Transportation Forum Hosts Federal and State Transportation Leaders

The 2009 Michigan Tech Transportation Forum hosted one of the highest ranking federal officials ever to visit the University, USDOT-Research and Innovative Technology Administration (RTA) Deputy Administrator Dr. Robert Bertini, and the Director of the Michigan Department of Transportation, Kirk Steudle. The day long forum included presentations and informational events for students, faculty, senior administration, and community officials. Michigan Tech’s multi-disciplinary transportation research initiatives and capabilities were highlighted in a number of presentations and new faculty on-campus had an opportunity to showcase their research. Attendees discussed current and future issues and opportunities for Michigan Tech to contribute to identifying solutions to transportation challenges. This event was co-hosted by the Michigan Tech Transportation Institute and the University Transportation Center for Materials in Sustainable Transportation Infrastructure (UTC-MiSTI).

Transportation Research a Multi-disciplinary Field

Michigan Tech Transportation Institute Director Dr. Larry Sutter kicked off the forum with an overview of transportation research at Michigan Tech and then invited guests to discuss the multi-disciplinary needs in transportation research. Dr. Sutter also serves as the Director of the UTC-MiSTI for Michigan Tech. Beginning with MDOT Director Steudle, the speakers emphasized the need for research in all areas of basic and applied discovery, including well-known areas such as materials, roads, and bridges, but also areas where universities are uniquely suited to focus in, such as climate change, safety, livability, economics, and planning. Director Steudle pointed out current research investments from the USDOT, Housing and Urban Development (HUD), and Environmental Protection Agency (EPA) are supporting transportation researchers for projects investigating the livability and economic viability of communities and many other expanding transportation research areas. Along with the traditional research questions of how to build better roads, multi-disciplinary teams of researchers are required to address other current and future needs such as the impact of transportation on climate change, implementation of communication and computing systems in transportation systems (e.g. IntelliDrive), land use planning, congestion pricing, CO2 cap and trade impacts, asset management, system wide safety measures, and many other areas.

Director Steudle pointed out solutions MDOT is currently researching and developing to help the agency and stakeholders adapt to the changing needs of transportation systems. One example is the use of new media to communicate between system users and managers. MDOT already uses Web-based information sites and social media to rapidly communicate...
Director’s Corner

In 2006 and 2007 when the faculty and staff within the Civil and Environmental Engineering Department and the Michigan Tech Transportation Institute met for hours over the course of 5 months to develop the UTC-MiSTI’s strategic plan, none of us would have predicted that two years later we would be hosting state and federal transportation leaders at the University for discussions on how Michigan Tech could further its leadership and innovation to meet the needs of our transportation system. At the time, the University had a strong construction materials and structures research program, but multi-disciplinary efforts were more scarce and were therefore a target of development for the UTC-MiSTI. The UTC-MiSTI stated in its strategic plan, under the Human Resources Program Activity section:

“MiSTI will strategically pursue an expansion of the research partnerships on the Michigan Tech campus, at other universities, and with outside research organizations. A transportation forum will be held in year one of the Center on the Michigan Tech campus to create awareness of the opportunities for multi-disciplinary research and external funding opportunities.”

The first transportation forum was held on campus in November of 2007 as an opportunity to begin identifying faculty, staff and students in other disciplines who were interested in applying their knowledge to develop solutions for transportation problems. A handful of faculty, students, and senior administrators ventured through a blizzard to attend the afternoon event.

The 2009 Transportation Forum, highlighted in this newsletter, is evidence of the growth Michigan Tech has experienced as a result of coordinated efforts and planning, catalysed and supported to a large part by the UTC-MiSTI. Hosting visits by USDOT-RITA Deputy Administrator Dr. Rob Bertini and MDOT Director Kirk Steudle further validated that we are on the right track in meeting our objectives to support state and national transportation agency needs.

As impressive as it was to have two high-ranking transportation leaders visit Michigan Tech, the interest and participation by the University’s senior administration was equally as impressive and spoke to the commitment Michigan Tech has made to support multi-disciplinary transportation research. From the President, Provost, and VPs for Research, Government Relations, and Advancement, to the College and School Deans and Department Chairs, the discovery and participation was encouraging and appreciated. They each actively participated in discussions, conducting their own discovery and broadening their understanding of how growth in transportation will provide many benefits, including growth in research and education for the University, all while improving the transportation system that we all unconsciously rely on as the general public.

- Larry
system problems such as congestion, construction, and weather conditions. Future capabilities could allow users and managers to communicate conditions back to agencies, further speeding up the accurate assessment and reaction to changing transportation system conditions. These systems could enable motorists, or even the cars they drive, to send messages reporting crashes or construction-based congestion, thereby helping responding agencies efficiently deploy resources and reduce congestion in real time, without the need to physically reroute traffic or patrol roadways looking for problems.

With expanded capabilities for transportation communications and management, MDOT also recognizes the implications these new technologies can have for society. Director Steudle pointed out that over 43,000 Americans die each year in vehicle crashes, and over 1.3 million die worldwide on roadways. An increasing level of congestion due to demand, construction, and changing user demographics will likely add further casualties to the already unacceptable numbers of injuries and fatalities. Safety therefore remains a top priority of transportation research, and researchers are already exploring the possibility of vehicles that refuse to crash and intelligent transportation systems that automatically modify traffic patterns as conditions change.

Director Steudle encouraged students, researchers, and university administrators to broaden their view of transportation research and to recognize transportation as part of the solution to many large-scale issues such as environmental sustainability and economic development. Through cooperation between universities and transportation agencies, both basic and applied research can help position transportation as a key driver of innovation and progress in Michigan and globally.

RITA Deputy Administrator Dr. Bertini followed Director Steudle’s presentation with further emphasis on the multi-disciplinary nature of transportation research. As an agency, RITA focuses on all modes and areas of transportation research and innovation, recognizing that a holistic approach to transportation innovation will best address national and global issues. As an agency under the US Department of Transportation, RITA focuses on the emphasis areas defined by Secretary LaHood, those being: safety, livable communities, stewardship, economic competitiveness, and environmental sustainability. In addition to these focus areas, RITA and all state and federal DOT administrators are concerned with the economics of transportation research and development, in addition to the larger burden of construction and maintenance.

As a veteran of local, state, and federal public service, and a university professor, Dr. Bertini strongly believes in public service and the need for encouraging and developing future generations of transportation professionals. RITA is an agency that relies on innovative and experienced transportation professionals, and he tasked the teachers and learners in the University audience to help keep the nation’s strong position as a leader in transportation research.

**Financing the Future**

During question and answer sessions, Michigan Tech deans, administrators, and researchers queried the speakers on the issue of funding transportation. Both Director Steudle and Dr. Bertini pointed out the critical need to redesign transportation research, development, and maintenance financing. As an example, Director Steudle pointed out that current financial projections have Michigan failing to meet the necessary state matching requirements to receive federal transportation funding in 2011. Michigan is not the only state facing such a crisis: The current economic downturn combined with outdated revenue models is leading to crises at most state and federal agencies. The speakers suggested that the redesign of revenue and financing models is a key research and innovation area to keep the country moving.

The speakers pointed out that the gasoline tax is a fixed amount per gallon of fuel purchased, and current developments in efficiency and alternative power sources, combined with the risk-
Russell Lutch selected as the 2010 UTC-MiSTI Student of the Year

**Thesis Title:** Ultimate Capacity Optimization of Prestressed Concrete Railroad Ties

**Advisor:** Dr. Devin Harris, Assistant Professor, Dept. of Civil & Environmental Engineering

**Nomination Information**

As one of the first students funded in collaboration between Michigan Tech’s Rail Transportation Program and the UTC-MiSTI, Russell Lutch was tasked with evaluating the sustainable use of concrete ties in arctic conditions. He participated as a graduate student mentor in the 2009 UTC-MiSTI Summer Scholars Program, co-advising an undergraduate team investigating the material and life-cycle assessment of cross-tie alternatives for rail applications. For his graduate work, Russ investigated railroad track structure, focusing on pre-stressed concrete railroad ties for heavy haul freight transportation. Deterioration of the rail seat is a prevalent failure mechanism of concrete ties used for this application. His study is a part of the project “Synthesis of Railroad Engineering Best Practices in Deep Seasonal Frost and Permafrost Areas,” sponsored through the University of Alaska at Fairbanks and conducted under Michigan Tech’s Rail Transportation Program and the UTC-MiSTI.

Russ was an active participant in graduate scholarship, presenting at the 14th ASCE Cold Regions Engineering Conference, “Causes and Preventative Methods for Rail Seat Abrasion in North America’s Railroads” and at the 2009 American Railway Engineering & Maintenance of Way Association (AREMA) Conference, “Pre-stressed Concrete Railroad Ties in North America.” In January 2010, Russ began his professional career as a structural engineer with Kiewit Construction Company (KECo) in Omaha, Nebraska. For more information on Russ Lutch, read his student bio featured in the UTC-MiSTI’s Transportation News Vol. 3 No. 2., available on the Center’s website.

**2009 Summer Scholars Project Spotlight: Geopolymer Concrete**

**Advisor:** Dr. Karl Peterson  
**Student Research Assistants:** Mary Christiansen ,Civil Engineering Ph.D. Student; Emily Lang, Environmental Engineering Undergraduate

The main goal of this 2009 Summer Scholars research project was to become familiar with geopolymer cement (GPC). This is the first time that research has been conducted on GPC at Michigan Tech, and because of this, a great deal of general research was necessary. The knowledge and experience gained during the summer of 2009 will be used to determine future research opportunities for furthering the sustainable development of GPC concrete.

To accomplish this goal a list of project objectives was produced:

- Complete a thorough literature review.
- Develop a GPC mixing procedure.
- Develop a method for creating GPC mix designs.
- Become familiar with working with GPC in the laboratory.
- Develop a list of future research possibilities.

Information gathered during the literature review was used to understand how to design a GPC mix and to develop a mixing procedure for Michigan Tech laboratories. The review and experimentation proved that the mixing procedure was functional and that a successful GPC mortar can be produced from our method of developing mix designs. The compressive strength was not as high as expected, but that opens another topic of research on what materials and curing conditions optimize compressive strength.

This project will provide great opportunities to make transportation and structural infrastructure more sustainable. Carbon emissions can be greatly reduced across the board in the manufacturing of concrete through the development of a viable GPC. GPC provides a method to increase the amount of packaging glass that is recycled by using it as a sodium silicate source. This eliminates the need to produce cullet for sodium silicate production and cuts back on carbon dioxide emissions. Finally, the use of ordinary portland cement (OPC), a major generator of carbon dioxide, could potentially be eliminated since it is not necessary in the production of GPC.

Overall this project was a great educational opportunity. Much experience and knowledge of GPC has been gained through the completed research. Future research on developing a GPC concrete made with sodium silicate, as an alternative for OPC concrete, will benefit greatly from the groundwork established under this project.
Eight projects were selected by an external advisory board for investigation for the UTC-MiSTI’s 2009 Summer Scholars Program. Center staff solicited 11 project ideas from faculty which were ranked by the Center’s Technical Advisory Council (TAC).

UTC Projects
From Road to Rails, Materials Provide the Focus

Projects selected for funding and exploration through the program include:
- Neutralizing the Adsorptive Effects of Carbon in Fly Ash for Use in Concrete (PI-Hand/Sutter)
- Extracting Sodium Silicate from Recycled Glass Cullet for Use in Geopolymer Concrete (PI-Peterson/Sutter)
- Concrete Bridge Deck Life Enhancement through the Application of UHPC Overlays (PI-Harris/Ahlborn)
- Durability of Porous Pavement Materials with Warm Mix Asphalt Technology (PI-You)
- Development of Wireless Sensors for Infrastructure Health Monitoring (PI-Deshpande/Mukherjee)
- Material and Life-cycle Assessment of Cross-Tie Alternatives for Rail Application (PI-Harris/Lautala)
- Developing Quantifiable Parameters for Carbon Sequestration of Sustainable Concretes (PI-Deshpande/Hiller)
- Project Summaries are available on the Center’s website at [www.misti.mtu.edu](http://www.misti.mtu.edu) Each summary provides a general description of the investigation, identifies the investigation team members and the objectives, methodologies and anticipated benefits if applicable.

Proposals not selected:
- Defining the heat of Hydration Signature for an Ultra-High Performance Concrete
- Development of a Web-based Information Repository to Support Sustainable Decision Making in Pavement Design and Construction (selected and cancelled)
- Improving the Environmental and Operational Performance of Unbound Road Materials by Removal of Noxious Seeds and Fines

TAC members include:
- Suneel Vanikar-Federal Highway Administration
- Donald Plotkin-Federal Rail Administration
- Kirk Steudle-Michigan Department of Transportation
- Roger Olson-Minnesota Department of Transportation
- Emily Lorenze-PCI Journal
- Al Innis-Holcim, Inc.
- Jim Klett-Klett Construction Company
- Robin Graves-Vulcan Materials
- Bruce Ramme-We Energies
- Richard Stehly-American Engineering and Testing

2009 Summer Scholars
ing cost of fuel per gallon and inflation, are putting tremendous pressure on this revenue stream. A $4.00 gallon of gasoline used to drive a hybrid 50 miles provides the same revenue to state and federal agencies that a $1.00 gallon of gasoline sends an SUV 10 miles. As Americans increase vehicle miles traveled while reducing the amount paid for each mile, all government agencies will find it harder and harder to build and maintain a high-quality, dependable transportation infrastructure.

The speakers also pointed out there are fundamental problems with the way the public perceives transportation funding. The concept of long-term investment in maintenance and repair has become alien to modern societies. The public is excited about new bridges, expanded capacity, and smooth new roads, but political support for the less dramatic practices associated with ongoing maintenance is more difficult to garner. Public policy and marketing therefore also play critical roles in keeping transportation development active and funded, once again pointing to the need for education and research in diverse areas.

Michigan Tech’s Future Transportation Researchers

Following a morning of meetings with high-level academic and research partners from the University, Dr. Bertini and Director Steudle joined students and new faculty to hear what Michigan Tech is doing right now in multi-disciplinary transportation research. At a lunchtime student poster session, the speakers and guests met with students currently conducting transportation research and others who are just beginning research careers supporting transportation. The speakers were impressed by the range and depth of undergraduate and graduate involvement, and their ability to communicate their activities to peers and the public.

The final presentations were made to the University community at large and the general public. Michigan Tech Transportation Institute (MTTI) Director Dr. Larry Sutter opened the session welcoming representatives of Senator Carl Levin, Representative Mike Lahti and Senator Debbie Stabenow. Dr. Sutter introduced three new faculty at Michigan Tech whose presence has further broadened the transportation research capabilities at the University. Assistant Professor of History Dr. Louise Dyble, Assistant Professor of Mechanical Engineering Dr. John Hill, and Assistant Professor of Forest Resources & Environmental Science and Biological Sciences Dr. Catherine Tarasoff presented overviews of their own research in public-private partnerships from a historical perspective, human factors related research, and the propagation of invasive species by transportation corridors.

Dr. Sutter provided an overview of the transportation research centers, groups, and activities at Michigan Tech and described the strong connection of these research groups to the academic departments at the University. As the day’s talks already highlighted, many departments across Michigan Tech participate in transportation research. Examples of the diverse University involvement include the Department of Mechanical Engineering – Engineering Mechanics, which is developing “rolling stock” that moves the people and goods on the roads, rails, and other avenues of the world’s transportation systems; the Electrical and Computer Engineering department, which is developing new power sources and communication systems to move and manage transportation infrastructure; the Materials Science and Engineering Department, developing
lightweight materials and components; the Department of Chemical Engineering, developing new processes and products that fuel transportation; and the Social Sciences Department, which is researching social aspects of transportation systems. In addition to the academic department contributions to support transportation education and research, Dr. Sutter pointed out that many of the University research organizations and undergraduate “Enterprises” are directly involved with transportation. Programs include the Michigan Tech Transportation Institute coordinating and fostering transportation activity at the University; the Local Technical Assistance and Tribal Technical Assistance Programs working with local and tribal transportation agencies throughout the Midwestern and Eastern United States; the Michigan Tech Research Institute applying remote sensing and imaging technologies to monitor and analyze transportation systems; and the Keweenaw Research Center investigating cold-weather vehicles, ice control, and other systems used in transportation. Undergraduate, student-led Enterprises are developing cutting edge hybrid, electrical, and alternative fuel systems for vehicles and paving systems for road construction.

Assistant Professor of Mechanical Engineering John Hill introduced the audience to human factors research, which deals with the interaction of humans and vehicles. His work assesses system performance when human behavior influences the operation of vehicles, such as distracted drivers not focusing on steering, behavior and reactions of elderly drivers to new technologies and increased speeds and growing traffic volumes, or intoxicated drivers failing to operate their vehicles properly. The research covers both physiological issues and mechanical performance, seeking to minimize adverse human behaviors on a vehicle and reduce the likelihood of failure and injury when the human operator crashes or incorrectly operates a vehicle.

Assistant Professor of History Louise Dyble described the general areas of research in the Department of Social Sciences related to transportation, such as the reasons why we do not choose to make decisions according to known good practices, community and system planning, and policy development. Her own work, which looks at intergovernmental relations and historical perspectives that influence our decision making processes, helps identify how new organizations can develop, work within existing political structures, and fund new projects. Social scientists are investigating public/private partnerships such as toll roads and bridges, a key area of contemporary transportation development, and how political movements can influence transportation projects.

Assistant Professor Catherine Tarasoff showed how work in biology and forestry contributes to transportation, including her work limiting the spread of invasive and undesirable plant species and encouraging the growth of beneficial plant species near transportation infrastructure. She highlighted applied research in the design of a new “wet blade” cutting system, which limits the spread of herbicides and focuses their application on the vulnerable parts of undesirable plants along roads. Her work also investigates how to encourage beneficial plant species growth by encouraging rapid root development in transplanted species.

**Summary**

After a full day focusing on everything from finance to system-wide growth, and how nearly every other aspect of Michigan Tech’s education and research applies to transportation, the guests met with the speakers and Michigan Tech leaders for informal face-to-face discussions. Joining the audience were local government officials, as well as several community members and business operators interested in the future of transportation research at Michigan Tech. The one-on-one discussions provided students, faculty, and guests the opportunity to connect with decision makers forming and directing policy at the state and national levels. The 2009 Transportation Forum clearly demonstrated how a multi-disciplinary approach to transportation research is necessary, and how Michigan Tech is meeting this demand by drawing in departments and students from across the academic spectrum. As the University moves forward with a progressive, leading role in transportation research, federal and state transportation leaders will continue to look to Michigan Tech to conduct the broad range of applied and basic research that the nation’s transportation system requires well into the future.
The University Transportation Center for Materials in Sustainable Transportation Infrastructure (UTC-MiSTI) at Michigan Technological University is a Tier II UTC. The Center conducts research, educational activities, technology transfer and workforce development in the areas of sustainability and infrastructure materials that address state and national transportation needs. Faculty, staff, students and industry work collaboratively to identify creative solutions to construct repair and maintain highway and airport pavements, bridges and rail systems.

Areas of material specialization include bituminous materials and asphalt binders; portland cement and ultra-high performance concretes; material characterization through petrographic analysis; aggregates, soils and geotechnical applications; and the use of recovered industrial materials including fly ash, slag, and cement kiln dust, and recycled asphalt and concrete materials. For more information on the activities of the UTC-MiSTI, visit the Center’s Website: www.misti.mtu.edu