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MID-AMERICA
TRANSPORTATION CENTER

Volume 4 Issue 1

IMPROVING SAFETY AND MINIMIZING RISK ASSOCIATED WITH INCREASING MULTI-MODAL FREIGHT MOVEMENTS

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Missouri S&T University of Science & Technology

The University of Iowa

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Student Spotlights

MID-AMERICA TRANSPORTATION CENTER

MATC Student of the Year: Cody Stolle

MATC is pleased to announce that Cody Stolle has been named the 2010 PhD student of the year. A student at the University of Nebraska–Lincoln, Cody Stolle is a graduate research assistant at the Midwest Roadside Safety Facility. During his time at MwRSF, he has taken on major roles in research projects funded by the National Cooperative Highway Research Program (NCHRP), state departments of transportation, and several private companies. Findings from these research studies are already being implemented by several state DOTs. Stolle has authored more than ten research reports, two refereed journal articles and four conference papers. He is also a member of the Society of Automotive Engineers.

Currently, he is conducting research for his dissertation on the modeling and optimization of cable attachment hardware for cable median barriers, as well as safety improvements for cable

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Student Spotlight: Cheryl Bornheimer

KU The University of Kansas

Cheryl Bornheimer is a master's student with a transportation emphasis at the University of Kansas. Bornheimer is working on calibration of the Interactive Highway Safety Design Model for the State of Kansas as part of her graduate research assistantship. For this project, she has performed speed studies and sorted and analyzed data. As an undergraduate research assistant,

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Celebration of Past, Present and Future at Whittier Research Center Dedication and Open House

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University Student Spotlights

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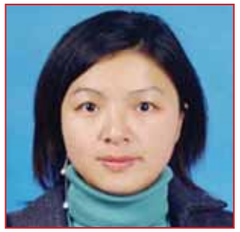
MATC Student of the Year: Cody Stolle

median barriers designed to reduce the number of critical injuries and fatalities resulting from cable median barrier impacts. Mr. Stolle will graduate with a PhD in the spring of 2012, and intends to pursue a university faculty position with an emphasis in transportation safety research.

Dr. Dean Sicking, who has worked with Stolle since his undergraduate career, expresses great admiration for Stolle as a student, researcher, leader, writer and colleague. Dr. Sicking stated: "His inquisitive mind spurs discussions that enhance the learning environment for all students. In fact, his questions have often forced me to look at traditional problems from an entirely new perspective."

Ying Huang: Missouri University of Science and Technology Student Spotlight



Ying Huang is pursuing a PhD in structural engineering with an emphasis in monitoring at Missouri University of Science and Technology. Huang is a highly accomplished researcher, with two articles published in peer-reviewed journals, a number of conference papers and two patents. Much of her work focuses on sensors and monitoring devices to improve the safety of transportation structures. She is currently at work on three major research endeavors, including a MATC-funded pilot study of rugged fiber optic brillouin sensors for large-strain measurements. For this project, Huang is investigating the ruggedness characterization of various coated optical fibers for implementation in sensors.

Huang is also participating in another MATC project, an initial study and verification of a distributed fiber optic corrosion monitoring system for transportation structures. She is working on the development of an iron-epoxy coated corrosion sensor and testing the sensor system on steel rebar and reinforced concrete structures. Huang's colleagues and advisors describe her as a passionate and dedicated researcher who has made essential contributions to successful projects, while always taking the time to assist others.

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Cheryl Bornheimer: University of Kansas Student Spotlight

she worked on a project that addressed mitigation of wind-induced truck crashes.

Currently, Bornheimer serves as the president of KU's student chapter of the Institute of Transportation Engineers and was treasurer for the group in the past. Under her leadership, the ITE Student Chapter is thriving and was selected as the outstanding student chapter in the Missouri Valley Section of ITE.

Bornheimer has also worked as a teaching assistant at KU and as a logistics intern at Black and Veatch, a leading global engineering and consulting firm.

Brandon Bortz: Kansas State University Student Spotlight

Brandon Bortz is pursuing his PhD in civil engineering at Kansas State University. As a graduate research assistant in Kansas State University's Asphalt and Civil Infrastructure Systems laboratories, he functions as an important leader, with responsibilities ranging from managing and performing asphalt and base testing to mentoring undergraduate research assistants. Currently, his primary focus is on a project involving accelerated pavement testing which is being sponsored by multiple states. He has played a role in many aspects of the research process, including test section construction, performance monitoring, data collection and data analysis. This innovative research involves the use of geocells as a reinforced base for low-volume paved roads. Geocellular refinement systems or geocells are three-dimensional honeycomb-shaped structures that vastly improve the strength of in-fill materials.

In addition, Bortz has planned and taught several civil engineering courses for both undergraduate and graduate students, including Civil Engineering Materials I and Pavement Design for Highway Engineering, Planning and Management. Bortz's advisor, Dr. Mustaque Hossain, sees him as a "dedicated researcher and instructor."

Letter from the Director

Dr. Laurence Rilett

Welcome to the first MATC newsletter of 2011. I would like to take this opportunity to discuss the most important resource of MATC—our students. Back in 2006 when the various consortium partners met to plan our program, we decided first and foremost that our program should have a positive impact on our students. As you will see in the accompanying articles, this commitment to our students has yielded wonderful results across all our consortium partners.

In this issue we have highlighted a number of our outstanding students, including Cody Stolle and Ben Grone from UNL, Cheryl Bornheimer from KU, Ying Huang from MS&T and Brandon Bortz from KSU. I should also add that Cody is the MATC Student of the Year and did an excellent job representing MATC at the Council of University Transportation Centers award dinner at TRB this past January.

One of the most visible aspects of this commitment was the choice to include at least one graduate research assistant on every sponsored research project. This has allowed our research projects to have a significant education component. The skills our students learn while conducting research is invaluable to their creative and intellectual development. These students are the future transportation professionals who will occupy permanent positions of influence in our region as well as the nation. To date we have had 133 graduate students on 62 projects at five consortium partners.

In addition, internship opportunities for our undergraduate students continue to be expanded at MATC's consortium schools. Currently, the MATC intern program is functioning in all four states of Region 7. Sponsor agencies include: the Kansas Department of Transportation, Missouri Department of Transportation, Nebraska Department of Roads, City of Lincoln Public Works and Utilities, Johnson County (Kansas) Public Works, Metro Area Planning Agency, Fellsburg Holt and Ullevig, Lamp Rynearson, George Butler and Associates, Iteris, Kaw Valley Engineering, and BG Consultants. Please feel free to contact us if your organization is interested in participating in this program.

Another initiative that I am particularly proud of is our MATC scholars program that was piloted at UNL in 2010 and is highlighted in this issue. Sixteen students and five faculty from HBCU's came to UNL to participate in a workshop which focused on teaching the students the "ins and outs" of graduate school. Our faculty mentors covered everything from the application process to lessons learned from students of underrepresented groups who have successfully navigated graduate school. I am particularly appreciative of Professor Judy Perkins from Prairie View A&M University who was a co-PI on this project.

It was also decided early on that we would leverage the resources of our partner institutions to broaden and improve the course offerings at each of our campuses. One outcome of this policy is that MATC will sponsor a distance-based graduate railway engineering course that will be offered at our partner schools. The instructors, who will teach in teams, will be Dr. Elizabeth Jones from the University of Nebraska-Lincoln, Dr. Tom Mulinazzi from the University of Kansas, and Dr. Gene R. Russell Sr. from Kansas State University. The students will benefit by having focused lectures on the various railway topics taught by distinguished researchers who are experts in the field. This type of multi-university collaboration, while involving considerable coordination and dedication, ultimately will benefit all our students by bringing together motivated students and teams of experts, thereby enriching the educational experience. This initiative will be highlighted in a future newsletter.

Another element of MATC's strategic plan was the development of a K-12 teachers' program that will promote transportation engineering education, and will specifically involve students from underrepresented groups. As such, UNL has expanded its summer institute for teachers, held annually since 2006. To date, over 65 middle and high school teachers have come to campus to work with our researchers to develop web-based resources that complement their curriculum. The teachers use these resources with their students as well as utilizing the teaching modules developed by other teachers. Based on student and teacher feedback, the modules are updated and ultimately are published on the MATC website to be used freely by any teacher. We are looking forward to the 6th anniversary of MATC's summer institute this year.

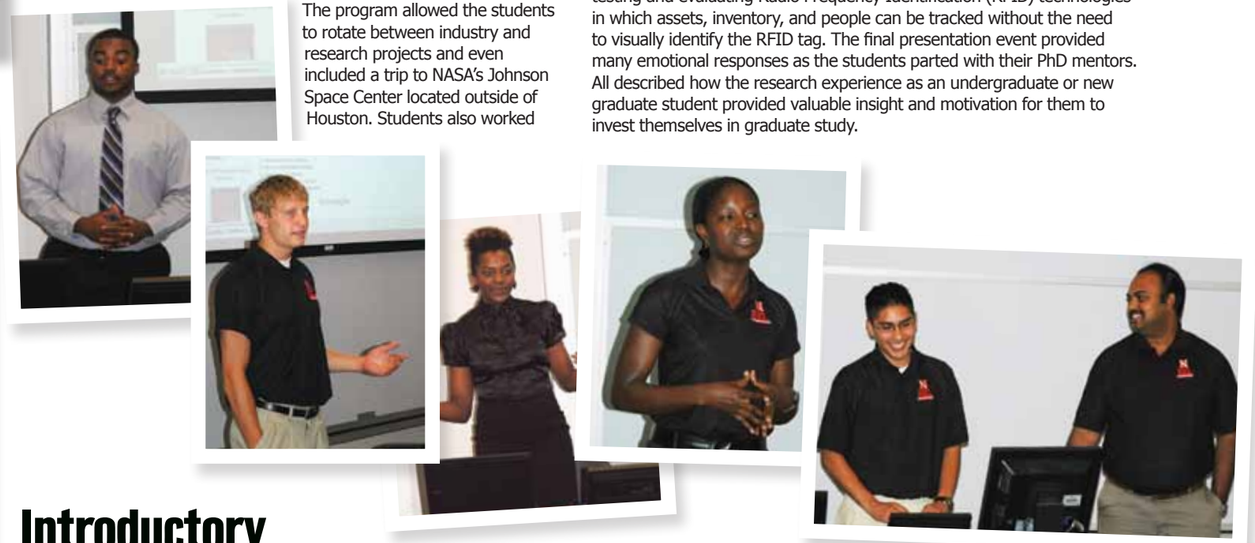
In summary, I am constantly impressed by the excellence of the students in our program, and proud that we continue to develop and deliver a meaningful and impactful educational program. I anticipate that our program will continue this momentum and I am looking forward to the next few years to see what new and innovative directions our MATC educators will take.

Sincerely,
Larry

RfSCL Lab Interns Sum Up a Great Summer

The RFID Supply Chain Lab (RfSCL), led by Dr. Erick Jones, served as a place of opportunity for undergraduate students in engineering to gain research experience over the summer. Funded by the Mid-America Transportation Center and NASA Nebraska EPSCoR, the research internships provided training for students of diverse populations and backgrounds. Undergraduate and first year graduate students teamed up with PhD student mentors to learn research activities, which provided valuable experience for the students. The diverse group of students came from Prairie View A&M, a Historically Black College and University (HBCU), located outside of Houston. A myriad of students from Nebraska Engineering also participated.

The program allowed the students to rotate between industry and research projects and even included a trip to NASA's Johnson Space Center located outside of Houston. Students also worked with Werner Trucking, Lancaster County Senior Living facilities, the John Baush Group, the University of Nebraska Computer Store and other groups to perform research activities. The research focused mainly on testing and evaluating Radio Frequency Identification (RFID) technologies in which assets, inventory, and people can be tracked without the need to visually identify the RFID tag. The final presentation event provided many emotional responses as the students parted with their PhD mentors. All described how the research experience as an undergraduate or new graduate student provided valuable insight and motivation for them to invest themselves in graduate study.



Introductory Transportation Course Now Requisite for Civil Engineering Students at KU

More engineering students at the University of Kansas now have an opportunity to learn about transportation engineering. Dr. Steven Schrock and Dr. Tom Mulinazzi planned and successfully launched a new required transportation course, CE 480 Introduction to Transportation, for the fall 2010 semester. The junior-level course offers an overview of the various modes of transportation, emphasizing highways, railroads and air transport. Students study the planning, design and operations of the various modes and complete a multimodal project as a culmination of their learning.

Dr. Mulinazzi credits the increased visibility of transportation engineering opportunities through MATC for the department's decision to integrate the new course into the curriculum. Particularly since it is offered at a key point, when students are narrowing down career options, this course will facilitate the recruitment of more students into the transportation field.

KU Student Chapter of ITE (Institute of Transportation Engineers) Named Best in Region

The student chapter of ITE at the University of Kansas has been selected as the outstanding student chapter in the Missouri Valley Section of ITE. In the past three years, this marks the second time that the chapter has received this honor. Dr. Steven Schrock is the faculty advisor and MS student Cheryl Bornheimer serves as the president.

Through their leadership, the chapter has been averaging 30 students at their meetings. Recently, Bornheimer brought Deb Miller, the secretary of transportation for the Kansas Department of Transportation, to be a guest speaker at the chapter's November meeting. MATC salutes the chapter's commitment to professional development of the region's future transportation engineers.

MATC Scholars Program Provides Tools for Success in Graduate Study

Students and faculty from Historically Black Colleges and Universities (HBCUs) and other institutions across the country came to the University of Nebraska–Lincoln campus for MATC's first Scholars Program Graduate Conference on September 23rd and 24th. Organized by Dr. Erick Jones, associate professor of Industrial and Mechanical Systems at UNL and Dr. Judy Perkins, professor of civil engineering at Prairie View A&M University, this diversity initiative seeks to prepare students from groups that are under-represented in the STEM fields for graduate study at research-intensive universities.

The group was welcomed by Dr. Ray Moore, associate dean of engineering at UNL, and Dr. Larry Rilett, director of the Mid-America Transportation Center. Dr. Moore spoke with anticipation about what the transition to the Big Ten means for research and education potential at UNL. Dr. Rilett gave an introduction to MATC and the Nebraska Transportation Center that emphasized the interdisciplinary nature of the research conducted at this facility and the importance of student contributions to such projects.

During the two-day program, students had an opportunity for networking with one another and with faculty, while also learning skills from targeted seminars given by experienced faculty members and educational administrators. Dr. Jones explained that "the MATC Scholars Program is distinct because it was developed by faculty who know the challenges underrepresented students face in making the transition to graduate school." The process of choosing, applying for, and entering graduate school can be overwhelming for any student, but the Scholars Program faculty also personally addressed the unique challenges that may face under-represented students in particular.

One of the highlights of the program was a panel of current graduate students in engineering and sciences at UNL who shared their experiences preparing for and adjusting to graduate school. Conference attendees listened attentively as panelist Maurice Cavitt, a PhD student in industrial engineering, spoke about the importance of developing strong support systems as a graduate student and taking advantage of the resources available. Sarah Asio, a master's student in industrial engineering, spoke about how she dealt with the challenges of moving to a new place with a different culture, far from family and friends. With no faculty present at this session, students had an opportunity to ask questions in a relaxed environment.

During the tour of the newly remodeled Whittier Research Center, students and faculty members alike were wowed by a presentation from Dr. Dean Sicking. Through video footage of crash testing, he demonstrated how the research conducted at the Midwest Roadside Safety Facility saves lives, and he explained the important roles that graduate students have in this work. Dr. Erick Jones offered students an introduction to the Radio-Frequency Identification (RFID) and Supply Chain Laboratory, where students conduct research on ways to use RFID technology to optimize logistics.

Students left the conference with a renewed sense of confidence in knowing that they have the skills and support needed as they choose, apply for, and transition into graduate school. To encourage students to stay in contact with one another, a MATC Scholars Program Facebook page was created.

MATC is committed to mobilizing talented students from all populations in order to strengthen the next generation of traffic engineering professionals.

MATC SEMINAR SERIES

MID-AMERICA TRANSPORTATION CENTER

MATC Seminar Series Offers Graduate Students a Variety of Perspectives

During the fall semester, Dr. Anuj Sharma, assistant professor of civil engineering at the University of Nebraska–Lincoln, facilitated the MATC Seminar Series as a one-credit course featuring guest speakers from industry and academia. Talks were open to all interested students and faculty, and were broadcast to students at UNL's Omaha campus via teleconference.

The seminars offered students a look at the diverse nature of the careers available to transportation engineering students and the current issues facing transportation professionals. Students also attended off-campus presentations and demonstrations to get a look at industry leaders in action. These activities offered students a context for their studies that may not be found in the classroom.

MATC Seminar Event: LOCATE Traffic Forum

MATC Seminar students crossed the Platte River for the 2010 Omaha-Council Bluffs Traffic Forum on October 15th at the Scott Conference Center in Omaha. Students joined 135 professionals from around the region for a day packed with speakers on key transportation issues. Among the diverse group were representatives from not only the transportation industry, but also fire, rescue, law enforcement, emergency management, transit, and towing and recovery.

Omaha Mayor Jim Suttle gave the opening remarks and shared information about several high-tech transportation projects planned for the area. Rita Brohman of Iteris discussed the development of a regional multi-disciplinary traffic incident management team in southwest Nevada, which could serve as a model for coordinated local TIM efforts.

Further local perspectives came from Joshua Meyer of the City of Lincoln, who gave an update on Lincoln's Intelligent Transportation Systems, and Mike Piernicky of Olsson Associates, who discussed the use of ITS for parking at Omaha's Qwest Center. Other presenters included Kyle Kovar of 3M, Barb Bennet of NDOR, Rusty James of Kansas City Scout, Ray Webb of the Mid-America Regional Council, and Mike Haas of Open Roads Consulting.

Benjamin Grone, a master's student with an emphasis in transportation engineering, noted: "It was interesting to hear so many perspectives on traffic incident management and how various metropolitan areas around the country are working to reduce the time required to reopen lanes after a crash. These concepts became most tangible through a presentation by Mike Jackson of the Iowa DOT on the latest TIM plan for the Omaha - Council Bluffs area." The forum provided an important opportunity for students to learn about the most important current transportation issues for regional professionals and see how practical solutions are being implemented through innovation and cooperation.

Sponsors for the day's event were the Nebraska Department of Roads, the Iowa Department of Transportation, Metro Area Planning Agency, Iteris, Delcan, Kirkham Michael, HDR, AAA Nebraska, Nebraska Trucking Association, TransCore, 3M and Olsson Associates, Kansas City Scout, Mid America Council, Benesch, and Open Roads.

MATC Seminar Series: Fall 2010 Speakers and Events

Dr. Virginia Baldwin, Head of the Engineering Library, UNL
Dr. Eric Thompson, Director, Bureau of Business Research, UNL
Jim Knott, Design Engineer, Nebraska Department of Roads
Diego Franca, Transportation Analyst, Kittelson and Associates
Monty Fredrickson, Director, Nebraska Department of Roads
Anna Lannin Division Manager of Planning and Programming, Nebraska Department of Aeronautics
Olsson Associates: ITS Demo
Lincoln, Omaha, Council Bluffs Association of Transportation Engineers (LOCate): Traffic Forum

MATC Fall Seminar Speaker Series: Monty Fredrickson, Director of Nebraska Department of Roads

MATC was honored to have the director of the Nebraska Department of Roads, Monty Fredrickson, as a speaker for the seminar series on October 29th. In the first part of his presentation, Mr. Fredrickson offered a look at NDOR's recent projects across the state. Eleven projects were examined from the westernmost part of the state to the bridge entrance into Omaha on the eastern edge of Nebraska. By way of introducing the NDOR organization, Mr. Fredrickson showed a video that examined the four key components of the organization's goals: Planning, Design, Construction, and Maintenance. Mr. Fredrickson's presentation also described NDOR's responsibilities to the public: managing upwards of 2,100 employees, handling more than 10,000 miles of Nebraska roads, and their work with the Nebraska State Highway Commission as public liaisons.

Of interest to many students in the audience was Mr. Frederickson's description of working as an engineer for NDOR. He explained how engineers employ different skills in design and field work. Mr. Fredrickson urged the students to take advantage of both work study and internship programs with MATC and NDOR organizations. Moreover, communication skills are key to a successful career, according to Mr. Frederickson. He explained that persuading, negotiating, and communicating effectively is crucial for engineers as they plan and execute public projects. Issues relative to funding raised many questions from the students in attendance. Mr. Fredrickson explained various methods for obtaining an increase in funding for roads and discussed the challenges for future transportation engineers.

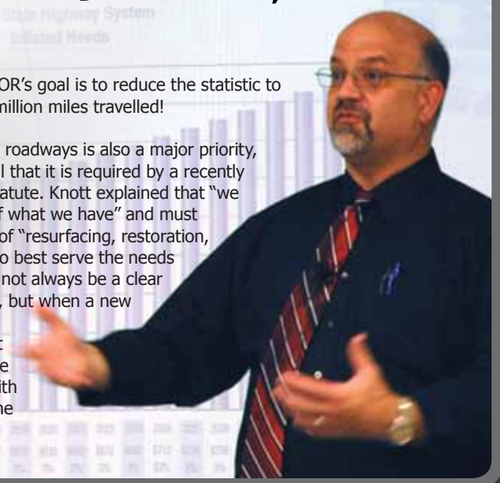
Mr. Fredrickson's presentation provided both an enlightening overview of NDOR from within and an in-depth look at some of the most important issues currently facing the organization, while also giving students an essential perspective on career opportunities at the organization.

MATC Fall Seminar Speaker Series: Jim Knott, NDOR Design Engineer

Jim Knott, a design engineer at the Nebraska Department of Roads, was the featured speaker on October 1st. Knott discussed the challenges faced by NDOR as their engineers strive to choose the right projects as revenues are declining but costs are escalating.

NDOR confronts these challenges by prioritizing decisions based on a clearly outlined mission with stated values, goals, and performance measures. Based on NDOR's mission to provide and maintain safe roadways, when allocating dollars the organization places great emphasis on preventing and reducing fatalities from vehicle accidents, especially in work zones. Knott noted that placing rumble strips along the interstate, for example, has proven to be a very cost-effective way of preventing fatalities, considering that one death equals about $4 million in costs to society, while the installation of rumble strips costs only about $1000 per mile. NDOR's goal is to reduce the statistic to 1.1 fatalities per 1 million miles travelled!

Maintaining existing roadways is also a major priority, deemed so essential that it is required by a recently revised Nebraska statute. Knott explained that "we need to take care of what we have" and must focus on the "3R's" of "resurfacing, restoration, and rehabilitation" to best serve the needs of the state. It may not always be a clear and simple decision, but when a new project emerges for consideration, Knott explained, it must be "the right project with the right scope at the right time."



Bryan Middle School Visits MATC Labs at Whittier & Nebraska Hall

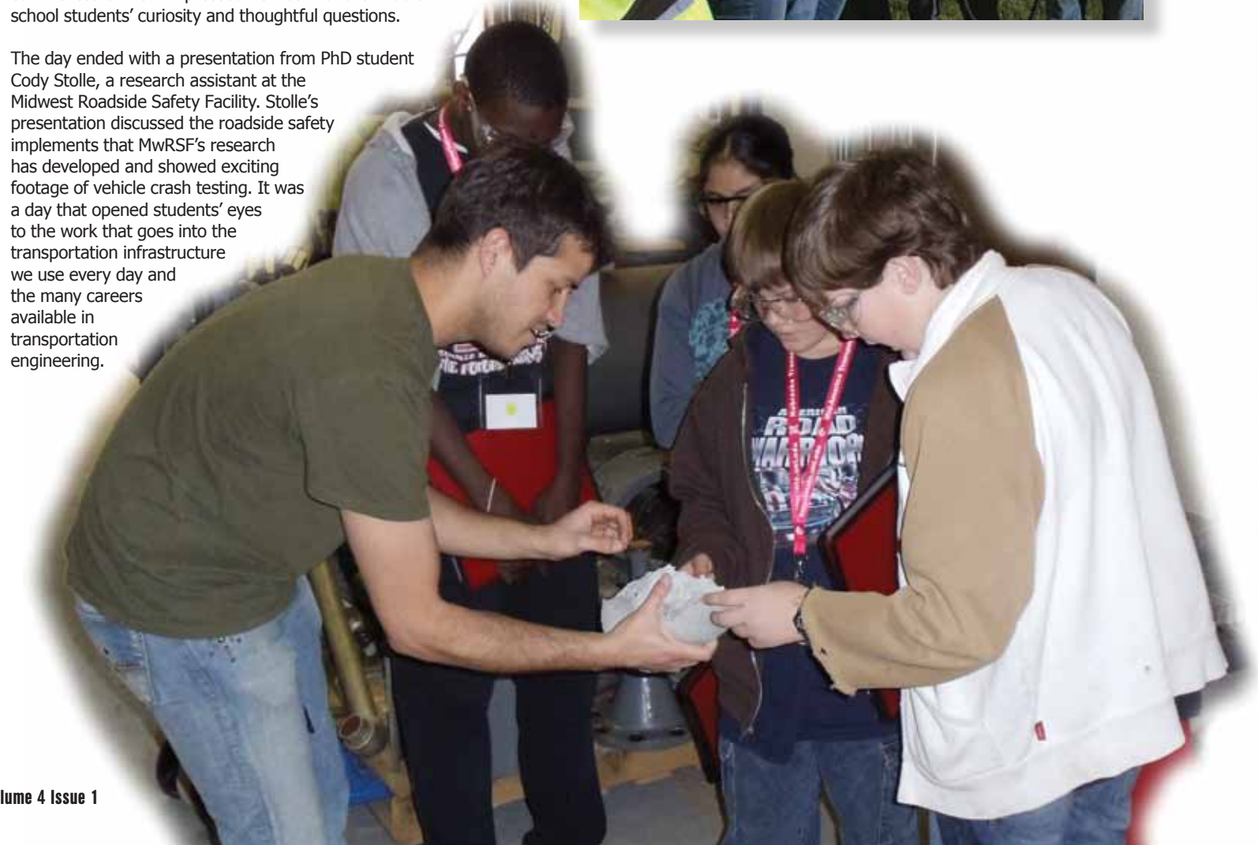
Students from Bryan Middle School in Omaha, Nebraska spent Friday, November 5th learning about transportation engineering from MATC graduate students. Tours, activities and presentations were prepared to introduce middle school students to the research conducted in the laboratory facilities.

Students enjoyed the perennial favorite activity of using the LIDAR speed guns. Master's student Ben Grone explained how researchers use the LIDAR guns to collect traffic data. The students, undeterred by a chilly breeze, then had a chance to measure the speeds of travelling vehicles. In the geographic information systems laboratory, master's student Walter Moy demonstrated how transportation engineers use maps with GIS data to identify transportation-related needs in certain areas and plan new construction projects. Students (and teachers) enjoyed creating colorful customized maps using the software.

In the Intelligent Transportation System lab, post-doctoral researcher Justice Appiah shared his passion for micro-simulation modeling. Appiah demonstrated how VISSIM micro-simulation software lets traffic engineers solve problems through experimentation with different virtual scenarios. The middle school students said they liked it because it looked "like a video game."

In the Structures and Pavement Labs, PhD students Thiago Aragao and Marcelo DaSilva performed a stress test on a concrete cylinder. The spectacular shattering of the cylinder amazed the students. DaSilva commented on how impressed he was with the middle school students' curiosity and thoughtful questions.

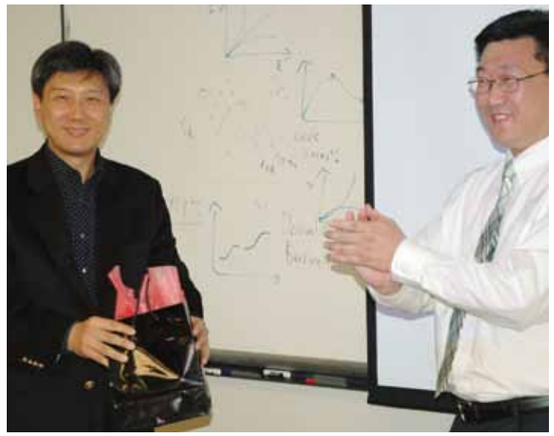
The day ended with a presentation from PhD student Cody Stolle, a research assistant at the Midwest Roadside Safety Facility. Stolle's presentation discussed the roadside safety implements that MwRSF's research has developed and showed exciting footage of vehicle crash testing. It was a day that opened students' eyes to the work that goes into the transportation infrastructure we use every day and the many careers available in transportation engineering.



Professor from Korea Speaks about Geomaterials' Effects on Transportation Infrastructure

University of Nebraska Lincoln

Dr. Seong-Wan Park, an associate professor of geotechnical engineering at Dankook University in Korea, spoke to MATC graduate students at the University of Nebraska–Lincoln on November 5th. Dr. Park discussed his experience in addressing issues that arise when predicting performance of road foundations on major transportation infrastructure in Korea. Dr. Park demonstrated how transportation engineers in all geographic areas can improve their understanding of the geomaterials which constitute road foundations in order to predict the long-term system performance of a roadway. For example, Dr. Park discussed the methods used to test and analyze materials and pavements on the Korean Highway Cooperation's test roads. He also presented information on laboratory analysis used to collect data for predicting load limits and permanent deformation on conventional pavements.



PhD student Przemyslaw Rakoczy, whose research focuses on structural reliability, noted afterward, "Dr. Park developed his own finite element program to calculate stress and strain in materials and he compared his findings with field tests. I found this very interesting because his methodology and research approaches to find material models are applicable to all fields of engineering. After his presentation, I have a better understanding of problems in pavement engineering."

Other topics covered included the use of bound and recycled materials in constructing roadways and the application of unsaturated soil mechanics. MATC would like to thank Dr. Yong-Rak Kim for his efforts in bringing Dr. Park to the University of Nebraska–Lincoln.

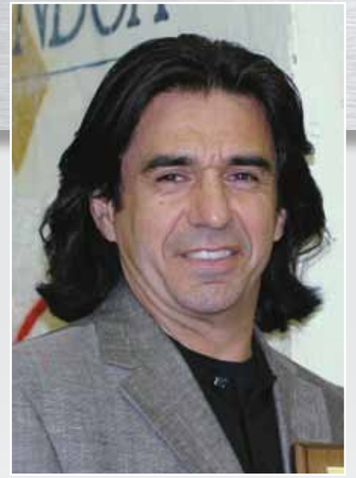
Missouri S&T University of Science & Technology

Missouri S&T Hosts Event for Local Students to Expand Horizons

"Expanding Your Horizons" is a day for seventh and eighth grade girls in the Rolla, Missouri area to experience careers in the math and science fields. This year's Expanding Your Horizons day was held on Missouri S&T's campus on October 15th. The middle school students rotated through workshops to learn about a variety of topics including biology, computer science, engineering, mathematics, and many other fields. The workshops emphasized hands-on experience to create excitement about science and technology. Hopefully, this experience will encourage the girls to choose a career in one of these fields later in life.

Laura Rathe, a MATC graduate student, led a workshop that offered an introduction into civil engineering, including an overview of the materials engineers use, the jobs available in engineering and why civil engineering is important. To get the students involved, Rathe asked them to build their own structures using noodles and masking tape. They were only given 20 fettuccine noodles and one yard of masking tape to make the strongest structure possible. After they were finished building, the students tested the structures with a box of pasta and a textbook as weights. This was followed by a discussion about which design features added to the strength of the structure and would be good elements in real buildings. The project was challenging, but the girls had fun making and destroying the pasta structures.

Thanks to the energy and creativity of MATC students like Rathe, middle school students had an opportunity to learn, experiment, and build the confidence necessary for someday choosing a career in engineering.



Azizinamini Receives AISC Achievement Award

Please join MATC in congratulating Ata Azizinamini, who has been selected by the American Institute of Steel Construction (AISC) to receive the AISC Special Achievement Award for the development of the Folded Plate Girder System for steel bridges. The award will be presented at the AISC National Steel Conference, held on May 11-14, 2011 in Pittsburgh, Pennsylvania.

According to AISC: "a Special Achievement Award provides special recognition to individuals who demonstrated notable singular or multiple achievements in structural steel design, construction, research or education. This award honors living individuals who have made a positive and substantial impact on the structural steel design and construction industry."

Congratulations, Dr. Azizinamini!

Graduate Student Presents Research in Webinar

PhD student Jennifer Schmidt presented as part of the 2010 Smart Work Zone Deployment Initiative (SWZDI) Research Showcase Webinar on July 26th. This session was the first in a series of webinars highlighting notable SWZDI projects. The seminar was hosted by the Federal Highway Administration, Iowa Division; the Iowa Department of Transportation; and the Institute for Transportation at Iowa State University. Local, state, regional and national work-zone-related researchers and professionals had a chance to experience the latest in new concepts, systems, and information with the potential to enhance work zone safety.

In 1999, the Midwest States Smart Work Zone Deployment Initiative (MwSWZDI) was created through a partnership between the states of Iowa, Kansas, Missouri, and Nebraska. Through pooled-fund studies, researchers investigate better ways of controlling traffic in work zones. Schmidt's presentation, "Safety Performance of Work-Zone Devices Under MASH Testing," discussed the results of research conducted with Ronald Faller, research assistant professor at the Midwest Roadside Safety Facility. "MASH" refers to the standards in the Manual for Assessing Safety Hardware, adopted by AASHTO (American Association of State Highway and Transportation Officials) and the FHWA in 2009 to establish comprehensive, updated testing and assessment guidelines for roadside and work zone safety equipment.

TRB Webinar Moderated by Dr. Aemal Khattak

On Thursday, September 16th, Dr. Aemal Khattak, associate professor at the University of Nebraska–Lincoln, moderated a webinar titled "Highway-Rail Grade Crossing Safety 101: A Primer on Grade Crossing Safety" for the Transportation Research Board. This webinar explored ways for municipal, county, and regional planners to improve safety at highway-rail grade crossings. Session presenters included Dr. Khattak, UNL; Jason Field, Moffatt & Nichol; Terry Byrne, Vanasse Hangen Brustlin (VHB); and Steve Laffey, Illinois Commerce Commission. Panelists highlighted topics including quiet zones, diagnostics, communications and agreements, as well as education and enforcement programs.

Dr. Khattak noted that the webinar was a success and was followed by many questions from the participants. The session was recorded by TRB and those interested in obtaining the link can email Reggie Gillum at RGillum@nas.edu.

Local MOVITE Chapter Visits Whittier Research Center

LOCate On August 31st, LOCATE featured MATC Director Dr. Laurence Rilett as a speaker during their monthly meeting. LOCATE, the Lincoln-Omaha-Council Bluffs Association of Transportation Engineers, is a chapter of MOVITE, the Missouri Valley section of the Institute of Transportation Engineers. Dr. Rilett spoke about the Mid-America Transportation Center, the Nebraska Transportation Center and their new facility at the Whittier Research Center. A total of forty-three people attended the meeting, about half of them engineering students from the University of Nebraska–Lincoln. Dr. Rilett especially focused on the role that students play in research at NTC along with the other opportunities that NTC and MATC provide students for academic and professional development.

A tour of the Whittier Research Center office, conference, and lab facilities followed the presentation. Dr. Aemal Khattak presented on NTC faculty members' current research endeavors and the role of NTC's resources in advancing new developments in transportation research. Several of the LOCATE members are also alumni of UNL's Department of Civil Engineering and were pleased by the coalition of departments working together under one roof, and the institutional support for transportation engineering indicated by the new space. Mark Meisinger, vice president of LOCATE and a transportation engineer for Felsburg Holt & Ullevig in Omaha, said: "The new space for NTC and MATC at the Whittier Building should provide UNL students and faculty resources to continue the nationally respected work that Nebraska has contributed to transportation research. The research labs and office space are extremely nice and should help to recruit the best and brightest minds to the university. As an alum of the program, I am happy to see the progress made and I only wish the facility was in place when I was in school!"

Transportation Career Path

by Ben Grone , master's student, UNL

At the end of August, fellow MATC graduate students Anna Rakoczy, Przemyslaw Rakoczy, and I had the opportunity to attend the AREMA 2010 Annual Conference and Exposition in Orlando, Florida. AREMA is the acronym for a professional organization whose full name is the American Railway Engineering and Maintenance-of-Way Association. While this may be a mouthful, the roles played by members of this association are fundamental to the success of the railroads in America. Railroading is a potential career that many transportation students overlook when they consider what they want to do with their lives, and I had a chance to learn about many of these opportunities at the AREMA conference.

There were a number of interesting presentations given the first day of the conference that outlined many areas in which AREMA is active, including safety and security regulations for the railroad, automation of track monitoring, high speed rail planning, bridge design and construction, track design, and signaling system standards. After the presentations, there was a session geared toward students in which we had the opportunity to ask questions of a panel of young professionals. The perspective they gave was invaluable, as was the networking session that followed. Tuesday provided an opportunity to gain even more perspective on the industry through six breakout sessions, which included presentations on communications and signals, engineering services, maintenance, passenger and transit, structures, and track. Overall, it was a great experience—I never even mentioned the free time spent in the Florida sun.

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MATC Funded Research Projects Fiscal Year 2011

K-STATE Kansas State University

Kansas State University Projects

Effects of Geometric Design Features on Truck Crashes on Limited Access Highways

PI: Dr. Sunanda Dissanayake

DESCRIPTION: Trucks are larger in size and weight and typically have different performance characteristics than passenger vehicles. Meanwhile more and more freight are transported using trucks, causing the number and percentage of trucks on the national highway system to gradually increase. The safety effect of these large trucks is a major concern as they disproportionately account for traffic fatalities. When trucks are involved in crashes with other smaller vehicles, a majority of the fatalities involve the occupants of the other motor vehicle. When looking at the ways of improving the situation, understanding the effects of geometric design features on truck crashes is expected to bring significant benefits as that is the area where transportation engineers have the highest level of influence. Accordingly, this project is expected to study truck crashes in detail by developing models to determine the influence of various geometric design features, traffic and other characteristics on truck crash occurrence.

BENEFITS: Through the findings of this research it will be possible to identify the most effective engineering countermeasures that would be useful in reducing truck crashes.

Accelerated Testing of Warm Asphalt Mixtures for Safe and Reliable Freight Transportation

PI: Dr. Hosin "David" Lee

Co-PI: Dr. Mustaque Hossain

DESCRIPTION: Warm Mix Asphalt (WMA) is rapidly becoming a mainstay of asphalt pavement construction in the United States due to an array of advantages: reduced fuel consumption, less carbon dioxide emission, longer paving season, longer hauling distance, reduced oxidation of asphalt, early opening to traffic and a better working environment in the field. To meet the growing demand from the public agencies, NCAT recently proposed a national WMA certification program (Kvasnak et al. 2010). It requires a full-scale test in their test track in Auburn, Alabama, where their full-scale test results may not be relevant to the performance of WMA pavements in the Midwest Region 7 because the climate and soil condition at NCAT test track are different. In previous studies at the University of Iowa, various WMA mixtures were tested in the laboratory for stiffness, rutting, and moisture resistance. To validate these laboratory results and to predict the field performance, it is proposed that select WMA mixtures be tested using the accelerated testing equipment in both a laboratory and an APT facility.

Wheel Loading Test Equipment at KSU

BENEFITS: The results from the accelerated tests will help contractors build safe and reliable WMA pavements for heavier truck traffic with higher tire pressure. Safe and reliable WMA mixtures will contribute to road safety by reducing the number of crashes and fatalities on heavily trafficked roadway system and will minimize the risk associated with increasing freight movements on the U.S. surface transportation system built with the WMA mixtures. The main product anticipated from this research is the accelerated performance of WMA materials, and experience building test sections with select WMA additives. This information would be very useful for all pavement engineers in Region 7 interested in WMA.

Use of High-Volume Reclaimed Asphalt Pavement (RAP) for Asphalt Pavement Rehabilitation Due to Increased Highway Truck Traffic from Freight Transportation

PI: Dr. Mustaque Hossain; Dr. Hosin "David" Lee

DESCRIPTION: The recent spike in asphalt binder prices has forced the state highway agencies and paving contractors to consider the use of high volumes of reclaimed/recycled asphalt pavement (RAP) in hot-mix asphalt (HMA). A national research project (McDaniel and Anderson 2001) developed the guidelines for the use of RAP in Superpave mixtures adopted by the Kansas Department of Transportation (KDOT). In the recent past, the contractors had been reluctant to use more than 15% RAP in Superpave mixture because of the change in required binder grade (usually more expensive binder). However, due to a recent increase in binder price, the contractors are opting for higher percentages of RAP in the Superpave mixtures.

Simple Performance Test Equipment

Most state agencies and paving contractors are advocating the use of high volumes of RAP in hot-mix asphalt (HMA). However, the use of large percentages of RAP results in nonhomogenity of Superpave mixtures that may not perform well. This project will study the use of fractionated RAP (FRAP) and/or a combination of RAP and FRAP at different percentages for asphalt pavement rehabilitation. Impacts of FRAP, with differing percentages, on the binder grading, and whether combinations of high percentages of RAP and FRAP in Superpave mixture designs can meet current mix design requirements, potential impacts on the mechanistic and rutting characteristics of the mixtures will also be studied in detail. The use of RAP/FRAP for shoulder mixtures will also be investigated.

BENEFITS: The study would result in some practical guidelines to be followed by KDOT in specifying RAP/FRAP percentages as well as PG binder selection for Superpave mixtures. The study will promote sustainability in asphalt pavement rehabilitation.

Determining the Transfer Length in Prestressed Concrete Railroad Ties Produced in the United States

PI: Dr. Robert Peterman

DESCRIPTION: Concrete ties have become the preferred choice for many railway lines in the Midwest, where extremely heavy freight movements occur daily. In order for these prestressed concrete ties to function adequately over their expected life, and to ensure the safety of freight movements across the Midwest region, the prestressing force must be fully introduced into the railroad tie at a location well before the rail load is applied. The length required to transfer the prestress force into the concrete member is referred to as the "transfer length." This research is aimed at conducting systematic measurements of the transfer length in concrete railroad ties that are produced by all of the major concrete tie producers in the United States. As such, this will be the first coordinated effort to measure transfer lengths of concrete railroad ties that has ever been conducted in the industry. This study will quantify the differences in transfer lengths that occur with indented wires, indented strands, and smooth strands currently used in prestressed concrete railroad tie construction.

BENEFITS: The proposed work will provide detailed information about the bond of three different types of prestressing reinforcement used in the manufacturing of concrete ties in the United States. This information will assist in the design of future ties and in evaluating the effectiveness of current designs.

MISSOURI S&T University of Science & Technology

Missouri University of Science & Technology Projects

Concrete Surface with Nano-Particle Additives for Improved Wearing Resistance in Highway Operation

PI: Dr. Genda Chen

DESCRIPTION: This proposal is focused on a feasibility study on the use of nanotechnology in concrete to improve the wearing resistance of concrete. Three candidates of nano materials are considered: nano TiO2 particles, nano carbon-tubes, and polyurea cross-linked aerogels. The tensile and compressive properties and the wearing resistance of concrete will be evaluated for various mix designs. The optimal amount of nano material additives will be determined following the ASTM standard test methodologies. The test results from three types of materials will be compared for their mechanical behaviors, including wearing resistance. The best practice in concrete application will be recommended in terms of technological, economic, and social benefits.

BENEFITS: The availability of such a technology may potentially improve the comfort level of passengers, the safety of highway operations, and the efficiency of fuel consumptions. It may also reduce the emission of CO2 associated with the poor condition of roadways.

THE UNIVERSITY OF IOWA

University of Iowa Projects

Monitoring the Effects of Knickpoint Erosion on Bridge Pier and Abutment Structural Damage Due to Scour (UNL and UI Project)

PI: Dr. Thanos Papanicolaou

Co-PI: Dr. David Admiraal

DESCRIPTION: The goal of this proposed research is to conduct laboratory and field research on knickpoint migration in western Iowa and eastern Nebraska to stabilize the streams and prevent future damage to bridge infrastructure. Knickpoints are abrupt drops in the stream bed over which plunges will flow and scour the downstream bed. Streambed downcutting increases bank height, which facilitates bank failures and stream widening, and damages critical bridge infrastructure. Preliminary studies in western Iowa indicate that geotechnical properties of the knickpoint bed stratigraphy control its migration rate. We propose to conduct state-of-the-art geotechnical analyses and continuous monitoring of knickpoint geometry and hydraulics in order to determine the presence of specific layers of weakness along which the streambed will fail. We believe that seepage is a primary contributor to knickpoint erosion in the Midwest, either through aggregate

Knickpoint located at Mud Creek, IA. The UI laser system is on truss.

Fiscal Year 2011

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detachment or static liquefaction, which creates layers of weakness. Seepage reduces the effective stress within the soil, thus facilitating failure of the subsurface structure.

BENEFITS: This research will assist local government agencies and the USDOT in better understanding the principal factors that cause knickpoint propagation and identifying appropriate grade control structures (e.g., sheet-pile weirs and flumes) near bridge crossings to control knickpoint propagation and reduce infrastructure damage.

Use of Fiber Bragg Grating (FBG) sensors for performing automated bridge pier structural damage detection and scour monitoring

PI: Dr. Thanos Papanicolaou

DESCRIPTION: The goal of the proposed research is to conduct laboratory and field research on fully adaptive bridge monitoring using automated sensors to minimize the problems inherent in human inspections of bridges. We propose a novel integrated condition-based maintenance (CBM) framework utilizing available sensors and sensing architecture for performing both scour and structural damage monitoring. A fiber-optic pier impact detection system is proposed to be developed and tested in the laboratory and the field. That system consists of state-of-the-art two-wave mixing (TWM) fiber Bragg Grating (FBG) sensors which can detect impacts with different frequencies. These two-wave mixing FBGs can sense deformations either in the pier structure and/or within the soil (sediment) river bed due to their unique ability to discern different ranges of frequencies. Practical guidelines will be developed on how we can use the FBGs to provide real-time state awareness information that can be used in making decisions on down time, repair cost, and functionality of bridges. The research will pave the way for inexpensive bridge automated monitoring, while providing an open framework to expedite the development of similar systems for other critical infrastructure, such as roads, highways, dams, levees, in order to prevent catastrophic events such as the Minnesota bridge collapse in 2007.

BENEFITS: The proposed methodology will assist engineers in monitoring bridge structures during extreme conditions, when failure is most likely, thus improving the overall infrastructure safety by offering new opportunities for monitoring high risk sites such as highway bridge crossings where there is frequent traffic.

Freight Bottlenecks and the Border Puzzle

PI: Dr. Miwa Matsuo

DESCRIPTION: Our research examines what causes the border effect, specifically, the effects of transportation bottlenecks. Trade data indicate that sixty percent of cross-border freight transportation between the US and Canada is concentrated at only three crossing points around the Great Lakes: Windsor, ON/Detroit, MI; Sarnia, ON/Port Huron MI; and Fort Erie, ON/Buffalo, NY (Transport Canada, 2003). Traffic concentration is associated with congestion, and capacity expansion is proposed at each site (Bowen and Slack, 2007). We will first develop panel data of inter-state or province trade since 1992. Then we assess how much the concentration and the congestion explain the empirically observed border effect by decomposing the border crossing cost into (1) indirect routing because of the limited number of crossings and (2) congestion at the crossings using a modified gravity model of trade developed by earlier research. In addition, we will develop panel data to examine the historical transition of border crossing costs. Our research would be helpful for federal government to plan a transportation infrastructure investment to achieve seamless freight transportation between the US and Canada.

BENEFITS: Our research is useful for a future infrastructure investment plan that the federal government can consider to achieve seamless freight transportation between the US and Canada. If the small number of cross-border points is the source of border effects, it is highly recommended to increase the number of points. If the delay at the border is the problem, we strongly recommend expanding the capacity of the gates.

University of Kansas Projects

Developing a Sustainable Freight Transportation Framework with the Consideration of Improving Safety and Minimizing Carbon Emission

PI: Dr. Yong Bai

Co-PI: Dr. Steven Schrock; Dr. Thomas Mulinazzi

DESCRIPTION: Freight transportation is the backbone of the United States' economy and is critical for the daily operations of every business in the United States. In 2002, $11,082,859 million worth of goods and services were transported throughout the nation. The volume of freight in the United States is expected to increase 70% by 2020. Freight transportation also provides jobs to millions of people, which contributes to economic growth. Transportation related industries, such as vehicle manufacturing, parts suppliers and for-hire services, employed more than 10 million people in 2000. Maintaining a sustainable freight transportation system is vital for the economy and daily life in the United States. The existing freight transportation system, which heavily relies on trucks, faces several major challenges that could undermine continuous economic growth and quality of life. These challenges include (1) carbon emissions that damage the environment, (2) congestions that increase the travel time and the risk of vehicle crashes and disrupt tightly planned supply chains, and (3) increased maintenance costs that are due to the frequent damage of pavements and bridges. The current situation requires transportation stakeholders such as state departments of transportation (State DOTs) and transportation related industries to adopt a new philosophy to plan and conduct their business.

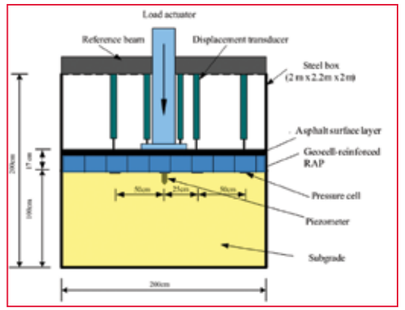
BENEFITS: The main objective of the proposed research is to develop a sustainable freight transportation framework with the consideration of improving safety and minimizing carbon emission. The framework will increase the utilization of other transportation modes such as rail and intermodal to diversify the methods of freight movements.

Onsite use of recycled asphalt pavement materials with geocells to reconstruct damaged pavements by heavy trucks

PI: Dr. Jie Han

Co-PI: Dr. Robert Parsons

DESCRIPTION: Asphalt pavements deteriorate with traffic (especially heavy trucks) and time. When the condition of a pavement becomes badly deteriorated, reconstruction of the pavement may become an economically feasible solution. Reconstruction of a pavement requires removal of pavement surfaces. On-site use of recycled asphalt pavement materials has obvious benefits from economic, environmental and sustainability points of view. One attractive option is to use recycled asphalt pavement (RAP) materials as base courses reinforced by geocells with a thin new overlay. This research will utilize the geotechnical test box available at the University of Kansas to simulate the reconstruction of damaged asphalt pavements by geocell-reinforced RAP bases overlaid by a thin asphalt layer and evaluate their performance under cyclic loading. In this research, at least four test sections will be constructed in the geotechnical test box, including control sections and geocell-reinforced sections.



Load frame and proposed configuration.

BENEFITS: This research will develop a green technology for pavement reconstruction, will reduce construction and maintenance costs, and improve performance of highway pavements for heavy trucks.

Statistical Modeling to Identify Heavy Truck Critical Crash Locations in Kansas

PI: Dr. Steven Schrock

DESCRIPTION: Transportation safety has been, and continues to be, a critical component emphasized by the United States Department of Transportation (USDOT). The number of deaths on highways in the United States has remained steady over the past fifteen years at approximately 40,000 fatalities per year. Although the total number of fatalities is relatively constant, the fatality rate is dropping due to an increase in the total number of vehicle miles traveled (VMT) in the nation (NHTSA 2009). Transportation funding bills have continually addressed the importance of reducing highway crashes, particularly fatalities, across the nation (USDOT 2009). The Kansas Department of Transportation (KDOT) has also placed transportation safety at the top of their priorities with special emphasis on work zones, heavy vehicles, and other strategic highway safety planning measures. To truly address transportation safety across the state of Kansas, safety data analysis must occur wherein models are developed to identify critical locations where crashes are occurring. This data mining includes analysis by route, by vehicle type, by severity and by other factors deemed critical by KDOT employees. The results of the research would be the identification of critical sections across the state where crash frequency exceeds the statistical average and acceptable confidence bands. These locations can then be targeted for safety improvements consistent with the types of crashes occurring therein.

BENEFITS: The results of this research will be compiled into a formal written report to be shared with the engineering community. The report is expected to include an evaluation of the safety data across the state along with identification of critical locations, particularly those where heavy vehicles have been involved.

University of Nebraska Projects

Calibration of Micro-Simulation Models for Multimodal Freight Networks

PI: Dr. Justice Appiah

DESCRIPTION: This research will develop a framework for incorporating the unique operating characteristics of multi-modal freight networks into the calibration process for microscopic traffic simulation models. Because of the nature of heavy freight movements in USDOT Region VII (Nebraska, Iowa, Missouri, Kansas), this project will focus on commercial vehicles and trains. In particular, a genetic algorithm (GA) based optimization technique will be developed and used to find optimum parameter values for the multi-modal vehicle performance model used by the microscopic traffic simulation model, VISSIM. The procedure will be implemented using a current micro-simulation model of the Nebraska State Highway System. The current VISSIM model will be expanded to account for both truck traffic and rail networks and will be developed such that the model can readily be updated as new information (such as ITS data) becomes available. As part of this project, the calibrated model will be tested for its suitability for performing operational analysis on urban and rural networks with very high heavy vehicle percentages for which standard procedures, such as those of the HCM, do not apply. Two test cases will be used to demonstrate the potential usefulness of the procedure: (i) the I-80 corridor in Iowa-Nebraska; and (ii) a highway-rail grade crossing in Lincoln, Nebraska.

BENEFITS: Expected increases in freight-carrying heavy truck and rail traffic in the Region VII area raises geometric design, safety, and operational concerns because of sight distance restrictions, low acceleration and deceleration capabilities-characteristics, and the ability to maintain speeds—particularly on steep grades. This project demonstrates how micro-simulation models may be adapted to: (i) serve as useful tools for understanding the issues raised by high truck and rail volumes, and (ii) assess potential investment and operational alternatives.

Reducing Impact of Heavy Truck Traffic on Service Life of Bridges - Experimental Phase

PI: Dr. Atorode Azizinamini

DESCRIPTION: The seamless pavement concept, developed in Australia, is a bridge deck enhancement that eliminates transverse joints through the entire bridge length and within a transition zone beyond the bridge limits. The transition zone beyond the bridge is a specially detailed reinforced concrete pavement that results in extended bridge life, improved ride quality for highway users, and reduced maintenance costs. The system was developed for use with continuously reinforced concrete pavement (CRCP), and modifications must be made to incorporate it into standard US practice, which typically uses jointed concrete pavement (JCP). Specifically, longitudinal movement, due to thermal effects, at the end of the transition region must be limited. The key factor in the development of a completely jointless bridge for US practice is establishing an effective and sustainable longitudinal force transfer mechanism from the transition zone paving to the base soil. The transition region designed using this force transfer mechanism should result in a reasonably short length of the transition zone with a very limited end movement and a predictable and controlled crack pattern. The objectives of the proposed research are to evaluate some of the promising longitudinal force transfer mechanisms and to compare the previous numerical study results against the actual field tests. The experimental work will begin with several small-scale, component tests. Based on the results of these tests, a proof of concept test will be performed on a larger, isolated bridge transition zone.

BENEFITS: The results obtained from the proposed research will be a comprehensive understanding of the proposed jointless bridge system, and the effect that various parameters have on the design and performance of the system. The final product, together with the results of the other related research activities, will be used for field implementation of the completely jointless bridge.

2011 MATC Research Projects

Crash costs at Rail Grade Crossings

PI: Dr. Aemal Khattak

Co-PI: Dr. Eric Thompson

DESCRIPTION: An accurate measure of crash costs is required to support effective decision-making about transportation investments. In particular, underinvestment will occur if measurement fails to capture the full cost of crashes. Such underinvestment may be occurring in the case of crashes at highway-rail grade crossings (HRGCs). HRGC crash costs can be substantial both because of the severity of crashes and their potential to cause significant disruption to the transportation and logistics system. Existing methodologies capture the first set of costs but often fail to fully capture the second set. As a result, this research will develop a methodology to assess the full costs associated with crashes at HRGCs, including the full costs to the transportation and logistics system. The research will focus on Nebraska, a state with a large and active rail industry and many HRGC locations. Nebraska also is a headquarters or major location for several national railroads and trucking firms, and the research team plans to gather information from private industry firms and associations on the impact of HRGC crashes on business costs. The research team will develop a methodology for gathering and valuing relevant data for estimating system-wide logistic costs due to HRGC crashes. The method will be comprehensive but will also develop specific cost estimates based on particular characteristics in and around HRGC sites.

BENEFITS: The research will result in methodologies to provide more accurate benefit cost analyses of safety improvements at highway-railroad grade crossings.

Truck Load Impact on Pavement - Phase III

PI: Dr. Yong-Rak Kim

DESCRIPTION: Trucking is a key component of US freight transportation and is expected to grow significantly in the future. Better preservation of existing roadways against heavy-load trucks is therefore necessary, and success can be achieved based on a more accurate and realistic analysis of pavement structures. To this end, a series of research efforts led by the PI was initiated in FY 2009 and continued in FY 2010 to investigate pavement performance predictions from

Freight Traffic on Pavement

both the newly released "mechanistic-empirical pavement design guide (MEPDG)" approach and the "purely mechanistic approach based on the finite element method (FEM)" particularly focusing on the impact of heavy truck loads on pavement damage. Analysis results of the two approaches during FY 2009 and FY 2010 clearly demonstrated that material inelasticity and realistic tire loading configuration, which are not rigorously implemented in the current MEPDG, can mislead predictions of pavement rutting. Further investigations of pavement responses between two methods need to be conducted to better understand the effects of truck loading on pavement damage, and, consequently, to advance the current MEPDG system for the future pavement design-analysis tool. Phase III is therefore proposed herein to extend research efforts conducted during FYs 2009 and 2010. In Phase III, a more detailed investigation of the pavement responses between two approaches will be pursued by focusing on the fracture (cracking) related damage behavior of pavement structure.

BENEFITS: The proposed effort will provide better understanding of the effects of heavy-load trucks on the overall structural performance and life of pavements in Region 7. In addition, more appropriate use and future advancements of the current MEPDG for pavement analysis and design can be achieved based on proper incorporation with mechanistic approaches.

Reliability-Based Evaluation Criteria for Railway Bridges

PI: Dr. Andrzej Nowak

DESCRIPTION: The performance of bridges strongly influences the operation of railway transportation networks. Railway bridges constitute a vital part of the transportation infrastructure system and they are vulnerable to extreme events, such as natural disasters and hazards stemming from negligence and improper maintenance, collisions, scour, intentional acts of vandalism, and terrorist attacks. Moreover, railway bridges are subjected to dynamic loads causing resonance phenomena in the structure. The simplified methods for evaluation of dynamic impact factors available in engineering code provisions do not cover the possibility of resonance. In the case of resonance, excessive bridge deck vibration can cause loss of wheel/rail contact, destabilization of the ballast, which exceed the stress limits and, consequently, reduce the safety margin. Railway bridges are very important and must be protected by an assessment of the appropriate level of safety. The objective for this study is to develop statistical models for loads and resistance, select the target reliability levels for railway bridges, and determine rational evaluation criteria for bridge owners.

BENEFITS: The major contribution of this project is the development of load models that are representative of actual and expected freight trains. The load model is to be used as a practical tool for evaluation of existing bridges. The load rating model and procedures for determining the remaining life span of bridges will find important applications in decision making processes regarding operation, maintenance, repair, rehabilitation and replacement. This information will allow owners to prioritize structures for repair/rehabilitation or replacement.

Assessing the Structural, Driver and Economic Impacts of Traffic Pole Mounted Wind Power Generator and Solar Panel Hybrid System

PI: Mr. Scott Rosenbaugh

Co-PI: Dr. Justice Appiah

DESCRIPTION: This project will evaluate the feasibility of using existing traffic infrastructure to mount wind power generators. Some possible places to mount a light weight wind generator and solar panel hybrid system are: (i) Traffic signal poles and (ii) street light poles. Traffic signal poles can themselves have multiple designs depending on type of mount (mast arm versus span wire) and the width of the intersection (load carried, etc). The close proximity of street light poles and traffic signal poles to the traffic cabinets, which can be used for storing the battery banks, make them good candidates to mount the hybrid system. This project will assess the structural impacts of the hybrid system on different poles in Lincoln, Nebraska and city standard plans will be used for identifying the pole and foundation design. Structural analysis will involve a first principal for windload analysis and an explicit finite element analysis using LS-Dyna for evaluating fatigue. Driver impacts and economic impacts of such a system will also be evaluated by performing a before and after study at a test location in Lincoln (Hwy 2 and 84). A cost and benefit analysis will be performed to assess the economic impact.

BENEFITS: The deployment of the proposed wind power generators on existing infrastructure can dramatically change the role of the public right-of-way from an energy consumer to an energy producer. This will not only reduce the roadway agency operating costs, but also generate new revenues for the agency. The use of renewable electric power will also promote the development of green roadways.

IntelliDrive Technology based Yellow Onset Decision Assistance System for Trucks

PI: Dr. Anuj Sharma

DESCRIPTION: This project aims to develop a prototype Yellow Onset Decision Assistance (YODA) system for trucks based on Intellidrive (Vehicle to Infrastructure Communication) technology. Drivers need to make a decision to stop or go on the onset of yellow. An erroneous decision to stop when it would have been safer to proceed can lead to severe rear end collisions. Similarly an erroneous decision to go when it would be advisable to stop can lead to red light running incidences and T-bone collisions. Trucks are relatively less maneuverable and have lower available acceleration and comfortable deceleration rates. The line of sight of truck or bus drivers is much higher than passenger vehicles and they may have difficulty in responding to the brake lights of the leading car; hence, trucks are at a higher risk of crashes in such situations. Dilemma zone protection systems are used at high speed intersections to enhance the safety of operation. These systems are generally designed based on dilemma zone boundaries for cars and are static systems with no intelligence to adapt to existing traffic, weather or visibility conditions. This research proposes to develop a prototype YODA system that would constitute of a pole mounted unit and an in-vehicle unit. The in-vehicle unit would request decision assistance from the pole mounted unit as the truck approaches an intersection. Based on the existing traffic, weather and visibility conditions, the pole mounted unit would respond to the in-vehicle unit with a recommended course of action.

BENEFITS: The developed YODA system will reduce red light violations and traffic crashes while increasing mobility at high speed intersections.

Improving the Performance of Cable Median Barrier

PI: Dr. Dean Sicking

Co-PI: Cody Stolle

DESCRIPTION: Cable median barrier has proven to be an effective safety treatment for prevention of cross median crashes in rural and suburban areas. A recent study of the effectiveness of cable median barrier in Missouri showed that it reduced fatalities resulting from cross median crashes by approximately 95%. Even though existing barriers are 95% effective, the remaining 5% of fatal crashes in Missouri, when extrapolated by population to the entire nation, are estimated to represent approximately 250 fatalities annually. Thus, there is still a great opportunity for improving highway safety by improving cable median barrier performance.

This project aims to reduce the number of vehicle penetrations through cable guardrail systems. The project consists of three distinctive approaches to improving cable barrier design guidelines: qualitative, analytical investigation of cable barrier crashes resulting in penetrations; computer simulation of a cable median barrier crash in order to capture the penetration mechanisms of cable barrier systems; and improvement of cable barrier simulation components for future crash simulations which will better predict penetrations and propensity for underride or override. The combination of approaches will provide insight into the mechanisms leading to cable barrier penetrations in order that design modifications and guidelines may be recommended to reduce the number of cable guardrail penetrations.

BENEFITS: The benefits of research are threefold: (1) guidelines for construction and design of new cable barrier systems will be created to reduce the propensity for penetrations to occur; (2) models of cable guardrail system components and interactions will be refined; and (3) qualitative assessments of cable barrier penetrations will enable researchers investigating alternative guardrail system failures to identify critical impact parameters.

Improving the Freight Transportation Roadway System during Snow Events: A Performance Evaluation of Deicing Chemicals

PI: Dr. Christopher Tuan

DESCRIPTION: The ability of state DOT's to adequately clear roadways during winter weather conditions is critical for a safe and effective freight transportation system. Variables affecting winter maintenance operations include the type of precipitation, air and pavement temperature, traffic, wind, time of day, day of week, and maintenance equipment. The main objective of this study is to identify the best practices for normal deicing operations, based on the performance rating of deicing chemicals. Optimum deicer/brine ratios and the associated application rates will be determined for various weather conditions. The best practices will ensure effective deicing operation and economical use of deicing chemicals. Although manufacturers provide performance data under specific conditions, a standardized test procedure for acceptance of a new deicing chemical is needed to confirm the manufacturers' claims and to compare competing products under the same controlled conditions and at various application rates. Several lab tests will be conducted and the correlation with field performance will be studied. Based on the results, a performance rating system will be developed.

BENEFITS: Nebraska Department of Roads spends over $4 million per year on highway deicing chemicals. A performance rating system and quality assurance methodology will ensure that the best value chemicals are procured and that performance is consistent throughout the season. Accurate information regarding the relative performance of different chemicals at specific environmental conditions will aid in decision-making to optimize the chemical combinations and application rate. It is anticipated that at least 5% reduction in operating cost (or $200,000/year) could be achieved without compromising the level of service for the traveling public. The end result will be clearer roads during snow events which will lead to a safer and more efficient freight (and passenger) roadway system.

Traffic in Winter Weather

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MATC Associate Directors

Dr. Elizabeth "Libby" Jones
Associate Professor, Civil Engineering
Associate Director, Mid-America Transportation Center
University of Nebraska–Lincoln
Phone: (402) 554-3869 • ejones1@unl.edu

Dr. Mustaque Hossain
Professor, Civil Engineering
Associate Director, Mid-America Transportation Center
Kansas State University
Phone: (785) 532-1576 • mustak@k-state.edu

Dr. Genda Chen
Professor, Civil, Architectural and Environmental Engineering
Associate Director, Mid-America Transportation Center
Missouri University of Science and Technology
Phone: (573) 341-4462 • gchen@mst.edu

Dr. Tom Mulinazzi
Professor, Civil, Environmental and Architectural Engineering
Associate Director, Mid-America Transportation Center
University of Kansas
Phone: (785) 864-2928 • tomm@ku.edu

Dr. Paul Hanley
Associate Professor, Civil & Environmental Engineering and Public Policy Center
Associate Director, Mid-America Transportation Center
University of Iowa
Phone: (319) 335-8137 • paul-hanley@uiowa.edu

MATC Master's Student of the Year: Ben Grone

MATC wishes to congratulate the Master's Student of the Year, Ben Grone. Grone is a second year student at the University of Nebraska–Lincoln with an emphasis in transportation engineering. As an undergraduate, Grone received the prestigious NU Regents Scholarship and achieved a GPA of 3.96. During this time, he worked on a Nebraska Department of Roads' stormwater quality study as an undergraduate research assistant. He recently completed work on a study sponsored by the Nebraska Department of Roads investigating non-intrusive detectors.

Grone is certified as a LEED Accredited Professional. He is a member of Chi Epsilon (the civil engineering honor society), the American Society of Civil Engineers, the Institute of Transportation Engineers, and the American Railway Engineering and Maintenance of Way Association.

Celebration of Past, Present and Future at Whittier Research Center Dedication and Open House

The ribbon-cutting and official dedication for the historic Whittier building, MATC and NTC's new home, took place on September 28, 2010. Faculty and staff of the University of Nebraska–Lincoln, along with community members, and alumni of Whittier Junior High School gathered to celebrate the transformation and the rich history of the building. Opened in 1923 as the nation's first junior high school, the Whittier building closed in 1977 and was purchased by UNL in 1983. In 2006, UNL Chancellor Harvey Perlman proclaimed his vision to "return Whittier to public use" and, with extensive renovations, the building has become a state-of-the-art research center.

Among the distinguished speakers at the event were City of Lincoln Mayor Chris Beutler, UNL Chancellor Harvey Perlman, UNL Vice Chancellor Prem Paul and former Whittier Principal and retired Lincoln Public Schools Superintendent Dave Myers. Each of the speakers shared his own unique experiences with the building along with optimism for its bright future as the gateway to UNL's planned Innovation Campus project. The other innovative research initiatives housed by the Whittier Research Center include the Nebraska Center for Energy Sciences Research and the Water for Food Institute. NTC and MATC are proud to be a part of this next chapter of research innovation and excellence in Nebraska and throughout the Midwest.

More Info: matc.unl.edu

ITS Heartland
12th Annual Meeting

March 28, 29, 30, 2011
West Des Moines, Iowa
For More Information,
Please Visit:
itsheartland.org

ITS Heartland Chapter

MATC Contact Info:

Mid-America Transportation Center

University of Nebraska–Lincoln

MID-AMERICA
TRANSPORTATION CENTER

2200 Vine St.
262 F Whittier Building
Lincoln, NE 68583-0152

Phone: **402-472-1974**
Email: **vlefler2@unl.edu**
Web site: **matc.unl.edu**