



To: US DOT/ RITA, University Transportation Centers

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A handwritten signature in blue ink that reads "Shauna J Hallmark".

Submitting official signature: Shauna Hallmark

1. Accomplishments

Major Goals and Objectives

MTC's theme is **Data Driven Performance Measures for Enhanced Infrastructure Condition, Safety, and Project Delivery** and will address related regional issues through a strategically focused program that is synergistic with U.S. DOT priorities and MAP-21 goals and objectives, with **State of Good Repair** as the primary goal. The objectives of the MTC are to

- Serve as a focal point within the region and nationally for research that develops data performance measures for Infrastructure Condition, Safety, and Project Delivery.
- Ensure efficient use of funds by building on existing programs, avoiding duplication, leveraging existing resources, and developing creative cooperative activities with industry.
- Develop products that are useful and relevant to stakeholders including regional, national, state, regional, and local transportation agencies as well as industry and other researchers.
- Provide leadership in the next generation of technology transfer. Beginning with the research itself—involving the user, innovative outreach, and new communications technology (i.e., phone apps).
- Develop the next generation of transportation professionals and provide opportunities for current professionals.
- Provide leadership opportunities for students and young professionals.
- Recruit and retain a diverse workforce.

Accomplishments Toward the Goals

Study Abroad

MTC has planned a study abroad opportunity in Istanbul, Turkey, for May 2015. The course is titled “Advanced Topics in Transportation Engineering,” and instructors will be Dr. Hallmark, Dr. Smadi, Dr. Williams, and Dr. Ceylan. The study abroad program is geared towards students in civil, construction, and environmental engineering. All instructors are professors of Civil, Construction, and Environmental Engineering at Iowa State University (ISU) and affiliated with MTC. The ISU professors will be present for the duration of the two-week course. Visiting professors from Boğaziçi University (Turkey) will also participate. Students from ISU and all partner universities will be invited to participate in this exciting opportunity.

Transportation engineering is an increasingly global profession. Through this course, students will begin to gain an understanding of the impacts of different engineering, historical, cultural, social, economic, ethical, environmental, and political conditions on the design and construction of various infrastructure projects outside the United States. In addition, this course will help students prepare for future careers in engineering firms and academia as well as in the non-profit arena, including local, state, federal, and international governments and entities. Specific topics include the following:

- History of transportation in Roman, Latin, Byzantine, and Ottoman empires
- Addressing transportation problems in a large metropolitan area

- Comparing U.S. and international traffic safety
- Mega transportation projects
- Public transportation

Presentations about the study abroad program were made at a graduate student welcome night hosted by the Department of Civil, Construction, and Environmental Engineering (September 11, 2014). The program was also presented at two orientation meetings for graduate/undergraduate students working at the Institute for Transportation (InTrans).

Flyers and posters were developed and are being distributed to all junior- and senior-level classes in civil, construction, and environmental engineering. An open house is planned for the beginning of November. The team has met with ISU Study Abroad program staff, who are very enthusiastic about finally having a program in civil engineering.

***Go!* Online Magazine (Workforce Development)**

Go! magazine, along with its Spanish counterpart *¡Vamos!*, aims to develop the transportation workforce by educating and stimulating young minds about the vast educational and career possibilities in transportation. During this term, *Go!* magazine has begun a major transformation of its website to allow for better access to its articles, videos, and features. Publishing four articles each month, the student staff at *Go!* write about transportation from a variety of angles. In addition, to better provide outreach to STEM teachers, an email-based newsletter has been developed with plans to be distributed once each month starting in November.

Although still being developed, in the next term *Go!* will be implementing a “My Mentor” video series and a web comic titled “Dot’s Adventures with Transportation,” which follows teenager Dot as she learns about the transportation field.

Go! magazine has also recently partnered with the Iowa Department of Transportation as it attempts to provide K–12 outreach through the AASHTO TRAC & RIDES programs. *Go!* will help provide deliverables (such as videos) in this outreach attempt.

AASHTO TRAC & RIDES (Workforce Development)

MTC and the Accelerated Bridge Construction University Transportation Center at Florida International University partnered with the Iowa DOT to pilot the AASHTO TRAC program at four central Iowa schools. Education is a key element of the activities conducted by InTrans for the MTC and the Accelerated Bridge Construction University Transportation Center, and this partnership will be valuable for both parties.

Transportation and Civil Engineering modules or TRAC PACs, an AASHTO educational outreach program, is designed for use in STEM classes. Their hands-on activities introduce students in grades 7–12 to the work world of transportation and civil engineering and inspires them to consider careers in those fields. The TRAC program is aligned with national standards and is currently being aligned with Core Curriculum Standards of Learning.

MTC is leading the program with a matching grant from the Iowa DOT. The following are the major activities for Phase I of the program:

- Identify states that have successfully implemented AASHTO TRAC & RIDES
- Select and review TRAC kits (the team has selected three potential kits that will be reviewed by high school math and science teachers)
- Identify pilot study locations
- Implement the program in two to four schools
- Develop a list of transportation professionals to serve as resources to teachers

An informational session for teachers will be hosted at ISU in late spring or early summer 2015 to give teachers and researchers the opportunity to review the materials together, discuss how these activities align with the national standards for math and science, and determine which additional TRAC PACs should be purchased for the 2015–2016 school year. Interest is also being explored in the AASHTO RIDES program (Roadways Into Developing Students), which caters to K–8 elementary and middle school classes.

MTC Scholars Activities

In this term MTC Scholars engaged in a wide range of activities.

Paige March, an undergraduate MTC Scholar, presented a poster on DDI interchange safety following selection for the University of Missouri System Undergraduate Research Day at the Capitol in March.

A graduate student class of MTC Scholars from the University of Missouri attended the Intelligent Transportation Systems Meeting in St. Louis, Missouri, in March.

First and second place in the annual poster competition at the annual Missouri Traffic and Safety Conference in May were won by MTC Scholars:

- First place: Yi Hou, “Traffic Flow Forecasting for Urban Work Zones”
- Runner up: Tim Cope, “Motorist Alarm for Moving W-Z Operations”



On June 29–July 2, five civil engineering graduate MTC Scholars from ISU attended the Joint Western-Midwestern ITE meeting in Rapid City, South Dakota, where they competed in the annual Traffic Bowl. The team achieved second place this year. MTC Scholar Georges Bou-Saab also presented during the research poster competition.

Ten MTC Scholars from ISU attended the annual fall MOVITE meeting on September 17–19, where they were awarded the “Best Student Chapter Award” for outstanding achievement as an ITE chapter. During the meeting, Yundi Huang was also awarded second place in the 2014 Thomas J. Seburn Student Paper Competition for her paper entitled “Analysis of Risky and Aggressive Driving Behaviors Among Adult Iowans”. For this honor she was given a \$500 honorarium.



Collaborative Research Efforts

Dr. Sharma and Dr. Nath had a brainstorming meeting about potential collaborative projects in early June of 2014. Based on the discussion, the City of Omaha Arterial Signal Timing Evaluation project was identified as a potential candidate. The City of Omaha is in the process of procuring an adaptive control system to improve the operations of Dodge Street. Dr. Sharma and Dr. Nath saw potential where traffic engineering skills can be combined with economic benefit-cost evaluations to assess the investment the city is making in procuring the system. Dr. Sharma and Dr. Nath then arranged a meeting with the City of Omaha Traffic Engineer, Mr. Murthy Koti, to discuss the idea. Mr. Murthy Koti was very positive about the idea and suggested an open RFP. The RFP will come out in early in 2015. Dr. Sharma and Dr. Nath will collaboratively put in a proposal for the RFP.

In addition, the MTC is coordinating with the Center for Advanced Infrastructure and Transportation (CAIT) at Rutgers. CAIT has successfully won a national center with a focus on state of good repair, which is similar to the MTC theme. We invited Dr. Ali Maher, CAIT Director, to speak at our spring seminar and to discuss collaboration on future activities.

Year 2 Research

The MTC partners have utilized year 2 funding to further develop their research projects. The ISU team worked with both Wichita State University and Creighton University to help them develop a transportation-focused research program. The University of Missouri-Columbia (UMC) and the University of Missouri-St. Louis (UMSL) worked with Harris-Stowe University to develop its research effort. The following guidelines were used to finalize the funded research projects:

- Whether the topic aligned with the MTC theme
- Positive recommendation from subject matter experts
- Involvement of students
- Amount and type of matching funds
- Regional and national significance

Iowa State University held a research open house on October 9, 2014. All faculty and staff were invited to attend this event to receive additional information and ask any questions about funding for future research projects.

The tables below list the ISU research program in addition to the research program at partner institutions. All projects are underway, and each semi-annual progress report will include an update on a few projects.

Iowa State University Funded MTC Projects

Project Title	PI Name	Department	Students
An Examination of How Firm Size Affects the Safety Performance of Commercial Drivers in the U.S. Motor Carrier Industry	Cantor, David	Supply Chain & Information Systems, Iowa State University	1- Undergraduate
Bio-cement for Road Repair	Chu, Jian	Civil, Construction & Environmental Engineering, Iowa State University	1- PhD Assistant
Data Driven Highway Infrastructure Resilience Assessment	Guiping, Hu	Industrial & Manufacturing Systems Engineering, Iowa State University	1- Masters
Research, Education and Development (RED) Examining Characteristics of Roadway Infrastructure in Various 3D Visualization Modes	Keren, Nir	Agricultural & Bio-systems Engineering, Iowa State University	1- PhD Assistant 1- Undergraduate
Using Operational Data to Assess Mobility and Crash Experience During Winter Conditions	Hans, Zach	Institute for Transportation, Iowa State University	1- 1/2 time Masters
High Friction Surface Treatment for High Crash Locations	Hans, Zach	Institute for Transportation, Iowa State University	1- Masters
Evaluation of Temporary Rumble Strips	Hawkins, Neal	Institute for Transportation, Iowa State University	1- MS Assistant
Development of Rural Road Bridge Weigh-in-Motion System to Assess Weight and Configuration of Farm to Market Vehicles	Dahlberg, Justin	Institute for Transportation, Iowa State University	1- Research Assistant
Terrestrial Laser Scanning-Based Bridge Structural Condition Assessment	Turkan, Yelda	Civil, Construction & Environmental Eng, Iowa State University	1- PhD Engineering
Integration of Structural Health Monitoring into Multilayer Statewide Bridge Maintenance and Management Practices	Phares, Brent	Institute for Transportation, Iowa State University	1- Research Assistant
Development of Crash Modification Factors for Lane Departure Countermeasures	Hallmark, Shauna	Institute for Transportation, Iowa State University	2- Eng Graduates 1- Stats MS Assistant
Risk-Based Bridge Management: A Methodology to Assess and Incorporate Risk in Decision-Making	Aldemir-Bektas, Basak	Institute for Transportation, Iowa State University	1-1/4 time Masters
Development and Evaluation of Portable Device for Measuring Curling and warping in Concrete Pavements	Ceylan, Halil	Civil, Construction & Environmental Eng, Iowa State University	1- Research Assistant 3- undergraduates
Assessing Segment and Corridor-Based Travel Time Reliability on Urban Freeways	Dong, Jing	Civil, Construction & Environmental Eng, Iowa State University	1- Masters 1-PhD 1-undergraduate
Historical Performance Evaluation of Iowa Pavement Treatments Using Data Analytics	Jeong, David	Civil, Construction & Environmental Eng, Iowa State University	1- PhD Assistant

Project Title	PI Name	Department	Students
Previous Concrete Physical Characteristics and Effectiveness in Stormwater Pollution Reduction	Ong, Say K	Civil, Construction & Environmental Eng, Iowa State University	1-PhD 1- 1/4 time Masters
Developing Green, Highly Flowable, Rapid Set, High Performance Concrete for Pavement Patch Repair	Wang, Kejin	Civil, Construction & Environmental Eng, Iowa State University	1-Research Assistant 1- Undergraduate
Toward Autonomous and Robotic Infrastructure Construction: A Workshop and Field Studies of Productivity, Quality and Safety Impacts	White, David	Civil, Construction & Environmental Eng, Iowa State University	1-Research Assistant 4- Undergraduates
Development of a Mix Formation and Pavement Design Using Asphalt-Rubber Binders	Williams, Chris	Institute for Transportation, Iowa State University	1-Research Assistant
Data Driven Urban Traffic Prediction for Winter Performance Measurements	Zhu, Zhengyuan	Statistics, Iowa State University	1- Statistics Masters
Economic Impact of Multi-Span, Pre-Stressed Concrete Girder Bridges Designed as Simple Span vs Continuous Span	Hosteng, Travis	Institute for Transportation, Iowa State University	1- Research Assistant

Subcontractors on Funded MTC Projects

Project Title	PI Name	Department	Students
HSSU Transportation Asset Management Research Project	Fara Zakery	Business Administration, Harris Stowe State University	
Asset Utilization and Management in the Airport Ground Transportation Industry	Ray Mundy	Center for Transportation Studies, University of Missouri-St. Louis	3- PhD Students 4- Masters Students
Mass Transit Sustainability in the Saint Louis Region	Ray Mundy	Center for Transportation Studies, University of Missouri-St. Louis	3- PhD Students 4- Masters Students
Trucking & Rail Intermodal Hub in the Saint Louis Region	Ray Mundy	Center for Transportation Studies, University of Missouri-St. Louis	3- PhD Students 4- Masters Students
Safety and Operations Data: Visualization and Communication	Ravi Nath	Business Intelligence & Analytics, Creighton University	1- MS Student
Pavement Performance: New Approaches using Data Analytics	Cindy Corritore	Business Intelligence & Analytics, Creighton University	1- MS Student
Bridges for Life	Nemmers, Charles	Civil & Environmental Engineering, University of Missouri	4-Graduate
The Technology Project	Nemmers, Charles	Civil & Environmental Engineering, University of Missouri	3-Graduate
A Decision Support System for DOT Fleet Operations	Nemmers, Charles	Civil & Environmental Engineering, University of Missouri	2-Graduate
Risk and Failure Resilience Quantification of Interdependent Transportation Systems	Pingfeng Wang	Industrial & Manufacturing Engineering, Wichita State University	1- Graduate Student
Data-Driven Health Management of Electrical Vehicle Battery Systems	Pingfeng Wang	Industrial & Manufacturing Engineering, Wichita State University	1- Graduate Student

Center Management

ISU and its partners have teleconference team meetings on the first Tuesday of every month. We are identifying commonalities among institutions and leveraging funding for similar activities. ISU has scheduled visits to the partners in the upcoming months.

The OST-R staff conducted a site visit to the MTC at Iowa State University on June 18, 2014 in Ames, Iowa. The Iowa State University MTC team and representatives from all partner institutions attended this meeting. Thematic areas for the MTC were discussed, and each partner described its research plans for the MTC. Future directions and strategic plans for the MTC were also discussed. Amy Stearns discussed the new reporting requirements for all UTCs, as well as reporting expectations for UTCs.

Progress of Research Projects

The majority of the research projects for Iowa State University started in June this year. There were few proof of concept projects that have been completed. The next report will have additional project summaries or various quarterly updates for projects.

The first project is an ISU project titled “Size Affects Safety Performance”, whose principal investigator (PI) is David Cantor from Supply Chain and Information Systems. This was funded as a “proof of concept” idea. A key result from the project is the development of a truck firm size database and model that will provide initial insights into motor carrier (truck) safety analysis. The PI developed a preliminary statistical model that provided insights into how carrier size affects safety performance. Project outcomes include a model that characterizes risk in the trucking industry. This research effort furthers our understanding of the current state of safety practices in the U.S. motor carrier industry. The results will be shared with the transportation community in future academic publications. Insights will also be disseminated in a supply chain doctoral course. The PI will present the study findings in his Fall 2014 doctoral seminar and in an MTC academic presentation. The PI is now collaborating with an ISU supply chain management doctoral student and with faculty from University of Maryland in an effort to produce an academic manuscript that will describe the results of the study. The initial target academic publication is the *Transportation Journal*.

The second project ISU project is “Utilizing 3D Visualization to Examine Characteristics of Roadway Infrastructure”, whose PI is Dr. Nir Keren from Agricultural and Biosystems Engineering. This project was also funded as a “proof of concept” idea. The overarching objective of the program is to examine the utility of modeling full-scale road infrastructure in order to maximize design opportunities. A simulation engine was adapted for the purposes of this program, and a two-way stop control (TWSC) intersection has been developed for deployment in the C6 virtual environment. Training may be deployed in the future with additional funding. Additionally, should the next phase be awarded we will promote utilizing the system in the Highway Design Course at Iowa State University. The final product will be a framework for deploying a dynamic full-scale modeling of road infrastructure. The Iowa DOT has provided expertise for this project. If additional phases are allowed for this project, deploying full-scale modeling of road infrastructure can be used in highway design (and maybe other) courses, where students can experience firsthand, in full-scale, and in real-time how their design decision impact the infrastructure.

The third project we will be highlighting is from University of Missouri-Columbia, titled “System-wide Safety Treatments and Design Guidance for J-Turns”, whose PI is Dr. Praveen Edara from the University of Missouri-Columbia. The goal for this project is to synthesize system-wide safety treatments that can be recommended for implementation in Missouri and to develop guidance on the design criteria for J-

turns. A review of literature on system-wide safety treatments is being conducted. A simulation model of a J-turn site in central Missouri is being developed and calibrated. Training can be provided on the design criteria for alternative J-turn designs. Guidance on system-wide treatments may also be disseminated via training events. The plan for this project is to continue reviewing literature and developing the simulation models. Analysis using simulation models may also be conducted. The Traffic Safety Division of the Missouri Department of Transportation has been working closely with the researchers. This project has a very high impact on traffic safety. Both system-wide safety treatments and alternative designs offer safety benefits by reducing the overall number of crashes and, more importantly, severe crashes.

The fourth project is titled “Trucking & Rail Intermodal Hub in the Saint Louis Region,” with Dr. Ray Mundy from the University of Missouri-St. Louis as the PI. This project seeks to examine the assets of stakeholders involved in the transportation and logistics industry in the St. Louis region and make a case for the viability of an intermodal hub in the region. The program has provided a few opportunities for training and development through the Center for Transportation Studies’ existing partnerships with local industry players. Guidance from professors has allowed for opportunities to interact with the Council of Supply Chain Management Professionals to get a deeper insight on the topic of the intermodal hub. Company partnerships with C.H. Robinson and Cass Information Systems will allow for the chance to examine trucking operating cost data more closely. At this time, initial geospatial results on transportation providers have been presented to faculty and economics students to get feedback and results. However, results have not been disseminated, and all research is pending revision. The majority of the project for the next reporting period will be dedicated to gathering and interpreting data. Once a report is written, it will be shared with local stakeholders, including shippers, rail companies, and local government officials. This project is aimed at contributing to transportation education through integrating methods of research from various fields of academia to support the underlying argument that there is a case for an intermodal hub in St. Louis. Using economic, public policy, and geospatial mapping mechanisms, this research project is anticipated to yield findings that can be utilized by regional planning agencies to start the dialogue between various stakeholders to better leverage the St. Louis region’s capacity to increase freight movement. This project has received support from the University of Missouri-St. Louis’ Center for Transportation Studies, Cass Information Systems, Ohio Rail Development Commission, International Port of Memphis, and Council of Supply Chain Management Professionals.

Plan for Next Reporting Period

The following activities are planned for the next reporting period:

- Continue to monitor progress of the research program
- Receive registrations for study abroad program for summer 2015
- Institute undergraduate research program
- Develop simulator scenarios with University of Iowa for K–12 outreach
- Report on field visits to all partners to coordinate future activities
- Produce additional content for *Go!* magazine
- Host a high school teacher who will be conducting research as part of an NSF research experience for teachers grant
- Continue planning for the Mid-Continent Transportation Research Symposium (August 2015)
- Attend coordination meeting with University of Minnesota to discuss collaborative activities
- Conduct open house for the 2015 study abroad program

- Conduct site visits
- Plan advisory panel meeting
- Develop slate of outreach and implementation activities
- Develop and finalize list of speakers for spring seminar

Contact has been made with all individuals on the MTC Advisory Panel, and arrangements will be made for council advisory board members to attend a meeting with MTC partner universities to discuss progress and opportunities.

We also plan to establish more educational, K–12, and outreach activities. Areas for collaboration are currently being investigated with internal and external university partners.

2. Products

Nothing to report.

3. Participants and Collaborating Organizations



The Midwest Transportation Center is composed of six universities. Iowa State University is the lead institution, and the Center is administered through ISU's Institute for Transportation. The key personnel include the following people from each institution:

- Iowa State University (lead university; Director, Shauna Hallmark)
- Iowa State University (lead university; Associate Director, Omar Smadi)
- Iowa State University (lead university; Associate Director, Chris Williams)
- Creighton University in Omaha, Nebraska (partner leader Ravi Nath)
- Harris-Stowe State University in St. Louis, Missouri (partner leader Fatemeh Zakery)
- University of Missouri, Columbia in Columbia, Missouri (partner leader Charles Nemmers)
- University of Missouri, St. Louis in St. Louis, Missouri (partner leader Ray Mundy)
- Wichita State University in Wichita, Kansas (partner leader Pingfeng Wang)

Seward County Community College (partner leader Janese Thatcher) in Liberal, Kansas, is also a collaborator.

Iowa State University and the other partner and collaborative universities have set up a monthly teleconference meeting on the first Tuesday of every month. We have a standardized agenda, which includes the following:

- Review of Previous Action Items
- Research Updates
- Advisory Council Updates
- Reports from Partnering Institutions
- Administrative Report
- New Business
- New Action Items

We also have a SharePoint site set up for our MTC partners and collaborator to easily share files with the different institutions.

We held a research focus group meeting on September 18, 2014 in Blue Springs, Missouri. We had 26 people present for this meeting, and we had representation from all our partners and research personnel from regional state DOTs including Iowa, Missouri, and Kansas, FHWA representation and an MPO representative from Kansas City. The goal of this meeting was to determine what research topics are important for sponsors such as the area state DOTs.

The large group broke into two smaller groups, a safety and geometric design group and an asset management group. Six research ideas were developed for the safety and geometric design issues group:

- 1) Changing Safety Culture: Increasing Seat Belt and Motorcycle Helmet Use in the Midwest
- 2) Non--traditional Vehicles and Alternative Intersection Designs: Evaluation of Safety and Access in J--turns/RCUTs and Roundabouts
- 3) Safety and Operational Effects of a Diverging Diamond Interchange in an Arterial Corridor
- 4) Crash Modification Factors for the Midwest
- 5) Safe Evacuation and Emergency Response for Major Planned and Unexpected Events
- 6) Social, Economic, and Public Health Impacts of Safety Improvements

The asset management group had three key areas: macro, micro, and integration, and the following research ideas were developed from these key areas:

Macro:

- Data Side:
 - Standardization tenets of a good system
- Decision Side:
 - Visualization to Communication
 - Decision science to document
 - Computational Tool (Risk Based)
 - Risk, Economic Analysis
 - Sustainability – economic

Micro:

- Other assets (Sidewalks)
- Geotech (walls, slopes)

Integration:

- Performance management across asset classes
 - NCHRP draft report
 - Non-technical
 - Technical (Micro feeds into this)

The goal is to pursue some research projects in these areas of interest from this collaborative meeting. Researchers and center directors will work together to achieve these research goals.



Iowa State University has established a collaborative program between the MTC and the Center for Biorenewable Chemicals (CBiRC). The program is titled “Research Experiences for Teachers” (RET) and is funded by the National Science Foundation (NSF). This Iowa State University program has been designed to inspire teachers through actively participating in scientific research. Each participating teacher is partnered with an ISU faculty mentor whom they will conduct research with over a six-week period. Following the project description and statement regarding the global and/or societal context of the project given by faculty, the teacher must first reflect on the problem to be researched using his or her current knowledge base. At the completion of their six weeks of research, the teachers then develop an oral presentation of their research activities and share their experiences. In the summer of 2014, 30 teachers participated in the program, which in turn will impact the education of thousands of students this fall. Objectives for this program are as follows:

- Provide high school teachers with first-hand experience in methods and analysis of research
- Develop teaching techniques and create classroom materials based on the teachers’ research experience
- Introduce teachers to the value of scientific inquiry in the context of high school STEM curricula
- Provide teachers with tools, experiences, and ongoing relationships with career scientists and fellow teachers to enable them to share scientific developments in STEM fields and inspire students to follow scientific career paths

4. Impact

Iowa State University and its partners have engaged in the educational and outreach activities summarized below. The subcontractors have engaged in outreach/educational activities as well.

Outreach Activities

Summary of Education and Outreach Activities

Date	Event	Topic	Impact
4/4/2014	Tom Maze Transportation Seminar	Traffic Safety Culture	65 participants
4/11/2014	Tom Maze Transportation Seminar	Highway Traffic Safety	85 participants
4/12/2014	College of Engineering Day for Kids	Concepts and Careers in Engineering	83 participants
4/17/2014	Taking the Road Less Traveled Conference	Alternative Fuels in Transportation	7 participants*
4/17/2014	Taking the Road Less Traveled Conference	Civil/Structural Engineering	24 participants*
4/18/2014	Tom Maze Transportation Seminar	Human Factors Challenge in Transportation Safety	60 participants
5/2/2014	Tom Maze Transportation Seminar	Toll Roads	50 participants
5/23/2014- 5/24/2014	National Student Steel Bridge Competition	Steel Bridge Construction	12 participants
6/2014- 7/2014	Research Experiences for High School Teachers (RET)	Research Involvement and Classroom Applications	31 participants*
7/7/2014	Research Experiences for High School Teachers (RET)	Research Perspectives	31 participants*

*Participating teachers anticipated applications in their own classroom activities

Tom Maze Transportation Seminars

The Tom Maze Transportation Seminars are presented at the Institute for Transportation weekly during Iowa State University's spring semester and feature nationally and internationally recognized speakers. The seminar has become an important feature of graduate transportation education at ISU, and it is broadcast real-time to students at the University of Northern Iowa, the University of Missouri in St. Louis and Columbia, and other sites via the Iowa Communications Network (ICN). The ICN allows viewers at remote sites to actively participate in the seminar, and each presentation is compiled as part of the MTC website so it can be further utilized as a resource for transportation students.

Date: April 4, 2014

Location: Online broadcast hosted through Iowa State University in Ames, Iowa

Speaker: Nic Ward, Montana State University (WTI)

Topic: Traffic Safety Culture

Participants: Ames, Iowa; Columbia, Missouri; St. Louis, Missouri; Others

Impact: 65 participants

Mr. Ward emphasized during this session that we can't only focus on design safety, but we must also focus on the diversity of the safety area itself. He then discussed the 15 leading causes of death and disease (DALYs) worldwide. It showed that road traffic injuries are projected to rise to third position from ninth position examining trends from 1990 to 2020. Then he continued the discussion with background on the Traffic Safety Model, which includes the physical environment, system hazards,

social environment, local culture, and behavior hazards. All of these elements are factors that influence traffic crash risk under various conditions, such as topography, climate, and population density. For example, rural cultures are significantly different from urban cultures. The three primary risk factors discussed fall under three areas: the road environment, road user, and vehicle.

Date: April 11, 2014

Location: Online broadcast hosted through Iowa State University in Ames, Iowa

Speaker: Tony Furst, Federal Highway Administration

Topic: Highway Traffic Safety

Participants: Ames, Iowa; Columbia, Missouri; St. Louis, Missouri; Others

Impact: 85 participants

The approach in traffic safety is driven by the data collected. It is then analyzed, and stakeholders are able to give input in order to help make safety decisions, implement improvements, and then evaluate benefits/effectiveness. There are five different safety analysis tools, the Highway Safety Manual, Systemic Approach to Safety Tool, IHSDM, SafetyAnalyst, and Crash Modification Factor (CMF) Clearinghouse. All of the data is used to coordinate transportation planning.

Mr. Furst noted that the CMF Clearinghouse has proven safety countermeasures. He noted two specific safety initiatives from Every Day Counts (EDC2): high-friction surface treatments (HFST) and intersection and interchange. EDC2 was launched in 2010 to encourage rapid deployment of existing, proven technologies to shorten project deliver, enhance highway safety, protect the environment, and reduce congestion. The HFST are resin-based pavement surfacing overlay systems. They help prevent skidding and help the road retain a higher friction property for longer periods of time.

SHRP2 safety program is intended to make a revolutionary improvement in the highway system, saving thousands of lives. The study design is to link two databases providing unprecedented detail on driver behavior and driver interaction with roadway features. The naturalistic driving study recorded every trip by volunteer drivers over 12–24 months and included 2,800 drivers, male and females of all ages, and 1,900 vehicles on the road at any time. The roadway data overview focused on data needed for lane departures and intersections. The FHWA safety training and analysis center uses SHRP2 safety data to enable and accelerate research in the community. SHRP2 will aid in the ideas and training ground for practitioners and researchers to help increase the demand for services from the broader research. With these studies and programs the FHWA is improving the roads we drive on every day.

Date: April 18, 2014

Location: Online broadcast hosted through Iowa State University in Ames, Iowa

Speaker: David Noyce, University of Wisconsin-Madison

Topic: Human Factors Challenge in Transportation Safety

Participants: Ames, Iowa; Columbia, Missouri; St. Louis, Missouri; Others

Impact: 60 participants

Dr. Noyce noted that transportation systems, for decades, have been designed and operated without careful consideration of the human user. This presentation covered a wide range of behavioral and physiological variables that affect how drivers accomplish driving-related tasks in the context of driver-vehicle system operation. It also highlighted some of the human factors challenges in transportation safety. A huge component of the challenge is in the area of effectively communicating transportation engineering design. In addition to ineffective communication is the inability to meaningfully anticipate

the human users' response to new design concepts. In any case, the study of human factors in transportation requires an ever-evolving mindset to keep up with the changes in the world of transportation as well as in the way the human user interacts with transportation systems.

Date: May 2, 2014

Location: Online broadcast hosted through Iowa State University in Ames, Iowa

Speaker: Carols Sun, University of Missouri-Columbia

Topic: Toll Roads

Participants: Ames, Iowa; Columbia, Missouri; St. Louis, Missouri; Others

Impact: 50 participants

Dr. Sun presented on several aspects of toll roads. The presentation discussed funding in transportation and how toll roads have had an extensive role in financing roads, highlighting the crisis behind transportation financing due to the increase in transportation demand. Sun showed a graph that depicted a rapidly increasing VMT, indicating the demand for more and more transportation facilities that in turn demand more financing. He also discussed the construction cost index, showing its rapid increase. But, as he mentioned, the transportation financing levels are not quite high enough to address this demand, noting that the federal gas tax has remained unchanged since 1993. With the cost of everything else increasing, this all adds up to a crisis for transportation financing. Dr. Sun then reviewed the history of toll roads, noting that there were toll roads in the nineteenth century in the northeast US, as well as in Missouri, Illinois, Iowa, etc. Even then, the toll roads made a tremendous economic impact on the local towns. He mentioned the very influential BPR publication about toll roads and free roads that was commissioned by congress in 1938, which was influential to the gas tax and Federal-Aid Highway Act of 1956. He also discussed topics addressed in the BPR report about financing roads. He then talked about the benefits of tolling, which he feels has the potential to have considerable impact on transportation funding, e.g., congestion pricing.

Other Outreach Activities

Engineering Day for Kids

Date: April 12, 2014

Location: University of Missouri, Columbia, Missouri

Topic: Concepts and careers in engineering

Participants: 3rd–5th grade students

Impact: 83 participants

Engineering Days for Kids is an opportunity for 3rd, 4th, and 5th grade students to learn about civil engineering through hands-on activities. During the event, students learned about the following:

- The different types of engineering
- What engineers do
- What college is like for an engineering student
- Mizzou Engineering's student competition teams

Taking the Road Less Traveled Career Conference

Date: April 17, 2014

Location: ISU Memorial Union, Ames, Iowa

Speakers: Dr. Jing Dong-ISU; Catalina Parada, Mary Gomez, and Dina Caicedo, ISU undergrad students

Theme: Alternative Fuels Used in Transportation

Participants: Middle school students and educators

Impact: 5 female students and 2 teachers directly; the teachers anticipated applying activities into their classroom curriculum

The Taking the Road Less Traveled (TRLT) Career Conference for Girls introduces students to STEM fields and encourages them to pursue STEM-related programs at a university. Over the last four years, 10% of all Iowa female undergraduate students currently attending Iowa State University participated in a TRLT conference. Of these 47% selected a STEM major as compared to 41% of non-attendees. Out of all attendees, 95% reported that the conference was helpful in expanding their ideas about career possibilities. Additionally, 89% of the middle school participants and 93% of the high school participants indicated they were considering a career in STEM after the conference. In both populations, these percentages were higher than their “before the conference” intentions.

The conference session was conducted in the Memorial Union at Iowa State University on April 17th, 2014. In the session, students learned about new vehicle technologies, assembled fuel cell car kits, and calculated the economic benefits of the alternative fuel vehicles compared to conventional gasoline vehicles. In particular, the following activities were conducted during the one-hour session:

- Dr. Dong explained alternative fuel vehicle technologies and gave examples on vehicle models that are currently on the market, available soon, or being tested. The alternative transportation fuels discussed included gasoline, natural gas, ethanol, solar cells, fuel cells and electricity. The presentation and discussion with the participants lasted for about 10 minutes.
- Catalina explained the first hands-on activity—comparing economically different technologies used to power cars, that is, gasoline, natural gas, electricity, plug-in hybrid (i.e., gasoline and electricity) and fuel cells. This activity consisted of a worksheet that contained the costs of the car, the tax incentives, the fuel efficiency, and fuel price for each car that uses a different technology. The miles travelled on average by a regular driver were given as well. The participants were asked to compare the total cost for purchasing and operating each car and identify which technology would be the most cost efficient for a period of five and of ten years.



Taking the Road Less Traveled Career Conference

Date: April 17, 2014

Location: ISU Memorial Union, Ames, Iowa

Speakers: Travis Hosteng-ISU

Theme: Civil/Structural Engineering

Participants: Middle school students and educators

Impact: 24 female students and 1 teacher directly; the teacher anticipated utilizing some concepts into the classroom curriculum

Part I – Introduction to structural engineering and bridge design concepts

- This was an interactive, critical thinking–based presentation focused on engaging the students to think about the fundamentals of civil/structural engineering, why it is important, and how it is applied to bridges.

Part II – Structural engineering/material mechanics demonstration of building a scale using only a strain transducer

- Several material specimens were instrumented with strain transducers by volunteers from the class, and then data was collected as various items were placed on the specimen (a) to determine how and why the specimen behaves the way it does based on the previous discussion and (b) to calculate how much the items weigh using what has been learned.

23rd Annual National Student Steel Bridge Competition

Date: May 23 & 24, 2014

Location: University of Akron

Topic: Steel Bridge Competition

Participants: 47 Teams from the United States, Canada, and Mexico

Impact: 12 participants

The University of Missouri Steel Bridge Team received support from the MTC to help fund supplies for their competition. This prestigious competition offers future structural engineers, freshmen–senior students, the opportunity to display their skills in steel design, steel fabrication, teamwork, and other engineering and leadership opportunities.

Research Experiences for High School Teachers (RET)

Date: June 2014 through July 2014

Location: InTrans, Ames, Iowa

Mentors: Dr. Shauna Hallmark-ISU, Skylar Knickerbocker-ISU

Topic: Research Involvement and Classroom Applications

Participants: Joseph Huebbe, Middle and High School Teacher with Johnston Community School District

Impact: 1 teacher directly, 100+ students reached annually

During the summer of 2014, 31 teachers participated in the RET program funded by the NSF through the ISU Center for Biorenewable Chemicals (CBiRC). Impacts on the education of thousands of students were anticipated for the coming fall. Objectives for this annual program are as follows:

- Provide high school teachers with first-hand experience in methods and analysis of research
- Develop teaching techniques and create classroom materials based on the teachers' research experience
- Introduce teachers to the value of scientific inquiry in the context of high school STEM curricula
- Provide teachers with tools, experiences, and ongoing relationships with career scientists and fellow teachers to enable them to share scientific developments in STEM fields and inspire students to follow scientific career paths



MTC researchers agreed to participate by mentoring a middle and high school teacher from Johnston, Iowa. Joe Huebbe was involved in multiple projects at the Institute for Transportation (InTrans). He started by learning about an intersection collision warning system (ICWS) that InTrans has been studying in cooperation with the Minnesota Department of Transportation. This process included understanding how the system works. The system warns traffic on a major roadway when a vehicle is present on a side road that may be entering the roadway. The system also helps the stopped vehicle on the side ride by warning if traffic is approaching on the major roadway. For this project, Joe looked at locations where this system is in place, as well as future locations that may provide good opportunities to study how drivers interact with the system. A video recording system will be used to observe driver actions, and Joe learned how to set up the mobile cameras and was responsible for assembling some of the cameras that will be used.

Another study involving the mobile cameras required looking at multiple road work locations utilizing a lane closure. Joe assisted in going to these sites and documenting the viability of placing the camera to watch vehicles. A key element of the program was for Joe to determine how to utilize the research processes he had been involved in to develop classroom applications. His final product was a case study to use in his classroom to teach problem solving and critical thinking skills to his students.

Research Experiences for High School Teachers (RET)

Date: July 7, 2014

Location: Coover Hall, Ames, Iowa

Mentors: Dr. Shauna Hallmark-ISU

Topic: Research Perspectives

Participants: Middle school and high school teachers from Iowa, California, and Pennsylvania

Impact: 31 teachers directly

As the summer RET program progressed, research mentors shared their experiences during sessions that included all participating teachers. Dr. Shauna Hallmark discussed her personal story and thoughts about STEM education. She also discussed her chosen path and research topic areas. Many of the participants had not considered presenting transportation career options to their students before her presentation. The teachers enjoyed it very much and learned a great deal.



MTC Website

Iowa State University has also developed a website for the MTC, and as research projects progress new information will be compiled for access online. The goal of this website is to share research results, publications, outreach opportunities, and other resources with students, faculty, and transportation professionals.

5. Changes/Problems

Nothing to report.

6. Special Reporting Requirements

Nothing to report.