MATC: Improving Safety and Minimizing Risk Associated with Increasing Multi-Modal Freight Movements
Letter from the Director: Reflections on the Past Year

I always enjoy compiling our MATC Annual Report because it represents an opportunity to highlight the outstanding accomplishments of our faculty and students over the past year. In this, our fourth annual report since our designation by the U.S. Department of Transportation Research and Innovative Technology Administration as the Region VII University Transportation Center, you will find a familiar organization. Similar to previous annual reports, we first provide a short capsule of the research, education, and technology transfer activities of each consortium partner. We also recognize each of the MATC-affiliated faculty participating in our research program. Because they represent the future of transportation research, one of our strategic goals at MATC is to involve junior, tenure-track faculty in the MATC research program. I am very happy to report that we have a significant number of junior faculty active in MATC and I expect you will be impressed with the innovative projects they are undertaking.

MATC is, above all, an organization that fosters and supports the transportation research work of the undergraduate and graduate students from our respective institutions. Because they represent the best of MATC, my favorite section of the annual report is where we introduce you to some of the students who are active in MATC and I expect you will be impressed with the innovative projects they are undertaking.

The next section of the annual report summarizes the research projects that were completed over the past year. The theme of our center is “improving safety and minimizing risk associated with increasing multi-modal freight movement on the U.S. surface transportation system.”

As you peruse these project descriptions you will see that our MATC-affiliated faculty have done an excellent job of implementing our theme by addressing a wide variety of multi-modal problems. Since 2006 when we first submitted our proposal to the U.S. DOT, our proposed research plan for MATC has been exceptionally ambitious—and I am heartened to report that yet again the faculty and students of MATC have met and exceeded our proposed research goals.

The penultimate section of our report provides an overview of our education program. Here you will meet MATC’s Master’s and PhD Students of the Year—Ben Grone and Cody Stolle—two of our finest ambassadors of the U.S. DOT University Transportation Center program. In addition, you will find in this section an update on our MATC internship program, which continues to expand each year. Last year we reached a total of 41 internship participants across the region. We are also taking the opportunity to present our K-12 initiatives for elementary and secondary school students. You will notice that MATC faculty and staff have been very busy working with teachers and students to our campuses—either for single day visits or for more substantive programs such as the MATC Summer Institute, which was attended by more than 145 students and teachers this year. I would also like to take the opportunity to point out our newest MATC activity, entitled “Roads, Rails and Race Cars.” This is an after-school program for middle school children who have an interest in engineering as a possible career. This year we had 25 students participate, and currently we are expanding to five schools and over 100 students.

While proud of MATC’s achievements this year in research, education, and technology, I fully recognize our success would not be possible without the continued support of our public and private sector partners. To them we owe a very large debt of gratitude. As you may be aware, the U.S. Department of Transportation has decided to implement a new competition for FY 2011 Regional Center funding. I remain confident that we have built one of the preeminent UTCs in the country, and I look forward to the competition. I am delighted to report that Iowa State University, the University of Missouri-Columbia, and Haskell Indian Nations University have joined the existing MATC team of the University of Iowa, Lincoln University, Indiana University (which hosts the Region V University Transportation Center). This joint research center will allow us to leverage the ITS work done by MATC-affiliated researchers, provide opportunities for students and faculty to collaborate with our partners in India, and to host faculty and students from those institutions. This is an exciting development in the outreach of MATC, and I look forward to sharing with you our successes in the coming years.

I look forward to the competition. I am delighted to report that Iowa State University, the University of Missouri-Columbia, and Haskell Indian Nations University have joined the existing MATC team of the University of Iowa, Lincoln University, Indiana University (which hosts the Region V University Transportation Center). This joint research center will allow us to leverage the ITS work done by MATC-affiliated researchers, provide opportunities for students and faculty to collaborate with our partners in India, and to host faculty and students from those institutions. This is an exciting development in the outreach of MATC, and I look forward to sharing with you our successes in the coming years.

Last, but certainly not least, we provide in this report a synopsis of our outreach activities. While most of these activities take place in Region VII, several of these activities are national or international in scope. Those familiar with MATC may know that we have developed key international partnerships over the past few years. For example, recently UNL has been awarded an Indo-US Forum Joint Research Center in Intelligent Transportation Center. Our partners in this endeavor are the Indian Institute of Technology-Madras, Indian Institute of Technology-Bombay, and Purdue University (which hosts the Region V University Transportation Center). This joint research center will allow us to leverage the ITS work done by MATC-affiliated researchers, provide opportunities for students and faculty to collaborate with our partners in India, and to host faculty and students from those institutions. This is an exciting development in the outreach of MATC, and I look forward to sharing with you our successes in the coming years.

Sincerely,
Larry
Vision
MATC’s vision is to become a nationally recognized center of transportation excellence focused on developing new knowledge, innovative solutions, and the next generation of transportation professionals necessary to sustain the U.S. transportation system in a manner that is safer, more effective, more efficient, environmentally friendly, and sustainable.

Philosophy
MATC is designed as a true partnership between the Iowa Department of Transportation (IDOT), the Kansas Department of Transportation (KDOT), the Missouri Department of Transportation (MOT), the Nebraska Department of Roads (NDOR), the United States Department of Transportation (USDOT), private and public sector transportation representatives, and the member institutions of the Region VII UTC consortium. MATC is a cooperative effort among the major transportation sector partners in Region VII.

Overview of Consortium Members
Each consortium member brings unique expertise and resources to MATC. These complementary components create a collective program that is greater than the sum of its parts. For example, the five state flagship universities—UNL, KU, KSU, IU, and UI—have all established nationally recognized transportation programs and facilities. The laboratories, equipment, computer resources, faculty and administrative support mechanisms are of the highest caliber. MATC faculty are committed to increasing the diversity of the nation’s transportation workforce and MATC is proud to partner with LU, the leading minority-serving institution in Region VII. Faculty from each consortium member university are nationally and internationally known for their research related to the multi-modal transportation system. This unique combination of resources and faculty allows MATC to succeed in meeting the programs and goals envisioned in the SAFETEA-LU UTC legislation. Because of MATC’s underlying partnership agreement, faculty and students in Region VII have unprecedented access to state-of-the-art laboratories, computer resources, and administrative support. These resources enable MATC researchers to develop multi-institutional, interdisciplinary research teams to seek out and solve the complex transportation problems faced by Region VII and the nation.

University of Nebraska–Lincoln (UNL)
The University of Nebraska–Lincoln (UNL) is the primary research and doctoral degree-granting institution in Nebraska. As Nebraska’s land-grant university, it serves as the flagship institution of the University of Nebraska system. UNL has extensive experience in federal and non-federal-sponsored research, as evidenced by its annual submission and receipt of grants in excess of $150 million. With two state-of-the-art transportation laboratories—an Intelligent Transportation Laboratory and a Visualization and Simulation Laboratory (as well as a Structural and Geomaterials Laboratory)—Whittier Research Center, the new UNL facility for Nebraska Transportation Center, is a substantive investment by the University of Nebraska Administration that is contributing substantially to MATC’s core initiatives of research, education, and technology transfer.

NTC at UNL serves as the umbrella organization for surface transportation-related research, education, and technology transfer programs on all four University of Nebraska campuses (Omaha, Lincoln, Kearney, and the Medical Center). These programs include the Midwest Roadside Safety Facility, MATC, and the Nebraska Technology Transfer Center on the Lincoln Campus; the UNL Center for Infrastructure Research and the UNO School of Public Administration on the Omaha Campus; and the Nebraska Safety Center at the University of Nebraska in Kearney. The Health Education, Rural Health, and Traffic Injury Prevention and Acute Treatment Programs are located in the NU Medical Center.

University of Kansas (KU)
The University of Kansas (KU) fosters cross-disciplinary research in emerging transportation issues that have broad significance. KU is home to the Kansas University Transportation Center, which conducts, coordinates, and promotes transportation research, training, and technology transfer. Campus researchers and graduate students participate in research across related disciplines with colleagues from other universities and public transportation entities. One example of such collaboration is the successful KU intern program, which merges public and private sectors in an intensive education experience. By planning and implementing a summer intern program in conjunction with the Kansas Department of Transportation, MATC faculty members at KU have placed an important emphasis on the professionalism, marketability and career knowledge of undergraduate students.

Faculty researchers at the University of Kansas conduct research on a variety of transportation topics, such as (i) new component and system technologies that advance vehicular and transportation systems; (ii) the development of a new generation of vehicles, with improved energy efficiencies and lowered pollutant emissions, increased safety and durability; (iii) the planning and development of new tools to design, model, and analyze components, transportation systems and environmental impacts; and (iv) the provision of advanced-technology educational research experiences through undergraduate and graduate programs, interaction with industrial partners, and outreach activities to state and regional groups.

Missouri University of Science and Technology (MS&T)
The Department of Civil, Architectural, and Environmental Engineering at the Missouri University of Science and Technology (MS&T, formerly University of Missouri-Rolla) has a broad-based program with seven emphasis areas, including structures, geotechnical engineering, construction, materials, transportation,
environmental engineering, and hydraulics. The MS&T research activities related to infrastructural engineering and intelligent systems are coordinated by several research centers. The umbrella organization, the Center for Infrastructure Engineering Studies (CIES), plays a significant role in the execution of initiatives within transportation infrastructure areas.

The primary research areas developed over the years include advanced materials and their application for existing structure rehabilitation, load test bridge assessment, nondestructive evaluation, and the monitoring of technologies for civil infrastructure. MS&T has developed research infrastructures for several of the proposed research theme topics, including a three-story structures testing laboratory that allows for the testing of full-scale structural members and systems, a structural health monitoring laboratory, a material testing laboratory, a nondestructive testing laboratory, and a network simulation laboratory.

In addition to research capabilities, MS&T has a strong education outreach program with ongoing K-12 programs—including involvement in local elementary education events and secondary school visits—and a well-developed undergraduate intern program with the Missouri Department of Transportation (MoDOT). Other education-related measures include expanding the internship program in conjunction with the Kansas Department of Transportation to offer both academic year and summer internships, and beyond being successful, these positions are increasingly sought after by students.

Other education-related measures include expanding the transportation curriculum at the university by offering courses on transportation construction and preservation. Furthermore, with multiple professional development curricula geared towards training professionals in the field, MATC affiliated faculty at KSU have been instrumental to MATC’s tech transfer objectives. This curricula process, along with the internships and curriculum development, are all part of KSU’s transportation workforce development initiative, which works with current students and professionals in the field to ensure a well-educated and prepared workforce—greatly advancing MATC’s overall aims.

University of Iowa (UI)

The University of Iowa (UI) brings a number of important research groups to the MATC consortium. UI’s Public Policy Center (PPC) was formed in 1987 to facilitate interdisciplinary academic research on public policy issues. Research teams at PPC address a number of important policy areas including transportation, health care, human factors and vehicle safety, economic development, social equity, and environmental quality. UI is also home to the National Advanced Driving Simulator—the most advanced driving simulator in the world. Developed by the National Highway Traffic Safety Administration (NHTSA), it is used to conduct research that will ultimately reduce the loss of lives and property on the nation’s roadways. In fact, research at UI is focused on improving the safety of roadways in a variety of ways by understanding the safety climate of commercial operations, improving the safety of bridge crossings, and mitigating accident severity by reducing the potential for freight-related explosions.

Educational programming at UI has included coordinating a research symposium that is open to undergraduate and graduate students. Speakers are composed of industry professionals, from the public and private sectors, and topics of discussion have included the future of the transportation industry. Additionally, UI faculty added two courses, “Public Transit Operations” and “Planning and Freight Transportation Planning,” to expand the transportation offerings for students.

Kansas State University (KSU)

Kansas State University (KSU) has all the facilities necessary for the successful completion of a wide range of transportation research projects, offering some of the best facilities in the nation for research related to the transportation infrastructure. These facilities include a full-scale, indoor accelerated pavement testing facility, two state-of-the-art Superpave Asphalt Laboratories, a falling weight deflectometer (FWD) calibration laboratory, and various other structural testing capabilities. Additionally, KSU has proven that it has the proper resources to achieve the education and tech transfer goals established by MATC. KSU has established an intern program in conjunction with the Kansas Department of Transportation to offer both academic year and summer internships, and beyond being successful, these positions are increasingly sought after by students.

Lincoln University (LU)

Lincoln University (LU), located in Jefferson, Missouri, has strong programs in business, finance, and accounting and has requested that education be the focus of their participation in MATC. As the only historically black college and university (HBCU) in Region VII, UI’s participation is critical to the success of the education and technology transfer components of the MATC program.

Prairie View A&M University (PVAMU)

Prairie View A&M University (PVAMU) was founded in 1876 and is the second-oldest public institution of higher education in Texas. PVAMU has an established reputation for producing engineers, nurses and educators, and offers baccalaureate degrees in 50 academic majors, 37 master’s degrees, and four doctoral degree programs through nine colleges and schools. A member of the Texas A&M University System, the university is dedicated to fulfilling its land-grant mission of achieving excellence in teaching, research, and service. PVAMU faculty members have demonstrated their commitment to MATC educational initiatives, time and again, by their integral leadership in promoting and planning educational programming, such as the Scholars’ Program. Moreover, with the help of PVAMU, MATC has furthered the established educational mission by reaching out to underrepresented students and urging them to utilize internships that can be critical in shaping their educational and career choices.
Transportation-Related Research Programs

The five state flagship universities (UNL, KSU, KU, UI, and MS&T) all have significant existing transportation-related research programs that include centers dedicated to roadway safety (UNL), infrastructure testing (UNL, KSU, KU, and MS&T), advanced highway materials (KSU, KU, UNL), driving simulation (U), public policy (UI), and advanced vehicle and fuel technologies (MS&T, KU, UNL). The expansive range covered by the research programs associated with the consortium indicates the interdisciplinary and complex nature of the research occurring within the MATC consortium. In fact, these centers are integral to enabling and expanding MATC research efforts.

Working in conjunction with such centers allows MATC researchers to have greater access to institutional resources, and contact creates an environment in which collaboration and communication can occur. These interactions expand and enhance the research dialogue, all while investing productive energy into local and regional networking between researchers and professionals. It is such relationships that are critical to producing and maintaining a strong workforce, securing the best minds and guaranteeing progressive research for a safer infrastructure.

Institutional Resources

The member institutions that comprise the consortium, particularly, the five state flagship universities (UNL, KSU, KU, UI, and MS&T) have excellent facilities and significant resources that are used in MATC activities. Combined budgets of the research, service, and educational activities of the consortium have exceeded tens of millions of dollars annually. More importantly, the synergy that exists among the consortium’s transportation faculty and researchers is leading to greater national achievements in research, education, and service than could have been accomplished if the consortium members were to work as single entities.

Major research libraries, state-of-the-art computer facilities, laboratories, and office space are available at each university. The institutional members of MATC also have a substantial array of classrooms, offices, and support services available for use by MATC personnel. All universities in the consortium have such computer-aided art training and video conferencing facilities that are capable of meeting the needs of all research and training (both onsite and distance learning) initiatives.

NTC has access to a comprehensive set of multi-modal, state-of-the-art research and testing facilities. These include the Nebraska Transportation Center’s (NTC) Intelligent Transportation Systems laboratory, which has recently moved into a new home, the Whetstone Research Center at the University of Nebraska at Lincoln, and has been expanded. NTC also houses the Midwest Roadside Safety Facility (UNL), where roadside safety initiatives such as the revolutionary Midwest Guardrail System have been developed. MATC consortium members also conduct research at various structural testing facilities (UNL, MS&T, KU, KSU), an Accelerated Pavement Testing Facility (KSU and UI), and environmental research facility (KU and UI). A wide range of research already has been conducted at these facilities, which include various public (FWHA, FRA, NDOT, ILENT, KDOT, MoDOT) and private agencies (NASCAR, Indy Racing League, Dickey Tool Company, Safelinc). To keep up with the latest research needs and new technology, these facilities are continually being updated and expanded. For example, NTC’s transportation researchers have recently set up a hybrid energy test bed, a mobile test bed trailer, an instrumented high speed intersection test bed, and coordinated arterial test sites that are monitored via stations in the ITS lab. In addition, the University of Kansas is running the first tests in their new Rail Testing Facility. KU has also established the interdisciplinary Emerging Technologies for Sustainable Infrastructure Laboratory, where research for the National Science Foundation, KU Transportation Research Institute, and various public and private agencies are ongoing.

Institutional Resources

The Institutional Resources section provides an overview of the resources available at each university. It includes information about the research labs, facilities, and other resources available for transportation-related research.
### Institutional Resources continued...

#### KU continued...

**Railway Testing Facility**
This facility is designed to test a section of track that is full width and five feet in length with 24 inches of ballast and 24 inches of subgrade soil, with the capability for repeated loading of the track panel up to 200,000 pounds.

**Structural Testing Laboratory**
The lab has equipment for the testing of steel, concrete, and composites using static and servo-hydraulic test equipment.

**Transportation Laboratory**
The transportation laboratory facilitates research on the characteristics of traffic flow and transportation systems.

**Transportation Materials Lab**
The Transportation Materials Laboratory has an ignition oven for asphalt binder, a rotational viscometer, a centrifuge and Abson extraction device for asphalt, a large oven, an asphalt pavement analyzer, a gyratory compactor, a light falling weight deflectometer, and other advanced equipment.

#### MS&T

**Applied Microwave Nondestructive Testing Laboratory**
Major activities in this laboratory include both basic R&D and applied research in the field of Microwave Nondestructive Testing & Evaluation, which includes fatigue crack detection, imaging, moisture detection, determination of aggregate-to-cement ratio on concrete, condition assessment of rebar.

**Highbay Structures Laboratory**
The HSL has a strong floor area of 8,800 square feet that can accommodate a 30-foot tall or 100-foot long specimen.

**Structural Health Monitoring Laboratory**
This laboratory supports research in the areas of damage detection and nondestructive testing in various engineering materials and structures.

**Trustworthy Systems Laboratory**
Here research is performed in many areas of networking, trustworthiness and security, such as network simulation, cryptography and wireless networks.

#### UI

**IIHR-Hydroscience and Engineering**
Formerly the Iowa Institute of Hydraulic Research, the labs feature state-of-the-art, in-house capabilities for both computational and physical modeling and experimentation.

**National Advanced Driving Simulator**
The NADS is a center for driving simulation excellence and is home to a range of simulators that offer varying levels of driving realism.

**Hank Virtual Environments Laboratory**
The Hank Virtual Environments Lab focuses on using virtual environments to study human perception and action, including understanding how children and adults negotiate traffic-filled intersections in our virtual environment.

**Operator Performance Laboratory**
In this lab, research is conducted in a number of areas of surface and air transportation.

**Combustion and High Speed Fluid Mechanics Lab**
Research in the CIHST lab is committed to finding solutions to important questions in combustion and related fluid mechanics.
**MATC Associate Directors**

**Dr. Elizabeth “Libby” Jones**  
Associate Professor, Civil Engineering  
University of Nebraska-Lincoln  
2018 Peter Kiewit Institute Building  
6001 Dodge Street  
Omaha, NE 68182-0178  
Phone: (402) 554-3850  
ejones@unl.edu

Dr. Libby Jones is an associate professor in the Department of Civil Engineering at the University of Nebraska-Lincoln (Omaha campus). She directs and oversees the MATC Intelligent Transportation Systems Lab at the University of Nebraska’s Peter Kiewit Institute. Dr. Jones has been a principal investigator or co-principal investigator on more than 15 research projects. She has authored or co-authored over 20 journal papers and served as committee chair for over 20 masters’ and doctoral students. Currently she is supervising five masters’ students and two doctoral students. Dr. Jones serves as the MATC associate director for UNL.

**Dr. Paul Hanley**  
Associate Professor, Civil & Environmental Engineering and Public Policy Center  
University of Iowa  
2030 South Oak  
Iowa City, IA 52242  
Phone: (319) 335-8117  
paul.hanley@uiowa.edu

Dr. Paul Hanley is an associate professor of transportation in civil and environmental engineering as well as urban and regional planning at the University of Iowa. He also has an appointment at the University’s Public Policy Center, where he is the director of transportation policy research. His principal research interests are transportation engineering, planning, and economic policy analysis. In general, his work focuses on assessing the impacts of policy changes on transportation behavior and on infrastructure provision as a means of enhancing safety, ensuring economic wellbeing, and promoting sustainable urban patterns. He serves as a MATC associate director for the University of Iowa.

**Dr. Genda Chen**  
Professor, Civil Engineering, Architectural & Environmental Engineering  
Missouri University of Science & Technology  
224 Engineering Research Laboratory  
Rolla, Missouri 65409-0090  
Phone: (573) 341-4462  
gchen@mst.edu

Dr. Genda Chen is a professor in the Department of Civil, Architectural, and Environmental Engineering at the Missouri University of Science & Technology (formerly, University of Missouri-Rolla) and the interim director of the Center for Infrastructure Engineering Studies (CIES). He is a registered professional engineer in the state of California. Dr. Chen has been principal investigator and co-principal investigator on over 55 research projects, totaling more than $8 million for his PI and approximately $35 million for his share. He has supervised 10 doctoral students and 35 masters’ students, and has published over 40 peer-reviewed journal papers and an additional 18 conference papers. Dr. Chen serves as the MATC associate director for the Missouri University of Science & Technology.

**Dr. Tom Mulinaazzi**  
Professor, Civil, Environmental & Architectural Engineering  
University of Kansas  
2102 Leaurned Hall  
Lawrence, Kansas 66045  
Phone: (785) 864-2928  
tomenuk@gmail.com

Dr. Tom Mulinaazzi is a professor and former department chair of civil engineering and associate dean of engineering at the University of Kansas (KU). He has been a member of the Kansas State Board of Technical Profession since 2009. He is very active with the Local Technical Assistance Program at KU. Dr. Mulinaazzi serves as the MATC associate director for the University of Kansas.

**Dr. Mustaque Hossain**  
Professor, Civil Engineering  
Kansas State University  
2124 Fiedler Hall  
Manhattan, Kansas 66506-5000  
Phone: (785) 532-0765  
mustakake@ksu.edu

Dr. Mustaque Hossain is a professor in the Department of Civil Engineering at Kansas State University. His main areas of interest include the application of new technologies in construction, quality control/quality assurance, mechanistic analysis and design of pavements, nondestructive testing of pavements, and pavement and maintenance management systems. Dr. Hossain has conducted over 50 research projects, published over 44 peer-reviewed journal articles and has four patents related to his research. He is a fellow of the American Society of Civil Engineers (ASCE) and is also very active in the Transportation Research Board (TRB). He serves as the MATC associate director for Kansas State University.

**MATC Advisor Board: Private Sector**

**Mr. E. Dean Carlson**  
Former Executive Director, FITWA  
Secretary of Transportation, Kansas

Mr. Carlson is the former executive director of FITWA, former secretary of transportation for the State of Kansas, and a member of the National Academy of Engineering. In 2003 Dean Carlson retired from his position as Kansas secretary of transportation and began his consulting practice. He has nearly fifty years of experience in the field of transportation, in addition to eight years as Kansas Secretary. He served for 16 years with the Federal Highway Administration, retiring as executive director in 1994. He has served as a member of the Executive Committee of the Transportation Research Board, and was its chairman in 2002. He is also former president of the Board of Directors of the American Association of State Highway and Transportation Officials. In 2001, Secretary Carlson was elected to the prestigious National Academy of Engineers for “outstanding leadership and dedication in developing national highway policy, systems management initiatives and research programs.” During his distinguished career, Secretary Carlson has received awards from Presidents G.H.W. Bush and Clinton, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, the National Research Council, the International Road Federation and the Road Gang.

**Mr. John L. Craig**  
Vice President  
HDR Engineering, Inc.

John L. Craig is vice president of HDR Engineering, Inc. and is leading a Joint HDR-Fluor venture to repair and replace 36 bridges throughout Oregon. Prior to this, he served over 10 years as the Director of the Nebraska Department of Roads (Department of Transportation) and as a member of the Governor’s Cabinet. He retired as a commissioned officer from the U.S. Army Corps of Engineers.

Craig is a past member of the Board of Directors of the American Association of State Highway and Transportation Officials (AASHTO); Board of Directors of the Intelligent Transportation Society of America; and the Executive Committee of the Transportation Research Board. U.S. National Academies. He currently serves on the Board of Directors of the Nebraska Transportation Center. He has also participated in and received awards from international, national, regional, state and local organizations in engineering, transportation, and defense.

**Mr. David Sehrt**  
Senior Vice President  
Ingram Barge Lines

Mr. David Sehrt is senior vice president of Ingram Barge Lines. Mr. Sehrt graduated with a BS in civil engineering from Tulane University in 1976. In 1990, Mr. Sehrt received an MBA from the Owen School at Vanderbilt University. Since 1990, he has been with Ingram Barge Company, working primarily in the motor vessel engineering and barge maintenance areas.

**Mr. David Connell**  
Vice President, Engineering  
Union Pacific Railroad

Mr. Connell is the vice president of engineering for Union Pacific Railroad. David has worked for Union Pacific and predecessor companies for 27 years holding a variety of staff and staff positions including AVP- Construction, Chief Engineer – Maintenance of Way and various track research positions. In his current position, Connell directs the design, construction and maintenance of all track, signal and bridge infrastructure in the nation’s largest railway. David holds a BS degree in civil engineering from NC State University and attended the Harvard Business School. He currently chairs the American Association of Railroad Heavy Axle Load Committee and is a member of the Railway Technology Working Committee at the Transportation Technology Center, Inc.
Mr. Dan Murray
Vice President, American Transportation Research Institute

Mr. Murray is vice president of research for the American Transportation Research Institute (ATRI), an award-winning, non-profit research arm of the trucking industry that conducts objective research, analysis and evaluation on a range of transportation issues, such as safety, technology, productivity and security. Mr. Murray has overall responsibility for directing ATRI’s portfolio of research and has served as project manager on research initiatives sponsored by numerous agencies within the USDOT. In addition, he has served on various transportation research committees for organizations such as the National Academy of Sciences, General Accounting Office, and Council on Competitiveness. Prior to joining ATRI, Mr. Murray worked for the Regional Transit Board (Minneapolis-St. Paul) as project administrator. He also spent several years working in economic development for a Chrysler-owned fortune 500 business, where Mr. Murray received his BA from Gustavus Adolphus College, and his MS from Northwestern University.

Mr. Robert VanderClute
Senior Vice President of Safety and Operations
Association of American Railroads

Mr. VanderClute is a senior vice president of safety and operations at the Association of American Railroads. Mr. VanderClute is the industry’s liaison with the FRA, NTSB, EPA, DHS, FCE, and other regulatory bodies. After graduating from the University of Tennessee, where he majored in transportation, Mr. VanderClute completed graduate school programs at both the Darden Graduate School of Business at the University of Virginia and the Harvard Business School. He is a fellow with CILT and is active in several public and professional organizations. Mr. VanderClute subsequently served as vice president of operations and later chief operations officer at Amtrak, reporting directly to Amtrak’s president and chairman. During his career, he supervised Amtrak’s new program, embarked on a $6 billion infrastructure improvement program, replaced virtually its entire motive power and car fleet, and became the largest contract carrier of commuter services in North America.

Mr. Michael Flanigon
Director, Office of Safety and Security
Federal Transit Administration

Mr. Flanigon has been with the transportation industry for over 35 years. He began his career as a brakeeman on the Southern Pacific Lines (SP). During his tenure with SP, he worked as a switchman, conductor, locomotive engineer, and operating rules instructor. He has also worked with the California Public Utilities Commission, where he had responsibilities in that state’s rail safety oversight program, and the Valley Transportation Authority, where he was responsible for managing safety and health and safety manager and subsequently as light rail superintendent. Later, at San Francisco Bay Area Rapid Transit (BART), he served as the chief safety officer. He was an NTSB railroad accident investigator and served as the investigator-in-charge on a number of high profile railroad and transit accidents before joining the FTA in 2002 as the director of the Office of Technology. He earned his bachelor’s degree in anthropology from California State University in Los Angeles, and his master’s degree in public administration from Golden Gate University in San Francisco.

Mr. Joseph Werning
Division Administrator
Federal Highway Administration
Nebraska Division

Mr. Werning was appointed division administrator for the Federal Highway Administration’s Nebraska Division on August 18, 2009. In this capacity, Mr. Werning serves as the principal representative of the FHWA and is responsible for administering the entire federal-aid highway program in Nebraska. He is responsible for providing leadership and guidance to state, local, industry, and American Association of State Highway and Transportation Officials in the identification of transportation needs and priorities that, when implemented, carry out national transportation and safety program goals. He is also responsible for establishing division office goals and objectives that will meet the agency’s strategic vision while maximizing available resources. Mr. Werning earned a bachelor’s degree from the University of Maryland, College Park in 1976. For the past 21 years, he has held numerous professional positions with FHWA throughout the country and with a private engineering firm. He has extensive experience in the transportation field, including state and urban planning and program development, transportation management, transportation finance, policy analysis, and legislative development. He has also received numerous performance awards, including the FHWA Administrator’s Award for Superior Achievement.

Mr. Monty Fredrickson
Director, State Engineer
Nebraska Department of Roads

Mr. Fredrickson was born and raised in Stromsburg, Nebraska. After graduating with a bachelor’s degree in civil engineering in 1969 from the University of Nebraska—Lincoln, he worked for Shell Oil Company as a mechanical engineer in New Orleans, Louisiana, for 18 months. In 1970, he began working for the Nebraska Department of Roads and spent one year as survey party chief and inspector in the Omaha, Nebraska, construction district. Mr. Fredrickson also spent 7 years working in the Roadway Design Division in Lincoln, Nebraska, and then the position of assistant design engineer in the following areas: Rural, Urban, Expressway and Interstate. After four years as district engineer in charge of construction and maintenance back in Omaha, he spent 7 years as deputy director for engineering services in Lincoln, Nebraska. He is currently serving his third year as director-state engineer.

Mr. Richard Reiser
Vice President of Government Affairs
 Werner Enterprises, Inc.

Mr. Reiser is vice president of government affairs at Werner Enterprises, Inc., an Omaha-based motor carrier and logistics company that provides trucking and logistics services in 48 states and several foreign countries. Reiser is responsible for managing all of the governmental, regulatory, and legislative affairs of Werner Enterprises. As a transportation expert, Reiser serves as chairman of the Transportation Council of the Greater Omaha Chamber of Commerce, vice-chairman of the Litigation Center Board of Directors for the American Trucking Associations, and member of the ATLA’s Board of Directors and executive committee. Reiser serves on the Board of Trustees of the Greater Omaha Alliance for Business Ethics and is past chairman of the Board of Directors of the Nebraska Chamber of Commerce and Industry. He is a former mayor of Cambridge, Nebraska. Reiser’s educational background includes a bachelor of science in business administration from the University of Nebraska—Lincoln (1979) and a juris doctorate degree from the University of Nebraska (1982). Prior to joining Werner Enterprises, he was in private practice in Omaha, Nebraska, from 1972 through 1993. He is admitted to practice law in Iowa, Nebraska, the U.S. District Court for the District of Nebraska, and the U.S. Circuit Court of Appeals for the 8th Circuit.

Mr. William (Bill) A. McWhirter, II
Senior Vice President and Group President
Trinity Industries, Inc.

William A. McWhirter, II was elected by the Board of Directors of Trinity Industries, Inc., on March 22, 2010, to Senior Vice President and Group President. On May 24, 2013, McWhirter was appointed by the Board to the position of Vice President and Chief Financial Officer. He served five years in this role before returning to an operating position in 2015 as Group President. McWhirter is responsible for the Construction Products, Inland Barge, and Rail Components business segments with combined revenue of $1.2 billion. During his tenure as CFO, he provided leadership in the overall financial strategy, cost reduction initiatives, and long-term strategic direction for a $3 billion multinational public company. In addition, he assisted the CEO with the planning and presentation of all significant Board material with an emphasis on executive compensation plans, audit issues and financing activities.

McWhirter is an active member of the Advisory Committee to the College of Business Administration at the University of Texas at Arlington. He is a past member of the CFO Executive Board. McWhirter is also a past member of the Board of Directors and Financial Management and Administrative Services for Trinity’s national ready mix association. Concurrent with these memberships, he served on the Board of Directors for the Texas Aggregate Concrete Association.

McWhirter received an undergraduate degree in Finance from the University of Texas at Arlington in 1986 and his CPA license in 1991.

Mr. Joseph Krammes
Technical Director, Research and Development
Turner-Fairbank Highway Research Center

Mr. Krammes has spent the last three decades establishing himself as one of the nation’s preeminent road geometry design scholars. Mr. Krammes, who holds a PhD in civil engineering from Pennsylvania State University and is a registered professional engineer, has more than three-dozen publication credits to his name and was recognized as the Federal Highway Administration Engineer of the Year in 2004. He is a member of the Institute of Transportation Engineers’ Transportation Safety Council.

Dr. Judy A. Perkins
Professor and TAMU Regents Professor Department of Civil and Environmental Engineering
Prairie View A&M University

Dr. Perkins holds a BS, MS, and PhD in civil engineering from Southern University, University of Illinois (Urbana-Champaign), and Georgia Institute of Technology, respectively. At the master’s level, her area of specialty was in reinforced concrete structures at the doctoral level. It was in transportation engineering. Since 1992, Dr. Perkins’ research has focused on statewide intermodal transportation planning, transportation logistics, hurricane evacuation analyses, and the impact of economic development. Moreover, Dr. Perkins has accumulated extensive experience in the development of survey design, data collection, state-level transportation planning, and the refinement of economic development methodologies used to evaluate transportation-related activities. Dr. Perkins extensive record of publications includes publications related to both the national and international transportation and environmental education arenas.

Dr. Ray Krammes
Technical Director, Research and Development
Turner-Fairbank Highway Research Center

Mr. Joseph Werning has been the transportation industry’s liaison with the FRA, NTSB, EPA, DHS, FCE, and other regulatory bodies. After graduating from the University of Tennessee, where he majored in transportation, Mr. VanderClute completed graduate school programs at both the Darden Graduate School of Business at the University of Virginia and the Harvard Business School. He is a fellow with CILT and is active in several public and professional organizations. Mr. VanderClute subsequently served as vice president of operations and later chief operations officer at Amtrak, reporting directly to Amtrak’s president and chairman. During his career, he supervised Amtrak’s new program, embarked on a $6 billion infrastructure improvement program, replaced virtually its entire motive power and car fleet, and became the largest contract carrier of commuter services in North America.

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McWhirter received an undergraduate degree in Finance from the University of Texas at Arlington in 1986 and his CPA license in 1991.
Research Directors

Mara Campbell
Customer Relations Director
Missouri Department of Transportation

Mara Campbell is the customer relations director for the Missouri Department of Transportation. She is responsible for leading the department’s communication and outreach efforts, performance management and process improvement development and policy planning. Prior to this position, Campbell directed MoDOT’s Organizational Results division, focusing on closing organizational performance gaps by implementing innovative transportation solutions. She has served as the department’s strategic planning and policy director, as well as the governmental affairs director.

Prior to joining MoDOT, Campbell was the public relations and marketing director for Memorial Community Hospital-Capital Region Medical Center in Jefferson City. She received her bachelor of science degree in public relations/communications in 1984 from Central Missouri State University in Warrensburg, and has a master of business administration degree from William Woods University.

Currently, Campbell serves on the American Association of State Highway and Transportation Officials’ Standing Committee on Performance Management as well as the Standing Committee on Research. She also serves as chair of the Transportation Research Board’s Strategic Management Committee.

Moe Jamshidi
Materials and Research Division Engineer
Nebraska Department of Roads

Mostafa Jamshidi is the materials and research engineer for the Nebraska Department of Roads (NDOR). Mr. Jamshidi is currently responsible for directing the activities related to pavement design, pavement management and materials testing for the State Highway System of Nebraska. He is also in charge of coordinating all the research activities related to pavements and materials for the Nebraska Department of Roads. Mr. Jamshidi has been involved in the design and construction of transportation related projects for over 25 years. He has served on numerous local and national Technical Advisory Committees for transportation related research projects. Mr. Jamshidi is a graduate of the University of Nebraska with a degree in civil engineering, and is a registered professional engineer in the state of Nebraska. He is a member of the AASHTO Subcommittee on Materials, a member of AASHTO Research Advisory Committee, and the Transportation Research Board’s (TRB) representative for the NDOR.

Mr. Jamshidi has been involved in the design and construction of numerous local and national Technical Advisory Committees for transportation related research projects. Mr. Jamshidi is a graduate of the University of Nebraska with a degree in civil engineering, and is a registered professional engineer in the state of Nebraska. He is a member of the AASHTO Subcommittee on Materials, a member of AASHTO Research Advisory Committee, and the Transportation Research Board’s (TRB) representative for the NDOR.

Sandra Larson
Research and Technology Bureau Director
Iowa Department of Transportation
Highway Division

Sandra Larson is currently director of the Research and Technology Bureau in the Highway Division of the Iowa Department of Transportation, a position she has held since 2002. During her 25 years with the Iowa Department of Transportation, she has held various positions, including Engineering Bureau director, state bridge engineer, Ames resident construction engineer, and bridge design engineer. Sandra has two BS degrees from Iowa State University in civil engineering (1980) and general science: biology (1975) and is a registered professional engineer in the state of Iowa in civil and structural engineering. She serves on numerous TRB, FHWA, and AASHTO committees in the areas of research, structures, winter maintenance, and pavements.

Rodney “Rod” Montney
Engineer of Research
Kansas Department of Transportation

Rodney Montney is the engineer of research for the Kansas Department of Transportation (KDOT). In this position, he directs the agency’s research activities and 25 staff members. He serves as chairman of KDOT’s Research Technical Committee and secretary of its Research Program Council. Mr. Montney is a member of the AASHTO Research Advisory Committee (RAC). He is also the Kansas DOT Transportation Research Board (TRB) representative. Mr. Montney serves on advisory committees for the University of Nebraska Mid-America Transportation Center and the Kansas State University Transportation Center.

Mr. Montney has a BS in mining engineering from the Colorado School of Mines and is a licensed professional engineer in the State of Kansas. He has worked for KDOT for years. Prior to being appointed engineer of research, his experience has primarily been in construction, materials tests, pavement design, and concrete.
Education Administrators

Dr. Elizabeth “Libby” Jones
Associate Professor, Civil Engineering
Associate Director, Mid-America Transportation Center
University of Nebraska-Lincoln

Dr. Jones serves as the MATC coordinator for education and equity and will be responsible for coordinating the MATC educational and diversity programs.

Dr. Erick Jones
Director, RFID Supply Chain Lab
Director, Transportation Logistics Lab
Associate Professor
Industrial and Management Systems Engineering

Dr. Jones serves as the lead principle investigator for the MATC Scholars Program and, as part of this position, coordinates the curriculum for the annual MATC Scholars Program Graduate Conference.

Mr. Tyrone Westergaard
Assistant Professor, Business Administration
Lincoln University

Mr. Westergaard serves as the MATC education coordinator at Lincoln University and will help coordinate, along with Dr. Libby Jones, the MATC diversity programs.

MATC Staff

Dr. Laurence Rilett
MATC Director
Keith W. Kaasmeyer Chair in Engineering and Technology
lrilett2@unl.edu
Phone: (402) 472-1992

Dr. Laurence Rilett
MATC Director
Keith W. Kaasmeyer Chair in Engineering and Technology
lrilett2@unl.edu
Phone: (402) 472-1992

The Mid-America Transportation Center employs staff and students from the Nebraska Transportation Center on an as-needed hourly basis to ensure the most efficient use of MATC funds. The staff and students draw on a wide range of qualifications and areas of expertise and contribute greatly to the success of the center’s programs and to the quality of its publications. Through their work on MATC projects, students engaged in such diverse majors as computer engineering, business, psychology, marketing, and English learn about transportation engineering and how it shapes the world while providing MATC with a talented, well-educated, and high energy staff to complete the activities necessary for the center to thrive.

Ms. Valerie Lefler
MATC Program Coordinator
vlefler2@unl.edu
Phone: (402) 472-1974

CONSORTIUM PARTNER HIGHLIGHTS

UNIVERSITY OF NEBRASKA–LINCOLN
KANSAS STATE UNIVERSITY
UNIVERSITY OF IOWA
UNIVERSITY OF KANSAS
MISSOURI S&T
University of Nebraska-Lincoln Lead Institution

Highlights at a Glance

For Letter from UNL Director see pages 6-7

Educational Programming

Education is at the forefront of MATC’s initiatives and each year existing programs are expanded and new programs are conceived. MATC supports and spearheads educational initiatives that benefit a broad range of students, from kindergarten to graduate school. Our educational programs are distinctive in incorporating a hands-on, interactive, multidisciplinary approach and are focused on recruiting students to transportation careers. Yet, we recognize, as have education-based researchers in recent years, the need to reach our students by focusing on recruitment and success in transportation careers.

MATC Scholars Program: One of the newest MATC educational initiatives, the Scholars Program, prepares students for success in industry by offering them a unique opportunity to work with faculty mentors. The program includes a mentorship component, a research component, and a professional development component. The program is designed to provide students with the skills and knowledge necessary to succeed in the transportation industry.

The Summer Institute helps teachers integrate engineering concepts into their curriculum by providing them with the requisite engineering concepts needed to develop lesson plans. Teachers will extend to other Lincoln schools in the upcoming fiscal year.

In the summer institute, Dr. Lisa Rilett traveled to India to attend and present at the INDO-US and the Intelligent Transport Systems conferences. Both conferences brought together professionals and industry leaders from India and the US, and speakers represented an array of expertise from private and public sectors, academia and research groups. Upon his return, Dr. Rilett received news that the INDO-US Science and Technology Forum (USSTF) has agreed to support a student exchange proposal—a collaborative project conceived at last year’s INDO-US conference. To find out more, please see page 83.

INDO-US Forum and ITS India Conference: The collaboration efforts that began at last year's conference continued in 2011 as Dr. Larry Rilett traveled to India in February to attend and present at the INDO-US and Intelligent Transportation Systems conferences. The collaboration efforts were successful, with the two countries agreeing to continue their collaboration on transportation technology.

Tech Transfer and Career Development

With MATC’s relocation to the Whitther Transportation Research Center at the end of fiscal year 2010, we have been busy promoting and spreading our research and initiatives through lab tours, webinars and seminars. Fiscal year 2011 has seen MATC researchers, undergraduate and graduate students, and industry leaders from India and the US, and speakers represented an array of expertise from private and public sectors, academia and research groups. Upon his return, Dr. Rilett received news that the INDO-US Science and Technology Forum (USSTF) has agreed to support a student exchange proposal—a collaborative project conceived at last year’s INDO-US conference. To find out more, please see page 83.

ITS Heartland and ASCT Showcase: The 12th Annual ITS Heartland Meeting was held this year in Des Moines, Iowa, and was an important multi-state conversation about transportation among members of the public, private sectors, and of various higher education institutions. At this meeting, MATC students were honored for their research efforts and awards were given for the student paper competition. The ASCT Showcase was held in conjunction with this event by the Iowa Division of the FHWA, and served to highlight Adaptive Signal Control Technologies.

For more information on this conference and the students recognized with awards, please see page 91.

University Research Technology Transfer US DOT: Several MATC researchers were invited to present their projects at the first annual RITA showcase, which highlighted DOT-funded transportation research projects. Dr. Dean Sicking and PhD student Cody Stolle, both of UNL, gave a poster presentation of their work studying median barrier crashes—offering solutions to improve safety. Dr. Robert Peterman of KSU was asked to give a podium presentation on his project, which uses laser speckle imaging to measure strain in bridges and rail members. Find out more about these presentations by turning to page 88.

Check out the exciting new research funded in fiscal year 2011:

- Calibration of Micro-Simulation Models for Multi-modal Freight Networks
- Improving the Safety of Freight Transport by Monitoring the Effects of Knuckle Joint Erosion on Scour around Bridge Infrastructure
- Crash Costs at Rail Grade Crossings
- Truck Load Impact on Pavement - Phase III
- Reliability-Based Evaluation Criteria for Railway Bridges
- Assessing the Structural, Driver and Economic Impacts of Traffic Pole Mounted Wind Power Generator and Solar Panel Hybrid System
- IntelliDrive Technology Based Yellow Onset Decision Assistance System for Trucks
- Improving the Performance of Cable Median Barrier
- Improving the Freight Transportation Roadway System during Snow Events: A Performance Evaluation of Deicing Chemicals

For project details see pages 60-63
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 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, Chancellor 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.

University of Nebraska MATC Affiliated Faculty, Research Staff, & Partners

Dr. Junke (Drinker) Guo
Assistant Professor of Hydraulics and Fluid Mechanics, Civil Engineering
University of Nebraska-Lincoln
and U.S. 67th St. Pk, K21704D
Omaha, NE 68106-0128
Work: (402) 554-3193
jguo2@unl.edu

Dr. John Rohde
Associate Professor, Civil Engineering
University of Nebraska-Lincoln
362G Whittier Research Center
PO Box 830856
Lincoln, NE 68583-0856
Phone: (402) 472-8807
jrohde1@unl.edu

Dr. John Reid
Professor, Mechanical Engineering
University of Nebraska-Lincoln
Noel Walter Scott Engineering Center
Lincoln, NE 68583-0856
Work: (402) 472-3014
jreid@unl.edu

Dr. Yong-Rak Kim
Associate Professor, McNeel Professor of Engineering, Civil Engineering
University of Nebraska - Lincoln
362M Whittier Research Center
Lincoln, NE 68583-0856
Work: (402) 472-1727
ykim3@unl.edu

Dr. Andrzej Nowak
Interim Chair, Robert W. Brightfelt Professor of Engineering, Civil Engineering
University of Nebraska
Wyatt Nebraska Hall
Lincoln, NE 68583-0639
Phone: (402) 472-1176
anowak1@unl.edu

University of Nebraska MATC Affiliated Faculty, Research Staff & Partners

Dr. Laurence Rilett
Chair in Engineering and Technology Director, Nebraska Transportation Center
University of Nebraska-Lincoln
2630 Whittier Research Center
Lincoln, NE 68583-0128
Phone: (402) 472-1062
lrilett2@unl.edu

Dr. Elizabeth “Libby” Jones
Associate Professor, Civil Engineering Associate Director, Mid-America Transportation Center
University of Nebraska-Lincoln
201 Price Tower Institute Building
600 Dodge Street
Omaha, NE 68102-0128
Phone: (402) 554-3627
ejones@unl.edu

Dr. Anuj Sharma
Assistant Professor, Civil Engineering
University of Nebraska-Lincoln
330F Whittier Research Center
Lincoln, NE 68583-0128
Phone: (402) 472-6391
asharma3@unl.edu

Dr. Aemal Khattak
Associate Professor, Civil Engineering
University of Nebraska-Lincoln
362G Whittier Research Center
Lincoln, NE 68583-0128
Phone: (402) 472-8126
akhattak2@unl.edu

Dr. Junke (Drinker) Guo
Assistant Professor of Hydraulics and Fluid Mechanics, Civil Engineering
University of Nebraska-Lincoln
and U.S. 67th St. Pk, K21704D
Omaha, NE 68106-0128
Work: (402) 554-3193
jguo2@unl.edu

Dr. John Rohde
Associate Professor, Civil Engineering
University of Nebraska-Lincoln
362G Whittier Research Center
PO Box 830856
Lincoln, NE 68583-0856
Phone: (402) 472-8807
jrohde1@unl.edu

Dr. John Reid
Professor, Mechanical Engineering
University of Nebraska-Lincoln
Noel Walter Scott Engineering Center
Lincoln, NE 68583-0856
Work: (402) 472-3014
jreid@unl.edu

Dr. Yong-Rak Kim
Associate Professor, McNeel Professor of Engineering, Civil Engineering
University of Nebraska - Lincoln
362M Whittier Research Center
Lincoln, NE 68583-0856
Work: (402) 472-1727
ykim3@unl.edu

Dr. Andrzej Nowak
Interim Chair, Robert W. Brightfelt Professor of Engineering, Civil Engineering
University of Nebraska
Wyatt Nebraska Hall
Lincoln, NE 68583-0639
Phone: (402) 472-1176
anowak1@unl.edu

Dr. Hamid Sharif
Husam Professor, Computer & Electronics Engineering
University of Nebraska
200C PKI
Omaha, NE 68102-0128
Phone: (402) 554-3628
hsharif@unl.edu

Dr. David Admirala
Associate Professor, Civil Engineering
With NII
Lincoln, NE 68583-0128
Phone: (402) 472-8614
dadmirala@unl.edu

Dr. Tian Zhang
Professor, Civil Engineering
2015 PKI
Omaha NE 68102-0128
Phone: (402) 472-3626
tzhang1@unl.edu

Mr. Bob Bielenberg
Research Associate Engineer
Midwest Roadside Safety Facility
University of Nebraska-Lincoln
110 Whittier Research Center
Lincoln NE, 68583-0853
Phone: (402) 472-9064
rbielenberg2@unl.edu

Dr. Michael Hempel
Research Assistant Professor, Computer & Electronics Engineering
University of Nebraska-Lincoln
2015 PKI
Omaha NE 68102-0128
Phone: (402) 554-2288
mhempel@unl.edu

Dr. Laurence Rilett
Chair in Engineering and Technology Director, Nebraska Transportation Center
University of Nebraska-Lincoln
2630 Whittier Research Center
Lincoln, NE 68583-0128
Phone: (402) 472-1062
lrilett2@unl.edu

Dr. Elizabeth “Libby” Jones
Associate Professor, Civil Engineering Associate Director, Mid-America Transportation Center
University of Nebraska-Lincoln
201 Price Tower Institute Building
600 Dodge Street
Omaha, NE 68102-0128
Phone: (402) 554-3627
ejones@unl.edu

Dr. Anuj Sharma
Assistant Professor, Civil Engineering
University of Nebraska-Lincoln
330F Whittier Research Center
Lincoln, NE 68583-0128
Phone: (402) 472-6391
asharma3@unl.edu

Dr. Aemal Khattak
Associate Professor, Civil Engineering
University of Nebraska-Lincoln
362G Whittier Research Center
Lincoln, NE 68583-0128
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Dr. Junke (Drinker) Guo
Assistant Professor of Hydraulics and Fluid Mechanics, Civil Engineering
University of Nebraska-Lincoln
and U.S. 67th St. Pk, K21704D
Omaha, NE 68106-0128
Work: (402) 554-3193
jguo2@unl.edu

Dr. John Rohde
Associate Professor, Civil Engineering
University of Nebraska-Lincoln
362G Whittier Research Center
PO Box 830856
Lincoln, NE 68583-0856
Phone: (402) 472-8807
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Professor, Mechanical Engineering
University of Nebraska-Lincoln
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Lincoln, NE 68583-0856
Work: (402) 472-3014
jreid@unl.edu

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Associate Professor, McNeel Professor of Engineering, Civil Engineering
University of Nebraska - Lincoln
362M Whittier Research Center
Lincoln, NE 68583-0856
Work: (402) 472-1727
ykim3@unl.edu

Dr. Andrzej Nowak
Interim Chair, Robert W. Brightfelt Professor of Engineering, Civil Engineering
University of Nebraska
Wyatt Nebraska Hall
Lincoln, NE 68583-0639
Phone: (402) 472-1176
anowak1@unl.edu

Dr. Hamid Sharif
Husam Professor, Computer & Electronics Engineering
University of Nebraska
200C PKI
Omaha, NE 68102-0128
Phone: (402) 554-3628
hsharif@unl.edu

Dr. David Admirala
Associate Professor, Civil Engineering
With NII
Lincoln, NE 68583-0128
Phone: (402) 472-8614
dadmirala@unl.edu

Dr. Tian Zhang
Professor, Civil Engineering
2015 PKI
Omaha NE 68102-0128
Phone: (402) 472-3626
tzhang1@unl.edu

Mr. Bob Bielenberg
Research Associate Engineer
Midwest Roadside Safety Facility
University of Nebraska-Lincoln
110 Whittier Research Center
Lincoln NE, 68583-0853
Phone: (402) 472-9064
rbielenberg2@unl.edu

Dr. Michael Hempel
Research Assistant Professor, Computer & Electronics Engineering
University of Nebraska-Lincoln
2015 PKI
Omaha NE 68102-0128
Phone: (402) 554-2288
mhempel@unl.edu
Highlights at a Glance

**Dr. Ronald Faller**
Research Assistant Professor, Midwest Roadside Safety Facility
University of Nebraska-Lincoln
311 Whitter Research Center
Lincoln, NE 68583-0853
Phone: (402) 472-6864
rfaller@unl.edu

**Dr. Erick C. Jones**
Associate Professor, Industrial and Manufacturing Systems Engineering
Director RFID & AutoID Deployment Lab
420 Woolf Hall
Arlington, TX 76019-0017
Phone: (817) 272-7592
eyecjones@uta.edu

**Dr. Judy A. Perkins**
Professor and Department Head
Civil & Environmental Engineering
Prairie View A&M University
P. O. Box 519, MS #2510
Prairie View, TX 77446
Phone: (936) 261-1665
japerkins@pvamu.edu

**Dr. Senem Velipasalar**
Assistant Professor, Electrical Engineering
University of Nebraska-Lincoln
290 N SEC
Lincoln, NE 68588
Phone: (402) 472-5086
velipasalar@unl.edu

**Dr. Dr. Anil Thakur**
Assistant Professor of Economics and
Director of the Bureau of Business Economics
University of Nebraska-Lincoln
CBA 547
PO. Box 880489
Lincoln, NE 68588-0489
Phone: (402) 472-3318
ethompson@unl.edu

**Dr. Eric Thompson**
Associate Professor of Economics and
Director of the Bureau of Business Economics
University of Nebraska-Lincoln
CBA 547
PO. Box 880489
Lincoln, NE 68588-0489
Phone: (402) 472-3318
ethompson@unl.edu

**Dr. Sanjay Singh**
Associate Professor, Neurological Sciences
University of Nebraska Medical Center
92245 Nebraska Medical Center
Omaha, NE 68198-6904
Phone: (402) 559-4496
ssingh@unmc.edu

**Dr. Atorode Azizinamini**
Endowed University Professor, Civil Engineering
University of Nebraska-Lincoln
West Nebraska Hall
Lincoln, NE 68583-0351
Phone: (402) 472-5086
azizinamini@unl.edu

**Jim Holloway**
Research Manager
Midwest Roadside Safety Facility
University of Nebraska–Lincoln
4180 NW 34th St.
Lincoln, NE 68524
Phone: (402) 472-5070
jholloway1@unl.edu

**Dr. Karla A. Lechtenberg**
Research Associate Engineer
Midwest Roadside Safety Facility
University of Nebraska-Lincoln
311 Whitter Research Center
Lincoln, NE 68583-0853
Phone: (402) 472-5070
kplechtenberg@unl.edu

**Dr. Aazizi**
Research Associate Engineer, Dr. Aazizi
Midwest Roadside Safety Facility
University of Nebraska-Lincoln
311 Whitter Research Center
Lincoln, NE 68583-0853
Phone: (402) 472-5070
aazizi@unl.edu, aazizina@fiu.edu

**Dr. Dean Sicking**
Leonard A. Lovell Professor, Civil Engineering
Director, Midwest Roadside Safety Facility
University of Nebraska-Lincoln
311 Whitter Research Center
Lincoln, NE 68583-0853
Phone: (402) 472-9332
dsicking@unl.edu

**Dr. Steven Faller**
Research Assistant Professor, Midwest Roadside Safety Facility
University of Nebraska-Lincoln
311 Whitter Research Center
Lincoln, NE 68583-0853
Phone: (402) 472-3318
ethompson@unl.edu

**Letter from the Associate Director - Dr. Mustaque Hossain**

Last year was a very productive one for MATC at Kansas State University (KSU). Most of KSU’s research projects concentrate on the preservation and safety of our regional transportation infrastructure due to increased truck loads resulting from freight movements. The longevity of our transportation infrastructure is a major focus due to diminishing highway revenues and increased use. Dr. Sunanda Biswas has been very successful in this regard. She has been awarded a new focus on railroads and estimated that the railroads will continue to increase due to increased demand for freight movements.

The technology transfer projects at KSU have been successful as well. KSU has implemented a variety of programs in the last year, including a Master’s degree program in Transportation Engineering. MATC was a sponsor of the Annual Kansas Transportation Engineering Conference in April of 2011, and over 50% of Kansas Master’s students attended the conference.

A number of graduate students supported by MATC have received their degrees. These students have received their master’s degrees and two have moved on to doctoral studies at other institutions.

The technology transfer projects at KSU have been successful as well. KSU has implemented a variety of programs in the last year, including a Master’s degree program in Transportation Engineering. MATC was a sponsor of the Annual Kansas Transportation Engineering Conference in April of 2011, and over 50% of Kansas Master’s students attended the conference.

Presentations and peer-reviewed publications are now being generated from these research projects. One poster from a MATC-sponsored project was presented at the 1st ASCE T & D Congress in Chicago, Illinois, in March of 2011. The paper was also published in the proceedings of the Congress. One of my graduate students and I published a paper in the Transportation Research Record, Journal of the Transportation Research Board. A number of graduate students supported by MATC have received their degrees. These students have received their master’s degrees and two have moved on to doctoral studies at other institutions.

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Overall, this past year has been a very productive one for MATC at KSU, and we have achieved several milestones and points of pride. We look forward to contributing positively to MATC in the future.
KSU Educational Programming, Tech Transfer and Career Development

As recent years have well proven, KSU continues to value educational initiatives which advance transportation students and professionals through on site experience and continued education. KSU’s programs not only ensure a solid, diverse workforce, but expand recruiting opportunities by teaching new university students about transportation engineering. Importantly, the certificate program underlines KSU’s interest in promoting and educating professionals on the latest technologies and research in order to ensure safe roadways and properly trained roadway workers.

• Workforce Development Initiative: While this expansive program includes academic year and summer internships for undergraduate students, it is also focused on educating existing professionals through training-based certificate programs. One such program is the Superpave Field Laboratory Technician Certification Training, which is a joint program between KSU and KDOT—with sponsorship by MATC. This course is designed to certify personnel who will be involved in the construction of Superpave pavements using the specifications of the state of Kansas. Held on campus three times this winter, the four-day program had good attendance and provided professionals with key information regarding Superpave Hot-Mix Asphalt (HMA). For more information, please see page 86.

• Annual Transportation Conference: In its 93rd year, the Annual Kansas Transportation Engineering Conference was once again, as has been the case since its inception, hosted by the KSU campus. This event brings together transportation officials, professionals and representatives for a two-day conference on important transportation topics. In fact over 500 representatives were in attendance at this year’s event! Flip to page 87 to learn more about this longstanding educational event.

Kansas State University Research Projects

Check out the exciting new research funded in fiscal year 2011:

- Effects of Geometric Design Features on Truck Crashes on Limited Access Highways
- Accelerated Testing of Warm Asphalt Mixtures for Safe and Reliable Freight Transportation
- Use of High-Volume Reclaimed Asphalt Pavement (RAP) for Asphalt Pavement Rehabilitation Due to Increased Highway Truck Traffic from Freight Transportation
- Determining the Transfer Length in Prestressed Concrete Railroad Ties Produced in the United States

For project details see pages 55-56

Matching Funds Provided by:

- Kansas Transportation Research and New Developments
- Civil Infrastructure System Laboratory
- PRS Mediterranean Ltd. (Israel)
- Kansas State University
- Kansas Department of Transportation

Dr. Mustaque Hossain
Professor, Civil Engineering
Associate Director, Mid-America Transportation Center
Kansas State University
2014 Fieiller Hall
Manhattan, KS 66506-5000
Phone: (785) 532-1576
mustak@k-state.edu

Dr. Sunanda Dissanayake
Associate Professor, Transportation Engineering, Civil Engineering
Kansas State University
2014 Fieiller Hall
Manhattan, KS 66506-5000
Phone: (785) 532-1540
sunanda@ksu.edu

Dr. Robert Peterman
Professor, Civil Engineering
Kansas State University
Manhattan, KS 66506-5000
203 Fieiller Hall
Phone: (785) 532-2812
bopk@ksu.edu

Dr. Robert Stokes
Professor and Director
K-State University Transportation Center, Civil Engineering
Kansas State University
2018 Fieiller Hall
Manhattan, KS 66506-5000
Phone: (785) 532-1795
drbobb@ksu.edu

Dr. Robert Peterman
Professor, Civil Engineering
Kansas State University
Manhattan, KS 66506-5000
203 Fieiller Hall
Phone: (785) 532-2812
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Dr. Robert Stokes
Professor and Director
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2018 Fieiller Hall
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Phone: (785) 532-1795
drbobb@ksu.edu
University of Iowa Educational Programming, Tech Transfer and Career Development

As a valued consortium member, the University of Iowa has again achieved a commendable level of educational and outreach efforts. This year, as in previous years, UI has continued to create activity that promotes the initiatives of MATC as a whole. The university has sought academic growth by adding yet another course to the offerings for students in transportation engineering, several of these students also had the opportunity to attend a national meeting of the TRB. In addition, faculty members have been active over the last year as sharing their research on the conference circuit.

• Added Courses at UI: Over the last two years, the campus has created new course offerings for transportation engineering students, expanding the selection of topics covered in their programs of study. Each focuses on a specific area of transportation planning, with the intention of furthering students’ understanding of transportation operators as a whole. One course—“Transportation and Land Use Planning”—combined elements of history, economics, and social issues to shape a new perspective of land use. Another course was co-instructed, adding to the depth of the knowledge students received inside that particular classroom.

• Faculty Presentations: Iowa faculty members have been active in recent months, traveling the country and the globe to share the findings of their research projects. For instance, Dr. Albert Ratner made several conference presentations using research from his three MATC projects. Dr. Papanicolaou also traveled, visiting domestic and international conferences to spread his particular research efforts. Such activities help disseminate information gathered via MATC research and projects, and helps further the initiatives and goals proposed by MATC.

University of Iowa Research Projects

Check out the exciting new research funded in fiscal year 2011:

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

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

• Freight Bottlenecks and the Border Puzzle

• Transportation Impacts of the Chicago River Closure to Prevent an Asian Carp Infestation

• Earmarked revenues, fiscal stress, and spending volatility: The case of highway finance and implications for freight movement

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

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

For project details see pages 57-59

University of Iowa Urban Transportation Center (KICT)

Matching Funds Provided by:

Korea Institute of Construction Technology (KICT)

University of Iowa

Iowa Department of Transportation

Letter from the Associate Director - Dr. Paul Hanley

With exciting new research, faculty and student conference presentations, and new course offerings, this year has been another wonderful example of the successful partnership between UI and MATC.

In FY 2011 exciting and progressive research by Iowa faculty was funded by MATC. Dr. Mina Matou’s new project, “Freight Bottlenecks and the Border Puzzle” examines the border effect as it pertains to transportation bottlenecks. Her research concentrates on three border crossing points between the US and Canada and explores traffic concentration and congestion in order to aid in infrastructure planning. Thomas Papanicolaou’s project “Monitoring the Effects of Knickpoint Erosion on Bridge Pier and Abutment Structural Damage Due to Scour” researches knickpoint migrations in western Iowa and eastern Nebraska in order to stabilize streams and prevent damage to existing bridge infrastructure. This research will assist local government agencies in identifying appropriate grade control structures near bridge crossings to reduce infrastructure damage. Papanicolaou’s other project “Use of Fiber Bragg Grating (FBG) Sensors for Performing Automated Bridge Pier Structural Damage Detection and Scour Monitoring” utilizes state-of-the-art two-wave mixing fiber bragg grating (FBG) sensors to detect deformations in pier structures and/or within sub-river beds via frequency range. Information from FBGs will be used in making decisions relative to down time, repair costs and functionality of bridges. To learn about other Iowa projects funded in fiscal year 2011, please refer to pages 57-59.

To help spread MATC research and initiatives, Iowa faculty and students were active at conferences and in print. Dr. Albert Ratner made presentations at three conferences based on the research from his three MATC projects and has a forthcoming publication relative to his work on mist mitigation. Dr. Papanicolaou gave presentations on his research, described above, while attending conferences in Palm Springs, California and Braunschweig, Germany. UI students—Colin Husman, Nikhil Sikka and Nick Hatz—attended the annual TRB meeting in Washington D.C.

On campus, we expanded course offerings for transportation engineering by offering a new course to supplement the two courses added last fiscal year. “Transportation and Land Use Planning” instructed by Miwa Matou examined transportation planning and land use interactions by exploring the historic, economic and social background of related issues and discussing the need for comprehensive planning. The two classes added last year were “Public Transit Operations and Planning,” taught by Dr. James Stoner and Dr. Paul Hanley in the spring semester, and “Traffic Transportation Planning,” taught by Dr. John Fuller in the fall semester.

The University of Iowa continues to work alongside the Tier 1 UTC, thereby allowing connections between researchers across campuses and colleges from Urban Planning and the College of Business to Public Health and Engineering.

University of Iowa Consortium Partner

Highlights at a Glance

Mid-America Transportation Center 2011 Annual Report

Highlights at a Glance
The University of Kansas has emphasized activities involving students over this past year. In January, one faculty member, one post-doc, four graduate students and two undergraduate students attended the annual TRB meeting in Washington, D.C. In May, a graduate student was provided travel funds to attend the meeting of the International Chinese Transportation Professionals Association in Los Angeles. Also in May, one faculty member, one post-doc, four graduate students and three undergraduate students attended the Midwestern District ITE meeting in Dubuque, Iowa. For the second time in three years the KU students won the Midwestern District of ITE Traffic Bowl and will be going to the national competition. MATC funds were used throughout the year to support six meetings of the ITE student chapter, and based on their performance in the Traffic Bowl, students learned a great deal from the professional presentations at their chapter meetings.

In April, MATC funds helped Dr. Schrock attend the Train the Trainer Workshop on the Highway Safety Manual in Irvine, California. In the fall, funds were provided for several geotechnical graduate students to attend a geotechnical conference in Dallas, Texas. Throughout the academic year, I conducted four half-day work zone signing workshops and two all day workshops on the Manual on Uniform Traffic Control Devices. These workshops were presented throughout the state of Kansas.

The interest in transportation has increase significantly at KU since the MATC program started. A new course, CE 480 Introduction to Transportation, has existed for a year now and has had an impact. This is evidenced by the fact that the enrollment in CE 382 Highway Engineering for this coming fall is 42 students, while in the past several years the enrollment in CE 382 was in the low 20s.

During this year, two PhD students and two master’s students have graduated. One of the PhD graduates is on the faculty at the University of Nevada in Las Vegas (UNLV). Two additional PhD students will graduate this summer. One of these PhD graduates has accepted a position with Purdue University in Calumet, Indiana, and the other works for the Kansas Department of Transportation.

During the spring 2011 semester, three students had internships with the Kansas Department of Transportation. Aaron Boehmker and Hilary Urkevich were two of the KDOT interns. Aaron is also interning with KDOT this summer. Three undergraduate students, Ryan Hager, Ben Mugg and Sarah Thompson are working this summer as interns on transportation research projects here at KU.

The University of Iowa MATC Affiliated Faculty

University of Kansas Consortium Partner Highlights at a Glance

Letter from the Associate Director - Dr. Tom Mulinazzi

The University of Iowa has a wide range of transportation research projects, including the Mid-American Transportation Center (MATC). The MATC is an affiliate of the University of Iowa and is dedicated to advancing transportation research and education. The center is supported by the Midwestern Transportation Center and the University of Kansas.

MATC has a strong focus on geotechnical engineering and has hosted several workshops and conferences on the topic. In 2011, they hosted the Train the Trainer Workshop on the Highway Safety Manual in Los Angeles. The workshops were attended by students and professionals from across the state of Kansas.

The MATC also offers graduate and undergraduate research opportunities. Two PhD students and two master’s students graduated in 2011, and several others are currently pursuing their degrees. The center has a strong focus on transportation research, and many of the projects are funded by external sources.

The MATC is also engaged in collaborative research with other universities, such as the University of Kansas. They have a long-standing relationship with the University of Kansas, and they have co-hosted several events together.

The MATC has a strong emphasis on education, and they offer a variety of courses and programs, including the Mid-Iowa Transportation Center (M-ITC) and the Mid-America Transportation Research Center (M-ATRC). These programs provide students with hands-on experience in the field of transportation research.

Overall, the MATC is a vital resource for transportation research and education in the Midwestern United States. They are dedicated to advancing transportation research and education, and they are committed to fostering a collaborative and innovative environment for their students, faculty, and partners.
Through the MATC partnership, KU has successfully implemented and continued educational programming that enables students to experience transportation engineering first hand. With an ongoing internship program, KU has ensured that undergraduate students receive the opportunity to experience a transportation career while they are establishing degree plans. Moreover, such on-site training helps students implement classroom concepts—enabling richer classroom discussions and ensuring better prepared graduates. An expanded transportation curriculum at KU means that more recruitment can occur at the graduate level and that all undergraduate students will learn about the transportation field.

• KU Intern Program: Offering both summer and academic year internships, KU has yearly opportunities for undergraduate students to gain experience in the transportation field. The KU internship program is conducted with the help of KDOT, which offers students the chance to work and learn in one of their many departments. To learn about the students who have participated in this program, please see page 69.

• Undergraduate Introductory Transportation Course: KU has made great inroads as it concerns transportation engineering curriculum for undergraduates. CE 480 is now a required course for engineering students, and one that will come at a key point in their advancement through the degree and their determination of career choices. This course provides students with a survey of the field, going over the various modes of transportation, as well as giving students a sense of the work done with transportation engineering, such as design and planning. See page 77 for more information.

University of Kansas MATC Affiliated Faculty

Dr. Tom Mulinazzi
Professor, Civil, Environmental & Architectural Engineering
Associate Director, Mid-America Transportation Center
University of Kansas
2150 Learned Hall
Lawrence, Kansas 66045
Phone: (785) 864-3766
tomm@ku.edu

Dr. Steven Schrock
Assistant Professor, Civil, Environmental & Architectural Engineering
University of Kansas
2150 Learned Hall
1530 W. 15th Street
Lawrence, KS 66045
Phone: (785) 864-3418
schrock@ku.edu

Dr. Yong Bai
Associate Professor, Civil, Environmental & Architectural Engineering
University of Kansas
2150 Learned Hall
1530 W. 15th Street
Lawrence, KS 66045
Phone: (785) 864-2991
ybai@ku.edu

Dr. Robert Parsons
Associate Professor, Civil, Environmental & Architectural Engineering
University of Kansas
2150 Learned Hall
1530 W. 15th Street
Lawrence, KS 66045
Phone: (785) 864-2946
rparsons@ku.edu

Dr. Jie Han
Professor, Civil, Environmental & Architectural Engineering
University of Kansas
2150 Learned Hall
1530 W. 15th Street
Lawrence, KS 66045-7609
Phone: (785) 864-3714
jiehan@ku.edu

University of Kansas Research Projects

Check out the exciting new research funded in fiscal year 2011:

- Developing a Sustainable Freight Transportation Framework with the Consideration of Improving Safety and Minimizing Carbon Emission
- Onsite use of recycled asphalt pavement materials with geocells to reconstruct damaged pavements by heavy trucks
- Statistical Modeling to Identify Heavy Truck Critical Crash Locations in Kansas
- Mechanical and Hydraulic Properties of Recycled Railroad Ballast
- Development of Modification Factors for Truck Related Crashes at Bridge Sites on Highway Operations

Matching Funds Provided by:

- Kansas Department of Transportation
- University of Kansas

For project details see pages 59-60
LED technology has been widely used in sustainable traffic signal management to facilitate the smooth freight movement of increasing demands. However, the useful life and luminosity characteristics have not been sufficiently studied and documented for a life cycle analysis of the technology. MS&T faculty will conduct a detailed field study of LED traffic signals in Missouri and develop a replacement schedule based on key findings. The outcomes of this study will provide a methodology for engineering managers in state departments of transportation and local communities to identify best practices and replacement standards for LED traffic signal technology.

A feasibility study on the use of nanotechnology for the wearing resistance of concrete has been initiated this year. Three types 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 has been initiated this year. Three types 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 best practice in concrete application will be recommended in terms of technological, economic, and social 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.

To meet the transportation workforce needs, an undergraduate internship program initiated with Missouri Department of Transportation will continue in the fourth year. The main objective of this program is to motivate undergraduate students to experience the design, maintenance, and operation process of the transportation system in Missouri. Missouri S&T will also continue promoting civil engineering careers to K-12 students, particularly in transportation engineering and structural monitoring, by making presentations and organizing workshops at schools and during public events.
In this study, Schapery’s nonlinear viscoelastic constitutive model is implemented into the commercial finite element software ABAQUS via user defined subroutine (UMAT) to analyze asphalt pavement subjected to heavy truck loads. Then, creep-recovery tests are conducted at various stress levels and at two temperatures (30°C and 40°C) to obtain nonlinear viscoelastic material properties of hot mix asphalt mixtures. With material properties characterized and the UMAT code, a typical pavement structure subjected to repeated heavy truck loads is modeled considering the effect of material nonlinearity with realistic tire loading configuration. Three-dimensional finite element simulations of the pavement structure present significant differences between the linear viscoelastic approach and the nonlinear viscoelastic modeling in the prediction of pavement performance with respect to rutting and fatigue cracking.
was also improved by preparing project reports. Using several statistical software packages, I have learned how to analyze transportation-related data crashes/violations and a host of associated factors. From the investigation of truck crashes in Nebraska” with my advisor Dr. Aamal Khattak. Both projects focused on collecting safety data using statistical and multiple databases structures that keep the infill material from being pushed out. The bases under asphalt pavement. Geocells are 3-D honeycomb-like dynamic traffic entities. My greatest contributions are the complete storage of traffic environment information technology domain. My interdisciplinary research experience and education background spread the opportunities of my future career development.

Hang Yue, PhD
Project: Impact of Trucks on Signalized Intersections
My current research project is in statistics and multiple databases for transportation applications. In a creative way, I use spatio-temporal databases to archive static and dynamic traffic entities. My greatest contribution is the complete storage of static traffic environments and dynamic moving objects based on the development of non-linear numerical and statistical models. I have written four research papers for publications in the transportation or information technology domain. My interdisciplinary research experience and education background spread the opportunities of my future career development.

Cheryl Bornheimer, MS
Project: Educational Activities through MATC at KU: Evaluation of Interactive Highway Safety Design Model Crash Prediction Tools for Kansas Department of Transportation
The past year I have been involved with making the Highway Safety Manual’s (HSM) crash prediction model and the software that accompanies it, the Interactive Highway Safety Design Model (IHSDM), usable for the state of Kansas. I tentatively helped find calibration factors for this process and am currently creating a new safety performance function using geometric and crash data that has been collected. This will help me in my future career as I will already have a great familiarity with the HSM as the industry begins to use it more in practice to aid in reducing crashes. The amount of truck traffic has increased significantly in the US and, with the growing demand, the loss of pavement life is a major concern. This project aimed to develop a design catalog for the existing AC (Asphalt Concrete) pavements to be overlaid with TWT that would be effective in lengthening asphalt pavement life. The finite element (FE) analysis of TWT was performed to obtain this design catalog. The design considered different TWT thicknesses, existing AC layer thickness and modulus, the bonding condition between TWT and the existing AC layer, shoulder condition and temperature differentials. This research study refined my ability to form clearer questions and a clear idea of the path of research problems, which include analyzing and presenting data, and developing recommendations. I hope that with this experience I can go forward and use these skills in my future career.
In the past year, we have developed, identified, and characterized rugged optical fibers based large strain sensors. In addition, these packaged optical fiber sensors have been applied to measure the large strains in various structures, especially in harsh environments such as post-earthquake fire-induced high temperature conditions. With frequent disaster occurrence in recent years, these researches meet the great needs of structural health monitoring in disaster-induced harsh environments, which will open great opportunities for my future researches and career.

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**Student Research Spotlight**

**Ying Huang**, MS

**Project:** Initial Study and Verification of a Distributed Fiber Optic Corrosion Monitoring System for Transportation Structures

In the past year, we have developed, identified, and characterized rugged optical fibers based large strain sensors. In addition, these packaged optical fiber sensors have been applied to measure the large strains in various structures, especially in harsh environments such as post-earthquake fire-induced high temperature conditions. With frequent disaster occurrence in recent years, these researches meet the great needs of structural health monitoring in disaster-induced harsh environments, which will open great opportunities for my future researches and career.

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**Thiago Aragao**, PhD

**Project:** Modeling of Asphalt Mixtures Subjected to Rate-dependent Fracture

Computational microstructural models have been actively pursued by the pavement mechanics community as a promising and advantageous alternative to limited analytical and semi-empirical modeling approaches. The primary goal of my dissertation research is to develop a computational microstructural modeling framework that will eventually allow researchers and practitioners of the pavement mechanics community to evaluate the effects of constituents and mix design properties (one of the key factors directly affecting the quality of the pavement structures) on the mechanical responses of asphalt mixtures. To that end, the mixture are modeled as heterogeneous materials with elastic mechanical behavior. To account for the complex geometric characteristics of the heterogeneous mixtures, an image treatment process is used to generate finite element meshes that closely reproduce the geometric characteristics of aggregate particles (size, shape, and volume fraction) that are distributed within a fine aggregate asphaltic matrix (FAM). These two mixture components, i.e., aggregate particles and FAM, are modeled, respectively, as isotropic elastic and isotropic linear viscoelastic materials and the fundamental material properties required as inputs for the computational model are obtained from simple and expedited laboratory tests.

In addition to the consideration of the complex geometric characteristics and inelastic behavior of the mixture, this study uses a cohesive zone model to simulate fracture as a gradual and rate-dependent phenomenon in which the initiation and propagation of discrete cracks take place in different locations of the mixture microstructure. The results presented in this research demonstrate that computational microstructure models, such as the one developed in this study, have a great potential to become efficient design tools for asphalt mixtures and pavement structures.
Award Winning Research
Midwest Roadside Safety Facility Achievements

The Transportation Research Board (TRB) Committee on Roadside Safety Design (ATRB) awarded the Best Paper Award for 2011 to the Midwest Roadside Safety Facility (MwRSF) at the University of Nebraska-Lincoln for “Development of a Low-Cost, Energy Absorbing, Bridge Rail.” This project focused on developing a bridge rail designed to be compatible with the Midwest Guardrail System (MGS) previously developed by MwRSF. The Midwest Guardrail System has been widely implemented and is a uniquely modified W-beam guardrail designed for vehicles with a high center of gravity, which are increasingly common on modern roadways. Development of the bridge rail involved incorporating energy-absorbing components that would allow for dynamic deflection of the bridge rail such that a transition would not be required when used with the MGS. Dr. Dean Sicking, Dr. Ron Fallert, Ms. Karla Luchtenberg, Dr. John Reid, Mr. Scott Rosenbaugh and Mr. Jeff Thiele, a former MwRSF graduate student, co-authored the winning paper.

Dr. Dean Sicking, director of the Midwest Roadside Safety Facility and professor at the University of Nebraska-Lincoln, received the 2011 Kenneth A. Stonex award in honor of his countless contributions to roadside safety. This award was established in 1991 by General Motors to recognize lifetime contributions to roadside safety. It was named for Ken Stonex, a GM employee who was a pioneer in roadside safety long before the seriousness of run-off-road crashes was recognized by most transportation agencies. The TRB Committee on Roadside Safety Design now presents the award annually through the support and sponsorship of TRC, Inc.; Energy Absorption Systems, Inc.; Trinity Industries; and Transpo industries. Congratulations to Dr. Sicking for this well-deserved recognition!

Azizinamini Receives AISC Achievement Award

Please join MATC in congratulating Ata Azizinamini, faculty emeritus at UNL, who was 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 was 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!

MATC Energy Research Focus of Mayoral Press Conference

The City of Lincoln spends over $72,000 annually on energy to power the city’s traffic signals. MATC researchers are working to change that, however, by testing a solar/wind hybrid power generator installed on existing traffic signal infrastructure. Assistant Professor Anuj Sharma, Associate Professor Libby Jones, Assistant Professor Wei Qiao and Professor Larry Rilett’s project, sponsored by the US Department of Transportation and the Mid-America Transportation Center, is an initiative to move toward “energy-plus” roadways that generate more energy than is needed to power the signal—allowing the excess to be supplied back to the main grid.

At a special press conference on Thursday, March 3, in the Whitner Research Center at the University of Nebraska-Lincoln, Mayor Chris Beutler discussed the city’s initiatives to develop and implement sustainable energy systems through partnering with university researchers. At the press conference, Dr. Sharma discussed the benefits of the technology and his hopes for advances in energy-plus roadways in the future. He discussed the need for using alternative energy sources to power traffic infrastructure not only to save taxpayer dollars and move toward sustainability, but also necessary back-up in the event of disruptions to the electrical supply.

The next phase of the project involves installation of four more wind generator-solar panel hybrid units at new locations and the researchers will continue collecting data on the reliability of the hybrid system in all types of conditions. Mayor Beutler praised the potential inherent in the project and said it will “help to further Lincoln’s growing reputation as the green capital city of Great Plains. For more information on this and related projects, please visit: http://energyplusroadways.unl.edu/
Roundabout Recommendations in Driver’s Manual

Drivers who have encountered a roundabout and felt uncertain about the correct course of action are not alone, it seems. At the University of Nebraska-Lincoln, Dr. Aemal Khattak, associate professor of civil engineering, with Karen Schurr, civil engineering lecturer, and Dr. Ram Bishu, professor of industrial and management systems engineering, conducted a survey of five Nebraska cities in order to determine roundabout elements and identify characteristics of drivers who are more likely to incorrectly navigate roundabouts. This project, titled “Investigation and Mitigation of Driver Confusion at Modern Roundabouts,” was sponsored by the Nebraska Department of Roads. Survey respondents indicated that, to mitigate confusion at roundabouts, they would like to receive information on proper negotiation via the Nebraska Driver’s Manual. The researchers submitted recommendations based on the survey results, which were recently incorporated into the revised Nebraska Driver’s Manual. One NDOR design engineer called the updates a great improvement. The new manual is available online (http://www.dmv.ne.gov/examining/pdf/engdrivermanual.pdf) with the new information on roundabouts featured on pages 44-45.

NDOR will consider implementing the Pavement Quality Indicator (PQI) and will expand on the Light Weight Deflectometer (LWD)’s current findings to eventually implement soil compaction at their Soils and Geotechnical facilities. The PQI model 301, manufactured by Transtech Systems Inc., is a non-nuclear alternative to measure HMA density. The PQI estimates density by measuring the change in an electromagnetic field when a current is sent through the compacted material. A dielectric constant proportional to the pavement’s density is measured when the electrical current is transmitted. The PQI model 301 is shown in Figure 1. Different measurement modes can be used to improve the accuracy of the PQI results. The average mode, for example, automatically calculates an average of all the densities at the measured spot, as long as they are within close proximity to each other (about 1 ft). The highly portable and easily carried device on job sites also provides faster data measurement than a nuclear gauge. The LWD, manufactured by Zorn Materials (Figure 2) consists of measuring a surface deflection as a result of applying an impulse load to it by using ASTM E496-97, the Standard Test Method for Measuring Deflections with a Light Weight Deflectometer (LWD). The LWD consists of a light mass, an accelerometer and a data collection unit that can give hard copy results on the field. The LWD can automatically compute both the stiffness and modulus of elasticity of a soil to determine whether a soil has been properly compacted.

NDOR is utilizing this technology along with Dr. Cho’s recommendations because they believe it will have profound implications for simplifying the process of density measurements. According to Robert Rea, Assistant Materials and Research Engineer, NDOR’s goal with this research is “to identify an improved testing and acceptance system utilizing non-nuclear devices and have much lower costs by less permitting and regulatory requirements, less accounting and documentation systems, as well as lower storage and maintenance costs on the equipment and personnel.”

Non-Contact Laser Speckle Measurement Device to be Used by Concrete Manufacturers

Researchers at Kansas State University recently tested a new device for determining the transfer length in prestressed concrete railroad ties. Dr. Robert Peterman, professor of civil engineering at KSU, with colleagues Dr. Terry Beck and Dr. Chih-Hang Wu, spent the last seven years developing and refining innovative methods to inspect prestressed concrete in bridge structures and railroad ties using a laser-speckle imaging (LSI) device.

Two MATC projects, “Determining the Transfer Length in Prestressed Concrete Railroad Ties Produced in the United States” and “Determining the Stresses in Steel Railroad-Track Rails Due to Freight Movements Using Non-Contact Laser-Speckle,” have contributed to the development of the device. The former project is the first ever coordinated effort to measure transfer lengths of concrete railroad ties. Dr. Robert Peterman, professor of civil engineering at KSU, with colleagues Dr. Terry Beck and Dr. Chih-Hang Wu, spent the last seven years developing and refining innovative methods to inspect prestressed concrete in bridge structures and railroad ties using a laser-speckle imaging (LSI) device.

This work is important to Region VII, as 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 lives, and to ensure the safety of freight movements across the Midwestern states, 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 prestressing force into the concrete member is referred to as the “transfer length.” The laser speckle imaging device uses laser speckle patterns that are generated and digitally recorded at points along the surface of the concrete member. The pattern is formed by the random interference of light reflected from the member’s surface during testing. Use of the device makes evaluating the performance of concrete members much easier, quicker, more accurate, and more cost-effective than the traditional use of strain gauges that must be mounted to the surface of a concrete member.

Dr. Peterman, MATC student Steven Hammerschmidt, and MATC student Robert Murphy conducted systematic measurements of the transfer length in concrete railroad ties produced by all of the major concrete tie producers in the United States. Hammerschmidt’s contribution focused on refining methods for testing the laser speckle device and evaluating the performance of the ties at a 2.25 inch gauge. The research team recently tested the laser speckle device at concrete plants in Tucson, Arizona; Cheyenne, Wyoming; and Spokane, Washington, with promising results. The work on the MATC project helped lead to a $1.2 million award from the Federal Railroad Administration for work on the automation of the hand-held LSI strain sensor device for field testing and production. The commitment of Dr. Peterman and his team is making the nation’s railways safer by working toward meeting the industry’s need of revolutionary sensor technology for highly accurate diagnostic testing of commercially manufactured prestressed concrete.
Completed MATC Research Projects

University of Nebraska Projects

Project Title: Impact of Truck Loading on Design and Analysis of Asphaltic Pavement Structures-Phase II

Trucking is a key component of freight transportation in the US. Trucks moved 95% of the total tonnage and 80% of the total value of US shipments in 2010. By 2020, the US transportation system is expected to handle about 25 billion tons of cargo valued at nearly $5 trillion. More specifically, Table 1 presents information on freight shipments that have either an origin or a destination in Nebraska (FHWA Freight News 2002). As shown in the table, trucks moved a large percentage of the tonnage and value of shipments, and these values are expected to grow throughout the US over the next 10 years. Therefore, the need to preserve the existing highway infrastructure and to accomplish an appropriate design-analysis for new pavements is a high priority.

Table 1.1

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Trucking and freight transportation are expected to increase in the future due to population growth and an increase in the middle class population. The primary objective of this study was to develop a mechanistic model for predicting pavement performance with particular focus on the impact of heavy truck loading on pavement damage. Specifically, we looked at the impact of truck-loading configurations (realistic tire footprints) and the more realistic constitutive material behavior of the asphalt layer (nonlinear viscoelastic) in the prediction of pavement performance. As a continuation to our previous research we have sought a more advanced constitutive model for asphalt mixtures to more accurately predict pavement performance. As a continuation to our previous research we have sought and studied its performance in an effort to overcome the limitations of ZigBee for freight car WSNs. Small battery operated wireless sensor nodes can easily be installed onboard freight railcars to monitor a variety of systems from wheel imbalances and brake failures to refrigerator units, boxcar doors and much more. This study first evaluated the propagation characteristics at the physical layer of wireless sensor nodes deployed onboard railcars and found that placement of these nodes significantly impacts the radio wave propagation characteristics. In addition to placement, the effectiveness of the nodes is further complicated by the materials used in railcar construction and their design. This in turn drastically impacts the requirements upon the wireless communication protocols at the medium access control (MAC) and routing layers.

"Providing safe, secure, and efficient freight transportation through advanced onboard wireless sensor technologies for real-time monitoring and alerting."

Detailed investigations of the pavement responses resulting from different constitutive relations (i.e., linear viscoelastic and nonlinear viscoelastic) provided interesting observations and findings that can be used to better understand the effects of truck loading on pavement damage, and consequently to further advance current pavement-analysis design methods.

This project focused on studying the characteristics of Wireless Sensor Networks (WSN) onboard freight trains. In North America, freight railroad companies are searching for ways to improve their monitoring capabilities and the fault detection of individual railcars. Small battery operated wireless sensor nodes can easily be installed onboard freight railcars to monitor a variety of systems from wheel imbalances and brake failures to refrigerator units, boxcar doors and much more. This study first evaluated the propagation characteristics at the physical layer of wireless sensor nodes deployed onboard railcars and found that placement of these nodes significantly impacts the radio wave propagation characteristics. In addition to placement, the effectiveness of the nodes is further complicated by the materials used in railcar construction and their design. This in turn drastically impacts the requirements upon the wireless communication protocols at the medium access control (MAC) and routing layers.

"Providing safe, secure, and efficient freight transportation through advanced onboard wireless sensor technologies for real-time monitoring and alerting."

In our second research effort for this project, we studied the performance of ZigBee, a communication protocol stack commonly used in traditional wireless sensor networks. This protocol was found to be inadequate for the requirements placed upon freight train wireless sensor networks. We therefore proposed an alternative method using a multi-tiered approach that leverages a long-distance communication technology added to the wireless sensors, and studied its performance in an effort to overcome the limitations of Zigbee for freight car WSNs.

The proposed solution has been shown in our simulation study to be very promising in overcoming the observed problems and provides significant performance, energy efficiency and network lifetime improvements over the traditional approach.
Project Title: Extending Asphalt Pavement Life Using Thin Whitetopping

Due to budget constraints, many highway agencies are becoming interested in pavement preservation or rehabilitation rather than reconstruction to ensure pavement is in serviceable condition. In thin whitetopping (TWT), distressed asphalt concrete (AC) pavements are rehabilitated using a thin concrete overlay. This study was done to develop a design catalog for existing AC pavements that will be overlaid with TWT. The finite element (FE) analysis was done with SolidWorks, a 3-Dimensional FE software program, to develop this design catalog. The design considers different TWT thicknesses, existing AC layer thickness and modulus, the bonding condition between TWT and the existing AC layer, various shoulder conditions and temperature differentials. Each model was built as a three-layer pavement system—composed of concrete (TWT), asphalt layer, and subgrade soil. The traffic load was modeled as a constant pressure with a rectangular area applied at the surface and with intensity equal to the tire inflation pressure of 100 psi. The expected lives of TWT overlays were estimated using fatigue equations developed by the Portland Cement Association (PCA).

Results obtained from this study show that interface bonding condition is the most important factor affecting the behavior of TWT. With the increase of TWT thickness or existing AC thickness or AC modulus and the addition of a paved shoulder, concrete tensile stress decreases. Curling stress increases with the increase of TWT thickness but is independent of AC properties. A design catalog was developed in terms of service life of the pavement. Unlike the unbonded TWT with an unpaved shoulder that results in catastrophic loss of rehabilitated pavement life, bonded TWT is expected to last 10 years, assumed in design. Thus, proper bonding must be ensured for cost-effective and longer lasting rehabilitation using TWT.
Project Title: Performance Measures of Warm Asphalt Mixtures for Safe and Reliable Freight Transportation Phase II: Evaluation of Friction and Raveling Characteristics of Warm-Mix Asphalt Mixtures with Anti-stripping Agents

WMA technology was introduced in the United States in 2002 for lowering emissions and improving the working environment. Crows (2008) and Newcomb (2009) reported that 45 states in the US have used warm-mix asphalt technology in real construction or field trial projects. Moreover, Alabama, California, Florida, Illinois, New York, North Carolina, Ohio, Pennsylvania, Texas, Virginia, Washington and Wisconsin have allowed the use of WMA mixtures on many highway projects. To provide a safe and reliable highway for truck traffic, warm-mix asphalt (WMA) pavement must meet requirements for moisture sensitivity, raveling and friction resistance. However, a major difficulty in evaluating WMA mixtures is that there is no national research evaluating these fundamental characteristics.

**"Evaluating the materials themselves will remain important as freight movements continue to increase."**

The objective of this research was (1) to evaluate impacts of various amounts of WMA additives on the viscosity and low-temperature cracking of asphalt binder; (2) to evaluate the skid resistance of WMA mixtures and (3) to investigate the effectiveness of anti-stripping agents to improve moisture sensitivity of warm-mix asphalt mixtures. To address a safety concern for WMA pavements under heavy truck traffic with a high tire pressure, the friction and raveling characteristics were evaluated in the laboratory.

The main product from this research is the evaluation results of various warm-mix asphalt (WMA) materials with respect to their moisture sensitivity, raveling and friction characteristics. This information is very useful for pavement engineers who are interested in implementing WMA technologies. Reliable WMA technologies identified by this research will contribute to road safety by minimizing an accident risk caused by unsafe road surface conditions. This is particularly important as freight movements continue to increase on the US surface transportation system and, with such added numbers, create further wear and tear on roadways.

**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 (Kousnak et al. 2006). 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 VII because the climate and soil condition at NCAT test track are different. In previous studies at the University of Iowa, various WMA mixes 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 mixes be tested using the accelerated testing equipment in both a laboratory and an APT facility.

**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 VII interested in WMA.
**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 polyeurea 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 these 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:**
- Technology is currently used in Highway Operation and the efficiency of fuel consumption. It may also reduce the emission of CO associated with the poor condition of roadways.

### MS&T LED Traffic Signal Replacement Schedules: Facilitating Smooth Freight Flows

**PI:** Dr. Suzanna Long  
**DESCRIPTION:** Over the last two decades light-emitting diodes (LEDs) have replaced incandescent bulbs in traffic signals use because of their energy savings and much longer service life. The standard practices of maintaining and replacing incandescent lamps cannot be simply transferred and applied to LED signals. This project develops a statistically significant maintenance and replacement schedule for LED traffic signals. Data collection develops a unique process for taking readings from the driver perspective to better correlate ITE guidelines with properties of LED technology.

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

**DESCRIPTION:** The goal of the proposed research is to conduct laboratory and field research on full scale bridge pier monitoring using automated sensors to minimize the problems inherent in human inspections of bridges. We propose a novel integrated condition-based monitoring (ICBM) framework utilizing available sensors and sensing architecture for performing both scour and structural damage monitoring. A fiber-optic peer impact detection system is proposed to be developed and tested in the laboratory and the field. This system consists of state-of-the-art two-way mixing (TWMI Fiber Bragg Grating (FBG) sensors which can detect impacts with different frequencies. These two-way 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 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, etc., as well as for important natural-occurrence 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 flow.

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

**PI:** Dr. Thanas Papavasilious

**Co-PI:** Dr. David Minchak  
**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 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 knockdown propagation and identifying appropriate grade control structures (e.g., sheet-pile wiers and flumes) near bridge crossings to control knockdown propagation and reduce infrastructure damage.

**Co-PI:** Dr. David Admiraal  
**DESCRIPTION:** This research will assist local government agencies 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 flow.

**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 flow.
Transportation Impacts of the Chicago River Closure to Prevent an Asian Carp Infestation
PI: Aaron Strong
DESCRIPTION: Recent evidence suggests that Asian carp are within 50 miles of entering the Great Lakes. Asian carp comprise an invasive species that has the potential to destroy the commercial and recreational fisheries in the Great Lakes if left unchecked. They are able to out-compete the native species of fish so that commercial species have nothing on which to feed. At present, there is a lawsuit from the states of Michigan, Wisconsin, Ohio, Minnesota, and Pennsylvania against the state of Illinois to physically close the link between the Mississippi River and the Great Lakes. The Army Corps of Engineers has stated that a study of the area will be completed by 2013, but opponents state that this is just not quick enough to prevent the spread. The goal of this research is to provide two pieces to the benefit-cost analysis needed: first, what is the shadow value of infrastructure capacity if shipping through the Chicago River is no longer viable; second, where on the transportation infrastructure are the impacts most likely to be seen. Additionally, the modeling framework will be flexible enough to allow for the evaluation of alternative closures other than the Chicago River.

BENEFITS: One of the two main products that will result from this research is a GIS model of the rail and river transportation system for Illinois and Iowa. This model may be of interest to other researchers as a single place to obtain data on the transportation network not only in terms of geography but also the associated costs and capacity constraints. The second main product will be a report together with an article-length description of the findings.

Earmarked revenues, fiscal stress, and spending volatility: The case of highway finance and implications for freight movement
PI: Dr. Thoong Nguyen-Huong
Co-PIs: Dr. William Duncombe
DESCRIPTION: One of the distinguishing characteristics of highway finance in the United States is the heavy use of earmarked revenues. This study is the first to examine how such revenues affect the volatility (or stability) of a state’s total highway revenue and highway spending, as well as the potential effects of fiscal stress on the volatility of highway spending. We hypothesize that states with a greater share of highway funding from earmarked revenues have more stable overall highway revenues and spending, and fiscally stressed states have more volatile highway spending than those with no fiscal stress. We provide implications for freight movement based on our research findings.

BENEFITS: This research will be the first to provide evidence of the role for lack thereof of earmarked revenues in stabilizing states’ highway revenues and expenditures and the potential negative effect of fiscal stress on highway spending. The findings of this study will be particularly important given the heavy use of earmarked revenues in highway financing, the current serious budget crises in most states, and the need of sufficient funding for highway expansion and maintenance, and thus freight movement. The results will also contribute to the existing research on innovation in highway financing conducted by MATC Associate Professor Paul Hanley.

Use of High-Volume Recycled Asphalt Pavement (RAP) for Asphalt Pavement Rehabilitation Due to Increased Highway Truck Traffic from Freight Transportation
PI: Mustakhe Hosain
Co-PI: David Lee
DESCRIPTION: Most state agencies and paving contractors are advocating use of high volumes of Recycled/Reclaimed Asphalt Pavement (RAP) in hot-mix asphalt (HMA). However, use of large percentages of RAP results in a lack of homogeneity of Superpave mixtures that may not perform well. This project will study the use of fractionated RAP (FRAP) and/or 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 and 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 and FRAP percentages as well as PG binder selection for Superpave mixtures. Implementation of this study is expected to be carried out by the Bureau of Materials and Research of KDOT.

Accelerated Testing of Warm Asphalt Mixtures for Safe and Reliable Freight Transportation
PI: Hossein ‘David’ Lee
Co-PI: Mustakhe Hosain
DESCRIPTION: Warm Mix Asphalt (WMA) is moving rapidly into the mainstream of the asphalt pavement construction in the United States and the world because of the reduced fuel consumption, less carbon emissions, significantly longer haul distances, reduced oxidation of asphalt, early opening to traffic and a better working environment in the field. To meet the growing demand from the public, academia and industry, recently, NCAT proposed a national WMA certification program.

At the University of Iowa, various WMA mixtures were tested in the laboratory for their strength, stiffness, rutting, and moisture resistance. We have evaluated WMA mixtures with six additives which include CECABASE R8®, Sasobit®, Asphalt-ment®, Advera WMA, Ethaliner J, and Radise® WMA, along with the control WMA mixture without any additive and the control HMA mixture. However, based on the moisture susceptibility test, no WMA mixtures satisfied the Superpave requirement of 5%. To provide a safe and viable highway for heavier truck traffic with a high tire pressure, however, the WMA mixtures should be tested using the accelerated testing equipment such as wheel tracking tests in both laboratory and the apt facility.

BENEFITS: The main product anticipated from this research is the accelerated performance of WMA materials. This information would be very useful for all pavement engineers in Midwest who are interested in WMA for application.

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 Milmazz
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, more than 427 billion tons worth of goods and services were transported throughout the nation. The volume of freight in the United States is expected to increase to 553.2 billion tons 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 8 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, freight 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 deteriorates to the point that the pavement may become an economically feasible solution. Reconstruction of a pavement requires removal of pavement surfaces. Onsite 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 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.

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 15 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. To meet the USDOT’s goals of reducing fatalities and crash rates, high-impact countermeasures need to be developed. The primary focus of this project is to determine the location of critical crashes along highways in Kansas that are due to the frequent damage of pavements and bridges. The current situation requires transportation stakeholders such as state departments of transportation, freight transportation related industries to adopt a new philosophy to plan and conduct their business.
2011 Research Projects

Mechanical and Hydraulic Properties of Recycled Railroad Ballast

PI: Robert Parsons
Co-PI: Ju Hun

DESCRIPTION: A thorough understanding of railroad ballast drainage and strength properties is required for developing ballast specifications. With the properties of new ballast meeting AREMA specifications have been investigated, as much as 75% of the ballast applied to track during maintenance activities is recycled ballast. This ballast—and a great deal of ballast currently in service under track—has experienced degradation due to particle breakdown and rounding. The report is expected to include an evaluation of the safety data across the state along with historical accidents, particularly those where heavy vehicles have been involved.

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 historical accidents, particularly those where heavy vehicles have been involved.

University of Nebraska Projects

Calibration of Micro-Simulation Models for Multi-modal 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 heavy vehicle percentages for which standard procedures, such as those of the HCM, do not apply. Two test cases will be used to evaluate the potential usefulness of the procedure: (i) the I-480 corridor in Iowa-Nebraska and (ii) a highway-rail grade crossing in Lincoln, Nebraska.

BENEFITS: The expected increases in freight-carrying heavy truck and rail traffic in the Region VII area raises geometric design, safety, and operations 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 Azinimmini

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 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 that have been identified in the previous numerical studies and test 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 benefits 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.

Development of Modification Factors for Truck Related Crashes at Bridge Sites on Highway Operations

PI: Dr. Steven Schroed

DESCRIPTION: Crashes that occur at bridge sites tend to be more severe than those on typical segments of roadway. The greater density of operations on the roadway crossing the bridge is a source of stress for drivers as they navigate through the transition region designed using this 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 that have been identified in the previous numerical studies and test 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: Expected increases in freight-carrying heavy truck and rail traffic in the Region VII area raises geometric design, safety, and operations 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.

UNL Improving the Safety of Freight Transport by Monitoring the Effects of Knucklepoint Erosion on Scour around Bridge Infrastructure

PI: Dr. David Admiral

DESCRIPTION: Streambed degradation poses a continuing risk to bridge infrastructure. Often, degradation occurs as a series of abrupt drops, called knucklepoints, migrate upstream. The passage of a knucklepoint may leave the foundations of bridges jibbers and abutments dangerously exposed. This project will study the flow behavior and geology associated with knucklepoint migration and provide highway engineers with a set of tools that they can use to stem stream degradation.

BENEFITS: The objective of this research by the Universities of Iowa (UI) and Nebraska – Lincoln (UNL) is to examine the geologic and hydraulic mechanisms that most strongly control knucklepoint erosion rates. The ultimate benefit of this research is that it will allow highway engineers to more accurately predict knucklepoint migration rates and more adequately prevent damage caused by streambed degradation.

Crash Costs at Rail Grade Crossings

PI: Dr. Asem Khattak
Co-PI: Dr. Eric Thompson

DESCRIPTION: An accurate measure of crash costs is required to support effective decision-making on transportation investments. In particular, underinvestment may occur if measurement fails to capture the full cost of crashes. Such underinvestment may occur 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 disruptions 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.

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**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 and development of new ones, particularly for heavy-truck load, are therefore necessary for success. The project was initiated in FY 2009 and continued in FY 2010 to investigate pavement performance predictions from both the newly released “mechanistic-empirical guide on MEPDG” approach and the fully mechanistic approach based on the finite element method (FEM) particularly focusing on the impact of heavy truck load on pavement damage. The focus was placed on the fracture (cracking) related predictions of pavement rutting. Further investigations of the different approaches were performed for pavement design and evaluation. Based on the results of the project, future improvements of the current MEPDG performance and life of pavements in Region VII. In addition, more sophisticated models for heavy-load trucks on pavement damage and performance were developed in Phase IV, which can be used for future advancements of the current MEPDG approach. The project was focused on the development of load models that are representative of actual and expected freight loads. The load model to be used is 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 Rosenbaug
**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 (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 (Hay 2 and 8th Street). A cost and benefit analysis will be performed to assess the economic impact.

**Reliability-Based Evaluation Criteria for Railway Bridges**

**PI:** Dr. Andray 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 the recent economic collapse, terrorism, and high-speed rides. Moreover, railway bridges are subject to dynamic loads causing resonant phenomena in the structure. The simplified methods for evaluation of dynamic load effects are 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 integrity, and/or lead to demobilization 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 structural reliability. 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 loads. The load model to be used is 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.

**IntelliDrive Technology Based Yellow Onset Decision Assistance System for Trucks**

**PI:** Dr. Arjun 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 accidents and T-bone collisions. Trucks are relatively less manoeuvrable 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 with 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 correspond 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. Deen Sickling
**Co-PI:** Cody Stolle

**DESCRIPTION:** Cable median barrier has proven to be an effective safety treatment for prevention of cross median crashes on 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 still effective, the remaining 5% of fatal crashes in Missouri, where extrapolated to the 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 guided model to capture the penetration mechanics of cable barrier systems, and improvement of cable barrier simulation components for future crash simulations which will better predict penetrations and propensity for under/over. The combination of approaches will provide insight into the mechanisms leading to cable barrier penetrations in order that design modifications and guidelines would be recommended to reduce the number of cable guardrail penetrations.

**BENEFITS:** The benefits of research are threefold: (i) guidelines for construction and design of new cable barrier systems will be created to reduce the propensity for penetrations to occur; (ii) models of cable guardrail system components and interactions will be refined, and (iii) 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 DOTs to adequately clear highways during winter weather conditions is crucial 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/biore ratios and the associated application rates will be determined for various winter 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 chemicals/brine combination is necessary 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 $2 million per year on highway deicing chemicals. A performance rating system and quality assurance methodology will ensure that the best value chemical is selected 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 $100,000/year) could be achieved with less winter weather conditions and increased level of service for the traveling public. The end result will be clearer roads during snow events which will lead to safer and more efficient freight (and passenger) roadway system.
Cody Stolle was named the 2011 MATC Doctoral Student of the Year. Stolle is studying mechanical engineering at the University of Nebraska-Lincoln. As a graduate research assistant at the Midwest Roadside Safety Facility, 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 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 (Stolle’s) 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.”

MATC wishes to congratulate the Master’s Student of the Year, Ben Grone. Grone is a second year MS student at the University of Nebraska—Lincoln with an emphasis in transportation engineering. As an undergraduate, Grone received the prestigious NU Regent’s 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. He has also been an active participant in MATC’s K-12 educational outreach programming, regularly demonstrating to young students how traffic engineers use LIDAR guns to conduct speed studies.
**MATC Scholars Program: Offering Tools for Success in Graduate Study**

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. 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. Panelists Maurice Cavitt, a PhD student in industrial engineering, and Sarah Asio, a master’s student in industrial engineering, spoke to the importance of support systems and the trials of separation from family. During the tour of the newly remodeled Whittier Research Center, students and faculty members alike were wowed by a presentation from Dr. Dean Sicking. With video footage of crash testing, he explained how the research conducted at the Midwest Roadside Safety Facility saves lives, and the important roles graduate students have in this work.

MATC is committed to mobilizing talented students from all populations in order to strengthen the next generation of traffic engineering professionals. To encourage students to stay in contact with one another, a MATC Scholar Program Wiki page was created.

**MATC Intern Program: Providing Practical Professional Experience**

Since 2000, the MATC Intern Program has been working to attract the best and brightest undergraduate students to transportation careers by providing opportunities for professional experience. The program matches students to employers in the public and private sectors and to faculty researchers for summer or semester-long internships. At the University of Nebraska-Lincoln, civil engineering lecturer Karen Schurr has been leading the program since its inception. Nine UNL undergraduate engineering students were selected for the 2011 UNL program.

At the annual Intern-Sponsor Luncheon, just prior to the start of the internships, new interns had the opportunity to meet their new employers for the first time, discuss what they can expect for the summer, and ask questions. Ms. Schurr gave an overview of the program and explained to interns and sponsors a few ways to make the most of the experience. Schurr believes the experience helps students enlarge their frame of reference and exercise their “engineering judgment.”

University faculty who teach the undergraduates benefit as well. Ms. Schurr explained. Interns help translate the needs of private sector firms to transportation research ideas for faculty members. Interns also tend to interact more with the instructor and with fellow students in the classroom. The program is a key element of MATC’s goal of demonstrating the benefits of transportation careers to talented undergraduate students.

One of the highlights for many interns is the field trip that takes place each summer, when all interns have a chance to visit their peers’ internship sites and learn about one another’s work. On July 15, students traveled all over Lincoln to some of the area’s top firms and to MATC headquarters. John Dickman worked alongside the traffic team at Olsson Associate’s Lincoln office, contributing to several high-profile projects. For instance, he helped monitor the innovative new parking management system near Omaha’s Qwest Center, which monitors parking to tell drivers which lots are full and directs drivers to available parking. He enjoyed the hands-on nature of his experience. Kevin Hock presented on his internship at HDR working on traffic design. He discussed how he discovered some of the challenges traffic engineers face, including working to avoid traffic while installing vehicle sensors on a roadway late at night! At the Nebraska Department of Roads, Garret Menard discussed his experience working in the traffic engineering division. There was a great deal of reading necessary to become familiar with state and national standards and regulations, but he enjoyed using the new PathWeb and WorkDesk software to gather data on traffic accidents. A new experience was writing an official memo presenting his findings. Erica Odegard had a unique internship experience in the materials testing lab at the City of Lincoln. She explained the kinds of materials used locally and the testing specifications for the concrete.

Research intern Leah Kampschneider talked about her work on Dr. Anuj Sharma’s driver stress study, examining the effects of stress on driving performance. Nate Hubener also worked on MATC research, assisting Dr. Khattak with a project assessing truck safety on highway rail grade crossings. Hubener said he enjoyed learning what an engineer’s average day involves and also appreciated the networking opportunities.
**MATC Intern Program: Alumni in Action**

National defense demands individuals with a wide range of skills, from commanding a ship to managing traffic safety on base. US Navy Ensign John Parizek is part of the Civil Engineer Corps (CEC) and serves as the assistant public works officer for the Naval Facilities Engineering Command Mid-Atlantic Region Public Works Department in Newport, Rhode Island—he is also a 2006 alumnus of the MATC intern program. Ensign Parizek attributes his success in the Navy to a well-rounded undergraduate experience, including an internship at the Olsson Associates consulting firm in Lincoln. After graduating from the University of Nebraska—Lincoln with a degree in civil engineering, Parizek earned his Navy commission at Officer Candidate School and continued on to the US Navy’s Civil Engineer Corps Officer School.

At Naval Station Newport, Ensign Parizek is assisting with the largest renovation and infrastructure overhaul on the base since World War II. Parizek is responsible for space management, traffic safety and construction project management, and he also serves as a member of the anti-terrorism team. His internship experience contributed to his ability to “adapt and embrace leadership opportunities in the Navy Civil Engineer Corps.” His Navy career has been very rewarding, Parizek says, and he is grateful for the opportunities provided by his education. MATC salutes Ensign Parizek for his service.

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**MS&T MoDOT Intern Program Enters Fourth Year**

Missouri University of Science and Technology is now in its fourth year as a highly successful internship program in conjunction with the Missouri Department of Transportation, sponsored in part by the Mid-America Transportation Center. After development of a strategic recruitment plan with MATC and MoDOT, Dr. Genda Chen of MS&T has worked to consistently attract a number of top undergraduate students to the program. To date, a total of 49 students have participated.

Interns are competitively selected with assistance from MoDOT staff and then are assigned to an area that fits their background and interests: construction, materials or traffic operations. Upon successfully completing the internship and composing a final report, interns are awarded a scholarship from MATC, in addition to their hourly pay.

Congratulations to the summer 2010 MoDOT/MS&T Interns:

- Ashley Overschidt
- Derek Christison
- Tabitha Fisk
- Joseph Ridpath
- Brandon Braun
- Joseph Ridpath
- John Komaromi
- Ashley Overschidt

Summer 2011 interns will be featured in the fall MATC newsletter.

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**Successful Spring for KU KDOT Interns**

At the University of Kansas, several students participated in an internship with the Kansas Department of Transportation (KDOT) during the spring 2011 semester. Aaron Boehmker, a senior in civil engineering; Hillary Urkovich, a graduate student in transportation; and Jessica Peat, a senior in civil engineering, gained on-the-job experience this semester working with in a Highway Design Squad. KDOT has been a key part of the MATC intern program by offering opportunities to student interns from the University of Kansas and Kansas State University. One intern also assisted MATC associated director Dr. Tom Mulinazzi with development of a “Toolkit for County Road Administrators.”

For the summer of 2011, three undergraduate KU students—Ryan Hagerty, Ben Mudd, and Sarah Thompson—are getting the chance to work on transportation research projects with KU faculty. Stay tuned for MATC’s next newsletter to read more about their projects.

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**KSU Intern Program Expands for Second Year**

The Kansas State University Internship Program, in partnership with the Kansas Department of Transportation, is having a successful second year. Over the summer months, interns work in various KDOT departments to gain skills and experience that cannot be replicated in the classroom. The internship also serves to introduce students to transportation career options. The program began with 9 interns in the summer of 2009 and, this summer, 18 students were selected to participate. Congratulations to this year’s KSU/KDOT interns:

- Taylor Smith
- Sara Mann
- Nick Theimer
- Andrew Bruner
- Abe Harpel
- Jeremy Hauser
- Devon Jackson
- Dillon Dowling
- Bronton Boyer
- Garrett Sharp
- Nick Koch
- Kyle Goetz
- Daniel Huffman
- Joseph Ollersson
- Adam Emerson
- Andrew Shearrner
- Eric Fletcher
- Jonathan Varner

Look in the fall MATC newsletter for more information on the interns’ projects!
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. Several students came from Prairie View A&M, a Historically Black College and University (HBCU), located outside of Houston. 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 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.

During the final presentation event, students discussed their experience and there were emotional responses as the students parted with their PhD mentors. All of the interns described how the research experience, for undergraduates or new graduate students, provided valuable insight and motivation for them to invest themselves in graduate study.

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

“Expanding Your Horizons” was a special event 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” was held on Missouri S&T’s campus on October 15, and students rotated through hands-on workshops to learn about a variety of topics, including biology, computer science, engineering and mathematics.

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 many 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 the buildings were finished, 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.

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During the project, Rathe also led students in an interactive project to get them engaged and excited about engineering. First, students built a structure out of spaghetti noodles and mini marshmallows. The objective was to build the strongest structure possible within the time limit. This tested the students’ ability to problem-solve and be creative with the given materials. The part they enjoyed the most was, of course, testing and destroying the structures. While the marshmallows didn’t make for strong structures, the high school students had fun making and demolishing their creations.

Another activity Rathe engaged the students in was testing which shape produced the strongest column. Students were given small columns made out of cardboard shaped into a square, rectangle, triangle, hexagon, and circle. The students put weights on top and found that the more sides that a column had, the stronger it became. They even ran out of weights before the circle and hexagon shapes were crushed! Overall, the students were very excited to see the columns held a significant amount of weight despite the fact that they were made from paper. MATC applauds the efforts of such programming in reaching out to the next generation of engineering students.

Rolla High School Students Experience Engineering

On January 27 and 28, Laura Rathe of Missouri University of Science and Technology visited Rolla High School, in Rolla, Missouri, to present information on civil engineering to students in Principles of Engineering classes and at the Science Olympiad. The purpose of the presentation was to get students interested in future careers in the field of civil engineering. Rathe discussed the goals of civil engineers, technology used in practice, the many potential career options, and graduate student research.
Summer Institute brings Middle and High School Teachers and Students to Engineering

Dr. Larry Rilett, MATC Director, teamed up with Dr. Gina Kunz and Dr. Gwen Nugent of the Nebraska Center for Research on Youth, Families, and Schools (CYFS) for the sixth presentation of the popular Professional Development Science and Math Summer Technology Institute. The summer institute is a unique opportunity for middle and high school math and science teachers to learn about transportation engineering and incorporate core math and science concepts into transportation-based lesson plans. MATC faculty, research staff, and students provided engineering knowledge and access to first-rate research facilities, while CYFS faculty and graduate students provided K-12 educational expertise and invited education experts to help teachers think about incorporating new information into the classroom.

This year, specially trained instructional coaches—experienced local math and science teachers—worked closely with teachers to encourage them to think about ways to use inquiry to spark students’ interest. Ten teachers and eight coaches spent four intensive days learning about transportation engineering from faculty and graduate student presenters, who discussed the latest research projects and the math and science concepts essential to the field. Civil engineering lecturer Karen Schurr, for example, discussed how geometry informs highway design, and mechanical engineering PhD student Cody Soffel explained how physics are used to design vehicle crash tests at UNL’s Midwest Roadside Safety Facility. After group discussions and one-on-one meetings with these coaches, teachers created lesson plans that incorporate inquiry and hands-on math and science learning through transportation applications.

After a trial run with their peers, teachers were ready to show their lessons in middle and high school students. Over 125 students from 24 schools in the Lincoln and Omaha area attended this year’s Engineering Education Excellence Experience, in which students had the opportunity to spend one or two days on campus learning about engineering research while experiencing and reviewing the new lessons. MATC had the chance to host a special guest group of students from Culler Middle School’s “Camp Cougar” summer program and a group of young ladies from Girls Incorporated of Omaha. Throughout the mornings, students were separated into groups and participated in several exciting lessons. For example, a math teacher at Lincoln North Star High School designed a lesson around vehicle braking distance to have students make observations on the relationship between stopping time and distance as illustrated in an interactive online simulation. Students then calculated time and distance for real-life scenarios. Ms. Hoglund illustrated how transportation engineers need to take these calculations into account to safely design intersections or advance warning signal flashers.

After lunch, students, accompanied by coaches and teachers, toured the UNL engineering labs. In the Structural Laboratory, students learned about how bridges are designed to be safe and reliable and watched a concrete cylinder undergo a compression test and explode. In the Geomaterials Laboratory, students learned about how many different components are used to make asphalt and were entertained by PhD student Thiago Aragão’s anecdote about coconut fibers being used in asphalt mixtures in his home country of Brazil. At the Midwest Roadside Safety Facility proving grounds, students watched a truck, a “bogie,” ramming into a wooden post and breaking free from its asphalt moorings. They were fascinated by the cars that had been crushed in past tests. Afterwards, a representative from Flatbed Express, a Nebraska freight company, showed students a flatbed truck and talked about the many career opportunities at trucking companies. Students took turns sitting in the cab and asked questions about the mechanical parts of the truck. On Wednesday, students also had a chance to hear from several MATC graduate students about how they became interested in studying engineering and students were given the opportunity to ask questions.

At the end of the day, students enjoyed a tasty snack while completing post-evaluations to measure learning and to gain feedback to inform future Summer Institutes. Amazingly, students still had energy at the end of the jam-packed day and were excited to head home with a water bottle to match their new Engineering Education Excellence Experience t-shirts!
In the fall of 2010, MATC graduate students helped launch an after-school program focused on transportation engineering at Culler Middle School in Lincoln, Nebraska. With support from the U.S. Department of Transportation and in partnership with the University of Nebraska-Lincoln’s Center for Children, Youth, Families and Schools, the program introduced middle school students to engineering with hands-on activities. Students learned from lessons plans developed with input from NTC faculty and graduate students, which complemented their STEM curriculum and brought transportation research into the classroom. Transportation systems engineering graduate students Quinton Rodgers and Scott Sorenson acted as mentors—providing engineering expertise, answering questions, and supporting students in completing lesson activities. In addition, the graduate students gave engaging presentations including “What is an Engineer?” Culler science teacher Mary Herrington, who provided the initial inspiration for the program, led many activities and coordinated the curriculum.

On February 28, program participants showcased all that they learned in a celebration of the successful first quarter of the program. Students demonstrated their knowledge by answering their favorite activities and most memorable moments to their parents and school administrators. Dr. Steven Joel, the Superintendent of Lincoln Public Schools, was on hand to welcome parents and praised the Roads, Rails and Race Cars program for providing “opportunities for students to connect with what they learn and what they want to become.” Mr. Gary Czapala, the principal at Culler Middle School, also welcomed parents and thanked the engineering graduate students for helping to show “new worlds” to the students. As part of the program’s goal to help students begin thinking of their post-secondary plans, Nyko Aguirre, the Diversity and Community Outreach Coordinator for the UNL Admissions Office, discussed resources available to both students and parents, and spoke about his own path to college.

After the positive reception from students, parents, teachers, and administrators alike, students took an even more active role in a special culminating celebration on May 9. Radious Walker-Woods and Zach Harris, students in the program, gave parents and guests a warm welcome. Tony Glenn, an education specialist in the skilled and technical sciences career field for the Nebraska Department of Education, was one of the special guests. Club participants led parents and guests in some of the most memorable activities from over the past quarter, illustrating concepts ranging from the importance of communication in transportation to the challenges faced by geotechnical engineers. Students chose and planned the activities as well, and explained the directions—it was a challenge, but one that left everyone laughing and smiling at the end of the day.

“ROADS RAILS AND RACE CARS”: MATC’S AFTER SCHOOL SPECIAL
More engineers are needed at the University of Kansas now have an opportunity to learn about transportation engineering. Dr. Steven Schrock and Dr. Tom Mulnazzi planned and successfully launched a new required transportation engineering course, CE 480 Introduction to Transportation, in the fall semester of 2010. 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 multi-modal project as a culmination of their learning. Dr. Mulnazzi 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 in the undergraduate curriculum, when students are narrowing down career options, this course will be an opportunity for more students into the transportation field.

The student chapter of ITE (Institute of Transportation Engineers) 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 in the region’s future transportation engineers.

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MATC hosted the director of the Nebraska Department of Roads, Monty Fredrickson, as a speaker for the seminar series on October 29. In the first part of his presentation, Mr. Fredrickson offered a look at NDOR’s recent projects and across the state. Eleven projects were examined, from highways in 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 employers, handling more than 10,000 miles of Nebraska roads, and working with the Nebraska State Highway Commission as public liaisons.

Of interest to many students in the audience was Mr. Fredrickson’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. Fredrickson. 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 that will face 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.

Speaker: Monty Fredrickson, Director of Nebraska Department of Roads

MATC Seminar Series: All 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 France, Transportation Analyst, Kittelson and Associates
Monty Fredrickson, Director, Nebraska Department of Roads

Speaker: Jim Knott, NDOR Design Engineer

Jim Knott, a design engineer at the Nebraska Department of Roads, was the featured speaker on October 1. Mr. Knott discussed the challenges faced by NDOR as its engineers strive to choose the right projects while 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 of 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 “three Rs” 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.

MATC Seminar Series: LOCATE Traffic Forum

MATC Seminar Series: Offers Graduate Students a Variety of Perspectives

During the fall semester of 2010, Dr. Anuj Sharma, assistant professor of civil engineering at the University of Nebraska–Lincoln, facilitated the MATC Seminar Series, a one-credit course featuring guest speakers from industry and academia. Talks were open to all interested students and faculty and broadcasted 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.

Jim Knott, 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 TTM 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, the Metro Area Planning Agency, the City of Des Moines, the City of Council Bluffs, the City of Omaha, and the City of Lincoln.

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MATC Students Network, Present Research at TRB Annual Meeting

MATC was well-represented by students at the 90th annual meeting of the Transportation Research Board, the largest event of its kind, with hundreds of sessions and workshops and over 10,000 attendees. The theme this year was “Transportation, Livability, and Economic Development in a Changing World.”

MATC students attended meetings, presentations, networking events and several students presented posters. Post-doctoral research associates Bhaven Naik and Justice Appiah (former MATC students) and Remigiusz Wojtal, a MATC PhD student at the University of Nebraska—Lincoln, presented a poster for their project, “Safety Effect of Dilemma Zone Protection Using Actuated Advance Warning Systems.” PhD student Zheng Luo presented with his advisor Dr. Aemal Khattak on their project, “Pedestrian and Bicyclist Violations at Highway-Rail Crossings,” at the meeting of the Committee on Highway—Rail Grade Crossings.

Missouri S&T PhD student Mojtaba Ale Mohammadi presented a poster on his MATC project with Dr. Ghiyam Bham titled “Vehicle Speeds in Work Zones: An Objective and Subjective Analysis.” Additionally, MATC PhD Student of the Year Cody Stolle presented on his project, “Improving the Performance of Cable Median Barrier.”

University of Kansas undergraduate students Tiffany Brown and Sarah Thompson were selected to attend the meeting as “Jayhawk Transportation Scholars” with travel expenses funded by MATC. This was a great opportunity for these two students as they had a chance to network with faculty from potential graduate schools. At the conference, Ms. Brown met Dr. Seth Young, chair of TRB’s committee of Aviation System Planning, and was invited to be a “young member” of the committee. She hopes to pursue her interests in airport planning and design by applying for graduate studies at Ohio State University. Congratulations to Ms. Brown and Ms. Thompson for a successful conference experience!

Here’s what MATC students had to say after the conference:

Scott Sorensen – MS Student, University of Nebraska—Lincoln: After attending the conference, I now have a better understanding of different research organizations and the way they function, as well as discovering new areas of interest for my own research.

Ben Grone – MS Student, University of Nebraska—Lincoln: The highlight of the conference was being able to hold one-on-one conversations with various experts in my area of research.

Lessons in Leadership at IRF “Road Scholars” Program

The International Road Federation (IRF) Road Scholars Program is a prestigious program for future professionals in the roadway industry. MATC PhD student Thiago Aragão was nominated by the University of Nebraska—Lincoln to represent the institution as an IRF Executive Fellow at the 2011 program, held in Washington, D.C., from January 19-28. The program provides a unique opportunity for an elite group of graduate students to meet with IRF members, interview with potential employers, gain exposure to many public and private organizations within the roadway industry, and hear from executives about how to become a leader in the industry.

Reflecting on the experience, Aragão expressed his new appreciation of the many facets of the transportation industry that the program illuminated, ranging from economics to safety to legal issues. The program spanned a wide range of perspectives on the most current and pressing issues within the field and showed the overall structure of the nation’s transportation organizations. Aragão noted that the unique aspects of the program included the opportunity to network with professionals from various sectors and the overall emphasis on leadership. Also noteworthy was the respect with which the fellows were treated and the hospitality of their hosts, who arranged the schedule to accommodate students presenting at the TRB (Transportation Research Board) Annual Meeting.

The International Road Federation (IRF) is a non-governmental, non-profit organization with the mission to promote development and maintenance of better, safer and more sustainable roads and road networks. For more information on the International Road Federation and Road Scholars program, please visit http://www.irfnet.org/.
During the month of February, MATC received international attention as Larry Rilett traveled to India to attend and present at the INDO-US and the Intelligent Transport Systems conferences. Uniting professionals from the United States and India, the 2011 INDO-US Workshop on "Transportation and Greenhouse Gas Emissions," held in New Delhi on February 10-11 at the Central Road Research Institute (CRRI), merged the public and private sector, universities and research agencies for a two-day event. The goal of this workshop was to discuss current trends and research in the area of transportation and greenhouse gas emissions, and to identify research needs and potential areas of collaboration between India and the US. The principal investigators for this year’s workshop were Anuradha Shukla of CRRI and Josias Zietsman of Texas Transportation Institute (TTI). The event consisted of technical sessions, which addressed such topics as broad policy overviews, inventory methods, sources and mitigation strategies, technological solutions, as well as modeling approaches, policies and programs. Like last year’s workshop, the two day INDO-US event highlighted the capability for the United States and India to work together to solve global transportation issues through collaborative efforts.

After returning from the conferences in India, MATC received the great news that the INDO-US Science and Technology Forum (IUSSTF) has agreed to support a student exchange proposal—a collaborative project conceived at last year’s INDO-US conference. Under this program, India students would travel to the US and US students would travel to India to learn at transportation facilities in the respective countries. Once implemented, the student exchange program will enact the kind of collaboration that the INDO-US conference strives to create through its annual meeting of transportation professionals.
MATC Discusses Transportation Initiatives with NDED

In Nebraska as elsewhere, transportation is an essential aspect of the economy. On March 2, the Nebraska Department of Economic Development (NDED) met with Dr. Larry Rilett to learn about the ways in which the Mid-America Transportation Center’s education, research, and workforce development initiatives contribute to the well-being of the local, state, and regional economies. Also present were Larry Johnson, the president of the Nebraska Trucking Association, and a session and long-time partner with MATC, and NDED, and Ryan Anderson, the Director of Industry Relations with the UNL Office of Research and Economic Development.

Transportation Distribution, and Logistics constitute one of Nebraska’s core industries clusters, which have continued to grow at a much faster rate in Nebraska compared to the national average.

MATC is committed to supporting industry growth through working with state and community leaders to address the needs of businesses in this sector.

MATC hosted NDED development consultants, business recruiters, and interns from the Business Development Division, which provides assistance with business and economic development programs and represents statewide interests in retaining, expanding, and recruiting businesses to Nebraska. NDED works to provide leadership and services that enable Nebraska communities, businesses, and residents to succeed in the global economy.

Dr. Rilett was excited to share information about MATC’s industry partnerships, from working with local consulting firms that host student interns, to helping Nebraska truck drivers retrofit their vehicles with money- and energy-saving technologies. NDED staff members were particularly interested in MATC’s summer intern program and expressed interest in collaborating on an internship program in the future.

Dr. Rilett gave the group a tour of the laboratory facilities at the Whittier Research Center and discussed the exciting transportation research in progress. The group had a chance to see how research projects at the Mid-America Transportation Center make an impact at the local, state, and regional levels. Conversations with entities such as NDED are key for ensuring that MATC’s research priorities meet the needs of the local community, and contribute to the economic well-being of the state, region, and nation as a whole.

Local MOVITE Chapter Visits Whittier Research Center

On August 30, LOCATE featured Dr. Larry Rilett as a speaker during its 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 43 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.

Professor from Korea Speaks about Geomaterials’ Effects on Transportation Infrastructure

Dr. Seong-Hwan 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 5. 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.

TRB Webinar Moderated by Dr. Aemal Khattak

On Thursday, September 16, 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 LaFey, 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 it was followed by many questions from the participants. MATC PhD student Jennifer Schmidt assisted with gathering data for the project.

The session was recorded by TRB and those interested in obtaining the link can email Reggie Gilman at RGilman@nas.edu.

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 26. 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 among 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.
Workforce Development Initiative at Kansas State University Keeps Going Strong

Since 2009, MATC has supported the Workforce Development Initiative at KSU. Mustaque Hossain, MATC associate director and professor of civil engineering, oversees this effort. Currently, this initiative consists of the Transportation Certificate Program, the Superpave Field Laboratory Technician Certification Training Program, and a Kansas Department of Transportation (KDOT)-KSU Summer Internship Program.

Superpave Field Laboratory Technician Certification Training is a four-day course offered jointly by KSU and KDOT. This course is intended to certify engineers, technicians, and other personnel who will be involved in the construction of Superpave Hot Mix Asphalt (HMA) pavements using Quality Control and Quality Assurance (QC/QA) specifications in the state of Kansas. Successful completion of the course and certification (subjected to a combined passing score on two written tests and a laboratory proficiency test given at the end of the course) is required for all KDOT and contractor personnel performing tests on Superpave projects. On three occasions this winter, KSU campus in Manhattan hosted four-day Superpave training sessions. Sixty-six participants from KDOT, HMA industry, and consulting companies attended these classes.

Instruction was provided by a select group of instructors from KDOT, HMA industry, and KSU. This year’s successful program resulted in the total number of participants completing this program since 1997 reaching close to 1,500.

PhD Student Facilitates Research Seminars at MS&T

Ying Huang, a PhD student at Missouri University of Science and Technology, encourages her fellow students to share their research projects in a bi-weekly research seminar that she organizes. Undergraduate and graduate students alike are welcome to attend the seminars, which are a forum for students to learn about research in other areas and to practice communicating their research endeavors to others. Seminar attendees are free to ask questions at any time and presenters exercise their communication skills to help students from different backgrounds comprehend their research methods and goals.

Huang has presented her own research, which involves using sensors to measure strain in structures, and presenters have discussed projects in areas that include civil materials, corrosion resistance, structural dynamics, finite element analysis, and structural health monitoring. Huang says the main intent of the seminar is for engineering students to learn about different research approaches and methodologies, show one another the latest interdisciplinary research developments, and to encourage collaboration across disciplines.

This dynamic, scholarly program is a wonderful example of leadership and vision in action—thank you, Ying Huang!
University Research Technology Transfer Day at the USDOT Headquarters

The Research and Innovative Technology Administration (RITA) held a special event to showcase the most exciting university-based, DOT-funded transportation research projects—which included the work of MATC faculty and students from Kansas State University and the University of Nebraska-Lincoln. On Wednesday, April 6, USDOT Department of Transportation staff had a chance to meet student and faculty researchers, learn about the latest research projects, and participate in panel discussions.

MATC Director Dr. Larry Rilett, Professor Dean Sicking, and PhD student Cody Stolle traveled to the USDOT headquarters in Washington, D.C., to showcase the MATC research project “Identification of Impact Conditions in Severe Median Barrier Crashes.” Authored by Mr. Stolle and Dr. Sicking, this project examines the characteristics of crashes from different angles with various vehicle types in an array of conditions to identify ways to prevent cars from penetrating the cable barrier or rolling over—the deadliest crash incidences. Their early conclusions suggest that improved testing standards should be adopted, and, once implemented, the resulting safety improvements could prevent 350 fatalities annually. Mr. Stolle reported that the event was an exciting opportunity to share work in this area of specialty with USDOT representatives from a variety of departments.

In one of only six podium presentations, Dr. Robert Peterman of KSU gave an overview of his project, “Non-Contact Strain Sensor for Prestressed Concrete Inspection in Bridge Structures and High-Speed Rail Cross-Ties.” The sophisticated technology developed at KSU (by a research team consisting of Dr. Peterman, Dr. Terry Beck, Dr. John Wu, and graduate student Weixin Zhao) saves both time and money by providing a safe and efficient inspection method that does not require technicians to have any contact with the surface of the bridge or rail member. The sensor device measures strain by using Laser Speckle imaging, in which a speckle pattern is generated by reflection of a laser beam on the surface of the bridge member at two points. The device shows potential to be very useful for concrete tie manufacturers, and the two Federal Railway Administration representatives in the audience were able to ask questions relative to implementation. With the device at hand, Dr. Peterman was able to demonstrate its many practical applications to USDOT staff and other visitors.

With a impressive poster and podium presentations, the University Research Technology Transfer Day was a great opportunity to demonstrate the size and value of innovative projects from MATC faculty.

Dr. Sharma Presents Hybrid Energy Project at LOCATE Meeting

On Thursday, April 14, Dr. Anuj Sharma, an assistant professor of civil engineering, presented his latest research at the meeting of the Lincoln-Omaha-Council Bluffs Association of Traffic Engineers. Dr. Sharma is currently working with Dr. Jerry Hudsons, Dr. Larry Rilett, Dr. Elizabeth Jones, and Dr. Wei Guo to test a solar-wind hybrid power generator as part of a project sponsored by the Federal Highway Administration. The project utilizes the expertise of faculty from electrical engineering and transportation systems engineering.

In the first phase of the project, a wind generator was installed on existing traffic infrastructure at an intersection on the southeastern outskirts of Lincoln, Nebraska. The generator provided power for the traffic signals at the intersection. Depending on conditions, the system occasionally produced more power than it consumed, which was then sold back to Lincoln Electric Systems. The goal of the project is to move toward “Energy Plus Roadways,” in which the system consistently generates more energy than it needs. In the next phase of the project, a solar panel is being added to the generator to produce a hybrid system.

Dr. Sharma discussed the many practical considerations that had to be addressed in the course of planning and implementing the project. Navigating zoning requirements, choosing the type of windmill to use, finding the ideal infrastructure on which to mount the system, predicting the systems’ impact on driver behavior, and finding ways to predict conditions are just a few aspects that Dr. Sharma discussed.

Overall, while generating electricity with wind is initially more expensive than with coal, over a short time the benefits begin to exceed the cost. The system emits no greenhouse gases, and can be used as a backup during a disruption in electrical power. The City of Lincoln and Lincoln Electric Systems have stated that the energy-saving project is an important one for making the city “cleaner and greener” and it is anticipated that the project will set a precedent for similar ones in the Midwest. For more information, visit http://energyplusroadways.unl.edu/.
ITS Heartland Annual Meeting Brings Together Regional Professionals

The Heartland Chapter of the Intelligent Transportation Systems Society of America held its 12th annual meeting on March 28-30 in Des Moines, Iowa. Representatives from the public and private sector and institutions of higher education convened for the highly anticipated event to share ideas, projects, products, and conversations. ITS Heartland exists to create and sustain dialogue among transportation professionals in the states of Missouri, Iowa, Kansas, Nebraska, and Oklahoma. The Mid-America Transportation Center has provided administrative and event coordination services to the organization since 1999.

The first day of the meeting marked the 4th annual ITS Heartland Operations Symposium. In 2010, an Operations Working Group was established to optimize operations and communication among the region’s transportation management systems. Each state gave operations updates on current uses and recent enhancements of each state’s 511 traveler information service, coordination and communication practices with other states, and other updates on practices and procedures. Group leadership then facilitated tabletop exercises to prepare for various regional events or emergencies.

General and concurrent sessions were featured on Tuesday and Wednesday, including an address from the president of ITS America, Scott Belcher, on the upcoming ITS World Congress and other national ITS updates. Panel presenters covered a variety of topics including:

- Economic Benefits of ITS
- Using Smart Phone Technology to Provide Real-Time Traveler Information
- Work Zone Applications of ITS
- Arterial Travel Time Monitoring Using Bluetooth Technology
- Rural ITS Deployments

In addition, students from Iowa State University, the University of Kansas, and the University of Nebraska-Lincoln were selected as winners of the student competition and presented their projects in the concurrent sessions. Attendees rated the conference as an overall success, with plenty of opportunities for networking and learning about the most innovative ITS products and approaches.

MATC Helps Facilitate Adaptive Signal Control Technologies Showcase for Federal Highway Administration

The Iowa Division of the Federal Highway Administration (FHWA) held an Adaptive Signal Control Technologies showcase on Wednesday, March 30, In West Des Moines, Iowa, in conjunction with the ITS Heartland Chapter’s 12th Annual Meeting. ASCCT is one of five technologies being promoted under FHWA’s Every Day Counts (EDC) Technology and Innovation Initiative, which focuses on accelerating the deployment of technology and innovation, going greener, and shortening project delivery time.

Fifty-two people were in attendance and represented a number of public agencies and private firms from around the Midwest. Presenters came from across the US and Canada, including the Denver Regional Council of Governments; Iteris, Inc.; Pennsylvania Department of Transportation; Delcan; the New Jersey Meadowlands Commission; the City of Ann Arbor (Michigan); Siemens; Cobb County (Georgia) Department of Transportation; and Rhythm Engineering.

Organized in two parts, the first half of the event offered a series of presentations demonstrating why improving traffic signal operations is important, how an agency can align its objectives with adaptive control strategies, and how this approach fits within the goals of the EDC initiative. The second part of the event provided a showcase of successful examples of Adaptive Signal Control Technology deployments from an agency perspective. Presenters discussed the principal functionality of each system and how their agency identified the need to improve traffic signal operations, how adaptive control was identified as a strategy, how the project was funded and implemented, and the extent to which the system met agency expectations.

Overall, participants indicated that the sessions were highly informative and every evaluation indicated that the individual’s level of knowledge about ASCCT increased after the showcase. Several indicated that they would like to see more investments in ASCCT nationwide and that they were considering implementing ASCCT in a corridor in their region.
Publications

Fiscal Year 2011 Highlighted Publications


Highlighted Presentations


Presentations


Peterman, Robert J. “Use of Laser-Speckle Imaging Device to Measure Transfer Lengths in Pretensioned Concrete Crossties.” Presentation, Precast/Prestressed Concrete Institute Committee Days, Chicago, IL, Mar. 1, 2011.

Peterman, Robert J. “Quantifying the Effect of Prestressing Steel and Concrete Variables on the Transfer Length in Pretensioned Concrete Crossties.” Presentation, Precast/Prestressed Concrete Institute Committee Days, Chicago, IL, Mar. 1, 2011.


MATC Financial Information for FY 2011

**Expenditures**
Federal and Matching Funds Allocated for Education, Research, Administration & Technology Transfer

- Education/Human Resources/Diversity: 21.6%
- Technology Transfer: 9.8%
- Research: 63.6%
- Administration: 15.0%

**Distribution of Federal Funds to Partners**
TOTAL = $1,869,520

- KSU: 25%
- KU: 25%
- MS&T: 25%
- UI: 25%

UNL receives 50% of the federal funds and the remaining 50% is distributed to our partners.

**MATC Source of Funds**

- University: 13.46% ($670,494.21)
- Private: 3.24% ($161,437.33)
- State DOT: 36.73% ($1,829,900.39)
- RITA - USDOT: 46.57% ($2,319,785.08)

For More Info:

http://matc.unl.edu

Mid-America Transportation Center
University of Nebraska–Lincoln

Dr. Laurence Rilett
MATC Director
Keith W. Klaasmeyer Chair in Engineering and Technology
2200 Vine St.
262 D Whittier Research Center
Lincoln, NE 68583-0851

Phone: (402)472-1992
Fax: (402)472-0859
Email: lrilett2@unl.edu

Valerie Lefler
MATC Program Coordinator
2200 Vine St.
262 F Whittier Research Center
Lincoln, NE 68583-0851

Phone: (402)472-1974
Fax: (402)472-0859
Email: vlefler2@unl.edu
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http://matc.unl.edu