

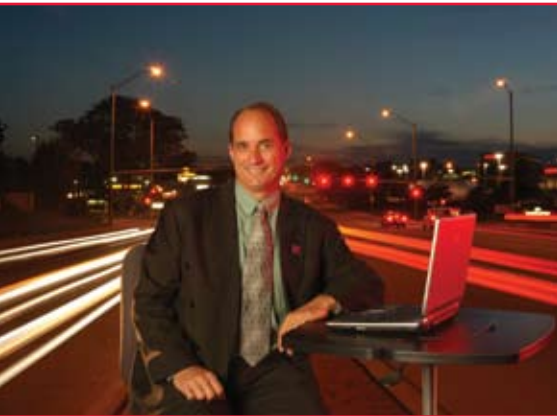
Palladian

Digest

Alumni Association of the University of Nebraska-Lincoln | Vol. 2, No. 1, November 2007

Tackling Transportation Challenges

Nebraska has been a vital link in the nation's transportation system since the days when carts, wagons and the Transcontinental Railroad first traversed the prairie. Today, cars, trucks and trains stream across the state's concrete, asphalt and steel arteries while local roads and bridges are the economic bloodstream for communities statewide.



Larry Rilett heads the new Nebraska Transportation Center at UNL, which integrates a wide range of transportation programs at all four University of Nebraska campuses.

Most motorists will never know that the guardrails, bridges, on-ramps, railroad crossings, traffic lights and construction zones they zoom past are safer and more efficient thanks to University of Nebraska-Lincoln research.

That's fine with UNL transportation researchers, said Larry Rilett, a civil engineering professor and one

of a growing cadre of highly regarded transportation researchers working at the university. "As engineers, what really motivates us is making things better and safer. The research we're all doing is definitely making a difference both in Nebraska and across the United States."

State, federal and international transportation officials are taking note of UNL's transportation expertise and contributions.

From guardrails and intelligent transportation system controls to innovative bridge designs and risk assessments, UNL transportation research is changing how bridges, highways and transportation systems are designed, built and operated.

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“In the end, Nebraska and the nation will get a safer, more effective transportation system.”

“UNL researchers are considered national and international leaders in various transportation areas such as safety, structures, materials and research,” said John Craig, director of the Nebraska Department of Roads. UNL engineers have long worked closely with the Nebraska Department of Roads (NDOR). This strong partnership has led to innovative road and bridge designs statewide and boosted Nebraska’s visibility in transportation circles nationally.

The university took a major step to enhance its transportation programs in 2006 when the Board of Regents approved establishment of the Nebraska Transportation Center (NTC) at UNL.

“This lays the groundwork for building a stronger, more integrated and more competitive transportation research program in Nebraska,” said Prem Paul, UNL vice chancellor for research.

Creating one of the nation’s premier centers for transportation research, outreach and education is the ambitious goal. Rilett, the Keith W. Klaasmeyer Chair in Engineering, was named the inaugural director earlier this year.

The NTC integrates a wide range of transportation programs at all four University of Nebraska campuses under an umbrella organization that will work closely with state government and industry partners. The center also links faculty from a variety of disciplines – from engineering to social sciences and medicine – on broad, multidisciplinary projects.

The center’s coordinated approach will expand the university’s ability to address complex issues, compete for larger grants, strengthen educational opportunities for students and increase public outreach.

“One of our goals is to bring together faculty from different areas with expertise to work collaboratively to solve bigger problems,” Rilett said. For example, improving railway crossings is a major safety issue

in many rural towns, which may have up to 150 trains passing through daily. Effectively addressing the issue requires the collaboration of researchers in psychology, statistics and engineering.

“In the end, Nebraska and the nation will get a safer, more effective transportation system,” Rilett said.

Partnerships with state government and industry are essential, Rilett said. The Nebraska Department of Roads is a key partner and provided much of the center’s initial funding.

NDOR’s Craig said he expects the center will help make Nebraska and the university more competitive.

“Over the long term, the investment of the university, government and industry in the NTC will have a major impact on the state’s economy by improving transportation systems, increasing the competitiveness of its industries and attracting highly capable faculty and students to the state,” Craig said. “It will provide state transportation agencies with improved construction, maintenance and operation practice in addition to improving transportation safety, efficiency and reliability for all citizens of the state.”



Ravenna, Neb., is home to the nation’s first post-tensioned, tied arch bridge, a UNL-patented design.

Industry officials also anticipate benefits.

“Transportation and supply chain management are key components of the economic engine that drives the U.S. and global economy. The Nebraska Transportation Center will provide innovations that improve safety and efficiencies throughout the supply chain, which add value and competitive advantage for all modes in the transportation Industry,” said Tonn Ostergard, president and CEO of Lincoln-based Crete Carrier Corp., one of the nation’s largest privately-held trucking companies.

Several already strong UNL transportation research programs based at Lincoln and the Peter Kiewit Institute in Omaha are associated with the NTC, including the Mid-America Transportation Center, the Midwest Roadside Safety Facility, and programs in structural and safety engineering, transportation systems engineering and technology transfer. NTC also works with public administration and finance programs in UNL’s College of Business Administration and at the University of Nebraska at Omaha; Nebraska Safety Center education programs at the University of Nebraska at Kearney; and health programs developed at the University of Nebraska Medical Center.

Nebraska’s location at the crossroads of the nation’s transportation system and transportation’s strong role in the state’s economy make UNL an ideal place to study transportation, Rilett said. The nation’s two largest railroads, Burlington Northern Santa Fe and Union Pacific, which is headquartered in Omaha, are major Nebraska employers and the state is also home to two of the nation’s top 10 trucking firms.

“The culture of excellence and collaboration that we are creating in our transportation programs will significantly benefit Nebraska, the nation and our university,” said UNL Chancellor Harvey Perlman. 🏆



The UNL-developed Steel and Foam Energy Reduction (SAFER) Barrier protects NASCAR and Indy Racing League drivers.

New home in Whittier

The Nebraska Transportation Center is slated for a new home in the historic Whittier Building.

The 84-year-old landmark junior high school building at 22nd and Vine is slated for renovation. The Nebraska Transportation Center and the Nebraska Center for Energy Sciences Research will be major initial occupants of the 26,000 square feet to be renovated in the first phase, scheduled for completion in December 2009.

Whittier’s renovation will provide critically needed additional research space at UNL and create a hub for many of the transportation projects linked through the NTC.

UNL officials envision Whittier serving as a gateway to the proposed UNL research and innovation corridor that is planned as part of the Antelope Valley Project. The corridor eventually could include space for UNL research, start-up companies and collaborations with the private sector. Expanding connections between university researchers and entrepreneurs to fuel the state’s economy is among UNL’s long-term goals.

Boosting The Safety Odds

Nobody gives a thought to highway guardrails, bridge railings or other roadside hardware – unless they hit one. On impact, safety engineering becomes a life and death matter.

Research by engineers at UNL's Midwest Roadside Safety Facility has greatly improved the odds of survival. This team, directed by civil engineer Dean Sicking, is an international leader in developing roadside safety hardware. Their inventions are installed along every major highway nationwide.



UNL civil engineer Dean Sicking (center front) and his Midwest Roadside Safety Facility team are internationally known for developing roadside safety hardware.

Sicking's team invented the first energy-absorbing guardrail terminal and subsequent generations of this technology, which save hundreds of lives annually. They also are estimated to save state transportation departments more than \$60 million annually, thanks to marketplace competition.

Recently, the team gained national notoriety for developing the Steel and Foam Energy Reduction (SAFER) Barrier, which won a 2003 R&D 100 Award, a top technology honor. This "soft wall" has been installed at NASCAR and Indy Racing League high-speed tracks. No driver has been killed when they hit the SAFER Barrier since its introduction in 2002, and it has greatly reduced serious injuries.

Sicking, the Leonard Lovell Professor of Civil Engineering, recently received the nation's highest honor for technology for his roadside safety innovations. President Bush presented the 2005 National Medal of Technology to Sicking and nine other individuals and companies at a White House ceremony this summer. The award honors America's leading innovators. It is given for outstanding contributions to the nation's economic, environmental and social well-being through technology development and commercialization. 🏆

Regional Leadership

UNL is home to the Mid-America Transportation Center (MATC), which works with researchers, government and industry in four states on regional transportation issues.

The U.S. Department of Transportation designated MATC as one of 10 regional University Transportation Centers in 2006 after a national competition. A \$6.2 million, three-year grant funds the center, which serves Iowa, Kansas, Missouri and Nebraska. Larry Rilett, the Keith W. Klaasmeyer Chair in Engineering, heads MATC, which is affiliated with the Nebraska Transportation Center.

Large increases in freight movements are a critical issue affecting highway and railway safety, especially in the region, Rilett said. MATC's

research, education and technology transfer efforts focus on improving safety and minimizing the risk associated with this increased freight congestion.

Through MATC, UNL transportation specialists from engineering and other disciplines in Lincoln and at Omaha's Peter Kiewit Institute, work on diverse projects to improve transportation safety and efficiency.

UNL's partners are the University of Iowa, Kansas State University, University of Kansas, University of Missouri-Rolla and Lincoln University of Missouri. The Nebraska Department of Roads and the Iowa, Kansas and Missouri Departments of Transportation also play key decision-making roles.

"UNL's designation as a regional transportation center positions us as a leader in transportation research and education in this region and puts our faculty, our university and our state at the table where national transportation priorities are set," said Prem Paul, UNL vice chancellor for research. 🐘

Smoothing Traffic Snarls

Traffic jams fascinate Elizabeth Jones. She studies the patterns behind the madness and finds ways to improve traffic safety and efficiency.

Jones, an associate professor of civil engineering, developed a mobile laboratory that enables UNL researchers to study traffic in a variety of locations, collect data and analyze it on the fly. From this van packed with computers, equipment, cameras and radar, researchers study rail crossings, intersections or other traffic bottlenecks, easily switching locations or angles.

This van extends the reach of the Nebraska Transportation Center's Intelligent Transportation Systems Lab at Omaha's Peter Kiewit Institute. Intelligent transportation systems tap information and computer technology to better manage traffic.

Researchers currently are using the van for a Federal Railroad Administration-funded project to improve highway railroad crossings. Using radar and video cameras on the van's tower, they track train speeds, traffic flow and nearby traffic signals. Back at the ITS Lab, this data is vital to creating computer models that simulate traffic flow under different scenarios.

"Simulation is invaluable but you have to have the real data first," said Jones, a Nebraska Transportation Center faculty member. Sharing these simulations with officials helps identify options for improving rail crossing safety and traffic flow.

"The goal is to get the right information about traffic to the right people at the right time." 🐘



Engineering graduate students Craig Schiller (left) and Jay Ling collect fuel emissions data from a truck. UNL researchers study a wide range of transportation-related issues.



Researchers use the Intelligent Transportation Systems mobile van to gather field data about traffic.

Building Better Bridges

Designing better bridges is at the heart of work by researchers at UNL's National Bridge Research Organization (NaBRO).

"We are a group aimed at improving bridge engineering," said Atorod Azizinamini, the UNL civil engineering professor who heads NaBRO, which is affiliated with UNL's Department of Civil Engineering.



Atorod Azizinamini

UNL engineers working with NaBRO study ways to improve bridge design and reduce costs of bridge repair and replacement. The organization also fosters collaborations between university researchers, government agencies and contractors.

NaBRO engineers are leaders in researching the use of high performance steel in bridge design. Their bridge innovations have been incorporated into standards and guidelines for modern bridge design and are used in Nebraska and across the nation.

The Nebraska Department of Roads has erected several next-generation bridges in Nebraska based on NaBRO's research, including the nation's first high performance steel bridge at Sidney, Neb.

Students also are involved in NaBRO's work, Azizinamini said. "We get them involved in practical projects with real-world applications."

NaBRO's international role is expanding. When the Republic of Korea decided to invest \$100 million to modernize its transportation infrastructure in 2006, it turned to UNL and NaBRO. Azizinamini is heading the five-year project that involves a consortium of U.S. universities, industry and government groups to research and develop a plan for Korea's transportation makeover. 🏗️

Concrete Results

UNL civil engineer Maher Tadros' is a huge fan of concrete. His pioneering research has enhanced its strength, versatility and utility as a bridge building material.

The internationally known bridge engineering expert developed high performance concrete that is almost as strong as steel and can be used in bridges and buildings. He turned his high performance concrete into inventions now used in bridges worldwide.

Tadros is the Charles J. Vranek Professor of Civil Engineering at

Omaha's Peter Kiewit Institute. He is best known for his NU I-Girder, which allows longer bridge spans and shallower struc-

Maher Tadros



tural depths. His Nebraska Inverted Tee System uses prefabricated parts assembled on site, minimizing the cost of short bridges often used in rural areas. His NUDECK system, patented by UNL, is a precast, prestressed concrete panel that creates longer-lasting bridge decks.

Using precast, prestressed concrete manufactured off site speeds bridge construction, reducing traffic tie-ups and danger for construction crews, and produces durable, long-lasting bridges.

Tadros recently teamed with the Nebraska Department of Roads on the nation's first post-tensioned, tied-arch bridge at Ravenna, Neb. The UNL-patented design uses steel tubes filled with concrete and reinforced with steel tendons to make the bridge less prone to fracture.

This strong partnership with the Nebraska Department of Roads enables UNL and the state to implement research innovations that routinely garner international attention, Tadros said. 🐘

Improving Risk Assessment

*W*hen it comes to bridges and other structures, the toughest question is: how safe is safe enough?

Bridge and structural engineers use complex calculations and tools to design structures to withstand worst-case scenarios. That usually works but it's expensive and there is a need to more accurately assess risks.

“We can't over-design because we can't afford the monetary cost. But we can't under-design because we can't afford the cost of human lives,” said UNL civil engineer Andy Nowak. His research on structural risk and reliability assessment aims to help decision-makers better answer that key question.

Nowak, the Robert W. Brightfelt Professor of Engineering, is an expert in structural reliability and bridge engineering. He has developed tools for bridge diagnostics and evaluation; risk analysis methods that have been incorporated into bridge design codes and guidelines in the U.S. and Canada; design criteria for wooden bridges; and models that help assess or predict bridge and structural reliability, load capacity, risk and safety.

He's concentrating on devising computer models that more effectively predict and evaluate bridge and structural performance. His goal is to give decision-makers robust information to identify, manage and reduce risks to infrastructure. Nowak aims to develop hazard mitigation plans that simulate the effects of natural disasters, collisions or terrorist attacks on bridges and other structures to help better balance the need for safety and security with financial and social limitations.

“My work is to optimize the way dollars are spent on structures and buildings,” he said. 🐘



Andy Nowak

The Palladian Literary Society was founded in 1871 by 20 young men and five young women a month after the University of Nebraska opened its doors. Members gathered weekly for social and intellectual activities, including plays, orations, debates, recitations, music, promenades and refreshments. The group was active in one form or another until the late 1960s and alumni held a reunion as recently as 2000. In the beginning, meetings were held at University Hall, which featured a bell tower.

Today, that same bell resides in the Holling Garden at the Wick Alumni Center.

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Palladian is published by the Nebraska Alumni Association in cooperation with the University of Nebraska-Lincoln Office of the Vice Chancellor for Research on current topics of interest to alumni members, friends and peer institutions of the University of Nebraska-Lincoln.

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Palladian subscriptions are included in alumni association dues of \$50 annually. Requests for permission to reprint materials and readers' comments are welcome.



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