pursuing his PhD in mechanical engineering in the Dynamic Simulation Laboratory of his mentor, Dr. Ahmed Shabana. His research focuses on railroad vehicle stability and the analysis of vehicle derailment criteria. This topic is becoming increasingly significant with the development of high speed passenger rail and public concerns about rail tank car derailments. James hopes to contribute to the prevention of derailment and promote safer vehicle operating standards through sound physics.

James has presented his research at several conferences, and some of this work has also been published in the ASME Transactions. In addition to his graduate work, James has also served as a reviewer of technical papers submitted to ASME conferences, as well as IMechE and ASME Transactions. During his undergraduate studies James participated in internships and other programs for various organizations such as Bremskerl North America, Caterpillar, and NASA Airborne Science. He is an alumnus of the Pi Tau Sigma mechanical engineering honor society and a member of the NURail Student Leadership Council.

James now works as a Research and Development Engineer at Computational Dynamics Inc., a multibody system software development and consulting firm in Berwyn, IL, in addition to his research.

US DOT University Transportation Center Students of the Year are chosen by their local UTC programs. They receive a $1000 honorarium, the cost of attending the Transportation Research Board annual meeting, two free registrations to the Council of University Transportation Centers banquet, and a certificate from the US DOT.

PROJECT TITLE	US DOT Strategic Goals					NURail Center Topic Areas														
	Safety	State of Good Repair	Economic Competitiveness	Livable Communities	Environmental Sustainability	Infrastructure	Rolling Stock / Equipment	Safety & Risk	Operations	Capacity	Reliability	Planning	Economics	Passenger/Public Transport	Freight	Multimodal	Institutional	Education	Workforce Development	Technology Transfer
High-Speed Rail as a Complex Sociotechnical System	•	•	•		•	•		•	•	•			•			•	•			
High-Speed Rail Productivity			•		•							•	•				•			
Austempered Ductile Iron (ADI) for Railroad Wheels		•	•		•		•						•	•						
Assessment of Aggregate Sources in Michigan for High Speed Railroad Ballast		•	•		•	•			•				•	•						
Influence of Driver Attention on Rail Crossing Safety	•			•		•		•						•						
Cross-Infrastructure Learnings for Alternative Bridge System Designs – A Case Study on the Hybrid Composite Bridge System		•				•														
Modeling of Rail Track Substructure and Rail Vehicle Energy Dissipation	•	•				•	•	•						•						
Rail Infrastructure Materials for High Speed Rail	•	•	•		•	•		•		•										
The Informed Railroad Traveler (Smartphone application)			•	•	•									•		•				
Immersive Visualization of Rail Simulation Data	•	•				•	•	•						•						
Integrated Dynamic Modeling of Rail Vehicles and Infrastructure	•	•				•	•	•						•						
Environmental Impact Assessment of Rail Infrastructure	•			•	•	•		•	•			•		•		•				
Railroad Grade Crossing Pedestrian Safety	•			•		•		•	•			•		•		•	•			
Value Capture Strategies for the Funding of Rail Construction and Operation		•	•	•								•	•	•			•			
Economic Benefits of Productivity Increases through Truck-to-Rail Mode Shift in Freight Transport			•	•	•							•	•			•				
Concrete Crosstie Fastener Sub-System Testing and Modeling	•	•				•														
Railroad Grade Crossing Micro-Level Safety and Rick Analysis	•							•	•											
Improving Track Substructure Designs and Settlement due to Complex Dynamic Loads from High-Speed Passenger and Freight Trains	•	•	•			•														
Impact of Lock and Dam Closures on Rail System			•			•			•				•							
A National Survey of Commuter Rail Policy – Shared Corridors			•	•	•							•	•	•						
3D Methodology for Evaluating Rail Crossing Roughness	•	•	•	•		•		•	•				•							
Rail life-cycle performance studies		•				•														
Assessment of Existing Railroad Bridges to Accommodate a Higher Speed Considering Chinese Practices	•	•				•		•											•	
Lateral Impact of Railroad Bridges with Hybrid-Composite Beams	•	•			•	•		•											•	
Development of New Damping Materials for Ballastless Trackbed and their Behavior under Mixed Traffic			•		•	•														
Computer Vision and Machine Learning Method for Detection and Assessment of Wheel Anomalies Using Sensor Fusion of Thermal and Visible Spectrum Cameras	•	•	•				•	•	•		•				•					
Rescheduling / Timetable Optimization of Trains along the U.S. Shared-use	•		•			•			•	•	•	•		•	•					
Rail Embankment Stabilization for Cold Climate Railroads – Case of Hudson Bay Railway	•	•	•		•	•		•			•				•	•				
Modeling of Rail Track Substructure for Coupling with Vehicle Dynamics Model	•	•				•	•	•						•	•					
Immersive Visualization of Rail Simulation Data	•	•				•	•	•						•	•					
Railway Infrastructure Materials and Design	•	•	•		•	•								•	•					
Incentivizing Off Peak Delivery of Freight	•		•	•	•	•	•	•				•	•			•	•			
Connector Transitway White Paper			•	•			•					•		•		•				
Integrated Network Capacity Analysis for Freight Railroads			•							•		•			•					
What is the Extent of Harm in Rail-Pedestrian Crashes?	•							•											•	•
Laboratory Investigation of Steel Tie Performance		•	•			•							•							
The Impact of Reduced Coal Consumption on the Southeastern Railroad Network			•		•					•		•	•		•					
Alloy Design and Testing of Austempered Ductile Iron for Rail Wheels			•	•			•						•	•	•					
Extension of Funded NURail Project – Lateral Impact of Railroad Bridges with Hybrid Composite, Concrete, and Steel Beams	•	•			•	•		•										•	•	
Seismic Performance of Stone Masonry and Unreinforced Concrete Railroad Bridge Substructures	•	•			•	•		•										•	•	

2014 Timeline

NURail Center

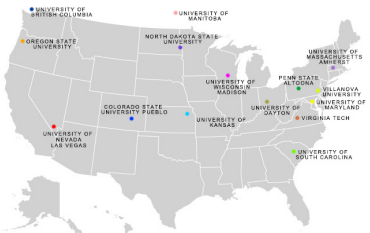
JANUARY

12TH-16TH

NURail partner universities had an outstanding showing at the 94th Annual Transportation Research Board meeting in Washington, D.C. Presentation topics included pedestrian safety at rail grade crossings, cost of rail congestion, and quantifying lateral wheel loading variation using truck performance detectors.

TRB
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

FEBRUARY



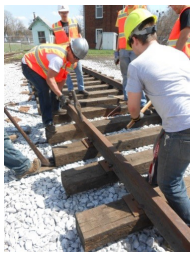
NURail Affiliates Map

The NURail Affiliates Program was officially launched and by-laws developed. Fifteen universities signed up for the program. See article on page 16.

MARCH

8TH-9TH

NURail MIT partner, Professor Joseph Sussman, became the 30th recipient of the Transportation Research forum's Distinguished Researcher Award. This award recognizes individuals who have distinguished themselves throughout their careers as research scholars in transportation.



At Rose-Hulman the 2014 spring CE490 class (Railroad Engineering) completed a 60' track construction project for the Wabash Valley Railroader Museum.

APRIL

15TH-18TH

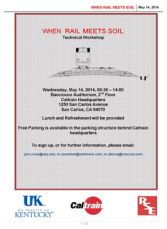
Two special sessions on NURail education and research projects were conducted at the 2014 Joint Rail Conference (JRC) in April.

15TH-18TH

The UIUC AREMA Student Chapter hosted a Railroading merit badge clinic. The merit badge covers wide topics ranging from signals to train types to model railroading and rail fanning. The material also included an Operation Lifesaver presentation along with other information about how to safely operate around the tracks.

MAY

14TH



The University of Kentucky hosted a NURail sponsored technical workshop in San Francisco, CA on Wednesday, May 14. The topic was "When Rail Meets Soil".

27TH

David Clarke, professor at UTK, gave a presentation at GeoShanghai 2014 as well as a presentation on "The North American Railway Industry," at the School of Transportation Engineering, Tongji University, Shanghai, on May 27.

JUNE

3RD-5TH

UIC-CUPPA hosted a webinar about pedestrian safety at rail grade crossings. The webinar allowed practitioners to participate "live" and obtain PDH's.

23RD-25TH

#REES 2014

Professors from around the country attended the Railway Engineering Education Symposium (REES) on June 23 – 25 in Overland Park, Kansas. The objective of the symposium was to further inform the professors of the workforce crisis and give them materials to educate students about rail at their respective universities.

JULY

18TH

Michigan Tech team members submitted their final report entitled "Rural Freight Rail and Multimodal Transportation Improvements – the Upper Peninsula of Michigan" which was prepared for the Michigan Department of Transportation.

27TH - 2ND

The Annual Summer Youth Program in Rail and Intermodal Transportation was held July 27 – August 2, 2014 for high school students on the Michigan Tech campus. A record number 24 students participated.

AUGUST

Three technical seminars on railroad engineering, high speed rail and experimental/field testing research were hosted by UIC-COE featuring industry professional and NURail researchers.

3RD-8TH

Over 230 attendees, representing 26 countries and 27 states, attended the 2014 Global Level Crossing Safety & Trespass Prevention Symposium (GLXS). Attendees exchanged information and shared best practices to improve safety of the at-grade interface between highway and rail systems. Highlights included rides on Little Obie and a keynote speech by Administrator Joe Szabo of the Federal Railroad Administration.

SEPTEMBER

28TH-1ST

Over 60 NURail students from the partner universities attended the 2014 AREMA Conference in Chicago in September. In addition to attending sessions and giving poster presentations, many worked the NURail booth in the exhibition hall.

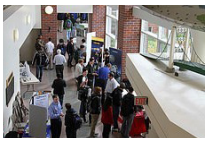
OCTOBER

9TH-10TH

Professor Sussman and first-year MST student Joanna Moody traveled to Tokyo. They reported on a new joint project with JR East applying the CLIOS Process to various high-speed rail development projects around the world.

14TH

October 14 was Michigan Tech's First Rail Day/ Expo and 10th Annual Railroad Night. A poster session highlighted student research projects. Twenty two industry companies participated and the day included a showcase of rail industry equipment and technology.



NOVEMBER

4TH

Ouri Wolfson, UIUC professor, was the keynote speaker at the 1st ACM SIGSPATIAL 2014 PhD Symposium and the 7th ACM SIGSPATIAL International Workshop on Computational Transportation Science in Dallas, TX.

10TH - 13TH

Professor Sussman and members of his research group attended the NEC FUTURE Open House Meetings in New Haven, CT, Providence, RI, and Boston, MA to keep up-to-date on the current vision and alternatives for NEC rail being considered by the multi-agency study.

DECEMBER

5TH

Professor Jerry Rose, UK, wrapped up the 2014 Hay Seminar Series on December 5. His presentation was on "Maintaining Adequate Trackbed Structural Support – An Important Railway Infrastructure Issue". There were 11 William W. Hay Seminar Series lectures in 2014 for a total of 649 in-person and 313 on-line attendees.

University of Illinois at Urbana-Champaign

Project: Track Arrangement and the Incremental Expansion of Rail Corridor Capacity and Operations

The majority of mainline rail corridors in North America consist predominantly of single track with passing sidings. These track arrangements lack the flexibility to reliably handle high volumes of heterogeneous traffic composed of multiple types of trains. Through research supported by NURail and the Association of American Railroads, UIUC is investigating how changes in traffic heterogeneity impact capacity consumption and how railways can most efficiently expand infrastructure to meet future demand for freight and passenger transportation capacity.

Heterogeneous traffic conditions are magnified on shared rail corridors where higher-speed passenger trains operate on the same track infrastructure as different types of freight trains, each with their own operational level-of-service requirements. To assess the impact of increasing traffic heterogeneity by adding passenger trains to routes with different combinations of intermodal and bulk unit trains, representative single-track routes were simulated with Rail Traffic Controller from Berkeley Simulation Software. Under heterogeneous traffic, certain types of freight trains experience greater increases in delay than others, degrading the provided level of service and limiting line capacity. The research concluded that the incremental capacity consumption of each passenger train is not a constant but is a function of the initial freight traffic composition.

One strategy for expanding freight rail capacity is to increase the length of freight trains. It is common practice to limit train length until the majority of passing sidings on a route can be extended to accommodate longer trains. However, results of this research indicate that only 50-percent of the sidings on a route need to be extended to facilitate long-train operations. Reducing the required number of siding extensions decreases the infrastructure investment needed to increase capacity via longer trains.

UIUC research seeks to quantify the impact of operating long trains on routes with short sidings

To further expand capacity beyond that achievable by extending and constructing additional sidings, railways may install second main tracks. Construction of double track requires substantial capital investment, particularly through difficult terrain and urban areas. Incremental construction of double-track segments along portions of the route can reduce capital investment while still providing capacity benefits. Simulation experiments reveal a linear relationship between reduction in train delay and the incremental capacity in transitioning from single to double track. While railroads must consider many factors in selecting capital expansion projects, the trends identified through this research can streamline the planning process by helping industry practitioners quickly identify track expansion project alternatives with the greatest potential capacity benefit for more detailed engineering evaluation.

Henry Wolf

Henry Wolf is a Graduate Research Assistant with the Rail Transportation and Engineering Center (RailTEC) at the University of Illinois at Urbana-Champaign. He received his BS in Civil and Environmental Engineering from the University of Illinois at Urbana-Champaign in December 2013. He continued his studies at UIUC and is currently pursuing a Master's degree in Civil Engineering with a focus in structures.

His research interests are focused on the flexural behavior of prestressed concrete monoblock crossties under varying ballast support conditions. His work has included analytical modelling and lab and field experimentation on concrete crossties. His main objective is to quantify bending moments experienced by concrete crossties in service and to use this information to improve current design practices in the AREMA Manual for Railway Engineering. He has enjoyed the collaboration of AREMA Committee 30 (Ties) and using the group's feedback to drive his work. He has presented his research at technical conferences and successfully passed updates to the AREMA Manual.

Henry is also interested in bridges, and hopes to translate his experience with prestressed concrete crossties to a career in bridge design.

University of Illinois at Chicago

Project: Modeling and Visualization of Rail Vehicle Substructure Interaction

Through a collaboration between the Civil and Mechanical Engineering departments, this work aims to create a full 3D finite element (FE) model of the mechanical interaction among the railroad vehicle, rails, ties, and track substructure. This substructure, including the ballast, sub-ballast, and subgrade, affects the stiffness, ride quality, and wear of the track and vehicles, and can transmit vibrations to nearby structures. By coupling the FE model to a multibody system (MBS) code that accounts for rail/wheel contact, different outputs of the model and investigate the effect of factors such as train speed and soil properties on system performance will be studied. 3D visualization will be facilitated by the Electronic Visualization Laboratory in the computer science department. This combined effort will produce better understanding of the train/substructure interaction and provide a baseline for investigating issues such as bridge approaches and vibration in nearby structures.

Project: Transit Value Capture

Capital transportation projects can be funded in part through value capture if local governments, transportation authorities and private development companies initiate the concept in the very early planning stages. This is a key finding from research completed in 2014 by the Urban Transportation Center (UTC) at University of Illinois at Chicago.

The report, "Value Capture Coordination: Case Studies, Best Practices and Recommendations," also states that transit systems in large metropolitan markets with many yet-to-be-funded transportation construction or expansion projects are being encouraged by the federal government to explore value capture to meet funding needs. Through value capture, funding is secured in the form of additional taxes or predetermined grants from the developers of properties that stand to benefit from the investment in public resources.

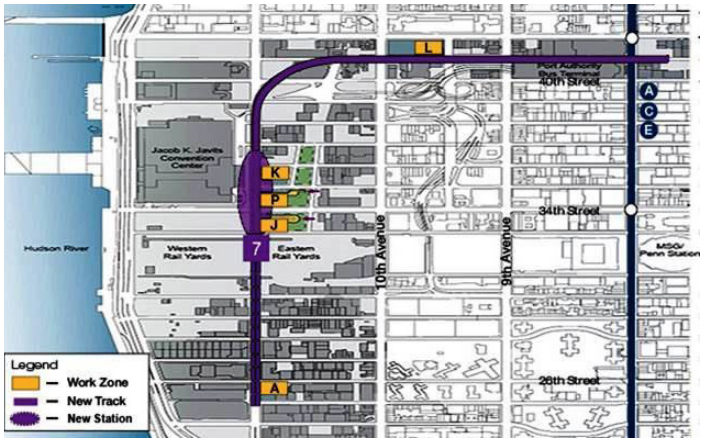
The UTC research team conducted field research in 2013 and 2014 in four major U.S. cities and learned that the incorporation of value capture to fund transportation differed, often dramatically, in the markets studied. Here's a brief analysis of the four case studies:

• **New York.** New York is extending the Number 7 subway to the Hudson Yards neighborhood in Manhattan at a cost of $2.3 billion. Two separate planning entities were created – one to control funding and financing, the other to manage the city's development plan.

• **San Francisco.** A new rapid transit station on the Muni M Line is planned to serve San Francisco State University and the Parkmerced apartment complex. To keep the project moving forward, funds for continued study were secured from community groups and the university through coordination between the city and transit agencies.

• **Washington, D.C.** Developers and local land owners were brought into the initial planning process on building the NoMa-Gallaudet U rapid transit station shortly after the project was announced. A new special taxing district generated $25 million, or roughly one-quarter of the total cost of the station, which opened in 2004.

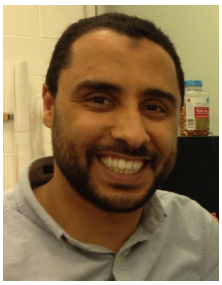
• **Chicago.** Researchers studied how TIF funds were used to improve six Chicago Transit Authority rapid transit stations where the ratio of value capture to total budget ranged from 2% to 100%. Other opportunities exist in Chicago to expand the use of other transit-specific value capture mechanisms, and Chicago developers are open to discussion value capture options.



Value Capture case study of MTA #7 line expansion.

Ahmed El-Ghandour

Ahmed El-Ghandour obtained his BS in Mechanical Engineering from Cairo University and his MS in Mechanical Engineering from UIC. He is now a PhD candidate in Civil Engineering at UIC. His work centers on the field of computational mechanics and Finite Elements (FE). His experience has been developed through various projects including the work of NURail, where his focus is on the interaction between the rails and the substructure with special reference to soil settlement and bridge approach problems.

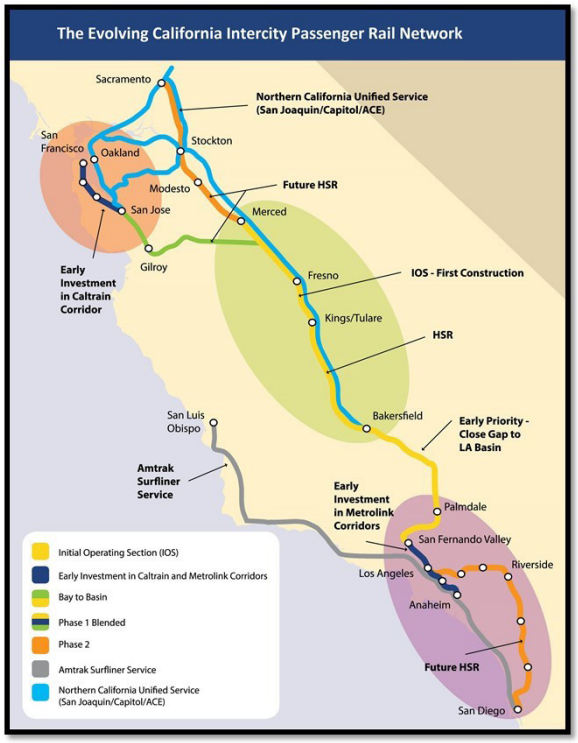


Ahmed polished his academic skills through practical internships at SHARMA & Associates and GE Global Research, where he worked on different projects using his railroad and computational mechanics knowledge. He has published his research in the Journal of Multi-body Dynamics and the Journal of Rail and Rapid Transit, as well as presented at several conferences. Ahmed is an active member in Egyptians Abroad for Development, a non-profit organization that aims to improve education and health resources in his home country. Ahmed also holds a 3rd Dan Black belt in Taekwondo, and is a certified referee in both Egypt and the USA.

Massachusetts Institute of Technology

Project: High-Speed Rail (HSR) as a Complex Sociotechnical System

The MIT Regional Transportation Planning and High-Speed Rail (R/HSR) research group under the direction of Professor Joseph Sussman, works in various areas. The intellectual glue of this work is considering rail systems including HSR as a Complex Sociotechnical System (CSS). These are systems with challenging physical technological characteristics, with substantial social impacts as well. The intent is to bring a variety of quantitative and qualitative tools that will shed more light on decision making in the high-speed rail context. There are technological issues, system architecture issues, and institutional issues that must be dealt with depending on a particular implementation and of the political locale within which it is taking place.



MIT's approach to studying these issues is built around the CLIOS (Complex, Large-Scale, Interconnected, Open, Sociotechnical) Process developed in Professor Sussman's research group over the past decade. Using the CLIOS Process, the objective of this project is to develop a deep understanding of particular HSR markets to enable effective system deployment strategies.

In 2013, MIT reported on research on the productivity of HSR services. Improvements in transportation productivity have helped fuel U.S. economic growth and wealth. With a focus on the Northeast Corridor, studies have analyzed the past productivity in rail passenger transport and have suggested how future configurations of high-speed rail might increase productivity. International HSR experiences in Japan and the European Union are also analyzed from a productivity perspective.

In 2014, MIT continued to consider fruitful areas of interest within the framework of HSR as a CSS using the CLIOS Process. A brief vignette follows:

Penn Station (New York City)

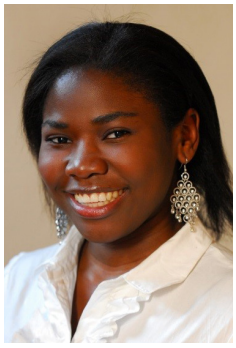
Rebecca Heywood, a second year candidate for the Master of Science in Transportation and the Master of City Planning, is studying Penn Station. The complexity in the physical sense of Penn Station is beyond debate, but what makes Penn Station particularly fascinating is the institutional complexity that characterizes it. Penn Station will be the lynchpin of the NEC HSR planned implementation but also is a vital commuter terminal in the New York Metro Region servicing both New Jersey Transit and the Long Island Railroad. Also, the Metropolitan Transit Authority subway interfaces to these other services in the Penn Station area. Investment in and operation of Penn Station must be considered at multiple geographical scales: intercity, the metropolitan region and New York City itself. This research is intended to provide insights into how Penn Station can be repurposed in the dynamic environment in which it finds itself.

Other work using the HSR as a CSS intellectual framework includes 1) a study of the California HSR system with particular emphasis on the northern portion where we are concerned with a "blended" system for operating HSR with a shared Right-of-Way with Caltrain's commuter service between San Jose and the Bay Area (Sam Levy). 2) a study of a potential HSR link from Chicago to Urbana / Champaign considering the economic growth opportunities of creating this service (Ryan Westrom).

Tolulope Ogunbekun

Tolulope Ogunbekun is a student in the MEng program in Civil and Environmental Engineering, specializing in transportation. She hails from Nigeria and first came to the U.S. for undergraduate studies at Mt. Holyoke earning her bachelor's degree. After graduation, she worked for three years in transportation consulting working for Steer Davies Gleave, a well-regarded firm in Boston. While there Tolu worked on various NEC studies among other projects.

Tolu decided to return to graduate school at MIT and joined the R/HSR Group. She has been a valuable addition, working effectively with her fellow students. Her research deals with the performance of Acela and regional services in the NEC, focusing on on-time performance. She is concerned with identifying the causes of schedule deviations and train cancellations. Further, Tolu is considering the relationship between performance and market share using econometric techniques. She will graduate in June 2015.



Michigan Technological University

Project: Austempered Ductile Iron for Rail Wheels

Advancements in any industry tend to come gradually and new designs must interface with the previous generation(s), so drastic component design changes are relatively rare. Material conversions can be powerful tools to increase load capacities and service life, and/or reduce equipment weight or cost without sacrificing cross-compatibility, but they must also be proven over well performing existing materials.

Cast steel rail wheels have a long history. Their main compatibility constraints are the rail head and on-tread air braking, both of which are geometrically simple. The wheels are major wear components that require regular replacement or reconditioning, and also contribute a significant amount of weight to each rail car. They are also key components affecting railroad noise, vibration, and impacts.

Austempered Ductile Iron (ADI) has the potential to decrease both weight and manufacturing costs and to increase service life as compared to cast steel wheels. ADI has a composite structure, consisting of graphite nodules dispersed in a metallic matrix. This results in a lower bulk density than steel, and the additional interfaces provide some inherent noise damping, which could help to reduce noise levels in rail communities. The graphite nodules have also been shown to provide a level of self-lubrication, which could reduce wear on both the wheels and track if applied to railroad wheels.

The current project, under the supervision of Dr. Paul Sanders, investigates the stability of the ausferritic iron matrix around the graphite. Heat treated materials often suffer changes in mechanical properties when exposed to additional heating, particularly at or near their heat treatment temperature. For ADI, this shift can occur with prolonged exposure to temperatures in the range of 350-450°C. Since a wheel tread might reach such temperatures intermittently in service (particularly on a steep downgrade or with a stuck brake), both the conditions for and effects of this transition must be investigated.

Rather than try to directly test all possible heating conditions a rail wheel might experience, the research team is taking a more fundamental approach. Using differential scanning calorimetry, researchers in Michigan Tech's MSE department are determining continuous heating transformation temperatures and kinetic parameters for the transformation in ADI. So far, the service temperature limits appear to be comparable to heat treated steel wheels.

Initial ADI samples were provided by commercial heat treater Applied Process, Inc. Additional alloy compositions are being produced in the Michigan Tech foundry and heat treated and tested in the same manner. The goal is to develop a model for designing an ADI grade with enough thermal stability to withstand rail wheel service conditions. While there are sure to be other challenges with implementing ADI wheels, the results to date show promise that ADI might be a material worth consideration for railroad wheels and perhaps other rail components.

Magnesium nodularizing treatment of 300 lbs of ductile iron in the Michigan Tech Foundry. Magnesium treatment is the critical step to make the round graphite nodules characteristic of ductile iron.

Karl Warsinski

Karl Warsinski is a PhD candidate in the Materials Science and Engineering Department at Michigan Technological University. His career focus is in process metallurgy and casting development. Karl completed bachelor's degrees in both materials science and engineering and civil engineering at Michigan Tech in 2011, before continuing into the PhD program. His dissertation work is focused on the effects of alloy composition on thermal stability in austempered ductile iron.

Karl is actively involved in the student chapters of the American Foundry Society (AFS) and Material Advantage, as well as the Smithing Guild at Michigan Tech. To date, Karl has presented his work in the Joint Rail Conference. In addition to his work on ADI railroad wheels, he is also involved in a cast wheel bearing project sponsored by Amsted Rail. A full test set of bearings will be cast in the Michigan Tech foundry for grinding, assembly, and testing by Amsted.

University of Kentucky

Project: Railway/Highway At-Grade Crossing Surface Management

An ideal railway/highway at-grade crossing is designed to fulfill its primary purpose of establishing a smooth surface while providing for the safe passage of rubber-tired vehicles across railroad tracks. Rehabilitating and/or replacing railway/highway at-grade crossings account for significant track maintenance expenses for public agencies across all levels of government and the railroad industry. However, large numbers of crossings have conventional all-granular trackbed designs that deteriorate at a more rapid rate than the adjacent trackbed and pavement.

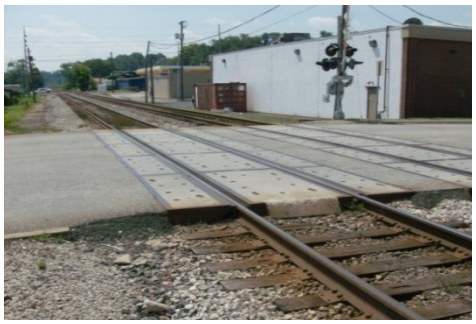
The primary cause of this deterioration is the structural pressures exerted by the combined railway and highway loadings within the shared crossing area as well as the difficulty in maintaining adequate drainage within the immediate crossing area. This jointly-used area is an expensive unit cost of the railway line and highway. State and municipal transportation agencies and railroad companies have expressed mounting interest in recent years in adopting improved trackbed crossing designs that provide enhanced structural properties, which in turn lengthens their service lives. This trend has spanned technology-based design parameters and crossing management techniques, with stakeholders working to identify the optimal engineering solutions to ensure that railway/highway at-grade crossing installations have acceptable long-term performances.

State transportation agencies and private railroad companies have expressed increased interest of late in incorporating asphalt underlayments and improved trackbed crossing designs and using premium materials in-lieu of traditional all-granular materials. These materials enhance the structural capability and waterproofing capacity of areas proximate to a railway/highway crossing; they will also extend the service lives of crossing surfaces. Technology-based design parameters and crossing management techniques for assessing optimal engineering solutions are now common practice for agencies responsible for crossing management and oversight.

Based on the results of this research, numerous railroad companies, transportation agencies and organizations have issued guidelines and standards for the proper design and construction techniques for railway/highway at-grade crossings, including AASHTO, AREMA, FRA, FHWA, MUTCD, and several states. Comprehensive information was summarized for the States of Illinois, Indiana, Iowa, Georgia, Michigan, and West Virginia. These selected states have been successful in developing standard at-grade crossing management practices.

This research is funded by the Kentucky Transportation Cabinet and the National University Rail Center. It has culminated in the publication of four Kentucky Transportation Center Research Reports.

Typical Rubber Seal/Asphalt Crossing Surface



Typical Concrete Panel Crossing Surface

Typical Timber/Asphalt Crossing Surface

Brett Malloy

Brett Malloy received his M.S. degree in Civil Engineering (Transportation Emphasis) from the University of Kentucky in 2014. His research topic was "Railway/Highway At-Grade Crossing Surface Management", where he worked closely with members of the Kentucky Transportation Cabinet and other state transportation agencies in effort to analyze and implement best practice procedures. A portion of Brett's graduate research was reported in a recent paper, of which he co-authored, entitled "Rehabilitation, Assessment and Management Practices to Ensure Long-Life, High Performance Highway-Railway At-Grade Crossings". It was presented at the 2014 Joint Rail Conference and contained in the Conference Proceedings.

Brett is a native of Kentucky. While a student, he was an active member of the AREMA student chapter at UK (RailCats). He was also a Provost Scholar and a member of the UK Honors Program and Phi Sigma Theta National Honor Society and is presently an Engineer-in-Training with Integrated Engineering in Lexington, KY.

University of Tennessee, Knoxville

Project: Seismic Evaluation of Existing Stone Masonry and Unreinforced Concrete Railroad Bridge Piers

The objective of this study is to evaluate the seismic resistance, damping, and energy absorption capabilities of stone masonry and unreinforced concrete (legacy) railroad bridge piers. These pier types were widely used in railroad bridge construction through the first half of the 20th century. Today, they represent some of the oldest substructures in the railroad bridge population, with thousands still in service around the country.

Railroad bridges have generally performed well during earthquakes, in part due to continuity provided by the rails. However, these legacy pier designs have weaknesses when subjected to seismic loading, particularly if the cross-section comes into tension. Masonry construction presents some particular concerns. To continue to rely on these substructures, railroads must be comfortable that they can perform satisfactorily under modern seismic criteria.

This study is reviewing seismic behavior of legacy piers in past earthquakes, as well as past research on railroad bridge seismic assessment. Using numerical modeling analysis supported by field and lab experimental data, the researchers will develop a quantitative approach to evaluate the seismic performance of existing legacy pier designs. To aid in this process, the researchers are gathering design and construction information for typical legacy pier designs.

Should legacy piers prove unable to withstand seismic loading, the researchers will identify and examine feasible and cost-effective pier strengthening methods to accommodate modern rail traffic demands and satisfy seismic criteria. Given the number of legacy piers and the historical significance of many of the bridges, retrofitting is likely preferable to constructing new substructures.

This research will hopefully help railroad bridge owners achieve cost savings while preserving the environment and cultural heritage of the nation.

Research at UTK is expected to contribute on the seismic capacity assessment of thousands of existing stone masonry and unreinforced concrete railroad bridge piers.

Qiang Gui

Qiang is a first-year doctoral student with a specialization in bridge seismic research at University of Tennessee Knoxville (UTK). Before enrolling in UTK, he obtained his Masters degree from the structural engineering department of Tianjin University, China in 2008 and had six years' industrial experience on railroad bridge engineering. Qiang arrived at UTK in August 2014. He is a member of Professor John Ma's research team and is working on a NURail-funded project "Seismic Evaluation of Existing Stone Masonry and Unreinforced Concrete Railroad Bridge Piers."

Recently, Qiang has started several preliminary works under the guidance of Professor Ma and AREMA Committee 9 experts. In his first year at UTK, he received the William H. Becker Memorial Scholarship from AREMA. He enjoys the pleasure that research brings to him and hopes to become a theoretical and experimental researcher on bridge engineering, and to benefit people of the world via his research findings.

Rose-Hulman Institute of Technology

Project: Wabash Valley Railroaders Museum Project

The Wabash Valley Railroaders Museum (WVRM) acquired a WWII Pullman Troop Sleeper Car for display at its Terre Haute site. The WVRM director approached Professor Jim McKinney about having his CE490 Railroad Engineering class take on the task of designing and constructing a 60 foot section of track to display the troop car. The class was composed of nine civil engineering and two mechanical engineering students.

After visiting the site and talking with the museum director the students developed a construction plan and schedule identifying construction activities, sequencing of activities, equipment and tools needed as well as project safety. The final design, based on modeling the troop car as an empty 50 ft box car, specified 6 inches of sub-ballast, 12 inches of ballast, 4 sections of 90-pound salvaged rail - slightly bent, and 2 rail joints offset by 5-8 inches to accommodate future rail expansion. The site was surveyed to determine proper horizontal and vertical alignment with a nod toward incorporating existing display tracks and future track expansion with the new track section.

Excavation for the sub-ballast and ballast was conducted by the Rose-Hulman Facilities Department with the students distributing ballast materials. Indiana Railroad supplied used ties, which were placed by a gang of 4 students using 2-man tie tongs to achieve the 21-1/4 inch tie spacing. The 90-pound rail sections, ranging in size from 25 ft-4 in to 31 ft, were placed by a 4-student gang using 2 man rail dogs. Students connected rail sections using bolted joint bars, spiked the rail to the ties and tie plates, while carefully maintaining the 4 ft 8-1/2 in rail gage. Due to the deformed portions of the salvaged rail alignment posed a challenge and required substantial effort to properly align the rail.

CE490 Railroad Engineering students pose by their completed track section built at the Wabash Valley Railroaders Museum.

The project required six weekly work sessions for a total of approximately 400 student hours. Despite the time involved and the scheduling challenges – including some work over spring break – the project was successfully completed in time to allow the troop car to be delivered and placed on the display track in early June. The students reported the project was a great hands-on learning experience, and they are justifiably proud of the final product.

Students received valuable experience on this project, among which was hands-on practice with a joint bar.

Allison Phillips

Allison Phillips is a sophomore civil engineering student from Mooresville, IN. She has held a long-time interest in transportation as well as historical and current railroad operations. Allison was awarded the 2014 Canadian National Diversity Scholarship and spent the summer of 2014 working as a design and construction intern for Canadian National in Homewood, IL. While there, she edited track charts, surveyed existing yard tracks and land for siding expansion, and examined track tie-plates for misaligned spikes.

Allison is the current Secretary/Treasurer of the Rose-Hulman AREMA student chapter. She is a second year member of the organization. She has been active in Rose-Hulman AREMA activities - recruiting new member at the annual campus wide activities fair, attending all field site visits, as well as all chapter meetings. She attended the 2013 AREMA Annual Conference in Indianapolis and the 2014 AREMA Annual Conference in Chicago.

In addition to her AREMA duties, Allison is fundraising manager for Engineers Without Borders, an active member of the Rose-Hulman ASCE student chapter, and a RHIT Homework Hotline Tutor.

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Dick, C.T. and L.E. Brown. 2014. Design of Bulk Railway Terminals for the Shale Oil and Gas Industry. In: Proceedings of the 2014 ASCE Shale Energy Engineering Conference, Pittsburgh, PA, July.

Fakhr Hosseini, S.M., A. Hardy, M. Jeon, and P. Lautala. 2014. Driver Behaviors with Various Visual Warnings at the Railroad Grade Crossings. In: 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/.

Farhat, M., M. Rahman, M. Ibrahim, and M.A. Issa. 2014. Design, Fabrication, Modeling and Experimental Study of a Totally Precast Concrete Counter-fort Retaining Wall System for Highways. In: Proceedings of the 2014 PCI Convention and National Bridge Conference, Washington, DC, September 8, 2014.

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Hardy, A., J. Hill, M. Jeon, and P. Lautala. 2014. Driver Response to Various Railroad Grade Crossings and Hazard Detection. In: Proceedings of the 2014 Global Level Crossing Safety and Trespass Prevention Symposium (GLXS-2014), IL, August 3-6.

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NURail Affiliate Program

The NURail Center, as part of its commitment to promote and facilitate railway engineering academic program development in North America, has established the Affiliate Program, in an effort to expand its research and education basis beyond the consortium membership. NURail is working to: (i) engage affiliate members in current and future research and education initiatives; (ii) offer affiliates assistance and guidance on curriculum development; (iii) facilitate and contribute to the development of affiliates' instructional and education material; (iv) collaborate and cooperate with affiliates on research initiatives; and (v) help affiliate members develop rail sector contacts.

Fifteen North American universities have joined the program (Figure 1). The Affiliate Group has established its own bylaws and membership criteria, and the leadership consists of the chairperson (Dr. Dimitris Rizos) and vice chairperson (Dr. Gordon Lovegrove) elected from the group and the secretary who is appointed by the NURail Center. The group holds meetings in person and/or through teleconferencing.

Dr. Dimitris Rizos

Affiliate institution rail programs are at different levels of development, ranging from one faculty and one rail-related course offered to over ten faculty members and a comprehensive railroad engineering curriculum.

As examples, the University of Wisconsin-Madison offers eleven non-credit continuing education courses annually. Penn State Altoona is the only institution in the U.S. offering a BS degree in Railroad Engineering. The Department of Civil and Environmental Engineering at the University of South Carolina is the first institution among the affiliates, and among a very few in the U.S., that offer Civil Engineering graduate degrees in Railroad Engineering.

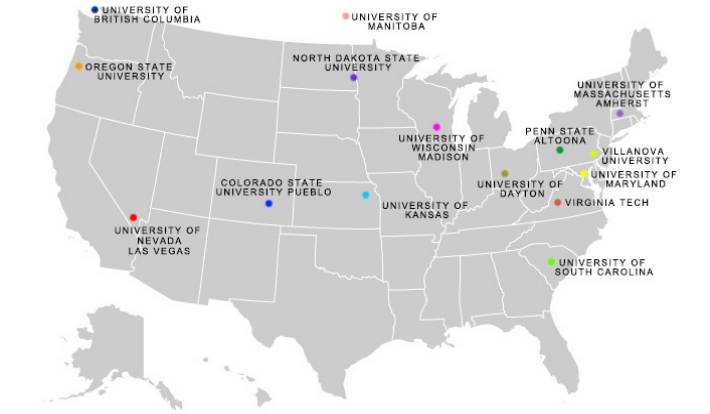


Figure 1

Most institutions have a chartered AREMA student chapter and maintain an active railway-related research program, and graduates of the affiliated institutions have been relatively successful in securing employment in the rail industry. All schools offer introductory courses in rail engineering/planning. Additional courses pertain to railroad operations, track design, and signaling while two members include a capstone design project in the curriculum. Most schools have reported other courses in the curriculum that pertain to infrastructure design, logistics, and multi-modal networks. In addition, most schools have reported that other transportation and infrastructure-related courses in their curricula include modules in railroad engineering.

2014 NURail Annual Meeting

The 2014 NURail Annual Meeting was held in Altoona, PA on August 18th and 19th. To reflect the theme of "Building a Railway Academic Community", the meeting was hosted by NURail Affiliate Pennsylvania State University – Altoona. The event was also held in conjunction with the Transportation Research Board (TRB) SummeRail Meeting staged each year by TRB AR040 Freight Rail Transportation Committee. In addition to PIs from the consortium institutions and their student researchers, the co-located events attracted employees from Class 1 railroads, consulting firms, universities, government, and industry.

The two-day meeting provided an opportunity to recap highlights of the previous year and discuss plans for 2015. Updates were provided on 15 different active NURail research projects and a variety of presentations on NURail education, outreach, workforce development, and research activities were made by NURail faculty and students.

A unique feature of the event was the mini-workshop on outreach to under-represented groups, technology transfer, and distance education. Attendees were split into small groups, each with a mix of faculty, students, and railway practitioners. The groups were given several minutes to brainstorm ideas prompted by questions related to one of the main topics. The groups reported back to the assemblage before repeating the process for the next topic. The fast-paced discussion with multiple stakeholders yielded many interesting ideas for future NURail activities. A collaborative free-flowing dialogue is sure to be a hallmark of future Annual Meetings.

Gio DiDomenico (UIUC) takes notes during the mini-workshop at the NURail Annual Meeting.

2014 Global Level Crossing Safety & Trespass Prevention Symposium

The 2014 Global Level Crossing Safety & Trespass Prevention Symposium was hosted by the Rail Transportation and Engineering Center (RailTEC) and the National University Rail (NURail) Center on the campus of the University of Illinois at Urbana-Champaign on August 3-8, 2014. More than 230 people from 14 different countries participated in the symposium where over 100 presentations were given focusing on level crossing safety and trespasser prevention. A contingent of nearly 50 students from the University of Illinois also participated in the symposium.

The symposium brought together engineering, safety, security, human factors, practitioners, academics and researchers from the global highway, rail, law enforcement, research, and regulatory communities. It provided an opportunity to exchange information, discuss the latest research and share best practices to improve the safety of the at-grade interface between highway, and rail systems, and prevent railway trespassing. Keynote speakers included Dr. Andreas Cangellaris – Dean, College of Engineering, University of Illinois at Urbana-Champaign; Michael Stead – Rail Safety Program Administrator, Illinois Commerce Commission; Joseph Szabo – Administrator, Federal Railroad Administration; and Norman Carlson – Director, Metra Commuter Rail Board.

Keynote Speaker – Joseph Szabo – Administrator, Federal Railroad Administration

2014 Joint Rail Conference

The 2014 Joint Rail Conference (JRC) was held in Colorado Springs, CO on April 1-4, 2014. Papers and presentations covered all aspects of railroad civil, mechanical, electrical, and systems engineering, as well as rail safety, planning, design, financing, operations, and management. Nearly 100 papers were presented at the conference, with 35 being presented by faculty and students from NURail Partner or Affiliate institutions. In addition two special sessions highlighted both research and educational activities of the NURail Center.

2014 International Crosstie and Fastening System Symposium

The 2014 International Crosstie and Fastening System Symposium was hosted by the Rail Transportation and Engineering Center (RailTEC) and the National University Rail (NURail) Center on the campus of the University of Illinois at Urbana-Champaign (UIUC) on June 3-5, 2014.

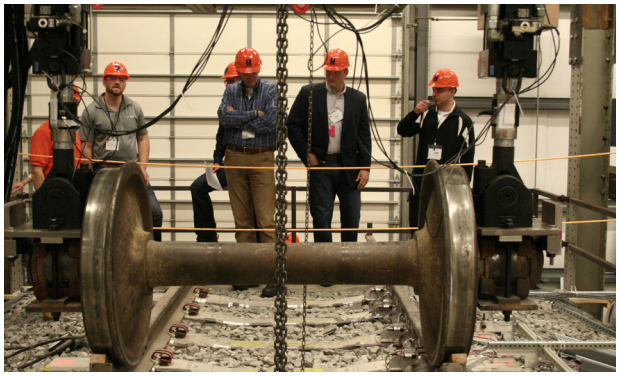
More than 125 attendees representing railroads, transit agencies, crosstie and fastening system suppliers, government personnel, and academic and industry researchers convened for the 2014 Symposium. Presentations focused on the performance and design of crossties, automated inspection technologies, and investigation of failure mechanisms. For the second time, the 2014 Symposium was co-located with the AREMA technical committee that is tasked with developing the recommended practices for crossties and fastening systems (Committee 30 – Ties).

As a part of the 2014 Symposium, a technical tour was conducted to RailTEC's Research and Innovation Laboratory (RAIL) as well as the voestalpine Nortrak, Inc. foundry in Decatur, IL.

The conference keynote address was given by Joseph Smak of Amtrak, who also held the position of AREMA President at the time of the Symposium. The keynote address included a presentation of the rich history of some of the organizations present at the Symposium and was also a call to be a part of the tradition of progressiveness represented by the attendees and organizations present for the Symposium.

Additionally, the 2014 Symposium included a new partnership with the Railway Tie Association (RTA). The RTA conducted their annual field trip in conjunction with the Symposium. This partnership provided new Symposium content related to timber crossties and treatment technologies.

The 2016 International Crosstie and Fastening System Symposium will be take place at UIUC on June 14-16, 2016.



Attendees of the Crosstie Symposium on their technical tour of RailTEC's Research and Innovation Laboratory.

Developing a New Generation of Railway Professionals

Michigan Tech's Summer Youth Program in Rail and Intermodal Transportation

For the past five years, Michigan Technological University has been running a Summer Youth Program (SYP) in Rail and Intermodal Transportation as a joint venture with the University of Wisconsin – Superior. The 70 students that have participated in the program have arrived from vast geographic backgrounds, covering 17 states. Over 20% of the participants have come from minority populations, and nearly 10% have been female students.

Students visited the CN Ore Dock in Duluth, MN during the Summer Youth Program in 2014.

The mission statement of the program is "A collaboration to attract a new generation." The program has seen continuous growth along with a diverse group of students, grades 9-11. The growth has been especially strong in years 2013 and 2014 after the arrival of NURail funding. This funding increased the scholarship levels from the original 50% (provided graciously by industry partners) to 100% of the program fee. In 2014, two minority students from Springfield, IL had travel sponsored by Hanson Professional Services, in addition to the normal full scholarship.

Over the five program days the students learn in a variety of formats, but most of the program time is devoted to industry field trips and hands-on activities. Hands-on activities include designing and constructing a scale model track section, operating a locomotive and train consist in a train simulator, and designing and racing maglev cars on a track layout.

Upon completion of the program, students received a certificate to commemorate the week. Feedback on the event from the attendees has been positive and one student even commented, "From what I have learned in the program, I am now interested in a future career with the industry."

"Grow Our Own" Minority STEM Initiative: Partnering in Outreach

To support higher-speed passenger rail operations between Chicago and St. Louis, a long-term effort to consolidate multiple rail corridors through Springfield, IL is underway. Future construction of a rail link will allow for a single grade-separated rail corridor to replace multiple routes through the central business district, eliminating multiple roadway grade crossings. However, the approved alternative passes within blocks of a high school and impacts minority populations in the surrounding community.

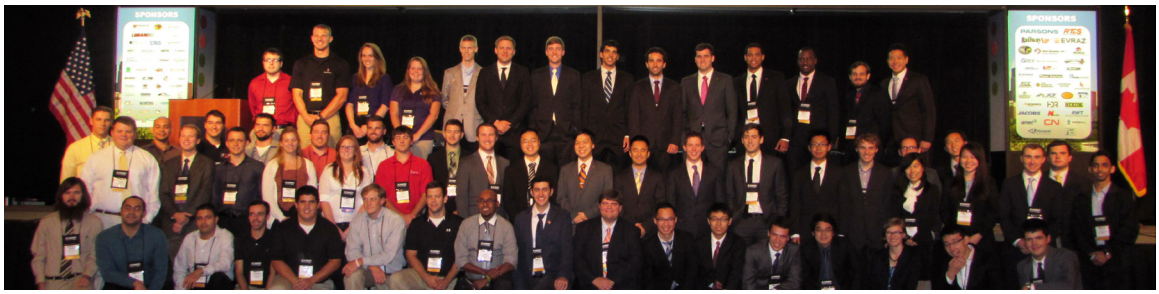
Through a unique partnership, local community leaders saw the proposed rail corridor as an opportunity to introduce local youth and minority populations to possible careers in related railway transportation, civil engineering and construction fields.

The "Grow Our Own" Minority STEM Initiative is led by Hanson Professional Services, a civil engineering consulting firm headquartered in Springfield. Hanson is joined by the City of Springfield, Sangamon County and the Illinois Department of Transportation in administering the initiative. Each group has pledged financial support to multiple programs including outreach to minorities through the NURail Center.

In March 2014, NURail and Hanson partnered to host 30 minority students from Springfield high schools and middle schools attending the annual Engineering Open House on the University of Illinois at Urbana-Champaign campus. With bus transportation provided by Hanson, NURail graduate student research assistants served as tour guides to escort these students around the engineering campus. The visiting students were able to participate in hands-on activities demonstrating applications of STEM topics to various engineering fields. Among the hundreds of displays was the award-winning "Railway Extravaganza!" exhibit, consisting of a locomotive simulator and other interactive railway engineering activities, organized by the UIUC AREMA Student Chapter and NURail-supported students.

Springfield, IL students toured Engineering Open House on the UIUC campus on March 15, 2014.

NURail Center Supported Students



Over 60 NURail students from the partner universities attended the 2014 AREMA Conference in Chicago in September. In addition to attending sessions and giving poster presentations, many worked the NURail booth in the exhibition hall.

A primary mission of the NURail Center is support and encouragement of student interest and study of rail engineering and transport. New students supported by NURail funds in 2014 are described below.

University of Illinois at Urbana-Champaign

Matthew Greve is an MS student and graduate research assistant. His research focuses on the behavior of concrete crosstie rail seats in response to varying loading environments and track structure.

Donovan Holder is a graduate research assistant focusing on quantifying the distribution and magnitudes of lateral forces through the track structure for improved fastening system design and performance.

Kevin Zhu is an MS student focusing on structural engineering. He is a graduate research assistant focusing on eliminating crack development around the rail end bolt-hole within rail joint sections among rail transit system.

Manuel Martin Ramos is an MS student interested in risk analysis, transportation safety, and high speed rail, along with the use of geographic information systems in transportation engineering.

Brandon Wang is a graduate research assistant focusing on safety and risk analysis for freight railroad.

Sam Chadwick is a BS and MS graduate of Civil Engineering working on her PhD. Her interests include railroad safety, highway-rail grade crossings, and developing a model to identify grade crossings with high risk of derailment.

Yu Qian completed his PhD in CE in December 2014 while developing an integrated computational and experimental framework for the assessment of railroad ballast life-cycle behavior.

University of Tennessee, Knoxville

Licheng Zhang is a PhD student in industrial engineering working on developing a simulation model for rail classification yards and is analyzing yard data from a major railroad.

Jun Liu is a PhD student in civil and environmental engineering. Jun is performing research in rail trespasser safety.

Meng Zhang is a PhD student in civil and environmental engineering. A first-year PhD student, Meng is working on a comparison of trespassing crashes at rail grade crossings and non-crossings.

Yuan Jing is a PhD student in civil and environmental engineering. He is supporting research into the lateral behavior of the HCB girder.

Qiang Gui is a PhD student in civil and environmental engineering. He is supporting rail bridge research. He was granted the 2015 AREMA William H. Becker Memorial scholarship.

Cody Stephens is an undergraduate student in civil and environmental engineering assisting rail bridge research activities.

Clint Lynch is an undergraduate student in civil and environmental engineering. He is assisting rail bridge research activities.

Tyler Rutherford is an MS student in civil and environmental engineering conducting research in materials for roadway and rail construction. His NURail work focused on hardened cement emulsified asphalt mortar as an underlayment for concrete slab track.

Weimin Song is a PhD student in civil and environmental engineering. Weimin is researching the interaction of ballast and crossties.

Rose-Hulman Institute of Technology

Allison Phillips is a sophomore CE student and the RHIT AREMA student chapter secretary. Allison interned with Canadian National RR and was awarded a Canadian National Diversity Scholarship, as well as an AREMA Scholarship.

Lauren Plouff is a junior CE student and the RHIT AREMA student chapter vice president. This summer she will intern with BNSF.

University of Illinois at Chicago

Krishna Bharadwaj is an MS student in computer science. He was appointed to port the rail visualization application to a desktop platform.

Ahmed El-Ghandour is developing an integrated vehicle-track-substructure model for train dynamics and applied this to measure forces at bridge approaches.

Mohammad Hosein Motamedi is developing advanced viscoplastic soil models for measuring long-term settlement under repeated loading.

Michigan Tech

Hanieh Deilamsalehy is a PhD student working at the Intelligent Robotics Lab. Her current research focus is developing an automatic method for detecting and categorizing railroad wheel and bearing defects from thermal and visual camera data.

Steven Landry is a PhD student in applied cognitive science researching driver behavior at highway-rail crossings. His master's thesis project is investigating the use of in-vehicle auditory alerts to promote safer driving behaviors at the crossings.

Hamed Pouryousef is a PhD student. He is working on railway capacity improvements along shared-use corridors by applying train scheduling and timetable management techniques.

Priscilla Addison is an MSc student in the geological engineering program. Her research focuses on characterization of root causes on a railway embankment underlain with thawing permafrost and on evaluation of potential stabilization methods.

Maryam Fakhr Hosseini is a PhD student in applied cognitive science researching driver behavior at highway-rail crossings.

Massachusetts Institute of Technology

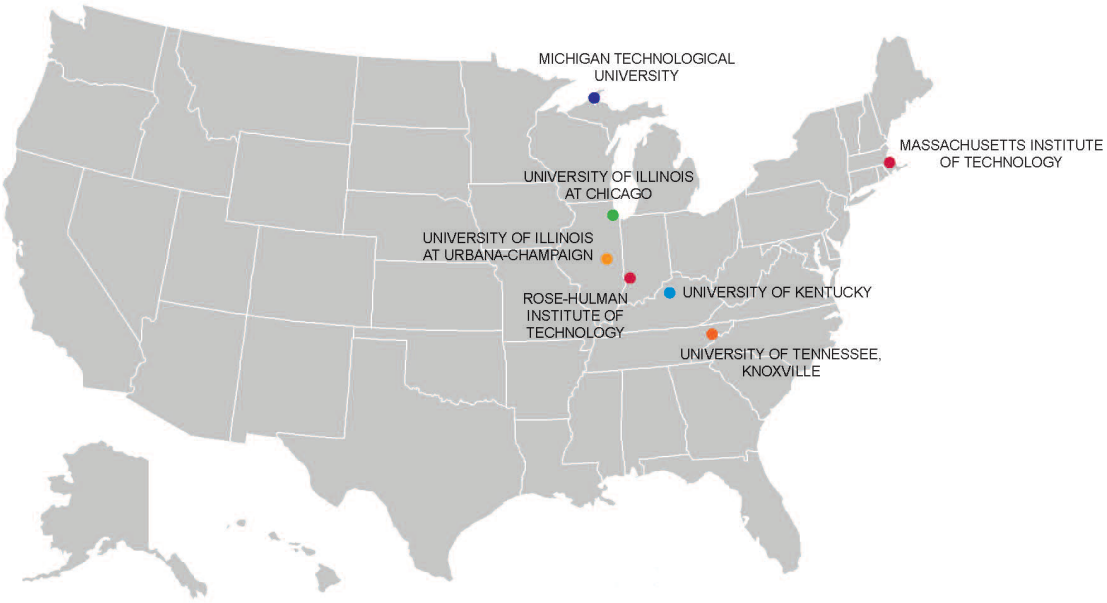
Maite Pena-Alcaraz is a PhD student in engineering systems. Her focus is on capacity planning in shared railway corridors at the intersection of decision making under uncertainty, industrial organization, and public policy fields.

University of Kentucky

Austin Dahlem is an MS student working on a multimodal transportation class curriculum.

John Magner is an undergraduate student working on tie and ballast research.

William Staats is an undergraduate student working on rail crossing research.



U.S. Department of Transportation

Office of the Assistant Secretary for Research and Technology

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