RITA *Office of Research, Development and Technology*

University Transportation Centers Program

Points of Pride 2009

U.S. Department of Transportation
Research and Innovative Technology Administration

Transportation is the lifeblood of our economy, and the challenges we face today bring new opportunities. The University Transportation Centers Program has been making important contributions to research, education, and development of innovative approaches to improving the nation's transportation systems since it was established in 1987.

The 60 Centers involving 125 universities are incubators of new ideas, and many of the projects initiated by these Centers have been translated into transportation improvements.

This document presents examples of significant University Transportation Centers' projects that are aligned with the nation's needs and with the U.S. Department of Transportation's goals of ensuring safety, livability and sustainability, and promoting economic and infrastructure investment.

Ray LaHood
Secretary
U.S. Department of Transportation

The University Transportation Centers (UTC) Program was the recipient of the Research and Innovative Technology Administrations (RITA) Administrator's team award in 2008, in recognition of its creation of an annual research Spotlight Conference. This and other innovations occurred during a time when it managed the expansion in the number of Centers from 33 to 60 and ensured high-quality execution of grant-management responsibilities.

Through the UTC program, the Department of Transportation invests in the future of transportation by awarding grants to universities across the United States to advance the state-of-the-art in transportation research and develop the next generation of transportation professionals.

There is growing recognition among policy makers that local needs and conditions vary substantially from place to place, influenced by socio-economic conditions, local political relationships, climate, topography, and a variety of other factors. The geographic range of the Centers enables them to contribute to solving problems at the regional and local level.

Solving these problems can contribute to solutions that have national significance. This publication highlights significant UTC projects that have yielded lessons and potential best practices that RITA believes merit sharing nationwide.

Peter H. Appel
Administrator
Research and Innovative Technology Administration

This document is first and foremost a tribute to the excellence of each University Transportation Center (UTC). The projects presented here exemplify the UTCs' abilities to offer pragmatic solutions to transportation problems and to respond to new and continuing needs. Each highlighted project is aligned with the Department of Transportation's strategic goals of safety, livability, sustainability, and economy and infrastructure investment.

Typically, a UTC brings together faculty and students from several parts of the university, or even from several universities and outside institutions, to work on projects managed under the umbrella of the center's administrative structure.

Further exemplifying the tradition of excellence, the document also presents a list of UTC Students of the Year along with their areas of research and expertise. UTCs provide excellent environments in which to learn and grow while tackling real world issues, and I am confident that these students will become transportation leaders of tomorrow.

Dr. Curtis J. Tompkins
Director
University Transportation Centers Program

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Introduction

The University Transportation Centers (UTC) Program is a critical part of the U.S. Department of Transportation's (U.S. DOT) efforts to use cutting-edge technologies and innovations to find solutions to the transportation challenges of the 21st century.

The UTC Program was initiated in 1987 under the Surface Transportation and Uniform Relocation Assistance Act, which authorized the establishment and operation of transportation centers in each of the 10 standard federal regions. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) reauthorized the UTCs for an additional six years and added four national centers and six University Research Institutes (URIs). The mission of the 14 UTCs was to advance U.S. expertise and technology transfer. The six URIs each had a specific transportation research and development mandate.

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) reauthorized the UTC Program for an additional six years and increased the total number of Centers to 33. In addition to the 10 regional Centers, which were to be selected competitively, TEA-21 created 23 Centers at institutions named in the Act. TEA-21 established education as one of the primary objectives of a UTC and institutionalized the use of strategic planning in university grant management.

In 2005, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) reauthorized the program, increasing the number of Centers to 60. In addition to the 10 regional Centers, which were competitively selected, 10 Tier-1-funded Centers were competitively selected. All of the UTCs except for the Title III Centers are required to have a one-for-one funding match. The current legislation does not require these centers to match their grant funding dollar for dollar.

The UTC Program is administered by U.S. DOT's Research and Innovative Technology Administration (RITA).

Vision

The UTC Program ensures that internationally recognized centers of excellence, fully integrated within institutions of higher learning, will continue to serve as vital sources of transportation research, professionals, and leaders to meet the nation's need for safe, efficient, and environmentally sound movement of people and goods.

Mission

The UTC Program advances U.S. technology and expertise in transportation through education, research, and technology transfer at university-based centers of excellence.

Goals

Each UTC is expected to accomplish the following goals:

1. *Education:* Provide a modern, multidisciplinary program of coursework and experiential learning that reinforces the transportation theme of the Center.

2. *Human Resources:* Ensure an increased number of students, faculty, and staff who are attracted to and substantively involved in the undergraduate, graduate, and professional programs of the Center.

3. *Diversity:* Ensure that students, faculty, and staff who reflect the growing diversity of the U.S. workforce are substantively involved in the undergraduate, graduate, and professional programs of the Center.

4. *Research Selection:* Conduct an objective process for selecting and reviewing research that balances the multiple objectives of the program.

5. *Research Performance:* Carry on an ongoing program of basic and applied research, the products of which are judged by peers or other experts in the field, to advance the body of knowledge and practice in transportation.

6. *Technology Transfer:* Ensure the availability of research results to potential users in forms that can be directly implemented, utilized, or otherwise applied.

Research and Development

Each UTC program focuses its research on a specific transportation theme. Themes vary and run the spectrum of transportation applications. UTCs often collaborate with each other on areas of shared interest, cultivating a community of knowledge. Frequently, they engage in a peer-review process of their work and

hold networking events to highlight program milestones and measure the progress of transportation research.

UTC research on cutting-edge innovations like Vehicle-Infrastructure Integration, durable pavement mixtures, and hydrogen fuel cells has contributed to advances in commercial applications through the facilitation of technology transfer to transportation stakeholders in government and industry.

Students participating in UTC research projects will offer a strong pool of continuing expertise in the transportation profession by working with faculty to advance their knowledge and experience. Maintaining a strong, diverse workforce of transportation professionals is vital for America to have a safe, resilient, and globally competitive transportation system.

The Future of the UTC Program

All 60 of the UTC programs nationwide are funded through 2009. Of these, 20 were awarded grants in 2007 following a competitive selection process. The next program competition, subject to continued authorization of the UTC Program by act of Congress, is due to occur in 2010.

For More Information

More information about the UTC Program, including past and current transportation research, can be found online on the USDOT's UTC Website at http://utc.dot.gov. The website includes:

- A list of current UTC programs and points of contact, including national, regional, Tier I and II, and Title III Transportation Centers.
- A search engine for the individual UTC websites, allowing users to find relevant site content using keywords and phrases.

Contact Information

More information can also be obtained by contacting the UTC Program Director, Curtis J. Tompkins at Curtis.Tompkins@dot.gov.

Other UTC program staff members include:

Amy Stearns, University Programs Specialist
Robin Kline, University Programs Specialist
Lydia Elena Mercado, University Programs Specialist
Denise Dunn, Program Coordinator
Judith Yahoodik, UTC Student of the Year and Strategic Planning Coordinator

Current University Transportation Centers

As provided for in the 2005 SAFETEA-LU

National UTCs
$2 - $3.5 million per year

- Marshall University
- Missouri University of Science and Technology
- Montana State University
- Northwestern University (see also Tier II UTC)
- Oklahoma State University
- Portland State University
- University of Alaska
- University of Minnesota
- University of Vermont
- University of Wisconsin

Regional UTCs
$1 - $2.25 million per year (competitively selected)

Region	
I	Massachusetts Institute of Technology
II	City College of City University of New York
III	Pennsylvania State University
IV	University of Tennessee
V	Purdue University
VI	Texas A&M University
VII	University of Nebraska
VIII	North Dakota State University
IX	University of California, Berkeley
X	University of Washington

Tier I UTCs
$1 million per year (competitively selected)

- Georgia Institute of Technology
- Iowa State University
- Rutgers University
- San Jose State University
- University of Florida
- University of Idaho
- University of Maryland, College Park
- University of Michigan
- University of South Florida
- University of Southern California and California State University, Long Beach

Tier II UTCs
$500,000 per year

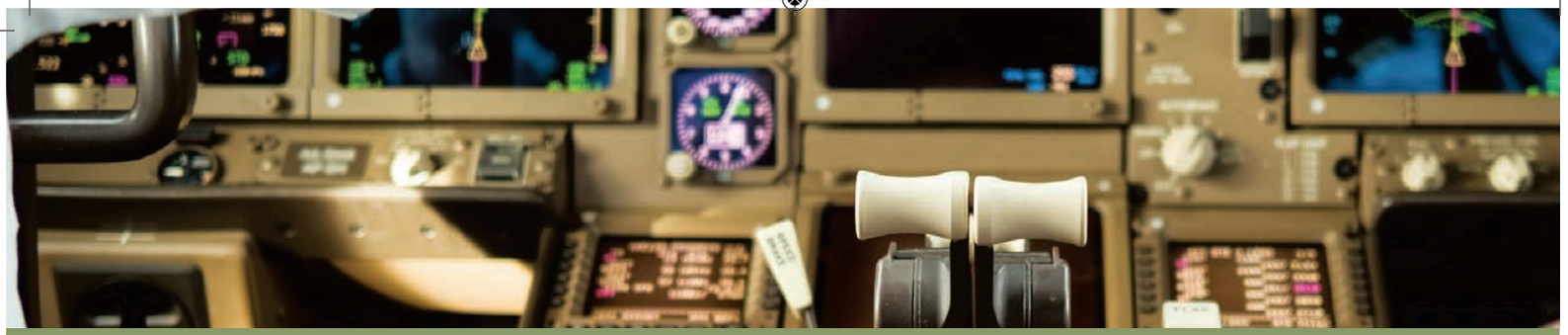
- California State University, San Bernardino
- Cleveland State University
- George Mason University
- Hampton University
- Kansas State University
- Louisiana State University
- Michigan Technological University
- North Carolina State University
- Northwestern University (see also National UTC)
- University of Akron
- University of Arkansas
- University of California, Davis
- University of Connecticut
- University of Delaware in Newark
- University of Detroit Mercy
- University of Massachusetts, Amherst
- University of Memphis
- University of Nevada, Las Vegas
- University of Rhode Island
- University of Toledo
- Utah State University
- Youngstown State University

Title III UTCs

Funding amounts vary

- Jackson State University
- Morgan State University
- North Dakota State University–Small Urban and Rural Transit Center
- Texas A&M University–Texas Transportation Institute
- University of Alabama, Birmingham
- University of Alabama, Tuscaloosa
- University of Denver/Mississippi State University
- University of Tennessee–Knoxville National Transportation Research Center

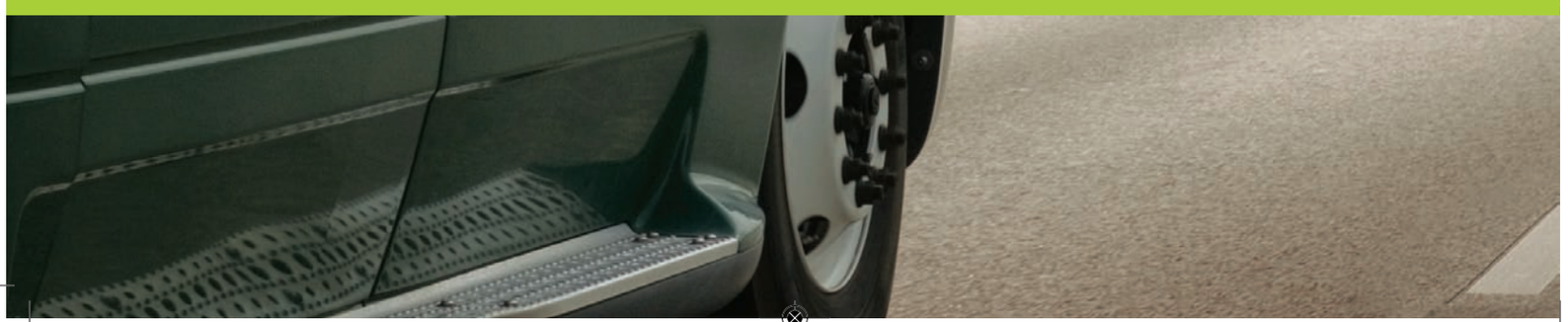
Map of University Transportation Centers



[S]afety … on the road, on the rails, in the air, and on the water … has always been and must continue to be the central focus of the Department of Transportation. This goal must guide everything done by both the leadership of the Department and its workforce, who will be our partners in everything we do.

DOT Secretary **Ray LaHood**

Before the Committee on Commerce, Science and Transportation,
United States Senate, January 21, 2009



Safety

Age-Related Changes in Driver Response

New England University Transportation Center, Massachusetts Institute of Technology (MIT)

The goal of this ongoing project is to develop a vehicle platform that reveals how a person reacts in various driving situations and identifies physical changes associated with distraction, lack of confidence, health issues, or other conditions that might diminish the ability to drive. The project is intended to lead to the creation of the first vehicle safety system that measures and responds to a driver's physical and mental status across the lifespan.

"Miss Daisy" is one of the MIT AgeLab's driving simulators, which uses real-time simulation software to better understand issues related to aging and driving. (photo: Sean Dougherty)

In collaboration with MIT's AgeLab, researchers are conducting studies with the simulator dubbed "Miss Daisy" and the road-going "Miss Rosie" and "AwareCar," the latter of which is equipped with more than $1.5 million worth of sensors, software, and data analysis systems. The three simulators were described in a June 22, 2008, *New York Times* article by Tanya Mohn: "Miss Rosie, a Volkswagen New Beetle, is a mobile lab used for research into how flexibility and strength affect driving performance. Miss Daisy, another New Beetle, and the AwareCar, a Volvo, are wired to track eye movements and to measure pulse, alertness, and stress levels as a measure of the kind of physical changes older people undergo while driving."

The project's simulated experimentation will focus on comparing response mechanisms of younger adults with those of aged drivers during secondary tasks such as talking on cellular phones. Additional research is being conducted to investigate the potential for differences in response style by age group, using

The AwareCar is equipped with more than $1.5 million worth of sensors, software, and data analysis systems. It is the world's most complex university-operated experimental vehicle. (photo: New England University Transportation Center, Massachusetts Institute of Technology)

a more complex cognitive task that may further elucidate the effects of secondary tasks on driving performance.

Making technology more responsive to older drivers will render it safer for all users. This research is likely to change the way that cars are designed.

Additional funding for the project was provided by Ford Motor Company, Volvo Cars, and the MIT AgeLab.

UTC Website: http://ctl.mit.edu/index.pl?id=5146

Smart Signals: Real-Time Guidance for Low-Vision Pedestrians

National Institute for Advanced Transportation Technology (NIATT), University of Idaho

"Smart" traffic signals can improve safety and traffic flow. Over the last six years, NIATT researchers have been applying distributed network control theory to develop systems that integrate networks and other appropriate components. The goal is to control pedestrian and vehicular signals on the basis of real-time data and to benefit underserved users such as pedestrians with disabilities.

Researchers recently developed hardware prototypes, including methods of improving the accuracy and safety of pedestrian countdown timers. They also demonstrated dynamic signaling, plug-and-play timers and sensors, an improved accessible pedestrian station, and a remote pedestrian button to communicate wirelessly with each other and with the traffic controller, using global positioning system (GPS) capability to guide pedestrians safely across an intersection.

Thus far, three students have contributed to smart-signals research while completing their master's degrees in computer engineering. By doing so, they have broadened participation in a field of study that historically attracted only civil engineering students. The work is challenging, as it combines computer-based electronics with safety-critical requirements, especially for end-users with low levels of vision and mobility.

The advisory group that oversees the project comprises the Federal Highway Administration (FHWA), the Idaho Department of Transportation (IDOT), the National Federation for the Blind, and the Idaho Division of Vocational Rehabilitation.

Additional funding for this project was provided by the Idaho State Board of Education's Higher Education Research Council, Econolite Traffic Control Products (Anaheim, California), and Campbell Company (Boise, Idaho).

UTC Website: http://www.webs1.uidaho.edu/niatt/

Communicating Incident Information from Remote Locations

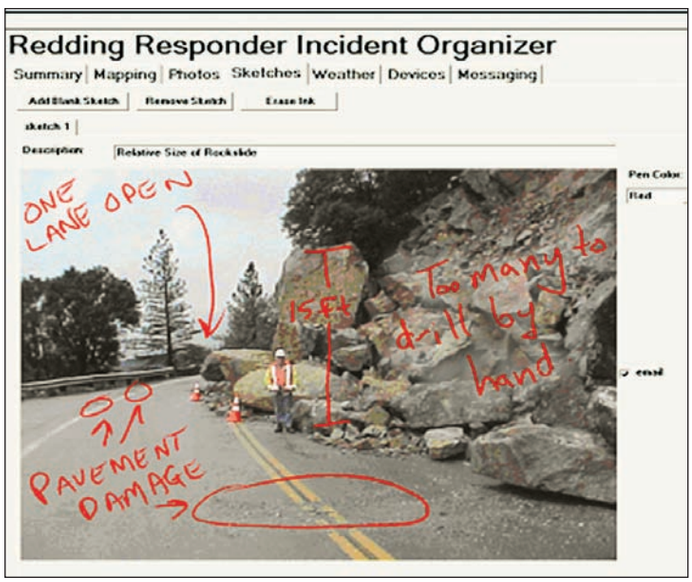
Western Transportation Institute (WTI), Montana State University

When transportation maintenance personnel respond to incidents in rural areas having sparse communications coverage, it can be difficult to accurately convey the extent of the situation to those involved in managing the incident scene. With driver safety and traffic flow at stake, it is important to be able to expeditiously collect, track, and share incident information with at-scene and secondary-incident responders, and the Traffic Operations Center (TOC).

Researchers at the WTI have developed a mobile communications/data collection system that will help first responders to overcome communications difficulties in remote locations. The system, known as the Redding Responder, was nominated for Best New Service, Product, or Application category of ITS America's Best of ITS Awards.

Arriving at the scene of an incident, a responder will use a tablet PC that can communicate with a GPS to determine location and display aerial photos and topographic maps. If digital photos are taken at the scene, they can be uploaded to the PC, and a stylus can be used to highlight certain points in the photo. This information can then be transmitted to the TOC, where management can make immediate decisions on what needs to be done. Maps and weather information are also available for automatic, location-specific display at the scene.

The proof-of-concept system has been successfully tested in the field, allowing responders to send and receive key data from the site of an incident. The Association of Public Safety Communications Officials International (APCO International) showcased the Responder project at its annual conference as an example of putting research into practice.



First responders can upload digital photographs to a tablet PC and highlight the photos with a stylus prior to transmitting the information to a Traffic Operations Center. (Provided by Western Transportation Institute, Montana State University)

Researchers continue to prepare the system for ongoing field use. Moreover, this technology could be readily replicated by other transportation or public safety organizations and adapted to fit their needs.

This project is additionally funded by the California Department of Transportation.

UTC Website: http://www.wti.montana.edu/

Onboard Automotive Electronic/Electrical Communications Systems

Center for Transportation and Materials Engineering (CTME), Youngstown State University

Communication between vehicles and intelligent transportation systems (ITS) is necessary to improve the safety of the transportation system. This ongoing project examines various aspects of electromagnetic compatibility (EMC) and its significance to today's onboard automotive electronic/electrical systems, which include navigation, communications, safety, information, and entertainment. The requirements for connecting these systems through a high-speed data-transmission network were examined, as was the importance of EMC assurance to minimize system emissions and susceptibility to electromagnetic interference.

The research is aimed at identifying critical parameters that affect the performance of the data-transmission network. The need to develop test methodologies and analytical techniques to define performance characteristics is being addressed, with a focus on increased use of new, more environmentally friendly materials to improve system longevity and sustainability for wiring and connectors. Also being considered is the need to provide EMC training, education, and workforce development to students due to increased demands for EMC engineers specializing in design and testing.

Additional project funding was provided by Youngstown State University.

UTC Website: http://stem.ysu.edu/CTME/

Emergency Medical Services and Congestion

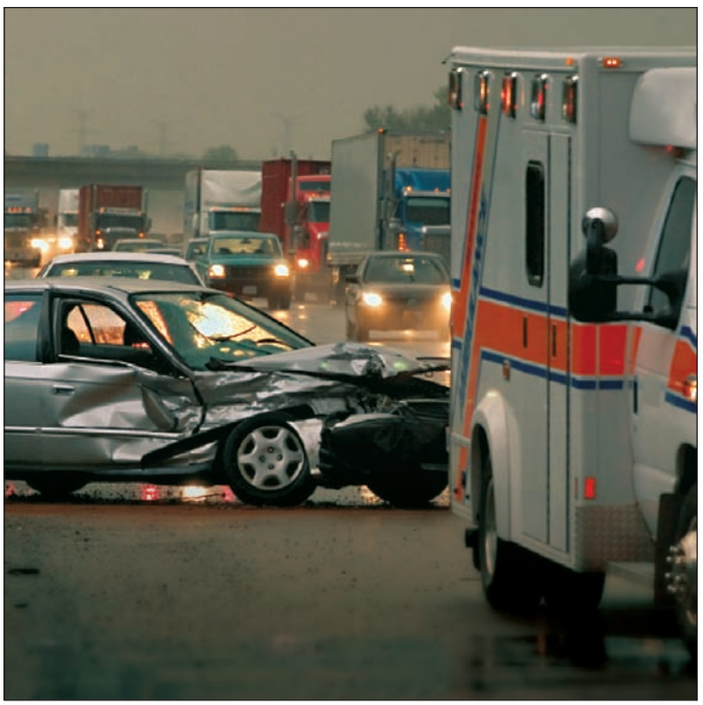
University Transportation Center (UTC), University of Alabama at Birmingham

In 2005, 43,443 of the more than 117,000 unintentional injury deaths in the United States were transportation-related. Congestion can have a considerable effect on motor-vehicle-crash injury outcomes, as ambulances and emergency personnel mired in traffic are delayed both in reaching crash victims and in transporting them to hospitals.

Researchers from the University of Alabama at Birmingham and the University of Virginia collaborated on the project, which addressed the impact of congestion on injury outcomes and sought ways to minimize its effect. Particular attention was paid to the role of first responders and the "golden hour" of time between the crash and the arrival of emergency medical services (EMS) personnel.

National EMS data were used to examine the association between urban sprawl and EMS response time. EMS providers were surveyed with regard to their professional training and their experience with congestion. Automatic collision notification systems were considered in light of the pretransport information they provide that can be used to tailor subsequent medical care. This information will be translated into practical techniques for EMS providers, dispatchers, and traffic managers to enhance their response to congestion.

UTC Website: http://www.uab.edu/utc/



Emergency medical response time is often adversely affected by congestion. Information from the automatic collision notification system can offer practical solutions that result in more timely emergency care.
(© iStockphoto.com/Tillsonburg)

Mitigating Crash Fires with Use of Mist-Controlling Additives

Mid-America Transportation Center (MATC), University of Nebraska–Lincoln

More than 100 years after the development of the liquid-hydrocarbon-fueled engine, our transportation system continues to be subject to the inherent fire risks associated with these fuels. This project aims to do for fuel safety what seatbelts and airbags did for passenger safety, by reducing the probability of a fire in the event of a crash.

The central challenge is to make fuel, which needs to burn in an engine, more fire-safe. Key to accomplishing this is the realization that liquid hydrocarbon fuels such as diesel do not burn readily in their liquid phase and are much more flammable in their gas phase. Liquid diesel, if it were to be spilled on the ground, is difficult to ignite and relatively safe.

The goal, therefore, is to minimize fine-mist formation. A fine mist formed during a crash is easily ignitable, and the resulting fireball will heat and ignite everything nearby, including spilled liquid fuel. If misting can be prevented, the probability of fire is greatly reduced or even eliminated.

It was previously shown that a polymer-based fuel additive can prevent misting for kerosene-based aviation systems. This MATC project builds on that work by testing the effectiveness of existing polymers for diesel fuel, creating benchmarks and correlation parameters for tests with diesel surrogates, and identifying conditions in real diesel systems to enable the design of next-generation polymers. Simple laboratory experiments will be conducted so that progress in these areas can be achieved more quickly and at less cost. A greater understanding of the science behind the misting of diesel fuels in crashes will move the development of safer diesel fuels closer to reality.

UTC Website:
http://matc.unl.edu/

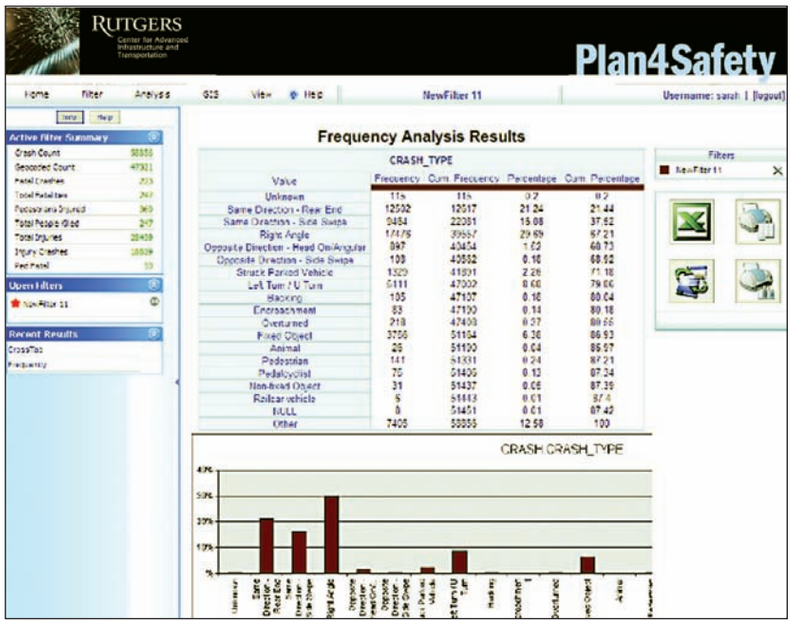
Liquid hydrocarbon fuels are more flammable in their gas form. Polymer-based fuel additives are used to minimize fine-mist formation and thus mitigate crash fires. (Prince George Citizen/The Canadian Press/David Mah)

Plan4Safety: Website for Crash Data Analysis

Center for Advanced Infrastructure and Transportation (CAIT), Rutgers University

Although the number of traffic fatalities and injuries in the United States is dropping, there were still 39,800 traffic fatalities in 2008. Careful analysis of crash factors gives safety professionals the insights that they need to address the problem.

Plan4Safety is a web-based crash analysis tool that compiles, organizes, and sorts tens of millions of bits of crash data. It allows users to search and filter data and to instantly compare results, providing a snapshot of the "who, what, where, when, why, and how" of crashes. DOTs, metropolitan planning organizations (MPOs), county and local engineers, and other decision-makers can use this software to resolve critical issues and assess the most effective and economical ways to approach safety management, enhancement, and improvement. Plan4Safety's ability to simultaneously perform statistical and geographical analyses allows local officials to zero in on where enforcement, education, engineering, and prevention are most needed. Using geographical information systems (GIS), Plan4Safety provides an



Plan4Safety presents crash data query results clearly, in automatically generated charts and tables, on the output screen. Tools and filter menus are conveniently located in a fixed position at the left of every screen.
(Courtesy of Center for Advanced Infrastructure and Transportation, Rutgers University)

immediate, at-a-glance overview of how many and what types of crashes are occurring at given locations. Users can choose to have results superimposed on a simple background map or a satellite map. Plan4Safety features include:

- Multiple sources of data, which give users a comprehensive view of crash factors. The program currently has access to New Jersey crash records from 2003 on (300,000-plus crash reports annually), in addition to straight-line-diagram components and census, land-use, spatial, and traffic data.

- GIS mapping, which provides visual analysis, pinpointing exact locations of pedestrian crashes and enabling the viewing of broad clusters of recurring incidents known as hotspots.

- Statistical analysis tools, which provide a variety of ways to understand the nature of problems at specific locations. The program generates diagrams that allow the frequency of particular collision types to be easily assessed. Users can choose parameters to create a situation as broad or as specific as needed to illuminate existing crash patterns.

- Network screening tools, for identifying high-incident sites on a macro- or microlevel. These evaluation tools can rank crash sites, allowing decision-makers to prioritize and proactively address potential problem areas. In addition, network screening can indicate the likelihood of crashes in particular areas.

The website is located at http://plan4safety.rutgers.edu/.

Additional funding for this project was provided by New Jersey DOT.

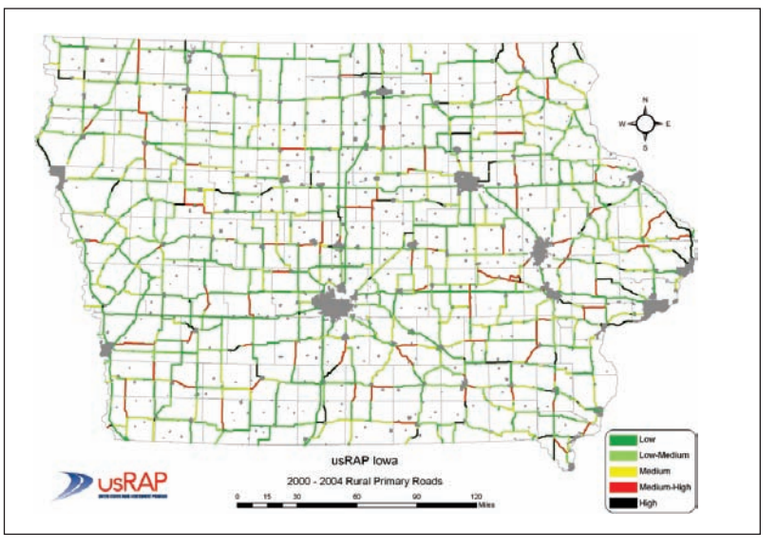
UTC Website: http://cait.rutgers.edu/

Risk Maps for Improving Roadway Safety: A Pilot Program

Midwest Transportation Consortium (MTC), Iowa State University

To make the highway system safer, decision-makers must be able to identify safety risks and to match them with remedies known to save lives. There is no nationwide system in the United States for rating the relative risks of different roads. In partnership with the American Automobile Association (AAA) Foundation for Traffic Safety, MTC is supporting a pilot project for the U.S. Road Assessment Program (usRAP) by developing risk maps for Iowa roadways. Based on a European model, the goal of usRAP is to provide a method to benchmark the safety performance of specific roadway segments compared with that of similar roadways while supplementing and complementing ongoing state highway safety planning. Based on recent crash and traffic-flow data for Iowa roadways, MTC researchers created four types of risk maps to show the following information:

- *Crash density:* fatal and serious injury crashes per mile.
- *Crash rate:* fatal and serious injury crashes per 100 million vehicle-miles of travel.
- *Crash-rate ratio:* fatal and injury crash rates compared with average crash rates for similar roads.
- *Potential crash savings:* number of fatal and serious injury crashes avoided for each three-year period if the crash rate were reduced to the average rate for similar roads.

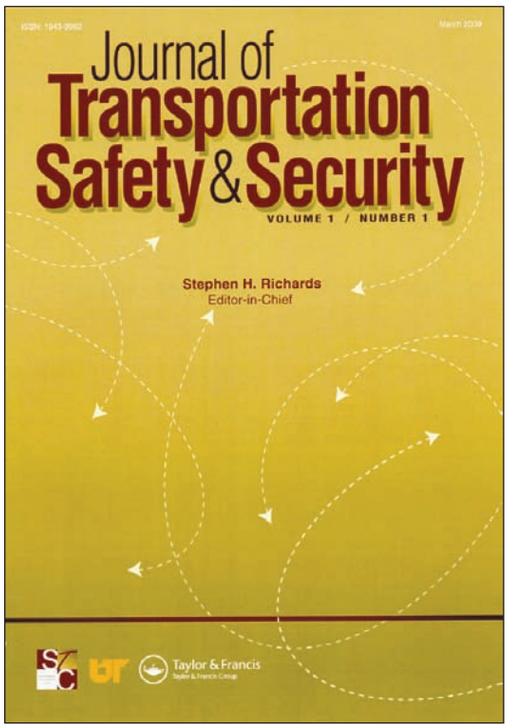


Risk map depicting fatal and major injury crashes per 100 million vehicle-miles traveled, representing average relative risk to motorists traveling on Iowa's state-maintained highways. Relatively, the safest roads are the state's interstates and other freeways. (Courtesy of Midwest Transportation Consortium, Iowa State University, AAA Foundation for Traffic Safety, and Midwest Research Institute)

The maps can help decision-makers at state and local levels to put their safety dollars toward making the highest-risk locations safer, adding improvements such as cable barriers and chevrons. The maps have been used to supplement Iowa's identification of high-risk rural roads in response to SAFETEA-LU requirements. The maps can also help road users to understand the risks involved in traveling on different types of roadways.

Additional funding for this project was provided by the AAA Foundation for Traffic Safety and the Midwest Research Institute.

UTC Website: http://www.intrans.iastate.edu/mtc/index.htm



New Transportation Safety and Security Journal

Southeastern Transportation Center (STC), University of Tennessee

STC, in collaboration with the University of Tennessee, is launching a new academic journal, *Journal of Transportation Safety & Security*. The journal will publish original, full-length articles, and all papers will be subject to rigorous peer review. It will be issued quarterly, possibly with a fifth, special issue in some years. The first volume was published in March 2009.

The mission of the journal is to disseminate research results and engineering experience to researchers, educators, students, practitioners, and policy-makers in order to promote transportation safety and security with use of comprehensive and integrated solutions. STC will provide strong leadership, assembling an editorial board, sponsoring academic conferences, controlling scientific quality, and attracting peer attention.

An exhaustive search was conducted to identify academic publishers that already publish at least one transportation-related journal and that have an international reputation in the field. The requirements were met by four publishers: Elsevier, Springer, Wiley-Blackwell, and Taylor & Francis. Each was sent a preliminary prospectus for the journal and was asked how they share the copyright, bear its costs, and streamline the submission and review process.

After extensive market research, Taylor & Francis concluded that the proposed journal was viable. It is entering into a publishing partnership with STC and the University of Tennessee.

Additional funding for this project was provided by the University of Tennessee and the Center for Transportation Research.

UTC Website: http://stc.utk.edu/

Risk Analysis of Maritime Traffic in Harbors and Waterways

Center for Advanced Infrastructure and Transportation (CAIT), Rutgers University

With more ships and more volatile cargo, maritime risks are higher than ever. Planning for accidents and other catastrophes is therefore critical. (© iStockphoto.com/Dan Prat)

Growing consumption of petroleum products worldwide has resulted in the proliferation of vessels carrying oil, chemicals, and gases into U.S. harbors. The surging demand for commodities and finished goods places a heavy responsibility on local authorities to secure infrastructure and protect the public. Disruption of port operations, whether from terrorist actions or natural disasters, not only would affect our quality of life but could have devastating global economic impacts by impeding or even halting international supply chains. To keep goods and services flowing freely and to prepare for, respond to, and recover from high-consequence events, the risks inherent in port operations and vessel traffic must be analyzed and effective strategies developed.

The CAIT Laboratory for Port Security (LPS) has developed a maritime transportation risk-modeling and analysis tool. Risk analysis involves a set of queries related to (1) the likelihood of an incident; (2) factors that may precipitate or instigate an event; and (3) costs in terms of human life, the environment, infrastructure, and property. The answers to these questions are derived from historical data and expert opinion. Maritime traffic-risk-analysis elements include:

- Multiple data sources on vessel types and movements, traffic rules, and tides.
- Simulation modeling that mimics vessel traffic and movements and other details, such as anchorage delays, vessel-to-vessel transfers, loading, and discharging.
- Statistical analysis of input parameters and output performance measures.

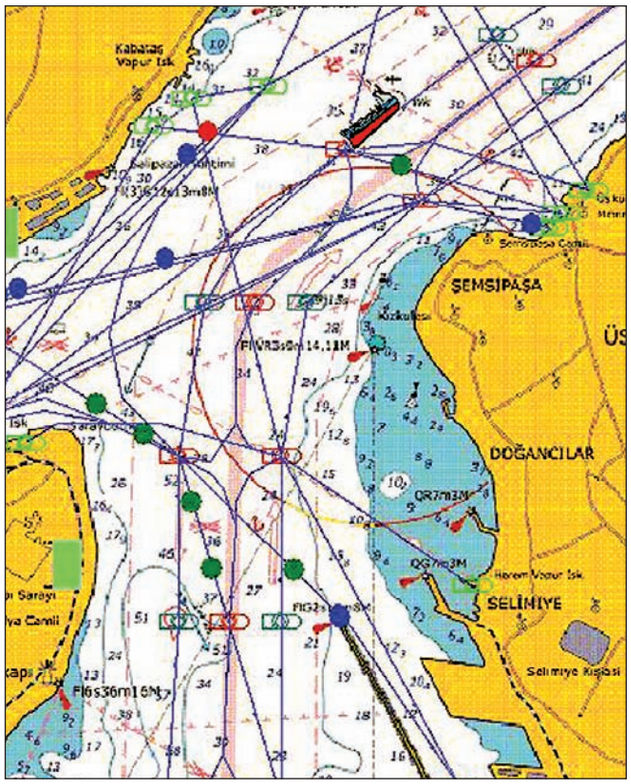
The first step is to develop a large-scale simulation model of vessel traffic and port and waterway logistics. Second, a risk model is generated for various incident scenarios. Finally, the two models are combined to allow various policies to be evaluated in terms of their potential for risk mitigation and traffic control effectiveness.

This regional study involves the states of New Jersey, Pennsylvania, and Delaware. Currently, the tool is being implemented in the Delaware River and Bay area, where

most inbound materials are crude oil and chemicals. It also is being used successfully in Turkey's Strait of Istanbul, one of the most dangerous waterways in the world.

Consumption of petroleum products worldwide has resulted in an increase in vessels carrying oil, chemicals, and gases. With more ships and more volatile cargo, maritime risks are higher than ever, which makes planning for accidents and other catastrophes critical.

To predict the impacts of an accident, risk-analysis models pose a set of queries related to the likelihood of an incident, what may precipitate or instigate an event, and what the costs would be in terms of human life, the environment, infrastructure, and property.



Detailed computer-simulation-model image showing transit vessel traffic in the Strait of Istanbul. Through collaboration with the Turkish Vessel Traffic Services (VTS) Center, CAIT has developed an accurate vessel scheduling algorithm based on the Maritime Traffic Regulations of the Turkish Straits. (Center for Advanced Infrastructure and Transportation, Rutgers University)

UTC Website: http://cait.rutgers.edu/

Intermodal Transportation Safety and Security Workshop

National Center for Intermodal Transportation (NCIT), University of Denver and Mississippi State University

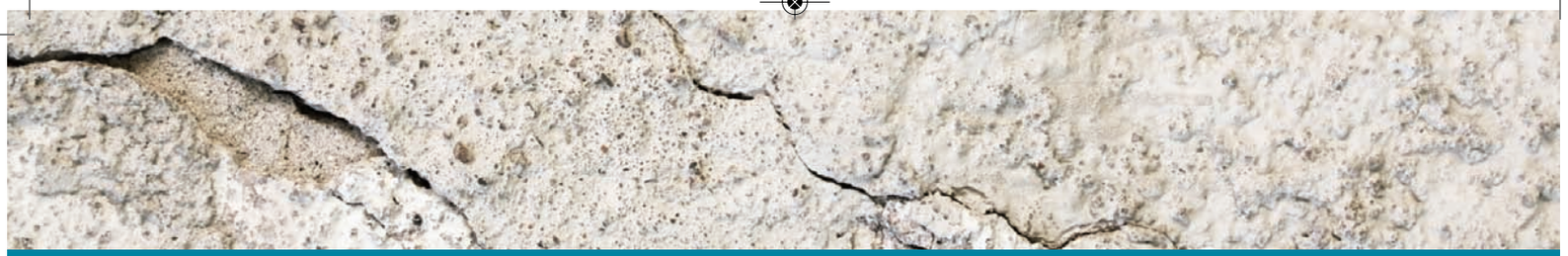
With transportation security and infrastructure among the top national concerns, the National Center for Intermodal Transportation, in conjunction with the Mountain Plains Consortium, hosted an Intermodal Transportation Safety and Security Workshop for experts in February 2008. Educators, policy-makers, private industry representatives, and researchers participated in the event.

Among the workshop presenters were Representative Ed Perlmutter (D-Colorado), a member of the U.S. House Committee on Homeland Security, and retired Major General Mason C. Whitney, Director of the Governor's Office of Homeland Security. Congressman Perlmutter delivered the keynote address, "Life, Liberty, and the Pursuit of Security," while Major Whitney presented on "Transportation and Homeland Security." Other presenters included Ronald Hynes, Deputy Associate Administrator for the Federal Transit Administration's (FTA) Office of Research, Demonstration and Innovation, and David Bassett, Federal Security Director for the Transportation Security Administration (TSA). Topics included:

- Transportation Security Administration
- Transit Security
- Improving Commercial Vehicle Safety at the Border
- Research Needs in Securing In-Land Cargo Container Transport
- Homeland Security Education and Transportation Safety and Security
- FTA's Role in Promoting Safety and Security in Public Transportation
- Security Laws and Programs

Workshop proceedings and next steps for the transportation community will be available in a report, which will assist in future research and policy-making decisions. The presentations are available at http://ncit.msstate.edu/events/ events_01.html.

UTC Website: http://www.ncit.msstate.edu/



We are charting a new course for America. The American Recovery and Reinvestment Act will enable our nation to rebuild, retool and revitalize the vast network of roads, tunnels, bridges, rail systems, airports and waterways that we have long depended on to keep the economy moving and growing. Our transportation infrastructure is critically important to our nation's economic health. We need to protect, preserve and invest in it to make sure it can meet the demands we all place on it now and in the future.

DOT Secretary **Ray LaHood**

Remarks at the Department of Transportation, March 3, 2009
on the occasion of President Obama and Vice President Biden's visit.

Economy and Infrastructure Investment

FHWA Long-Term Bridge Performance Program

Center for Advanced Infrastructure and Transportation (CAIT), Rutgers University, and Utah State University Transportation Center, Utah State University

The U.S. highway system is immense and is aging rapidly, yet it is being used more frequently and heavily every day. Highway bridges are a critical component of our nation's transportation system.

Long-term bridge performance researchers are conducting detailed bridge inspections using visual inspection as well as nondestructive evaluation techniques. (photo: Parsons Brinckerhoff)

The FHWA Long-Term Bridge Performance (LTBP) program was envisioned as a 20-year comprehensive examination of the nation's highway bridges. Objectives include providing highway authorities with tools to detect problems early and with procedures to address safety issues, extend the lives of current bridges, and build new structures that will carry us well into the future. Funding for the program was included in the highway and surface transportation legislation FHWA and SAFETEA-LU, enacted by Congress in 2005. The LTBP program represents the first time that comprehensive, quantitative bridge-performance data will be collected uniformly on a national basis.

FHWA selected a team to perform the first five-year contract of the LTBP program. Led by CAIT, the team comprises the Utah State University Transportation Center, PB Consulting, Virginia Transportation Research Center, Siemens Corporation, Bridge Diagnostics, Inc., Advitam, and the Institute of Transportation Studies at the University of California, Berkeley.

In addition to detailed visual inspections, LTBP researchers will use proven sensor, testing, and monitoring technologies, such as ground-penetrating radar, a geophysical method that uses radar pulses to image the subsurface. It can detect objects, changes in material, and voids and cracks. (photo: Dennis Connors Photography)

In the context of LTBP, "performance" refers to how bridges behave under myriad daily assaults, such as traffic loads and fatigue, and in relation to environmental factors, such as temperature fluctuations, freeze-thaw cycles, and corrosion. Researchers will conduct detailed inspections and periodic evaluations on a broad sample of bridges nationwide, monitoring and measuring physical and functional variables that affect longevity over the life of the program. The CAIT research team will supplement detailed visual inspections with advanced-condition assessments, using proven nondestructive evaluation and sensor technologies. The data will help bridge owners to make "smarter" decisions regarding maintenance and replacement.

This approach will lead to the development of quantitative measures that can be used to optimize performance, maximize return on investment, and minimize user impact, and ultimately it should result in increased bridge functionality, longevity, reliability, and safety.

UTC Websites: http://cait.rutgers.edu/ and http://transportation.usu.edu/

Evaluation of Highway Bridge Cables Using Acoustic Emission Sensors

Eastern Seaboard Intermodal Transportation Applications Center (ESITAC), Hampton University

With 14 to 16 percent of highway bridges falling into the functionally obsolete or structurally deficient categories, there is a need for advanced technologies that structural engineers can use to assess the "health" of these structures and monitor them. ESITAC took the lead in this important research, contracting with the Virginia Transportation Research Council (VTRC) to conduct a study, "Short-Term

Varina-Enon Bridge. The structural "health" of this cable-stayed bridge was evaluated using acoustic emission sensors. Corrosion of single-stay cables can be determined by this method. (photo: Virginia DOT and Virginia Transportation Research Councils)

Evaluation of Bridge Cables Using Acoustic Emission Sensors." This project focuses on the Varina-Enon Bridge, a cable-stayed structure located at the I-295 James River Crossing in Richmond, Virginia, with the goal of determining corrosion on the single-stay cable and evaluating signature sounds. The modern technique of acoustic emission was used to investigate fatigue, corrosion, initiation of cracks, and imperfections. The results of this ongoing project will facilitate maintenance and inspection of similar bridges across the state.

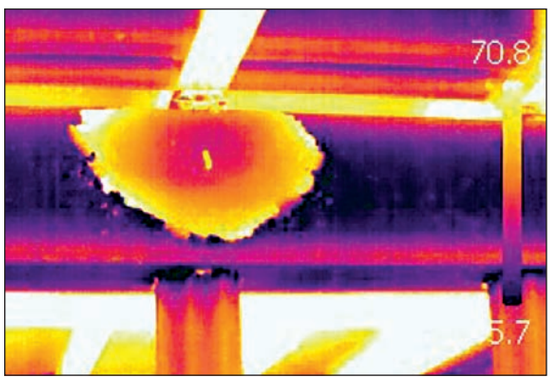
Additional funding for this project was provided by VTRC.

UTC Website: http://www.hamptonu.edu/academics/schools/business/esitac/esitac.htm

Innovative Nondestructive Evaluation Technologies for Assessing Bridges

Center for Transportation Infrastructure and Safety (CTIS), Missouri University of Science and Technology (Missouri S&T)

Researchers at CTIS are developing new technologies for inspecting and assessing the performance of existing and new bridges. These tools will help inspectors to assess the condition of bridges and infrastructure components so that defects and other problems can be identified before serious consequences occur.



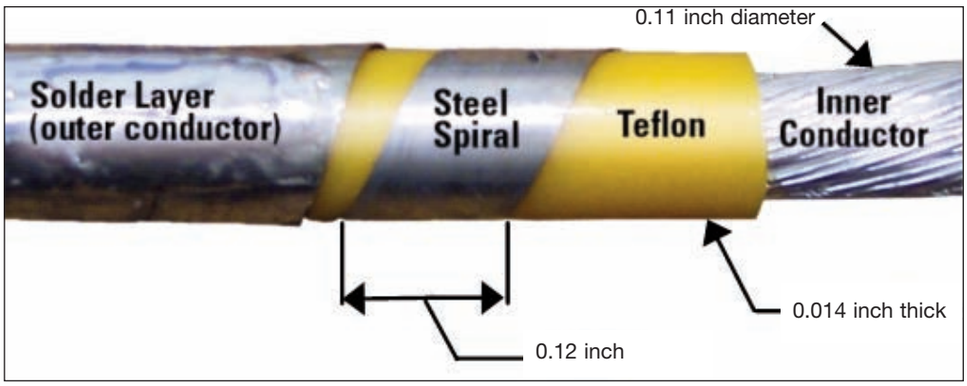
Thermal images of highway bridge subsurface targets at various depths, generated by handheld thermography—a nondestructive evaluation technology. (photo: Dr. Glen Washer)

Handheld Thermographic Technology

Researchers are developing handheld thermographic technology for the nondestructive evaluation (NDE) of highway bridges. The goal is to provide inspection and maintenance personnel with a tool for improving bridge safety by enabling the detection of subsurface damage in concrete during daily environmental variations. The technology allows for the assessment of concrete wrapped in fiber-reinforced-polymer (FRP) without disruption of traffic.

Infrared Cameras

States participating in this study are also field-testing infrared cameras for the inspection of concrete and FRP-overwrapped structures. The cameras are being



A prototype, recently patented, coaxial cable crack sensor that can be used for post-disaster assessment of reinforced-concrete structures. (Image: Dr. Glenda Chen)

used as part of daily inspection and maintenance activities and are helping to identify the advantages and disadvantages of thermographic technology in real-world situations.

Coaxial Cable Sensors

Researchers developed a distributed coaxial cable crack sensor for the post-disaster assessment of reinforced-concrete structures. The sensor was recently patented.

When embedded into a reinforced-concrete girder or column, a sensor that is intercepted by a crack can "sense" the crack formation. A crack interception results in a local separation between two spirals of the cable, generating a reflected wave as an electromagnetic wave travels through the coaxial cable. Cable sensors can memorize the most severe cracks during an earthquake, enabling engineers to retrieve crack data during or after the event and significantly enhancing the reliability of damage detection for post-earthquake assessments of transportation structures.

UTC Website: http://utc.mst.edu/

Reducing Bumps at Pavement-Bridge Interfaces

Center for Transportation and Materials Engineering (CTME), Youngstown State University

The goal of this research-in-progress is to determine cost-effective solutions for reducing bumps at pavement-bridge interfaces in order to improve ride quality and in turn to reduce safety hazards and maintenance costs. Researchers will develop new specifications and guidelines for the design and construction of approach slabs and adjoining embankments, which will prevent or at least minimize bridge bumps within acceptable limits. Activities will include checking existing codes and specifications of selected state DOTs, conducting field surveys on selected highway bridges with visible bumps, identifying long-term solutions for reducing bumps, and assessing the accuracy and effectiveness of these solutions through structural analysis and design. Solutions determined to be feasible will be used as the basis for new specifications and guidelines, which will be developed and recommended to Ohio DOT.

Additional project funding was received from Youngstown State University.

UTC Website: http://stem.ysu.edu/CTME/

Use of Advanced Materials in Infrastructure Systems

Center for Transportation Infrastructure and Safety (CTIS), Missouri University of Science and Technology (Missouri S&T)

Researchers at CTIS are using new, innovative materials and technologies to address the challenge of developing the next generation of durable, long-lasting transportation infrastructure systems and repair techniques that will extend the service life of the existing network as well as that of new bridges.

Deterioration of the Infrastructure

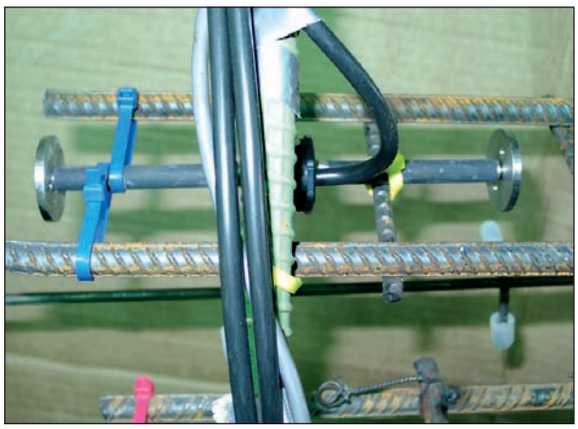
Many bridges in the nation's transportation network were built prior to or soon after World War II and have surpassed their intended service life. The transportation infrastructure is susceptible to deterioration due to corrosion from the application of deicing salts and to environmental conditions. Researchers are extending the service life of new bridges and applying various composite technologies to repair and strengthen existing bridges, many of which are categorized as structurally deficient.

Signs of deterioration in the aging U.S. transportation infrastructure system. (photos: Dr. John J. Myers)

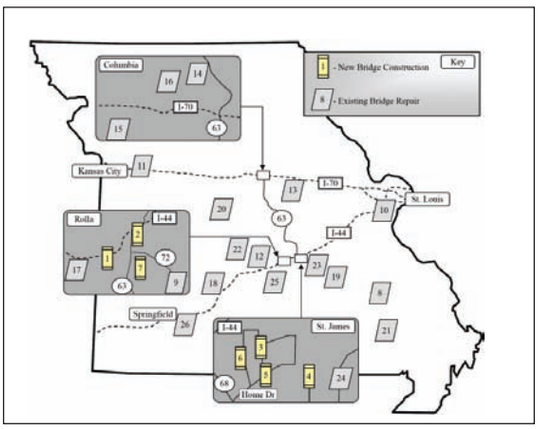
Advanced Materials for New and Existing Construction

CTIS has partnered with regional, state, local, and city officials to upgrade, replace, and repair transportation structures. In Missouri alone, more than 25 bridges have been the subjects of demonstration projects for several new technologies, including the use of noncorrosive materials known as fiber-reinforced polymers. These materials may be used alone as a self-contained bridge material, cast internally within concrete in lieu of traditional steel products that will eventually corrode as the structure decays, or used as a strengthening material to upgrade existing bridges in an effort to remove load postings. These

Fiber-reinforced polymers composite bridge. (photo: Dr. John J. Myers)



Internal Structural Health Monitoring (photo: Dr. John J. Myers)



Schematic showing the sites of demonstration projects in which composite materials are being used to construct new bridges and repair existing structures in Missouri. (image: Dr. John J. Myers)

projects validate new materials and technologies that will reduce maintenance costs and extend service life in the next generation of bridge construction.

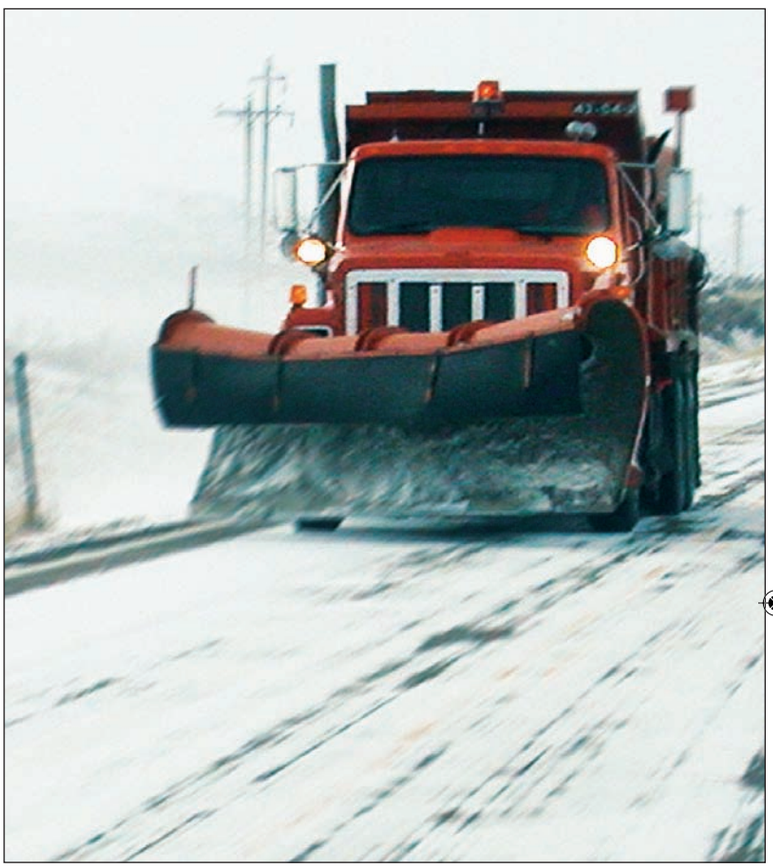
Concrete technologies are also being used to extend the service life of new bridges. Researchers at CTIS are investigating the development and implementation of high-strength-, self-consolidated-, and high-performance-concrete technologies. This new generation of concrete materials has many benefits, such as smaller member sizes, reduced construction time and labor, and improved durability and performance, with an extended service life targeted to nearly 100 years. Integrated Structural Health Monitoring (SHM) systems may be integrated with these systems to assess the "health" of the structure in real time.

UTC Website: http://utc.mst.edu/

Road Condition Maintenance Decision Support System: Benefit-Cost Analysis

Western Transportation Institute (WTI), Montana State University

State and local agencies throughout the United States spend an estimated $2 billion on snow- and ice-control operations every year. These costs, combined with concerns over traffic safety, mobility, corrosion, and environmental impacts, have motivated transportation agencies to explore more efficient strategies for snow and ice control. The strategies work best when agencies have tools to assess road conditions and to make informed decisions regarding treatments.



Controlling snow and ice buildup on roadways during winter weather events presents several challenges for winter maintenance personnel. The Maintenance Decision Support System helps transportation personnel to make effective winter maintenance decisions (treatment types, timing, rates, and locations). These decisions have a considerable impact on roadway safety and efficiency. Poor decisions can also have adverse economic and environmental consequences. (Courtesy of Western Transportation Institute, Montana State University)

A Maintenance Decision Support System (MDSS) is an integrated software application that provides users with real-time road treatment guidance for each maintenance route on the basis of current and forecast road weather conditions, available resources, and local rules of practice. The MDSS pooled-fund study, led by South Dakota and encompassing 13 state DOTs, developed and demonstrated an operational MDSS for winter maintenance. Participants found the system to be useful but wanted its tangible benefits to be identified to enable quantitative investigation of whether it is a good investment.

WTI, working with South Dakota DOT and Iteris, Inc., conducted a study to develop a methodology for a benefit-cost analysis of the pooled-fund MDSS. The methodology included three major activities: identification of winter-maintenance benefits and costs, definition of a base case and alternatives, and development of a benefit-cost model. Researchers applied the methodology to a case study based on the experience of one of the pooled-fund study states. They concluded that MDSS is able to reduce the use of materials, decrease delays, and improve safety. Reduced use of materials is expected to lead to cost-savings in labor and equipment.

The results of this project have immediate significance for the pooled-fund states, demonstrating that MDSS has more benefits than costs and thus is a valuable investment. The benefit-cost model will also help agencies in other states that are exploring the use of MDSS to improve winter-maintenance practices.

Additional project funding was provided by South Dakota DOT.

UTC Website: http://www.wti.montana.edu/

Efficient Movement of Goods in Large Metropolitan Areas

National Center for Metropolitan Transportation Research (METRANS), University of Southern California and California State University–Long Beach

METRANS conducts research that addresses transportation issues within large metropolitan areas. One of its major thematic research areas is goods movement and international trade, which concerns how crowded cities can efficiently move goods and provide transportation infrastructure to support economic growth. Examples of research that METRANS is conducting in this area are as follows:

- A major source of inefficiency in truck drayage is the handling of empty containers. One proposed solution is to establish depots closer to receiver destinations rather than to transport empty containers back to the shipper before reuse. Researchers found that container reuse would result in large reductions in truck travel time and cost.

- Another source of inefficiency in urban truck transport is the unpredictability of congestion. Because truck routing is based on optimization and does not take uncertainty into account, building in slack time for unforeseen events reduces the effects of even a big delay, increasing efficiency overall. This does not add time when everything goes as planned, but it minimizes costs when the unexpected arises.

- Efficiency can also be shaped by public policy. Researchers estimated the optimal toll for reducing the congestion generated by drayage trucks and found that tolls would be sufficient to cover the additional costs of off-peak dock operations. They also analyzed the impacts of the PierPASS program, which charges $100 per eligible container moved into or out of ports during daytime hours, and concluded that congestion reductions were approximately equivalent to two years of port growth.

Collaboration with trucking companies, railroads, ports, and local public agencies ensured that this research has real-world application, and some findings have already been adopted.

Additional funding for these projects was provided by Caltrans, the Ports of Long Beach and Los Angeles, the American Association of State Highway Transportation Officials, Union Pacific Railroad, South Coast Air Quality Management District, and the Southern California Association of Governments.

UTC Website: http://www.metrans.org/

Capital Cost Elements for Light-Rail Transit

University Transportation Research Center (UTRC2), City College of City University New York

The apparent increase in capital costs for light-rail transit is a significant concern. While unit costs have not changed, individual agencies are experiencing unexpectedly high project costs and could use guidance in reducing present costs and anticipating future ones. This project examines three distinct types of cost growth: cost overruns, unit cost escalation, and project escalation.

During the study period, a time of generally stable prices economy-wide, U.S. transit properties experienced no statistically significant increase in prices for capital investment in light rail projects, either overall or in any individual asset category. However, there were significant differences in unit costs among projects in all three types of cost growth. Ongoing problems with cost containment affect the ability of FTA and its partner agencies to keep up with demand for funding light-rail-transit capital projects.

FTA incorporated recommendations from City University's UTC study of capital cost elements for light-rail transit into its capital construction application guidelines. (© iStockphoto.com/Lane)

Researchers noted that, while prices had been stable over the preceding decade, there was anecdotal evidence of rising commodity prices driving up the cost of newly bid contracts, and that the overall picture of cost escalation could change. They identified several areas in which guidance or policy development would help agencies to better contain costs over the long term, including technical and institutional capacity, regulatory reform, competition,

accounting for lifecycle costs, and broader use of standards. FTA incorporated these recommendations into its capital construction application guidelines.

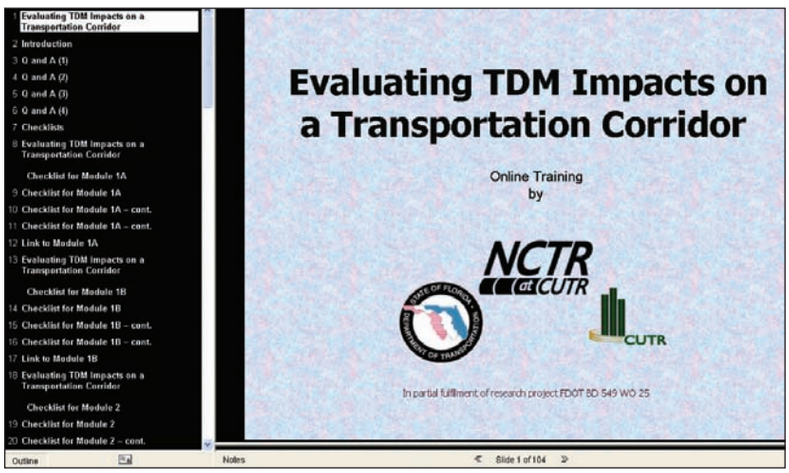
Additional funding for this project was provided by FTA.

UTC Website: http://www.utrc2.org/

Impacts of Employer-Based Transportation Demand Management Programs on Traffic Delays

National Center for Transit Research (NCTR), University of South Florida

Transportation demand management (TDM) is the application of strategies and policies to reduce automobile travel demand or to redistribute this demand in space or in time. In transport as in any network, managing demand can be a cost-effective alternative to increasing capacity. Employer-based programs include opportunities for employees to escape congested commutes through options such as alternative work schedules or telecommuting. Employers can also provide incentives such as subsidized bus passes or removing/reducing subsidies that encourage drive-alone commutes.



Employer-based TDM can help alleviate congestion by reducing or redistributing automobile travel demand. This website provides transportation professionals with a tool to evaluate the effect of TDMs on their traffic networks. (Courtesy of University of South Florida)

The goal of this project was to find a methodology for estimating the impact of employer-based TDM programs on the performance of a traffic network, using measures universal to traffic operations staff, transportation planners, and decision-makers. Researchers analyzed a case study of the Washington State Commute Trip Reduction program, implemented by 189 employers in an 8.6-mile segment of Interstate-5 in downtown Seattle. Performance measures that were analyzed included the spatial and temporal extent of congestion, recurring delay, speed, and travel time.

Results showed a significant reduction in morning and evening peak delays and in vehicle-miles traveled (VMT), as well as significant fuel saved. Overall, TDM reduced congestion, but not in all areas or at all times of day. This indicates that TDM, like every other solution, is not a panacea for every congested segment or period.

Transportation and traffic professionals can estimate the impacts of employer-based TDM programs on their traffic networks. A web-based course provides guidance on the methodology developed by this project. This self-guided training is available at http://131.247.19.1/training/77605-00.mht.

Additional funding for this project was provided by Florida DOT and NCTR.

UTC Website: http://www.nctr.usf.edu/

Memphis Regional Intermodal Infrastructure Assessment

Center for Intermodal Freight Transportation Studies (CIFTS), University of Memphis and Vanderbilt University

This study focused on Memphis, Tennessee, one of the primary logistics and distribution centers in the United States and an important hub of regional transportation and telecommunications infrastructure. With five Class 1 railroads, several interstate highways, the world's largest air-cargo facility, and the nation's fourth-busiest inland waterway port, it is also a major intermodal center.

The overall strategic goal of the project was to position the 16-county region for future economic development, taking into account the evolving changes in the global supply chain. Center researchers have developed an inventory of regional transportation and telecommunications assets and needs and have catalogued transportation facilities for all major modes (air, highway, rail, and water) and generated descriptions of locations, facilities, and capacities. GIS-based maps of all facilities were developed; commodity-flow maps of these modal networks will follow. Future scenarios will be analyzed and recommendations made for needed improvements.

Additional funding for this project was provided by Global Insight, Wilbur Smith and Associates, Design Nine, and the Memphis Regional Chamber of Commerce.

UTC Website: http://www.memphis.edu/cifts/

Assessing the Socioeconomic Effects of Vehicle Mileage Fees

Oregon Transportation Research and Education Consortium (OTREC), Oregon State University

It has become evident that a gasoline tax may not be able to generate all of the funds necessary to build and maintain the nation's highway system. An alternative financing option would assess fees on the basis of vehicle miles traveled (VMT) instead of gallons of gas purchased. There are concerns, however, about the possibility of shifting the tax burden from higher- to lower-income groups or from urban to rural areas, and about discouraging people from driving alternative-fuel vehicles.

Researchers at OTREC developed analytical techniques to examine the distributional impacts of alternative-fee structures. The results indicated that a VMT fee would amount to an increased cost of less than 1 percent of income for the lowest-income group, whereas the increase in total gasoline expenditures from 2001 to 2006, caused by price increases, was more than 5 percent of income. The impact on rural areas was far less than expected. On average, rural households would pay less under the VMT-fee option while those in urban areas would pay slightly more due to the lower overall fuel efficiency of the rural vehicle fleet and the greater number of miles driven by rural households. Because the change in fee structure had such a small impact on the cost of driving relative to the price of gasoline, it was considered unlikely to create a significant disincentive to purchasing fuel-efficient vehicles.

The study concluded that, since a single policy such as a flat VMT fee is unlikely to achieve multiple objectives, different policy goals, such as reductions in highway financing, vehicle emissions, or insurance rates, may require different policy alternatives, such as congestion pricing, tolling, parking fees, or hybrid subsidies.

The report is available at http://otrec.us/main/show_abstract.php?prop_id=3.

Additional funding for this project was provided by the Oregon DOT.

UTC Website: http://otrec.us/content/

Systematic Monitoring of Arterial Road Traffic and Signals (SMART-SIGNAL)

Intelligent Transportation Systems (ITS) Institute, University of Minnesota

Despite recent developments in the real-time measurement of freeway performance with use of routinely available loop-detector data, similar approaches are lacking for

the performance monitoring of urban arterial street networks. Building on advances in data-collection technologies, SMART-SIGNAL aims to bridge this gap, improving the ability to manage traffic flows and mitigate congestion on these urban thoroughfares. The ultimate goal of this project is to develop a holistic framework that systematically measures, automatically fine tunes, and realistically and practically models traffic flow on signalized urban arterials.

In Phase I of the project, researchers, using existing installed instrumentation, developed a system capable of simultaneously collecting and archiving event-based traffic-signal data and of automatically generating real-time performance measures, such as travel time and number of stops along an arterial and delay, queue length, and level of service for intersections. Phase II, now underway, focuses on enhancing the system's capabilities for the automatic diagnosis of operational problems and on fine tuning signal-control parameters through the integration of additional field instrumentation. The system has been deployed for testing along an 11-intersection arterial corridor known for problematic congestion and on a six-intersection segment of suburban trunk highway, both of which are key commuter routes.

Additional funding for this project was provided by the Minnesota Local Road Research Board, the University of Minnesota's Intelligent Transportation Systems Institute, and Minnesota DOT.

UTC Website: http://www.its.umn.edu/

Vehicle-Infrastructure Integration System for Real-Time Traffic Management Prototype

National Transportation Center (NTC), Research and Development, Morgan State University

Researchers from Morgan State University's National Transportation Center and Clemson University developed a new traffic surveillance system that detects accidents and traffic problems faster and more accurately than California Algorithm #7, an incident-detection system widely used by traffic control centers across the United States.

The proposed system, a vehicle-infrastructure integration system, assesses and predicts traffic conditions via wireless communication among roadside sensors, the increasing number of cars that have GPS technology, and traffic control centers. The data that are gathered can help in estimating the speed of traffic, the location of incidents (events that impede the flow of traffic), and the likely number of lanes blocked.

The system was tested in a microscopic traffic simulation of freeway networks, with Spartanburg, South Carolina, and Baltimore, Maryland, serving as the study sites.

As traffic volume increased in the simulated environment, the Morgan-Clemson model continuously outperformed the existing traffic surveillance system. In real-world use, the prototype would translate into faster response to emergency situations on highways, reducing congestion and increasing safety and mobility.

Student research assistants contributed to the project and gained valuable technical exposure.

UTC Website: http://www.eng.morgan.edu/~ntc/

Confidence in real-time travel estimates increased as a result of OTREC traffic management research projects. (photo: Oregon DOT)

Increasing the Traffic-Management Knowledge Base in Portland, Oregon

Oregon Transportation Research and Education Consortium (OTREC), Portland State University

Oregon DOT understood the value of intelligent transportation systems and other technologies to better manage freeways, but it did not have the ability to quantify and use data to show the impacts. Two distinct OTREC projects with different goals have collectively made a substantial contribution to increasing the traffic-management knowledge base in Portland and have had a positive effect on Oregon DOT's operational strategies. These projects are summarized below.

- System-Wide Adaptive Ramp Metering System (SWARM): Measuring Operational Benefits. The SWARM system uses detectors to feed algorithms that forecast when and where congestion will occur. SWARM forecasts the traffic state at predetermined problem points (bottlenecks) and adjusts metering rates accordingly. This research project provided Oregon DOT with a better understanding of efficiencies gained by comparing use of the SWARM system for the operation of freeway and ramp meters with that of a pretimed method. Archived ITS data were used to measure the operational benefits of the system. Contrary to initial expectations, the project validated that SWARM let more vehicles onto the freeway than did the pretimed system.

- Real-Time Travel-Time Algorithms: Assessment and Refinement. A methodology was developed to assess the impact of additional detection that would help

Oregon DOT determine where placement of new detectors would help to improve travel-time estimates. The assessment provided statistical confidence in travel-time estimates and helped identify the best travel-time-estimation approach for Oregon DOT.

Both studies revealed the importance of reliable communications and the need for installation of detectors to improve operations beyond current data limitations. The studies relied on the Portland Transportation Archive Listing (PORTAL), a system that archives the Portland metropolitan region's freeway loop detector data at the most detailed level and also archives area weather data. The system has proved to be a valuable tool for researchers and transportation practitioners. More significantly, the projects forged a stronger relationship between researchers and practitioners, bridging the gap between the two communities.

Additional project funding was received from Oregon DOT.

UTC Website: http://otrec.us/content/

Warehousing Regionally Archived Data from Transportation Management Centers: The STEWARD Project

Center for Multimodal Solutions for Congestion Mitigation (CMS), University of Florida

The potential benefits of maintaining data produced by traffic management systems are well recognized. With this in mind, STEWARD (Statewide Transportation Engineering Warehouse for Archived Regional Data) was developed to provide a central traffic-data archive that supports the development of transportation-system-related performance measures and promotes further transportation research as well as the generation of reports and queries. The project demonstrated that ITS data can be archived in a practical manner and that products from the archive are useful.

This project's aim was to expand the operation of STEWARD to provide a wide range of stakeholders with services related to detector-system calibration and maintenance, periodic performance-measure reporting, decision support, and data for research on congestion modeling. Florida DOT intends to implement STEWARD as a statewide resource.

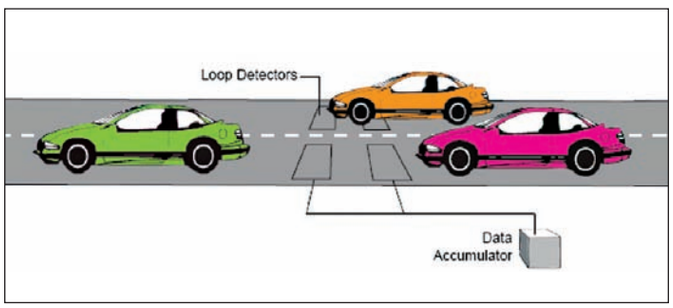
Additional funding for the project was provided by the Center for Multimodal Solutions for Congestion Mitigation and by Florida DOT.

UTC Website: http://cms.ce.ufl.edu/

Improving Dual-Loop Truck Data

Transportation Northwest (TransNow), University of Washington

Washington DOT has installed more than 1,000 dual-loop detectors on state freeways to measure vehicle speeds and lengths. These systems, which classify vehicles into four categories on the basis of length, are a potential real-time data source for freight movement studies involving trucks. The data are used for transportation applications such as planning, infrastructure management, model calibration, and traffic simulation and operations.



Graphical depiction of a dual-loop detector system consisting of two single loops separated by several feet. The system measures vehicle speeds and lengths to obtain data for use in transportation planning. (Courtesy of Transportation Northwest, University of Washington)

A 2001 study found errors in vehicle classification in some dual-loop detectors and identified inappropriate sensitivity-level settings as the cause. Research sponsored by TransNow and Washington DOT produced an algorithm for identifying and correcting dual-loop sensitivity problems, enhanced the reliability of the detection system, and improved the accuracy of truck-volume data.

As part of the project, a software application, Advanced Loop Event Data Analyzer (ALEDA), which allows convenient use of the new algorithm, was developed. The difference between vehicle counts from single loops and dual-loop detectors dropped from 95 percent to nearly zero with use of ALEDA. The researchers were recently awarded a patent for ALEDA.

Additional project funding was received from Youngstown State University.

UTC Website: http://www.transnow.org/

Handbook of Scour Countermeasures Designs

University Transportation Research Center (UTRC2), City College of City University New York

Scour is the term used for the hole left behind when sediment (sand and rocks) is washed away from the bottom of a river. Scour action may occur at any time, but it is especially strong during floods. If sediment or rock on which bridge supports rest is scoured by a river, the bridge could become unsafe for travel.

The literature contains numerous tidal flow and nontidal scour countermeasure designs that can be used on scour-critical bridges to control channel instability and to mitigate scour at foundations of abutments and piers. However, the *Handbook of Scour Countermeasures Design,* prepared by UTRC2, responds to a need to identify the most appropriate technologies and solutions for bridges in New Jersey. Scour-critical bridges across the state are retrofitted with use of different standards for countermeasures, depending on bridge ownership. The goal was to provide unified guidelines for the design of scour countermeasures for both new and old bridges.

The handbook presents concise, practical solutions for bridge-design engineers. Guidelines are recommended for application, design, and construction of selected, permanent scour countermeasures for identified scour-critical bridges, along with cost-effective technologies to match New Jersey's resources for existing structures and new bridge construction. Factors such as structural type, stream geometry, stream soil conditions, and environmental constraints are taken into account.

Peckman's River Bridge in New Jersey showing scour damage to approach following Hurricane Floyd. (photo: Dr. M. Ali Khan; from *Handbook of Scour Countermeasures Designs Final Report*)

The handbook also examines new technologies and innovative concepts, such as the Gabion wire basket anchor block and Gabion mat, flexible channel liner, geotextile containers, delta-wing-like fin in front of bridge piers, slot through piers, submerged vanes, and training walls, for their potential for scour mitigation and their cost-effectiveness. Guidelines for these additional countermeasures were developed on the basis of existing theoretical and experimental knowledge.

Additional funding for this project was provided by New Jersey DOT.

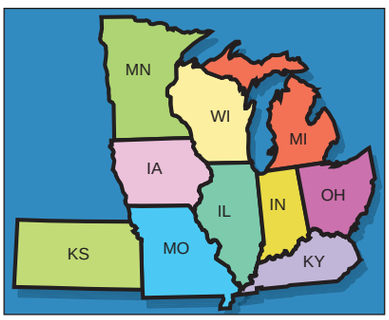
UTC Website: http://www.utrc2.org/

Mississippi Valley Freight Coalition Conducts Collaborative Freight Research

National Center for Freight and Infrastructure Research and Education (CFIRE), University of Wisconsin–Madison

In 2006, CFIRE organized the ten states of the Mississippi Valley Conference to form the Mississippi Valley Freight Coalition to protect and support the economic well-being of the region by keeping products flowing to markets reliably, safely, and efficiently. CFIRE facilitates the coalition and conducts research with direction from chief executives of the ten state DOTs. A technical committee of freight and operations professionals from across the region advises CFIRE. The Coalition already has several achievements:

- A series of policy positions which served as testimony to the National Surface Transportation Policy and Revenue Study Commission.
- An online training program to help public-sector professionals learn the fundamental of logistics.
- A handbook on freight planning for small- and medium-size jurisdictions with important advice on the availability and use of data.
- An innovative Google Maps application to analyze locations of regional truck parking needs and multimodal freight bottlenecks.
- Low-cost strategies to address truck parking and freight bottlenecks.



Ten States of the Mississippi Valley Freight Coalition

CFIRE also facilitates a traffic operations coalition to guide researchers in building the requisite frameworks for a Regional Truckers' Traffic Information Clearinghouse.

The coalition was reauthorized by all 10 states in 2008, and CFIRE is now working with them to define and support national transportation policies on freight movement. Additional new activities will include developing regional freight performance measures, analyzing resiliency of the freight network, characterizing the transportation profiles of major commodities, and preparing materials to explain the importance of freight to the general public and decision-makers.

Perhaps as important as the specific projects has been facilitating dialogue among states, allowing them to share ideas, information, and experiences. Also important is the information-sharing between agencies, private-sector shippers and carriers, and the research community. CFIRE's facilitation of this effort continues to be a good example of multistate cooperation.

UTC Website: http://www.wistrans.org/cfire/

Mapping Freight Bottlenecks and Parking Data

National Center for Freight and Infrastructure Research and Education (CFIRE), University of Wisconsin–Madison

Adequate truck parking at public rest areas, commercial truck stops, and travel plazas is a nationwide concern for the freight transportation industry. Most of the nation's freight moves by truck, and experts project that this traffic will increase significantly in coming years. A shortage of safe, affordable truck parking facilities increases congestion, decreases overall road safety, hinders compliance with hours-of-service rules designed to reduce fatigue-related accidents, and impedes national commerce. Information about freight movement across the nation is difficult to collect due to time commitments, proprietary restrictions, and the large number of independent carriers.

CFIRE researchers inventoried public and private parking facilities and developed an interactive map strategy to pinpoint and define locations where parking is a challenge. (©2009 Google)

Two CFIRE projects, Solutions to Short-Term Truck Parking Needs on Freight Corridors in the (Mississippi Valley) Region and Strategies for Addressing Multimodal Freight Bottlenecks, were the impetus for CFIRE researchers and students to develop an innovative geoinformation tool. Many routing and map information tools have been developed since the release of Google Maps, application programming interface (API) in 2006. CFIRE is using that technology to gather information on specific trucking issues over a large area from a wide cross-section of motor carriers. The main differences between CFIRE's tool and ones already available are that it captures information and promotes interaction between public- and private-sector stakeholders.

The parking project is collecting valuable information on truck-parking practices and where improvements are needed. The bottlenecks project is identifying constraints on regionally significant routes. Using maps familiar to carriers, state patrols, and freight planners, the research team is pinpointing key areas where parking issues arise and where bottlenecks choke freight movements. This assessment can lead to better performance measures and multistate project planning.

Another unique component of the project is the data collection process itself. Rather than relying on an e-mail survey to be completed voluntarily, researchers are

aggressively collecting information with a hands-on approach, attending regional trucking jamborees and shows, including the annual event at the nation's largest truck stop on Interstate-80. Hundreds of truckers completed the surveys. The anecdotal evidence collected has been used to further refine the tool.

Additional funding for this project was provided by the 10 states of the Mississippi Valley Conference of the American Association of State Highway and Transportation Officials (AASHTO), Illinois, Indiana, Iowa, Ohio, Missouri, Kentucky, Minnesota, Wisconsin, Michigan, and Kansas.

UTC Website: http://www.wistrans.org/cfire/

Intermodal Freight GIS Network Development

Center for Intermodal Freight Transportation Studies (CIFTS), University of Memphis and Vanderbilt University

The high cost of petroleum during 2008 heightened public awareness of transportation's impact on the cost of consumer products. It has become imperative that shippers use economical and efficient means to transport goods to market, availing themselves of intermodal solutions instead of relying solely on trucks.

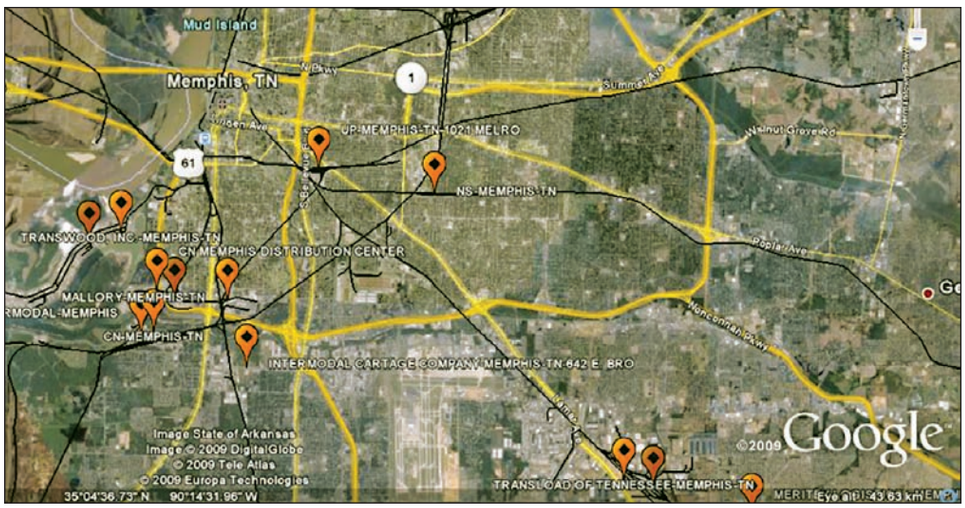
The goal of this project was to develop an intermodal freight transportation geographic information system (GIS) network that will simulate intermodal movements throughout the southeastern United States so that local transportation planning professionals can test scenarios, have a comprehensive view of freight operations, and take advantage of all modes of transportation.

Intermodal freight transportation poses unique challenges, including the conditions of terminal access roads and congestion in and around the terminal. Starting with the National Transportation Atlas Database (NTAD) highway, rail, and waterway networks, researchers needed to identify the locations of containerized intermodal terminals; however, it was often unclear where the connections actually took place. By creating a Google Earth layer of terminals and using the underlying satellite imagery to verify terminal locations, they were able to eliminate noncontainerized terminals from consideration and to adjust the remaining terminals to represent locations where containers actually changed modes.

The network was recently completed, with precise locations identified for modal connections, and the first set of shipments was routed successfully from origin to destination. The network is being modified so that link attributes, such as speed, congestion, and impedance, accurately represent current conditions. In the project's second year, the focus will be on creating a more detailed means of representing terminal capacity.

Additional funding for this project was provided by the Memphis Transportation Institute.

UTC Website: http://www.memphis.edu/cifts/



Intermodal freight transportation network superimposed on a Google Earth map to assist transportation planners in making informed decisions. (©2009 Google)

TransCAD, a transportation-related GIS package, is used to show the intermodal transportation network in Memphis, Tennessee. (Courtesy of Center for Intermodal Freight Transportation Studies, University of Memphis and Vanderbilt University)

Geospatial Intermodal Freight Transportation Model

Delaware Center for Transportation (DCT), University of Delaware

Sustainable-goods movement is a critical component of a healthy economy, a safe environment, and a secure nation. Freight transport is the fastest-growing energy sector and a major contributor to environmental problems.

The Geospatial Intermodal Freight Transportation (GIFT) model is the latest tool developed under the Sustainable Intermodal Freight Transportation Research program, a collaborative effort aimed at improving freight decisions through innovative, data-driven, transformative research in four key areas: energy and environmental analysis; economic, congestion, and modal analysis; safety, security, and infrastructure resiliency; and data acquisition, storage, and access.

GIFT integrates three freight transport modes—road, rail, and water—into a single GIS network. The model allows users to conduct route analyses on the basis of network attributes such as cost, time, distance, energy use, and emissions. GIFT can be used to evaluate economic, energy, and environmental impacts associated with freight movement; decisions related to various highway and intermodal facility infrastructure factors; and decisions aimed at improving highway-use efficiency.

In two Delaware Center for Transportation projects, researchers developed data inputs for GIFT and for evaluation of how infrastructure renewal options may impact freight service capacity. One of the projects, an analysis of multimodal freight activity for the I-95 corridor, the Northeast Rail corridor, and the Port of Wilmington, involved characterizing freight transportation data and conducting a validation/case analysis to improve the quality of the waterway network model. In addition to generating regionally important insights, this project provided transportation agencies and researchers with a springboard for a high-end, web-enabled modeling system.

The second project involved the application of a decision analytical framework in terms of cargo transportation performance to evaluate landside and waterside infrastructure-investment alternatives in a freight-focused context as provided by GIFT.

UTC Website: http://www.ce.udel.edu/dct/

Intermodal Container Security Monitoring Systems

Mack-Blackwell Rural Transportation Center (MBTC), University of Arkansas

There are continuing security concerns associated with the approximately nine million intermodal shipping containers that pass through the nation's ports every year en route to warehouses and retail centers. Existing security-monitoring systems for the transport of freight use technologies such as videocameras and infrared/ultrasonic proximity detectors in a line-of-sight configuration. However, these devices are costly and susceptible to failure due to harsh operating conditions such as vibration, temperature, and variability of materials and configurations.

The RFID Research Center's laboratory provides the technology and expertise to test products for RFID compatibility. The laboratory primarily conducts research into the most efficient use of radiofrequency identification and other wireless and sensor technologies throughout the supply chain. (photo: Roy McCann)

MBTC is one of seven institutions within the Department of Homeland Security's National Transportation Security Center of Excellence. Researchers developed an intermodal container security monitoring system incorporating recent advances in radio frequency-identification (RFID) technology and acoustical signature monitoring (ASM). Their findings demonstrated that recent advances in sensors and microelectronics can be used to create an effective security monitoring system for intermodal containers and trailers despite the variable and unpredictable conditions that are often encountered in practice. The report, "Development of an Intermodal Container Load Status and Security Monitoring System," is available at http://ww2.mackblackwell.org/web/research/ALL_RESEARCH_ PROJECTS/2000s/2084/MBTC%20-%202084.pdf.

UTC Website: http://www.mackblackwell.org/

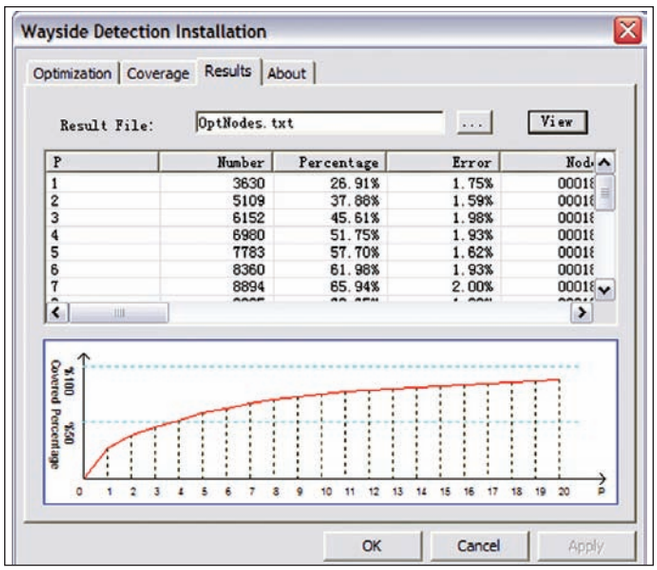
Sensor Network Design for Multimodal Freight Transportation Systems

NEXTRANS, Purdue University

Since the growth of freight movement has far outpaced that of the transportation infrastructure, ensuring efficiency and sustainability has become a major challenge. Recent developments in sensor technology will enable more efficient monitoring and management of complex transportation systems, improving the visibility of freight movement and allowing the identification of congestion chokepoints. However, the investment associated with new sensor networks requires careful analysis.

The benefits and costs of deploying sensors for freight transportation modes were calculated by drawing connections among sensor locations, the granularity of collected data, and the quality of information about the entire system, such as the percentage of traffic monitored and travel-time estimates. Network optimization models were developed to select optimal sensor locations, taking into consideration factors such as freight-traffic and transportation-network characteristics and operational uncertainty.

The purpose of this ongoing project is to establish principles for sensor network design, which can be used to create an integrated framework for enhancing the efficiency of multimodal freight transportation systems. Partnerships



Computerized tool to determine the optimal location of railroad wayside sensors (NEXTRANS, Purdue University)

with the public and private sectors will improve management at regional, state, and local levels and contribute to addressing critical needs such as reduced congestion. Preliminary efforts have been undertaken at the University of Illinois, where deployment of railroad wayside sensors is optimized to monitor freight train operations. The project extends the research to a broader multimodal context and establishes a more comprehensive sensor network design framework.

Additional funding for this project was provided by the Illinois Center for Transportation, the Illinois State Toll Highway Authority, and CSX Transportation.

UTC Website: http://www.purdue.edu/dp/nextrans

Regional Freight Information Resources for Identifying Market Opportunities in the Great Lakes Maritime Transportation System

Intermodal Transportation Institute (ITI) and University Transportation Center (UTC), University of Toledo

The Great Lakes Maritime Information Delivery System (GL MTS) is a comprehensive, diversified, web-based data-repository and information clearinghouse for the maritime industry in the Great Lakes and the St. Lawrence Seaway. Its main objective is to promote sustainable maritime transportation by serving as an information resource for public-policy decision-making and for identifying links among maritime freight movements, economic viability, and environmental quality throughout the region. The system houses detailed information on vessel movements and commodity flows, port and dock functions, regional economic activity, population and socioeconomic patterns, and environmental impacts. Early work emphasized the regional economic impact of GL MTS, linking it to the wider regional intermodal freight system, safety, environmental impacts and benefits, shipper savings, rate comparisons, and congestion effects compared with those of other modes.

The purpose of this project was to expand the Great Lakes Maritime Information Delivery System to include market-opportunity data for shippers and carriers for diverting freight to GL MTS. With a new deepwater port under development

in Nova Scotia, this data repository will be invaluable in realizing the promise of expansion of Great Lakes shipping as containers from the Far East arrive via the Atlantic Ocean and enter the United States via the St. Lawrence Seaway. The project will enable the retrieval of data on factors such as tonnages, cargo value, scheduled service, ship technologies, dock and port facilities, intermodal connections, and transshipment costs.

The project involved participants from organizations including the Great Lakes Maritime Research Institute, American Great Lakes Ports Association, Canadian Chamber of Maritime Commerce, Detroit Port Authority, Great Lakes Commission, Lake Carriers' Association, National Oceanic and Atmospheric Administration (NOAA), Port of Duluth, St. Lawrence Seaway Development Corporation, Transport Canada, U.S. Army Corps of Engineers, U.S. Coast Guard, and U.S. Maritime Administration.

Additional project funding was provided by the University of Toledo College of Arts and Sciences.

UTC Website: http://www.utoledo.edu/research/ututc/

A Nationwide High-Speed Rail Network for Freight Distribution

Mack-Blackwell Rural Transportation Center (MBTC), University of Arkansas

Highway congestion is a major problem in the United States, causing an estimated $7.8 billion per year in lost productivity. To alleviate congestion, it is often recommended that the nation build additional high-speed passenger rail and encourage increased use of this form of transit. However, since passenger traffic shares the highways with freight traffic, one alternative is to remove freight traffic from highways through the development of a national high-speed network for freight distribution.

French TGV bullet train speeding past highway trucks
(© iStockphoto.com/windowseat)

The objective of this MBTC project was to explore the maximum impact of instituting such a rail network. Researchers used the results of technology feasibility tests, which indicated that freight in a rail-network system would move approximately two to three times faster than freight distributed by way of the nation's highways.

As a case-study application of their model, researchers evaluated the impact of a high-speed freight network on the nation's highways with data from the federal government's Commodity Flow Survey as well as from a major truckload carrier. For example, a 20,000-mile network (equivalent to approximately half the length of the present U.S. interstate highway system) that utilizes current Maglev technology would be advantageous to a majority of freight traffic. Although a significant investment of $760 billion to $2.8 trillion would be required, the result would be an estimated 38 percent reduction in overall freight transit times and, perhaps more importantly, a net 78 percent decrease in annual total truck highway miles driven.

UTC Website: http://www.mackblackwell.org/

Potential for Increased Use of Titanium in Civil Structures

Ohio Transportation Consortium (OTC), University of Akron

On April 22, 2008, the Ohio Transportation Consortium held a conference, "Enhancing the Use of Titanium for Novel Areas Spanning the Domains of Structural, Performance Critical and Innovative Applications in Engineering." The conference addressed past, present, and potential future uses of titanium in civil and mechanical structures. The goal was to advance discussion between titanium-industry leaders and titanium researchers with regard to the production and use of titanium in place of other, more commonly used metals, and to highlight the need for research on the potential applications of titanium alloys in the transportation-infrastructure sector.

Corrosion is a major problem in steel-reinforced concrete and in steel bridge girders and deck slabs. The aging U.S. transportation infrastructure is deteriorating at a fast rate; of the nation's 590,000 highway bridges, 152,220 were recently rated as structurally deficient or functionally obsolete and 73,160 were rated as structurally deficient. New materials and techniques are constantly being developed to repair and/or strengthen existing structures. Titanium has grown to be recognized both in stature and strength as a high-performance metal for use in a spectrum of critical and noncritical applications spanning the diverse field of engineering. The newer generation of titanium alloys are recognized as being much stronger and lighter than the most widely chosen and used steels. The emerging titanium alloys are expected to have a tremendous influence in reducing corrosion-related deterioration of bridges and other structural elements, particularly those exposed to deicing salts and seawater.

Future research will focus on applications of the titanium alloys that are being developed and proposed for the construction and transportation-infrastructure sector. Replacement of steel with titanium-alloy hardware for critical elements, such as gusset plates, bridge girder bearings, and inserts in precast concrete structural members, is a viable solution that does not significantly increase overall project cost.

More information can be found at http://www.otc.uakron.edu/technologytransfer.php.

This project was funded in part by the Defense Metals Technology Center.

UTC Website: http://www.otc.uakron.edu/mission.php

National Urban Freight Conference

National Center for Metropolitan Transportation Research (METRANS), University of Southern California and California State University–Long Beach

In 2007, METRANS sponsored the 2nd National Urban Freight (NUF) Conference in Long Beach, California. The conference has become a signature METRANS outreach event.

The NUF Conference fulfills a particular need for the research community. Most freight research addresses goods movement between regions. The economic distribution of international trade activity across metropolitan areas is less understood. This conference provides a unique opportunity to discuss these issues in the context of large urban agglomerations.

The conference is also important because it provides a forum for researchers to present their findings to government officials and real-world practitioners. NUF 2007 concluded with a plenary session discussion among panelists representing academia, government, and the trucking industry. Panelists provide viewpoints from their respective sectors on current research and the direction that this research should take.

NUF attracts participants from all parts of the world where maritime ports, airports, and rail hubs are located. In addition to university-based research, NUF has featured papers from representatives of ports, city transportation agencies, research institutes, private engineering firms, and USDOT. International participants have come from countries as diverse as Australia, China, and the Netherlands.

UTC Website: http://www.metrans.org/about

By focusing on livability, we can help transform the way transportation serves the American people—and create safer, healthier communities that provide access to economic opportunities.

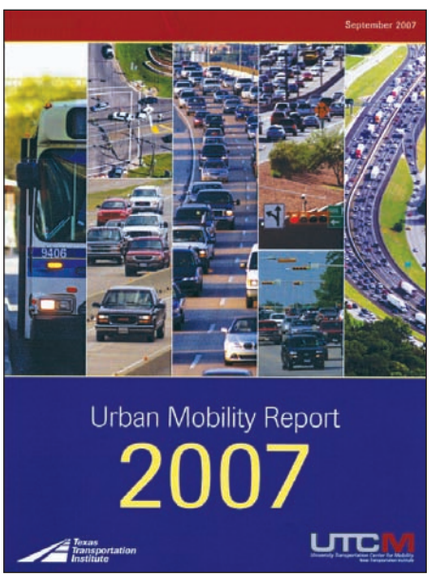
DOT Secretary **Ray LaHood**

The Fast Lane
The Official Blog of the U.S. Secretary of Transportation
http://fastlane.dot.gov, March 18, 2009

Livability/Focus on People and Communities

Urban Mobility Report—Detailed Analysis of Congestion in U.S. Cities

Texas Transportation Institute (TTI), Texas A&M University



The 2007 Urban Mobility Report addresses the issue of congestion, a problem shared by all of the nation's cities. The report gives a very detailed picture of a problem that is worsening. At a Washington, DC, press conference attended by national and international media, researchers announced that traffic congestion creates a $78 billion annual drain on the U.S. economy.

Congestion is far more complex than is immediately apparent. The better the data used to define the problem, the better the solutions used to address its root causes. Researchers spent two years revising their methodology, using additional sources of traffic information to provide more and higher-quality data for the current study. The study estimates the effects of congestion on all 437 U.S. urban areas and provides detailed information for 85 such areas.

In addition to aiding transportation professionals and the public, this analysis gives lawmakers accurate information on which to base policy decisions. Researchers have offered testimony to the U.S. House of Representatives Subcommittee on Highways and Transit, Committee on Transportation and Infrastructure, on a solution framework for America's congestion problems. The report is available at http://mobility.tamu.edu.

Additional funding for this project was provided by the University Transportation Center for Mobility. The project involved the collaborative efforts of the University Transportation Center for Mobility, Texas Transportation Center, Texas Transportation Institute at Texas A&M University, American Road and Transportation Builders Association, and APTA.

UTC Website: http://tti.tamu.edu/

Transit-Oriented Development

Mineta Transportation Institute (MTI), San Jose State University

In the 1950s, young families were moving away from urban areas and creating new suburban communities. While suburbia offered them larger yards and more privacy, it also distanced them from neighborhood necessities. Instead of walking to the market or to school, people had to drive an increasing number of miles to access shops, recreation, schools, and jobs. The suburbs also isolated those who could not get around so easily.

Today the trend is reversing, with people moving back to urban centers and again being at the hub of community life. To support that movement, municipalities and transit agencies needed data on how to provide optimal access to public transportation. MTI researchers initiated 14 site-specific case studies. Based on the resulting data, they provided testimony to local governments, which in turn helped municipalities to plan significant transit-oriented developments.

One development consists of two 10-story condominium towers adjacent to the Tamien multimodal railroad and light-rail station in San Jose, California. The site includes a park-and-ride lot, bicycle lockers, airport parking, municipal bus stops, a CalTrain shuttle, bicycle and footpath access, and a childcare center — all aimed at connecting urban residents with necessary services while reducing automobile trips.

Many other housing developments resemble typical townhome neighborhoods. In Hayward, California, 763 residential units have been built within two blocks of the Bay Area Rapid Transit line, and none of these structures are taller than three stories. Most resemble period architecture, with streetscapes that include trees and historic-looking lightpoles.

UTC Website: http://transweb.sjsu.edu/

Travel Behavior as It Relates to Public Transportation

National Center for Transit Research (NCTR), University of South Florida

NCTR extensively examined the USDOT Surveys — National Personal Travel Survey and the National Household Travel Survey — which are regarded as the most detailed sources of information on ways that people travel nationwide, including their use of public transportation.

The knowledge gained from analyzing these surveys is central to understanding the public's needs and desires, designing transportation services to address them, marketing available services, and influencing policy and investment decisions regarding public transportation and competing modes. The results of this analysis will inform federal policy decisions on public transportation, influence transit-agency service and marketing strategies, impact thinking regarding the design of competitive public transportation, and support the development of planning and modeling tools.

Information from these research efforts is being used in training and educational activities for public transportation professionals as well as in academic courses. Several student theses have focused on this research theme. The research findings have been presented at American Public Transportation Associations (APTA) conferences, in briefings to FTA and USDOT personnel, in numerous research forums, and to media outlets.

NCTR Reports analyzing two major travel surveys:

Exploring the Availability of Public Transportation Services through Analysis of the National Household Travel Survey Appended Data

Public Transit in America: Results from the 2001 National Household Travel Survey

A Framework of Modeling and Forecasting Stop-Level Transit Patronage

The Case for Moderate Growth in Vehicle Miles of Travel: A Critical Juncture in U.S. Travel Behavior Trends

Transit Use Opportunities and Issues for Older Drivers Losing Driving Privileges

A Closer Look at Public Transportation Mode Share Trends

The Role of Density and Captivity in the Success of Public Transit: Observations from the 1995 NPTS

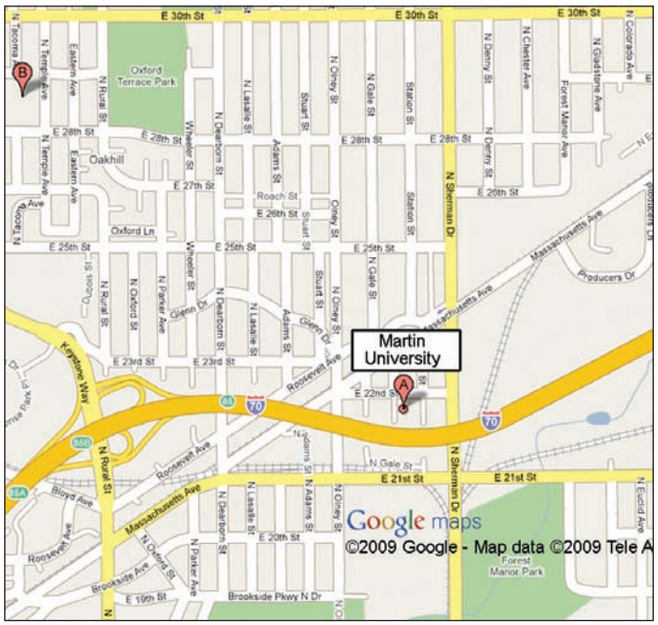
Mobility and Mode Choice of People of Color for Non-Work Travel

Additional funding for this work was provided by Florida DOT.

UTC Website: http://www.nctr.usf.edu/

Mitigating the Impact of Highway Development on a Community

NEXTRANS, Purdue University



NEXTRANS researchers analyzed the impacts of the I-70 renovation on the Martindale-Brightwood community. (©2009 Google)

The Martindale-Brightwood community on the east side of Indianapolis has a long history of heavy-industry and railroad activities in the setting of minority residential population. The neighborhood is traversed by four thoroughfares, each carrying heavy volumes of car and truck traffic. In 1965, construction of the I-70 route divided portions of the established community, causing disruptions to residents and businesses. The community was further compromised when residents were moved to accommodate the Rural Street and I-70 Industrial Park. Much of the area lacks either a major grocery or a drugstore within walking distance, and many blocks of street and sidewalk are in need of repair.

In partnership with the NEXTRANS Center, Martin University undertook a community research, education, and outreach project to explore the negative impacts of the I-70 renovation project, with particular focus on the neighborhood's senior citizens. In the first phase of the project, data were analyzed to identify key issues resulting from the highway construction project. In the second phase, the results were used to facilitate focus-group discussions. Results from both phases were disseminated to the local community, the general public, and business leaders through workshops and outreach events. The project's ultimate goal was to derive innovative solutions for mitigating the impacts of the I-70 renovation while providing opportunities for Martin University students to learn about transportation research methodologies and to engage in community development efforts.

Additional funding for this project was provided by Purdue University.

UTC Website: http://www.purdue.edu/dp/nextrans

Introducing WiFi on Commuter Rails in Utah

Utah Transportation Center (UTC), Utah State University

In April 2008, the Utah Transit Authority (UTA) began full service of the FrontRunner commuter rail line, running from Ogden along a 38-mile route south to Salt Lake City. A major feature of this new rail line is WiFi service onboard the train along the entire route. Researchers provided expertise to assist UTA in having

a functioning WiFi system on board the FrontRunner on Day One. This is the most significant application of WiFi technology on a commuter rail line in this country to date and among the few that have been implemented globally.

UTC contributed to the success of this venture by assessing the technological options available to provide wireless broadband service on the commuter rail in Utah. Researchers identified and evaluated technologies for realizable wireless architecture capable of handling large volumes of voice, video, and data communications in a highly mobile setting. Several existing WiFi deployments were examined and compared in terms of in-train WiFi service and train-to-ground backhaul communication. Newly emerging technologies were also considered and evaluated.

The resulting report, *Evaluation of the Technological Options Available for Providing Broadband Wireless Service on Commuter Rails in Utah*, is available at http://transportation.usu.edu/htm/research.

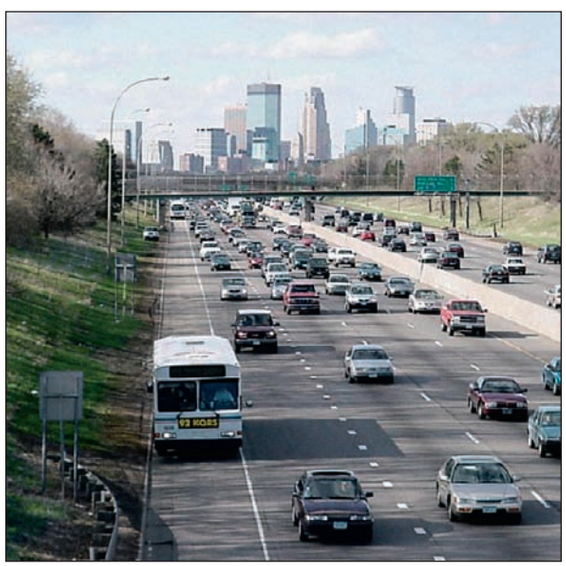
This project was additionally funded by Utah Transit Authority.

UTC Website: http://transportation.usu.edu/

Driver-Assistive Technologies for Bus Rapid Transit

Intelligent Transportation Systems (ITS) Institute, University of Minnesota

FTA has identified Bus Rapid Transit (BRT) as an efficient form of public transportation that uses buses to provide capabilities usually associated with rail transit systems. BRT is both less expensive to implement and more flexible than rail systems. According to the FTA document located at www.fta.dot.gov/documents/MBTATitleVIfinalreport.doc, "BRT combines the quality of rail transit and the flexibility of buses. It can operate on exclusive transitways, high occupancy vehicle (HOV) lanes, expressways, or ordinary streets. A BRT system combines intelligent transportation systems technology, priority for transit, cleaner and quieter vehicles, rapid and convenient fare collection and integration with land use policy."



Lane-assist technology will increase the operational safety of BRT vehicles in narrow lanes, allowing them to operate at higher speeds while maintaining the safety of passengers and the public. (photo: ITS Institute, University of Minnesota)

Because of the limited right of way available to build new (and possibly dedicated) lanes for BRT operations, FTA has identified lane assist as an emerging technology that will enable deployment of BRT systems. The premise behind lane-assist technology is that it will increase the operational safety of BRT vehicles in unique environments such as narrow lanes. It will also allow BRT vehicles to operate at desired higher speeds while maintaining the safety of passengers and the motoring public.

In the Minneapolis-St. Paul metropolitan area, transit agencies provide BRT-like services on a network of narrow, bus-only highway shoulders. Institute researchers have focused on the technologies needed to help buses operate safely and efficiently in these narrow lanes. Specific driver-assistive systems developed at the University of Minnesota include differential GPS receivers and radiofrequency identification readers, used in conjunction with high-accuracy geospatial databases, or "digital maps;" head-up displays that provide information on lane boundaries and nearby vehicles even in low-visibility conditions; rear-end collision-avoidance systems; and lane-departure warning systems that use haptic feedback mechanisms. These technologies are now being deployed on a fleet of buses operated by the Minnesota Valley Transit Authority (MVTA), which will go into BRT service by late 2009.

A final report on this work can be found at http://www.cts.umn.edu/pdf/CTS-04-12Vol1.pdf.

Additional funding for this project was provided by the University of Minnesota Intelligent Transportation Systems Institute, Hennepin County, and MVTA.

UTC Website: http://www.its.umn.edu/

Travel Assistant Device Aids Transit Riders with Special Needs

National Center for Transit Research (NCTR), University of South Florida

The goal of the Americans with Disabilities (ADA) Act is to provide equal opportunity, full participation, and independence to persons with disabilities. USDOT supports this goal by promoting accessible transportation for all, including nearly 50 million Americans with disabilities and the increasing elderly population who can no longer drive. Simple tasks, such as knowing when to pull the cord to indicate the need to exit a bus, can be challenging for people with cognitive disabilities.

The Travel Assistant Device (TAD) that was developed for this project is a prototype software system that can be installed on off-the-shelf, GPS-enabled cell phones to provide informational prompts, such as the recorded audio messages "Get

ready" or "Pull the cord now" and to vibrate to further cue the rider. The rider's real-time location can also be viewed by a trainer or a family member through a website while the rider is traveling independently. To facilitate deployment, TAD utilizes stop and route data provided by transit agencies in the de facto industry standard, Google Transit Feed Specification format.

TAD increases the mobility of the special-needs population, permits transit agencies to train these travelers more efficiently, and reassures their families. Field-test results with cognitively disabled young adults demonstrated that, of 23 skills that a trainee needs to travel independently by bus, TAD supports three: watching for landmarks, recognizing a landmark near the desired bus stop, and signaling to exit at the proper time. TAD also provides confidence and security to individuals using the fixed-route transit system.

Additional funding for this project was provided by the National Science Foundation's Research Experience for Undergraduates program and the Transportation Research Board's IDEA program.

UTC Website: http://www.nctr.usf.edu/

Educational Booklet for Widowed Drivers

New England University Transportation Center (NEUTC), Massachusetts Institute of Technology

In many traditional marriages, the husband does most of the driving. Consequently, a husband's death severely reduces a widow's mobility. This is a critical issue because mobility is essential to managing the necessities of life and maintaining social ties.

Based on a study of widowed drivers, researchers wrote a booklet designed to help widows cope with possible anxieties about becoming their household's primary driver. The booklet *Your Road to Confidence: A Widow's Guide to Buying, Selling and Maintaining a Car* will soon be available. The contents were derived from the responses and comments of widowed drivers who participated in a series of focus-group sessions.

Study participants were women who had great difficulty transitioning to their new role as primary driver, those who experienced little trouble with the transition, and some who relished their newfound independence. The women expressed common concerns about driving, ranging from questions of buying a car to issues of safety. Previously, if they were driving instead of riding as passengers, they could call their husbands if anything went wrong. To manage these stresses, many of the widows said, they bought cell phones or joined AAA or another automobile club.

Many study participants said that they felt empowered by taking charge of their mobility that driving helped them to cope with their grief and reestablish their lives.

Additional funding for the project was provided by The Hartford Financial Services Group.

UTC Website: http://ctl.mit.edu/index.pl?id=5146

North American Older Adult License Policies

Michigan Center for Advancing Safe Transportation Throughout the Lifespan (M-CASTL), University of Michigan

To inform policymakers in the driver-licensing community about best practices for policy, practice, and research relative to older drivers, and to guide the development of a robust, long-term research agenda on older-adult safety and mobility, a two-day workshop with experts in traffic safety and other relevant disciplines was held in Washington, DC. M-CASTL was responsible for managing and coordinating the workshop as well as for editing proceedings papers and summarizing outcomes. The workshop had three primary objectives: to summarize the present state of knowledge regarding older-driver safety as it relates to screening and assessment, to develop a consensus-based set of recommendations that could be used by policymakers and stakeholders, and to identify the most important knowledge gaps and research needs related to older-driver safety.

Workshop planners wanted the event to build on recent knowledge amassed in the field. To that end, findings from several past efforts were reviewed and incorporated into the workshop's framework, and 12 new papers and presentations relevant to older-driver licensing were commissioned. These papers discuss the roles of licensing agencies, clinicians, law enforcement, and families, as well as research needs, the current state of the practice, and best practices.

Participants were a diverse group of internationally recognized experts in older-adult licensing policy, practice, and research. Workshop topics included screening and assessment, license renewal and physician reporting, interventions for at-risk drivers, and elements of model driver-license systems. A list of more than 40 general themes, policy recommendations, best-practice guidelines, and research needs was developed at the workshop. The results are available at www.aaafoundation.org/reports.

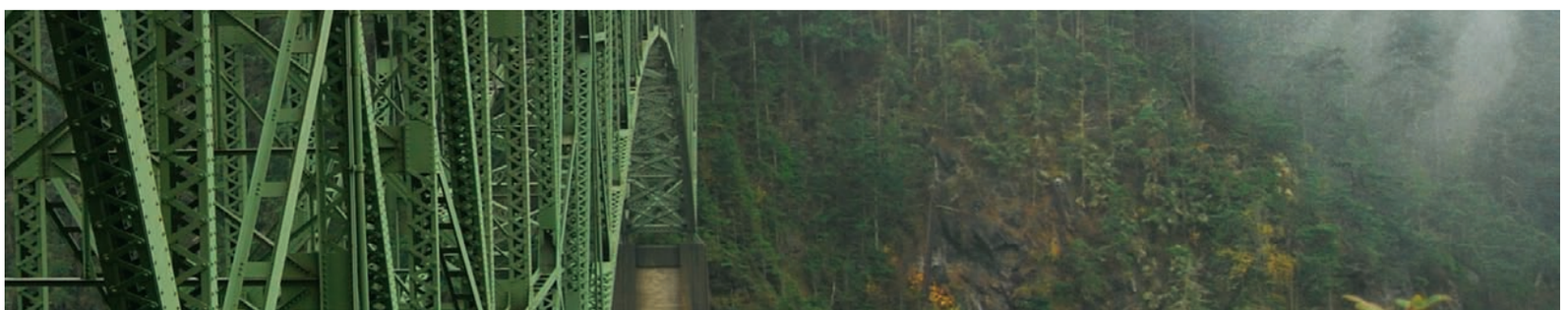
Additional funding for the project was provided by the AAA Foundation for Traffic Safety (AAAFTS).

UTC Website: http://m-castl.org/

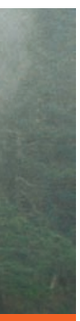
Sustainability must be a principle reflected in all our infrastructure investments, from highways and transit to aviation and ports.

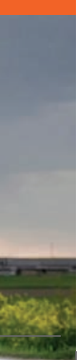
DOT Secretary **Ray LaHood**

Before the Committee on Commerce, Science and Transportation
U.S. Senate, January 21, 2009



Sustainability/Sustainable Transportation





Greenroads: An Environmental Rating System for Design and Construction of Sustainable Roadways

Transportation Northwest (TransNow), University of Washington

TransNow is contributing to the development of Greenroads— an environmental rating system used to distinguish more sustainable new, reconstructed, and rehabilitated roads. The system awards credits for approved sustainable choices and practices and can be used to certify projects.

The Greenroads system provides both a holistic way to consider roadway sustainability and a defined, quantitative means to assess it. It also serves as a tool to aid decision-makers, agencies, consultants, and contractors in making informed design and construction decisions regarding sustainability.

The Greenroads system rates and rewards sustainably designed or rehabilitated roads, instituting a new rating tool nationwide for more environmentally conscious planning and construction.

The ultimate goal is for the Greenroads system to be used as a nationwide standard for the design and construction of more sustainable roads. This will mean less impact on the environment, lower life-cycle costs, and more positive societal outcomes. Greenroads can accomplish this by:

- Defining basic roadway sustainability attributes.
- Allowing a larger population to participate meaningfully in roadway sustainability.
- Allowing sustainability tradeoffs and decisions to be made in a systematic manner.
- Providing a means for sustainability assessment.
- Conferring marketable recognition on sustainable roadway projects.
- Allowing for sustainability innovation because it is end-result-oriented.

Greenroads research is progressing rapidly. TransNow is working closely with CH2M Hill to develop a rating system. An interactive website that demonstrates the rating standard and also accepts and documents applications for Greenroads certification can be found at http://www.greenroads.us/1/home.html.

Information about Greenroads is being disseminated both nationally and internationally. Virginia DOT is considering using it to rate several pilot projects performed in conjunction with the Green Highways Partnership.

Additional funding was provided by the State Pavement Technology Consortium, a group of state DOTs from Washington, California, Minnesota, and Texas.

UTC Website: http://www.transnow.org/

Sustainable Streets: Greening Communities, Improving Mobility

Sustainable Transportation Center (STC), University of California, Davis

Sustainable streets are thoroughfares that apply sustainable-design principles, promote least-polluting ways to connect people and goods to their destinations, and contribute to livable communities.

The Sustainable Streets Project at STC highlighted connections between urban street design and sustainability and introduced a three-part framework for street design that addressed community, ecology, and movement. It also documented the plans and accomplishments of some of the country's largest cities with regard to these issues through a database of case studies that will support additional research efforts. Information was organized according to four themes:

- **Movement Plus:** Higher-volume streets, redesigned to meet sustainability goals ranging from improved parking for bicycles to support of high-density residential infill.
- **Neighborhood Plus:** New and redesigned neighborhoods that seek to foster community values, reduce transportation impacts, and preserve natural resources.

- **Downtown Revitalization Plus:** Projects in older communities that use street design as a tool to spur economic activity and support compact and infill development downtown.
- **Stormwater Plus:** Projects designed primarily to implement stormwater-management features.

Public outreach was a critical component of STC's mission and was essential to the development of strategies for reducing the environmental impacts of automobiles and fostering livable communities. Project findings were disseminated via the STC website and through conferences and online symposia. An online seminar series, held in June and July of 2008 for senior staff from major U.S. cities, provided a forum for researchers and practitioners to present their work on sustainable street design and implementation to their peers and to exchange information. Recordings of the presentations are available at http://stc.ucdavis.edu/outreach/ssp-seminar.php.

Additional funding for this project was provided by California DOT's Division of Research and Innovation and the U.S. Environmental Protection Agency.

UTC Website: http://stc.ucdavis.edu/

Sustainable Transportation Infrastructure Solutions

University Transportation Center for Materials in Sustainable Transportation Infrastructure (MiSTI), Michigan Technological University (Michigan Tech)

MiSTI researchers have focused on the use of recycled and recovered industrial materials in transportation infrastructure. They have integrated this research into solutions for the construction, repair, and maintenance of transportation infrastructure, using their existing expertise in applied transportation materials research.

For example, the use of concrete, which relies on portland cement for its key properties, is ubiquitous throughout the world, and for every pound of portland cement produced, current technologies produce an approximately equal amount of CO_2. Identification of alternatives and additives to offset the use of cement, such as recycled concrete or recovered industrial materials, will reduce CO_2 production while maintaining economic growth and development.

Traditional hot-mix-asphalt technologies rely on petroleum fuels and produce volatile organic compounds (VOCs). Researchers are investigating the use of warm-mix asphalt as a possible alternative that could reduce both fossil fuel dependency and air pollution. Additionally, they are considering the use of recycled materials, such as asphalt pavement and concrete aggregate, and are coming to a better

understanding of the material characteristics of recovered industrial materials, such as fly ash, slag, and cement kiln dust, which will allow them to predict the potential performance of infrastructure incorporating these materials. Use of recycled and recovered materials in pavement and infrastructure design will lead to a reduction in the carbon footprint of transportation infrastructure.

Current projects include:

- Use of Recycled Concrete in Michigan Pavements (sponsor: Michigan DOT)
- Specifications and Protocols for Acceptance Tests of Fly Ash (sponsor: National Cooperative Highway Research Program [NCHRP])
- Synthesis of Railroad Engineering Best Practices in Deep Seasonal Frost and Permafrost Areas (sponsor: Alaska DOT, subcontracted to University of Alaska at Fairbanks)
- Reduction of Minimum Required Weight of Cementitious Materials in Wisconsin DOT Concrete Mixes (sponsor: Wisconsin DOT)

UTC Website: http://www.misti.mtu.edu/index.php

Advanced Ceramic-Metallic Composites for Lightweight Vehicle Braking Systems

Center for Transportation and Materials Engineering (CTME), Youngstown State University

New materials and applications for manufacturing processes are constantly being identified in all modes of the transportation industry. This project examines the development of lightweight components for advanced braking systems as one way to reduce vehicle weight. Gray cast iron had been the material of choice because it is inexpensive; however, it is relatively heavy, which reduces fuel economy and safety. Despite the obvious benefits of lightweight materials, most cannot withstand the stress of a braking system, and others are cost-prohibitive for general use.

Researchers are investigating the properties of interpenetrating phase composites (IPCs) produced by a unique reactive metal penetration process and manufactured by Fireline TCON, Inc. (FTi). The material structure of these composites is substantially different from that of traditional metal- and ceramic-matrix composites, and they exhibit distinctive mechanical, physical, and thermal properties. These properties can be tailored to meet the requirements of specific applications and can reduce costs. The preliminary results were very promising; the IPCs exhibited friction and wear properties similar to those of cast iron, but with half the weight and better thermal conductivity.

Working with Ohio DOT (Trumbull County), CTME researchers have been presenting the advantages of the new braking system with respect to the agency's salt trucks that operate throughout Ohio. Preliminary meetings with officials and mechanics have been encouraging. Meetings at the Trumbull County garage, which houses 30 salt trucks, have addressed the issue of reducing the weight and size of existing braking-system components with use of the new TCON braking system. This would enhance fuel efficiency and increase the system's longevity and effectiveness.

Additional project funding was received from Fireline TCON, Inc.

UTC Website: http://stem.ysu.edu/CTME/

Portable Petroleum Byproducts Chemical Sensor

University Transportation Research Center (UTRC2), City College of City University of New York

Petroleum-contaminated soil and groundwater are the most common contaminants encountered by transportation agencies. Contaminated soils affect the design, construction, and real-estate acquisitions of these agencies. More realistic quantities and bids, minimization of construction delays, and fair compensation for contaminated property would be achieved if "clean" zones could be delineated early in project design. Current methods for determining contamination levels require that soil and/or groundwater samples be collected and sent to an offsite laboratory for analysis, an approach that does not work well for projects with tight design schedules or when unexpected contamination is found during construction.

New York DOT spends approximately $10 to 12 million per year on soil- and groundwater-sample testing. An accurate, real-time method yielding data comparable in quality to standard U.S. Environmental Protection Agency analytical tests would be of great benefit to the state and others in the environmental field.

The purpose of this project is to develop and evaluate a portable petroleum hydrocarbon sensor based on a microconcentrator and nanoparticle fluorescence. This device will be used to test soil samples for levels of petroleum hydrocarbons that include gasoline, diesel fuel, and dielectric fluids containing polychlorinated biphenyls (PCBs). It will provide an accurate and simple field analysis, reducing the time and money spent on laboratory analysis and minimizing the downtime at construction sites waiting for laboratory results.

Several phases of the basic research needed to realize this objective have been completed. The current phase focuses on broadening the range of hydrocarbons that can be detected and developing a prototype device suitable for field use.

The project entailed an innovative partnership among New York DOT, Region 2 UTRC2, and Albany NanoTech, a high-technology research center not traditionally involved in transportation research.

Additional funding was provided by New York DOT.

UTC Website: http://www.utrc2.org/

Hydrogen Fuel Vehicle Infrastructure

Hydrogen vehicle fueling-station components at Missouri S&T. (photo: Dr. John Sheffield)

The hydrogen fuel shuttle bus at Missouri S&T. (photo: Dr. John Sheffield)

Center for Transportation Infrastructure and Safety (CTIS), Missouri University of Science and Technology (Missouri S&T)

Fast-depleting energy resources and growing environmental concerns have encouraged the development of viable, safe energy alternatives, which have become a priority for many engineers and transportation professionals.

Alternative fuel and hydrogen vehicles face many implementation challenges that must be overcome for widespread public use and acceptance. Alternative fuel properties, especially those of hydrogen, can differ drastically from those of traditional fuels such as gasoline and natural gas, creating safety concerns for potential users. CTIS researchers have been working to develop safety codes, standards, and regulations for alternative fuels to alleviate some of these concerns and add to the general knowledge base. They have also deployed a hydrogen demonstration test-bed in rural Missouri. A training session was held for community emergency first responders to acquaint them with the special concerns associated with hydrogen fuel.

CTIS researchers have also contributed to developing the new, more efficient technology needed to transition to a hydrogen economy and, specifically, to devising ways to store, transport, and harness alternative energies. One solution that they have identified consists of the use of composite hydrogen storage cylinders. Pressurized hydrogen storage cylinders with appropriate emergency devices are critical components of hydrogen transportation systems, including vehicle fuel systems, bulk commodity transport, and portable and stationary storage.

The successful transition to an alternative fuel/energy infrastructure system requires fuel availability. Due to the initiative of CTIS researchers, Missouri S&T is now home to the Midwest's first hydrogen-fueling station, known as the Energy, Environment, and Education (E3, or E-cubed) Commons. In August 2008, simultaneous with its opening, the station hosted a stop on the Hydrogen Road Tour, a historic two-week, cross-country trek of a fleet of clean, efficient hydrogen vehicles, sponsored by USDOT. E3 Commons is also home to the EcoCAR Challenge Team, a student design team that will use alternative energy solutions to reengineer a Saturn VUE over the next three years.

UTC Website: http://utc.mst.edu/

Plug-in Hybrid-Electric Vehicles: Collaborative Research

National University Transportation Center (UTC), University of Vermont

Plug-in hybrid electric vehicles (PHEVs) have emerged as a near-term technology to reduce the nation's dependence on imported petroleum, address rising gasoline prices, and decrease carbon emissions associated with the transportation sector. Vermont has a very low carbon-electric generation mix but a very high dependence on personal automobiles for travel. This study, sponsored by Central Vermont Public Service, Green Mountain Power, the Burlington Electric Department, and the Vermont Department of Public Service, examined the impact of deployment of large fleets of PHEVs in Vermont on petroleum displacement, greenhouse gas (GHG) emissions, and the electric grid. Researchers found that:

- The existing electric grid could charge 100,000 PHEVs under a delayed nighttime-charging scenario without adding to system peaks or requiring additional generation and transmission.
- Switching 50,000 existing vehicles from the Vermont fleet to PHEVs could reduce carbon emissions by 31 percent, NOx emissions by 30 percent, and petroleum use by 11.4 million gallons. The miles per electricity equivalent of a gallon of gasoline would be $1.05.

This project demonstrated a strong partnership between the UTC, electric utilities, policymakers, and state planners. The state has funded a second study to continue the research, which will keep focusing on the feasibility of deploying large fleets of PHEVs in Vermont, identified by the state as one of its central transportation strategies.

UTC Website: http://www.uvm.edu/~transctr/

Catalytic Converter Advanced Material Research

University of Rhode Island Transportation Center (URITC), University of Rhode Island

URITC-sponsored research by University of Rhode Island's Department of Chemical Engineering is examining the synthesis of advanced catalytic materials that could enhance automobile performance. The expected outcome is a converter that costs less to produce. Reducing the amount of platinum used in the catalytic converter by at least 50 percent will lower the cost and will make it a less attractive target for criminals. The materials have been found to be environmentally friendly due to their high performance. Maximum conversions are reached at lower temperatures, resulting in fewer pollutants in the atmosphere.

The research has also been funded by Honda. Of 700 proposals that Honda received on a multitude of topics, this was one of only five that were awarded a one-year Honda Initiation Grant (HIG). Honda renews only a small percentage of grants, but it was so impressed with the progress of the research that it renewed the HIG for two more years.

As a result of the research and testing that has been completed, Honda is pursuing two patents for catalysts, to be held jointly with the University of Rhode Island.

UTC Website: http://www.uri.edu/uritc/

Use of Recycled/Recovered Industrial Materials in Transportation Infrastructure

University Transportation Center for Materials in Sustainable Transportation Infrastructure (MiSTI), Michigan Technological University (Michigan Tech)

Balancing the economic costs, environmental impacts, and social attributes of transportation infrastructure is a complex problem requiring a systemwide solution. MiSTI researchers are helping state agencies and other stakeholders to explore opportunities for greater use of recycled and recovered industrial materials in the construction of transportation infrastructure.

The stakeholder community, facilitated by MiSTI and known as MichRIM, comprises representatives from MDOT and Department of Environmental Quality offices as well as the U.S. Environmental Protection Agency, material providers, contractors, and county road association members. The purpose of MichRIM is to develop a better understanding of current practices related to the increased use of recycled and recovered materials by reviewing successes in other states, looking

at new applications, and attempting to identify obstacles prohibiting or restricting the use of these materials in Michigan.

Recovered industrial materials being considered by MichRIM include fly ash, blast-furnace slag, and cement- and lime-kiln dust. Recycled materials under review include concrete, asphalt, shingles, tires, and glass. These materials, which once were landfilled, are now being applied in civil infrastructure, reducing accumulating landfill waste while replacing materials that contribute to greenhouse gas emissions, carbon dioxide production, and global warming.

MiSTI, working with a subcommittee of the larger stakeholder community, is conducting "discovery calls" to individual stakeholder groups to gather independent input and feedback on agencies' roles and potential obstacles. The information obtained will serve as the basis for a white paper, which MiSTI will present to stakeholders. A technical meeting to address key issues is planned for later this year. The meeting will update stakeholders on current applications and opportunities for increased use, showcase new research, and provide a systemwide approach to understanding sustainability as it relates to transportation infrastructure.

For more information, contact misti@mtu.edu.

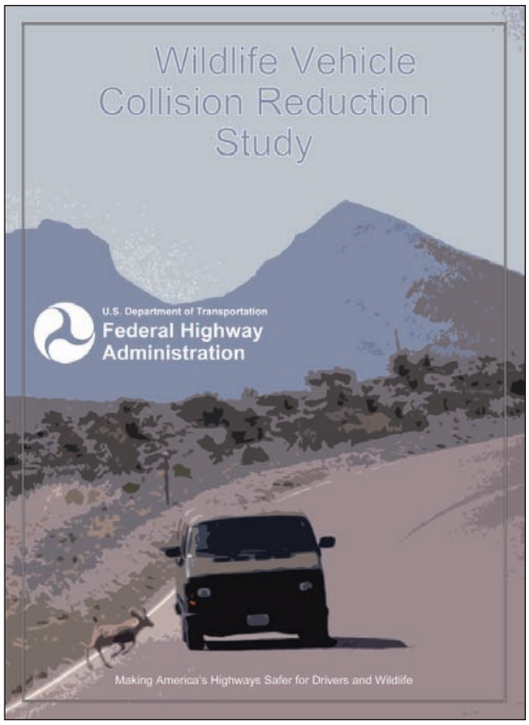
UTC Website: http://www.misti.mtu.edu/index.php

National Wildlife Vehicle Collision Reduction Study

Western Transportation Institute (WTI), Montana State University

America's highways enable people and products to travel safely and efficiently throughout the nation. These roads cut across the habitat of many wildlife species. Collisions can and do occur between wildlife and vehicles, presenting a real danger to human safety as well as wildlife survival. State and local transportation agencies are seeking ways to balance meeting travel needs with ensuring human safety and conserving wildlife.

On behalf of the FHWA, the Western Transportation Institute, in partnership with the Louis Berger Group, Inc., completed a national study detailing the causes and impacts of wildlife vehicle collisions and identifying potential solutions to this growing safety problem. Their report, submitted to Congress in 2007, focuses on tools, methods, and other measures that reduce the number of collisions between vehicles and large wildlife such as deer because these accidents present the greatest danger to travelers and cause the most damage. The report synthesizes and analyzes research from the United States, Europe, and Australia. Researchers calculated numerous metrics to estimate the severity of the problem. Their findings included:



- There are an estimated 725,000 to 1,500,000 crashes between vehicles and large-hoofed animals every year in the United States.
- The annual impact on humans is more than 200 human fatalities, approximately 29,000 personal injuries, and over $1 billion in property damage.

The study identifies and evaluates 34 techniques for reducing the number of wildlife-vehicle collisions. Benefits, costs, effectiveness, implementation guidelines, and case studies are presented for each method.

Ongoing phases of the project involve the development of a manual of best-mitigation practices and a training course based on the findings of the report. These technology-transfer materials will educate transportation professionals about effective collision-reduction methods and ways that they can begin to incorporate them into their own highway projects.

The report is available at http://www.wti.montana.edu/RoadEcology/documents/Wildlife_Vehicle_Collision_Reduction.pdf.

UTC Website: http://www.wti.montana.edu/

The Clean Snowmobile Challenge

National Institute for Advanced Transportation Technology (NIATT), University of Idaho

"Yellowstone National Park and the University of Idaho have had a long-term working partnership on projects such as biodiesel demonstration and the Clean Snowmobile Challenge. NIATT's continuing support of the development of clean, quiet snowmobiles has proved to be very beneficial to Yellowstone Park and more importantly, to the National Park Service."

— Jim Evanoff, Environmental Protection Specialist, Yellowstone National Park (informal correspondence with NIATT, August 1, 2008)

Due in part to stringent noise and air pollution control measures recently imposed on snowmobiles by the National Park Service, the Society of Automotive Engineers (SAE) instituted a student competition called the Clean Snowmobile Challenge

The direct-injected, two-stroke-powered snowmobile uses ethanol fuel, reduces pollution emissions, and decreases sound emissions while maintaining stock power and handling characteristics. (photo: © Michigan Technological University)

(CSC). CSC encourages the development of a snowmobile that meets or exceeds specific required pollution and noise control measures while maintaining or improving performance. Since 2002, NIATT's Clean Snowmobile Team has won the CSC title three times.

From 2005 to 2007, the team developed a direct-injected, two-stroke-powered snowmobile, which captured first place in the CSC competition in 2007. Direct injection reduces the amount of fuel needed by the engine by eliminating unburned fuel in the exhaust. The snowmobile utilizes E-85 ethanol fuel, which doubles fuel economy, reduces pollution emissions by 80 to 95 percent, and decreases sound emissions by a factor of ten as compared with a typical snowmobile while maintaining stock power and handling characteristics.

The team followed the Mechanical Engineering Department's Idaho Engineering Works, an innovative model for developing leadership skills among graduate student mentors, senior design students and other undergraduates, and faculty. This approach produces an environment that fosters professional and technical excellence by focusing on human dynamics, communication, teamwork, and professionalism.

The Clean Snowmobile Challenge is unique among SAE student competitions, as it addresses not only technology improvements but also political challenges of recreational vehicle use in sensitive environments such as Yellowstone National Park. The results that have been achieved by the University of Idaho and other universities have been very influential in the development of the Record of Decision and the implementation policy for snowmobile use in Yellowstone.

The University of Idaho Clean Snowmobile Team received the first-place award in the 2007 Clean Snowmobile Challenge. (photo: © Michigan Technological University)

There was strong stakeholder interest in the outcome of this work, as demonstrated by the additional funding received from many private-sector companies, including Bombardier Recreational Products, Wiseco, Fastenal, Nex-Tech, E-Lab, Alaska Mining and Diving Supply, Slydog, Aristo, Klim, Jimmy G's Motorsports, Blue Ribbon Coalition, Idaho State Snowmobile Association, and Latah County Snodrifters. Funding was also provided by the College of Engineering and the Mechanical Engineering Department at the University of Idaho.

UTC Website: http://www.webs1.uidaho.edu/niatt/

Motor Carrier Tracking and Interdiction Study

Mineta Transportation Institute (MTI), San Jose State University

In April 2007, a petroleum tanker crashed and exploded on a freeway in Oakland, California. The intense heat affected the supporting steel's temper, literally melting the structure. This necessitated the closure of a major accessway to the San Francisco Bay Bridge, which severely impacted commuter traffic. As a result of this accident, the California DOT (Caltrans) asked MTI's National Transportation Security Center to examine whether terrorists could use similar methods to cripple the state's transportation infrastructure.

In response to this request, MTI's transportation security team conducted the Motor Carrier Tracking and Interdiction Study and developed a preliminary definition of the threat and potential remedial actions. The results were shared with state security leaders. MTI's first detailed preliminary report on longer-term security options was delivered to Caltrans and the California Office of Emergency Services within 30 days. The study is now in its second phase, which involves examining the transport of toxics as well as combustibles.

UTC Website: http://transweb.sjsu.edu/

Infrastructure Security and Emergency Preparedness: Emergency Evacuation in Delaware

Delaware Center for Transportation (DCT), University of Delaware

Although Delaware has never been hit directly by a hurricane or experienced the fallout from a nuclear accident, the state has plans in place to deal with such disasters. The challenge is to increase public awareness about the plans.

To provide the state with suggestions for improving the development and dissemination of its disaster plans, researchers reviewed the current documentation for hurricane evacuation in Delaware, as well as that for emergency evacuation in Delaware and neighboring New Jersey for the Salem and Hope Creek nuclear power generators. They discovered a general lack of proactiveness about emergency preparedness, noting that, though a siren system is used to warn of nuclear accidents in Delaware, people in houses with windows shut might not hear the alarms. In addition, information dissemination is largely Internet-based, and many people, including tourists, lack access to computers.

Additional project funding was received from Delaware DOT, the Disaster Research Center, the National Science Foundation, and the University of Delaware.

UTC Website: http://www.ce.udel.edu/dct/

A Network Robustness Index as a Transportation-Planning Tool

National University Transportation Center (UTC), University of Vermont

Transportation planning, especially when it involves highway-capacity expansion, has traditionally relied on the volume-to-capacity (V/C) ratio to identify "highly congested" or critical links. This has often resulted in localized solutions that do not consider systemwide impacts related to congestion, security, and emergency response.

Recent major catastrophic events, such as Hurricane Katrina in 2005 and the World Trade Center attacks of September 11, 2001, highlighted the need for increased consideration of robustness in network design and optimization of critical infrastructures. The dynamics of disruption models for transportation networks are different than those for other infrastructure networks, such as telecommunications and electrical power.

For the last four years, a transdisciplinary, international research group, comprising experts in engineering, business, and geography, has worked to develop the Network Robustness Index (NRI), a comprehensive, systemwide approach to identifying critical links and evaluating overall transportation-network performance. The NRI is calculated with data generally available from the transportation-planning models of most states and regions. The research is based on the premise that a fundamental change in highway network design philosophy is needed — rather than identifying individual congested or critical links, infrastructure management should focus on maximizing the robustness of the overall transportation system and on minimizing system vulnerability.

Unlike other measures, the NRI accounts for both networkwide demand and traffic rerouting. It can also be used for emergency and security purposes to evaluate the overall resiliency of the network to disruption.

UTC Website: http://www.uvm.edu/~transctr/

Symposium on Climate Change and Transportation: Impacts and Solutions

University of Massachusetts Transportation Center (UMTC), University of Massachusetts, Amherst

The University of Massachusetts Transportation Center and H3B Media Ltd. cosponsored a Climate Change Think Tank Symposium on May 29–30, 2008. The symposium provided a venue for some 75 industry leaders and government representatives to share information about how transportation contributes to climate change, as well as the environmental impacts of climate change on the U.S. transportation infrastructure. The interrelationship between climate change and the planning, management, and operations of transportation facilities and services was also addressed.

UTC Website: http://www.ecs.umass.edu/umtc/index.shtml

With population, urbanization, and the need for infrastructure expansion and renewal projected to increase over the next several decades, the demand for transportation professionals could become more acute. If the needs of a growing society that is increasingly dependent on a functioning transportation system are to be met, steps must be taken to motivate students to choose transportation as a career. A highly qualified workforce is very important to state DOTs, local communities, and the private sector.

Georgia Transportation Institute, Georgia Institute of Technology

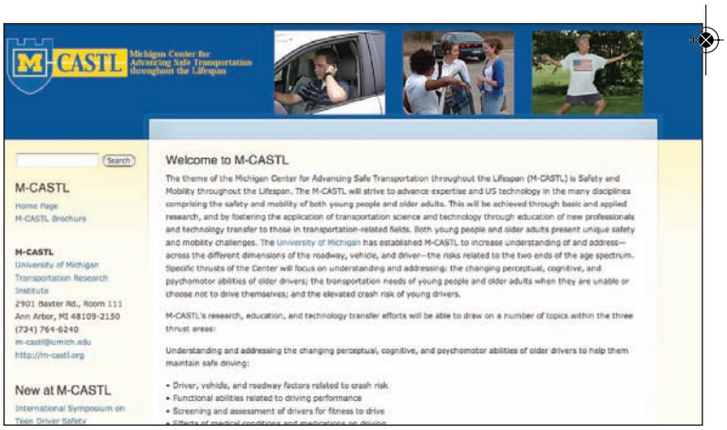
(from unpublished report on Georgia Institute of Technology's UTC project
"Transportation Engineers of the Future"
submitted to UTC program office October 2008)

Workforce Development

Website for UTC

Michigan Center for Advancing Safe Transportation Throughout the Lifespan (M-CASTL), University of Michigan

The construction of a website (http://m-castl.org) provided M-CASTL with visibility and the means to disseminate information to help ensure that resources and information about Center activities are available to M-CASTL staff, the public, researchers submitting proposals, advisory board and executive committee members, and interested colleagues.



The University of Michigan's M-CASTL website includes information about Center activities, resources, and research proposals as well as a program of interactive web-based modules on mobility and safety education.
(courtesy M-CASTL, University of Michigan)

The website interface allows staff to easily update the site by adding new text, photographs, video, and webpages. As the Center has grown over the past year, the website has been continually updated to reflect changes. Following the successful hosting of M-CASTL's first annual Transportation Research and Education Conference, for example, videos and slides were added. Once items have been added, the content is automatically fit to the website template.

As part of M-CASTL's global education program, interactive web-based modules will be featured on the website with the aim of providing information about issues related to the safety and mobility of young and older drivers. Users will be able to learn at their own pace by moving through the entire program of modules.

UTC Website: http://m-castl.org/

Integrating a Service Learning Approach to Transportation Education

Oregon Transportation Research and Education Consortium (OTREC), University of Oregon

These students are participating in a project to develop evaluation tools related to Lane Transit District's Emerald Express (EmX) Bus Rapid Transit System in the Eugene-Springfield area. (Photo: Mike Bray)

Educating future transportation workers is as much a part of OTREC's mission as is conducting research. At OTREC, service learning is a widely used educational model that provides teams of students with hands-on experience in developing products for real-world clients. Recent projects have included a student-led evaluation of the City of Eugene's 4J School District travel behavior, aimed at reducing automobile trips and charting a more walkable community, and work that culminated in the development of the new Eugene Pedestrian and Bicycle strategic plan. A report summarizing the experiential service learning approach and the Strategic Plan can be found at http://otrec.us/main/show_abstract.php?prop_id=51.

The service learning approach will also be used in an upcoming project to study the bus rapid transit system in the Lane County Transit District. Combined teams of first-

year students managed by second-year graduate students have produced high-quality work for local municipalities and in some cases have also contributed to scholarly research objectives. This is a unique model that OTREC can offer to the nation.

UTC Website: http://otrec.us/content/

Guide to Transportation Funding Options: New Website

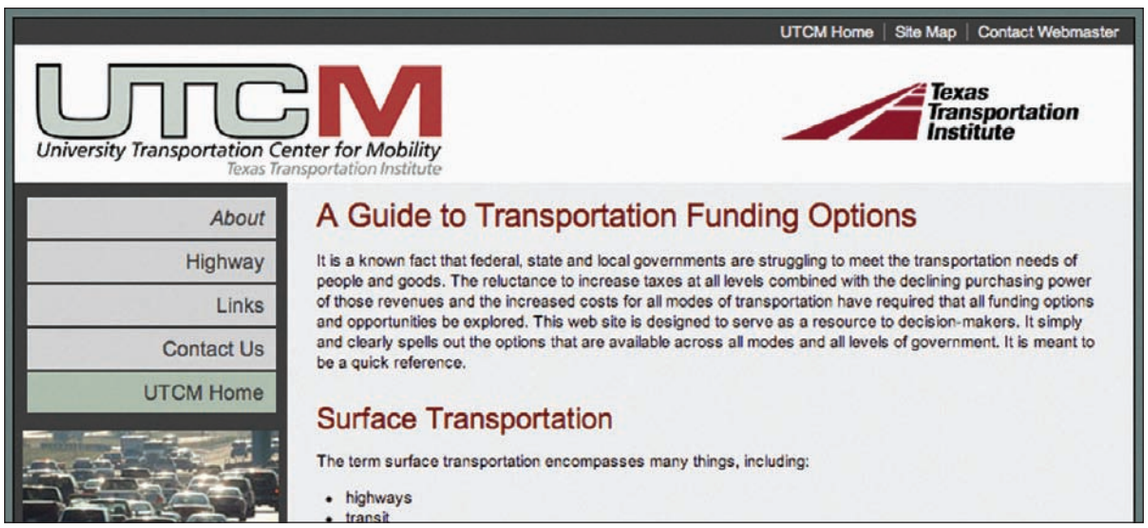
Texas Transportation Institute (TTI), Texas A&M University

To help transportation leaders and policymakers obtain the information and data that they need to make funding decisions, researchers at the Texas Transportation Institute developed a concise, user-friendly website, A Guide to Transportation Funding Options (TFO). TFO describes the array of such options available throughout the country and includes links to projects that are utilizing them.

In the first phase of the project, highway funding was examined; subsequent phases will focus on other modes of surface transportation. In the next phase, researchers at the Institute's Transit Mobility Program plan to develop a similar website for mass transit.

TFO site developers encourage feedback and contributions of material by other transportation-funding experts. For more information, visit http://utcm.tamu.edu/tfo.

UTC Website: http://tti.tamu.edu/



The new website helps transportation experts by compiling the funding options available throughout the country and includes links to projects that are utilizing them. (courtesy UTCM, Texas A&M University)

September 11th Memorial Program: Academic Initiative

University Transportation Research Center (UTRC2) City College of City University of New York

UTRC2 provides significant support for the September 11th Memorial Program for Regional Transportation Planning on behalf of the New York Metropolitan Transportation Council (NYMTC), the MPO for the New York City region. The initiative fosters the academic and professional development of students from UTRC Consortium schools by providing opportunities to participate in innovative research and planning projects. NYMTC established the program in 2005 to honor the memory of three of its employees who died during the attack on the World Trade Center. Thirteen students participated during the first three years of the program, and five additional candidates have been selected for the fourth year.

At the outset of the application process, NYMTC solicits internship possibilities from its nine members. Supervision is provided by sponsoring-agency staff to ensure that project outcomes are customized to meet the goals and objectives of both the agency and the region. Students are paid a monthly stipend funded by NYMTC in addition to receiving tuition grants.

The accomplishments since the program's inception reflect the wide range of regional benefits gained through students' efforts as well as the array of work products. The projects exemplify collaboration with clients and users, addressing critical transportation issues and creative problem-solving.

Examples of students' research and internship projects are listed below.

Completed Research (Years 1–3)	Agency Beneficiary
Time-of-day pricing strategies to develop better transit-management strategies in Westchester County	Westchester County DOT
Transit services for older adults in Westchester County	Westchester County DOT
Relationship between built environment and time-of-day ridership patterns at subway stations	Metropolitan Transportation Authority
Parking regulations and supply/demand issues in NYMTC region	NYMTC
Optimal incentive structures for encouraging diesel retrofits	New York City (NYC) DOT
Identification and modeling of next-generation travel guidance systems	New York State DOT
Participation in NYCDOT West Side Manhattan traffic and transportation study	NYCDOT

Completed Research (Years 1–3)	Agency Beneficiary
Development of five-part strategy to formalize NYMTC's data-management practices	NYMTC
Examination of NYMTC's shared goals and procedures, resulting in forum "Good to Go: Transit Options for Older Adults"	NYMTC
Coordination of human services–public transit planning	NYMTC
Pedestrian and traffic-safety planning	NYCDOT
Mobile-source-emissions reduction planning	NYMTC

UTC Website: http://www.utrc2.org/

Transportation Scholars Program

Midwest Transportation Consortium (MTC), Iowa State University

MTC is committed to educating the next generation of transportation professionals. At the heart of this mission is the Transportation Scholars Program for graduate students in transportation-related degree programs such as civil engineering and community and regional planning.

Since 1999, MTC has supported 20 to 30 students annually as research assistants. These student researchers work with transportation faculty on real-world projects, preparing them to interact with transportation professionals in their careers. Academic requirements include enrollment in the Transportation Seminar and participation in the annual Transportation Scholars Conference and paper competition.

Transportation Seminar. The Transportation Seminar, held each spring semester, features nationally and internationally recognized speakers. Topics covered in the 2008 seminar included safety corridors, rapid concrete replacement, highway safety, human factors research, and MPOs. The seminar is broadcast in real time over the Internet, allowing students at remote sites to participate actively.

Transportation Scholars Conference. Students at all MTC member schools are invited to submit their original research papers to the Transportation Scholars Conference, held each year at Iowa State University. The papers are judged by an outside panel, and the author of the best paper is awarded a cash prize of $1,000.

MTC Scholar of the Year. An MTC Scholar of the Year is chosen on the basis of outstanding research and scholarship. Award recipients have gone on to successful careers in transportation. The 2003 Scholar of the Year, Jamie Tunnell Bents, now

a transportation planner at Snyder & Associates in Ankeny, Iowa, describes her experience: "The Scholar of the Year designation helped me step up my studies and research and pushed me to better focus on my future career. The MTC allowed me to meet more professionals in the transportation sector and helped me decide how I wanted to fit into the sector after graduation."

UTC Website: http://www.intrans.iastate.edu/mtc/index.htm

Competency Model for the Recruitment, Retention, and Development of Intermodal Transportation Workers

National Center for Intermodal Transportation (NCIT), University of Denver and Mississippi State University

Faced with a possible shortage of qualified professionals in the next 10 years, the transportation industry has held "workforce summits" to identify workforce development needs of state DOTs and transit agencies. However, no similar effort has been made to address specific needs of the intermodal industry.

The goal of this project is to create a valid model of managerial and executive competencies needed to recruit, assess, train, and develop the executives and managers who will guide the intermodal transportation industry. To provide a conceptual basis for the research, NCIT convened a one-day workshop for human resource executives in the intermodal industry in February 2008. Attendees identified nine key competency areas needed to produce high-functioning employees in the industry:

- Strategic Thinking
- Leadership Skills
- Analytical Skills
- Marketing Skills
- Technical Skills
- Business Management Skills
- Communication Skills
- Financial Skills
- Cultural Awareness Training

Based on this framework, data collection will further delineate the behavioral indicators and benchmarks needed to successfully assess these competencies. The final result will be a tool that can identify the training and development needs of current and future transportation workers.

UTC Website: http://www.du.edu/transportation/AboutITI/index.html

Use of Campus "Smart" Buses as a Tool for Empirical Education and Research

Ohio Transportation Consortium (OTC), University of Akron

Ohio State University's (OSU) Campus Area Bus System (CABS) incorporates a smart-bus system that offers advanced automatic vehicle location (AVL) and automated passenger-counting (APC) capabilities. The system provided the impetus to develop a unique infrastructure for education and research, the OSU Campus Transit Lab (CTL).

In this project, investigators designed educational demonstrations and exercises based on CTL data, identifying three ideas for implementation in the curriculum:

- Use of empirical space-time vehicle trajectories, collected with the CTL AVL system, to illustrate traffic concepts. Theoretical trajectories are currently used.
- Use of passenger data, collected from the CTL APC system, and headway, dwell-time, and travel-time data, from the AVL system, for calculations of empirical passenger-travel times. Travel-time calculations currently rely on hypothetical values.
- Use of passenger-boarding and -alighting data to investigate effects on the length of bus-dwell times at stops. These data are currently collected manually.

The first two ideas would be incorporated into a large undergraduate transportation-engineering course, while the latter concept would be presented in a smaller, graduate-undergraduate elective public transportation course. Empirical data were collected to test the identified ideas. Because the CTL had not yet been implemented, data were collected manually; however, they are similar to data that will be available from the CTL system. Researchers are exploring potential uses of the unique data for educational activities at partner universities.

This research project involves the collaborative efforts of OSU Transportation and Parking Services and Clever Devices, Inc.

UTC Website: http://www.otc.uakron.edu/about.php

Global Transportation Supply-Chain Management: Building a Global Network of Scholars and Educators

Intermodal Transportation Institute (ITI) and University Transportation Center (UTC), University of Toledo

Research on global supply-chain management/transportation efficiency systems is critical to U.S. competitiveness. With the expansion of international trade, the

necessity of bringing together ideas, approaches, and solutions for the transportation that supports this flow of goods is vital to the United States and its trading partners. In one year, researchers have brought together more than 100 faculty members, researchers, and transportation practitioners in two international symposia, representing more than 20 universities in seven countries.

Global supply-chain management integrates information, material, and cash-flow processes across all functions, including sourcing, operations, return and recycling, and logistics and planning, for all partners. Supply-chain system professionals are the agents of change for e-business, manufacturing, high-tech, service, and consulting companies.

The objectives of the UTC project are (1) to engage an international network of research collaborators to identify, analyze, and solve complex transportation and supply-chain problems and communicate solutions for successful implementation, and (2) to develop educational and training programs that meet the needs of transportation, logistics, and supply-chain professionals around the world.

The first International Symposium and Workshop on Global Supply Chain, Intermodal Transportation, and Logistics Management was attended by over 80 academics, transportation practitioners, and students. The second symposium, held in Busan, Korea, in May 2008, brought together 64 researchers to discuss ideas, build partnerships, and identify specific actions that will foster future collaborations. Future meetings are planned in India (January 2009), Madrid (2009), and Spain (2010).

The 3rd National Urban Freight Conference took place in October 2008 and provided a unique opportunity for collaboration. METRANS also sponsored a one-day workshop of UTC researchers and other stakeholders in conjunction with the Midwest Regional UTC.

Additional funding for this project was provided by the University of Toledo College of Business Administration; Bowling Green State University; University of Detroit-Mercy; Great Lakes Maritime Research Institute; Toledo-Lucas County Port Authority; Business and International Education Grant (funded by the U.S. Department of Education); Pusan National University; Korean Society of Supply Chain Management; Korea Research Foundation; and Korea Science and Engineering Foundation; and International Cargo Handling Coordination Association, LLC (London).

UTC Website: http://www.utoledo.edu/research/ITI/index.html

Integrating Transportation Technology and New Educational Paradigms

National Institute for Advanced Transportation Technology (NIATT), University of Idaho

NIATT is recognized for its focus on real-world skills centered on practical applications and fieldwork. In the last 10 years, NIATT has maintained a close link between the development of new transportation technology and its integration into the classroom setting.

In 1998, NIATT met a challenge from FHWA to develop a new technology, the Controller Interface Device (CID), which directly links real traffic controllers with microsimulation models in a process known as hardware-in-the-loop simulation. Two years later, NIATT initiated the annual Traffic Signal Summer Workshop, a one-week, hands-on experience with traffic control systems based on the CID. Since 2000, the workshop has been attended by students from around the country, and the CID has been used by more than 40 organizations.

The success of the CID and the Traffic Signal Summer Workshop led to a project to develop a new traffic-signal workshop that could be delivered across the United States. The NIATT team developed a simulation infrastructure known as software-in-the-loop simulation, as well as a laboratory curriculum that will be delivered to FHWA in January 2009 after extensive testing.

Another project involves researching the incorporation of learning methods into the introductory (junior-level) transportation-engineering course. This topic, along with learning objectives and new ways to share the curriculum electronically, will be the focus of a national conference in June 2009.

A project to continue developing technology applications for transportation education began in September 2008. Through the Regional X Transportation Consortium, a collaborative team, led by NIATT, will develop and test four 10-week modules that will be delivered by distance-education methods to university students and state DOT staff in the Pacific Northwest.

Additional funding for these projects was provided by the UTC program, FHWA, PTV America (Portland, Oregon), Econolite Traffic Control Products (Anaheim, California), McCain Traffic Supply (Vista, California), and the Region X Transportation Consortium.

http://www.webs1.uidaho.edu/niatt/

CSU's summer teachers conference K-12 teachers learn from Shaker heights physics teacher, Joe Marencik, how high-school math and physics courses can easily be adapted to include engineering applications. The wind tunnel in this demonstration was purchased with Garrett Morgan program funds.

Professor Chin Kuo discusses basics of hydrology and flooding with K-12 teachers regarding New Orleans and Hurricane Katrina at CSU's summer teachers conference. (photos: Cleveland State University)

Teaching Engineering in the K-12 Classroom: Summer Conference

Cleveland State University Transportation Center (CSU-UTC), Cleveland State University

To address the perceived faltering of interest in engineering careers, CSU-UTC held a three-day Engineering Education Summer Conference for K-12 educators. The intent was to bridge the gap between the educators and engineering faculty. Twenty-three teachers and administrators from nine districts throughout Ohio and Michigan learned firsthand how they could teach engineering and plant seeds of awareness regarding careers as transportation professionals.

At the conference, the Shaker Heights City School District offered its preengineering program, the Engineering Applications Course, as a model to demonstrate how a standard physics and advanced mathematics curriculum could easily be adapted to include engineering applications such as wind tunnels, propeller design, slot cars, and robotics.

Teachers attended presentations and engaged in discussions with engineering faculty on topics ranging from GPS to biomedical research at the Cleveland Clinic. Participants also were given a tour of the Great Lakes Science Center.

Additional funding for the conference was obtained from the Garrett A. Morgan Technology and Transportation Education Program.

UTC Website: http://www.csuohio.edu/engineering/utc/

Transportation Research and Education Conference

Michigan Center for Advancing Safe Transportation Throughout the Lifespan (M-CASTL), University of Michigan

M-CASTL held its first annual Transportation Research and Education Conference in May 2008 at the University of Michigan, bringing together a diverse group of researchers and professionals with an interest in the safety and mobility of young and older-adult drivers. Keynote addresses were given by Dr. Bruce Simons-Morton from the National Institute of Child Health and Human Development ("The Young Driver Problem: Causes and Solutions") and Jacqui Smith from the University of Michigan Institute for Social Research ("Functional Diversity Is a Fundamental Characteristic of Aging: Implications for a Changing Society"). Panel discussions focused on young-driver distraction and drowsiness, technology to improve driving for young and older drivers, driving and dementia, and transitioning from driving to nondriving options.

Signifying a wide variety of backgrounds and interests, the conference was attended by professionals from MDOT, the Michigan State Police, the Office of Highway Safety Planning, the Office of the Secretary of State, AAA Michigan, the Ann Arbor Veterans Administration Medical Center, and automobile-industry representatives.

The conference provided a valuable opportunity for participants to learn about ground-breaking research in the area of safety and mobility, to discuss practical applications for professionals working in the field, and to identify future research needs.

Additional funding for this conference came from AAA of Michigan; Access Mobility Center, ADED–The Association for Driver Rehabilitation Specialists; Advantage Mobility Outfitters; Driving Evaluation, Education, and Research (DEER) Center; and Munson Medical Center.

UTC Website: http://m-castl.org/

First Annual Student Conference on Transportation and Congestion

Center for Multimodal Solutions for Congestion Mitigation (CMS), University of Florida

CMS held its First Annual Student Conference in March 2008. The conference showcased projects from eight CMS-affiliated graduate students from the University of Florida, departments of civil engineering, industrial and systems engineering,

occupational therapy, and urban and regional planning. Presentations were made on the following topics related to transportaion and congestion:

- "Breakdown Probability Model at Freeway Ramp Merges Based on Driver Behavior"
- "Optimal Dynamic Pricing Strategies for High Occupancy/Toll (HOT) Lanes"
- "Enhancing Traffic Crash Data with Supplemental Collection Systems"
- "Complexity Analysis of Network Flow Problem with Arc Reversals"
- "Modeling the Departure-Time Choice for Home-to-Work Commute Travel"
- "Discrete-Time Dynamic Traffic Assignment Model for Managed Lanes"
- "A Method for Predicting Network Distance Using Network Shortest Distance and Spatial Interpolation"
- "Florida as a Model State for Older Drivers"

The conference was attended by University of Florida faculty, students, and staff and transportation professionals from FDOT, the City of Gainesville, and various consulting firms.

UTC Website: http://cms.ce.ufl.edu/

Students of the Year

Each year at the annual winter meeting of the Transportation Research Board, the department honors the most outstanding student from each participating UTC for his/her achievements and promise for future contributions to the transportation field. The Students of the Year are selected based on their accomplishments in such areas as technical merit and research, academic performance, professionalism, and leadership. Continuing the tradition of One DOT, the Department also honors a student from the Air Transportation Centers of Excellence Program, sponsored by the Federal Aviation Administration. In this section we list the students who have achieved this honor in 2007 and 2008, along with a brief description of their areas of research.

2008 Outstanding Students of the Year

Eddie Arpin
ITS Institute, University of Minnesota
Area of Research: Research on developing a vehicle positioning system to work in urban environments.

Sean J. Barbeau
National Center for Transit Research, University of South Florida
Area of Research: Intelligent mobile systems.

Christo Brehm
Oregon Transportation Research and Education Consortium, University of Oregon
Area of Research: Community planning and landscape architecture.

Sam Cheung
University of Rhode Island Transportation Center, University of Rhode Island
Area of Research: Effective deployment of dynamic messaging signs.

Krista Citron
Southeastern Transportation Center (Region 4), University of Kentucky
Area of Research: Transportation systems management.

Stephen J. Damin
Mid-Atlantic Universities Transportation Center (Region 3), The Pennsylvania State University
Area of Research: Traffic operations, transportation planning, transportation safety, and roadside design and management.

Angelica J. Daniel
National Transportation Center, Morgan State University
Area of Research: Highway design.

Duane Davis
Alaska University Transportation Center, University of Alaska, Fairbanks
Area of Research: Merging fundamental concepts from both mechanical and civil area engineering, seeking to understand changes in material performance behavior in the arctic, and using those observations to provide useful solutions.

Phillip R. Donovan
FAA Center of Excellence for Airport Technology, University of Illinois at Urbana-Champaign
Area of Research: The influence of offset wheel loads on the strength and durability of unbound aggregate layers in airport pavements.

Aaron Elias
University of Florida University Transportation Center, University of Florida, Gainesville
Area of Research: International construction practices; transportation/land development issues.

Daniel J. Findley
Center for Transportation and the Environment, North Carolina State University
Area of Research: Transportation engineering.

Nancy A. Gallagher
Transportation Research Institute, University of Michigan
Area of Research: Examining the relationship of psychosocial influences (such as self-efficacy), neighborhood environmental influences, and mobility limitations on neighborhood walking in older adults.

Adam Gardner
National Center for Metropolitan Transportation Research, University of Southern California
Area of Research: The potential for additional privatization in the airport and aviation industry.

Brian Geiger
University Transportation Center, Kansas State University
Area of Research: Light rail in the Kansas City area.

Russell Griffin
University Transportation Center, University of Alabama, Birmingham
Area of Research: Trauma epidemiology.

Matthew Hardy
George Mason University–Transportation and Economic Development Research Center, George Mason University
Area of Research: Metropolitan planning and modeling of interdependent public policies.

Nicholas Harker
National Institute for Advanced Transportation Technology, University of Idaho
Area of Research: Engine design, development, and calibration for ethanol-gasoline blended fuels. This work is focused on improving emissions, efficiency, and power output.

Salvador Hernandez
NEXTRANS (Region 5), Purdue University
Area of Research: Freight transportation systems and logistics.

Doug Houston
University of California Transportation Center (Region 9), University of California, Los Angeles
Area of Research: Temporal and spatial distribution of diesel truck traffic on surface streets in adjacent communities.

David S. Hurwitz
University of Massachusetts Transportation Center, University of Massachusetts, Amherst
Area of Research: Static and dynamic evaluation of the driver speed perception and selection process.

Daniel Krier
Oklahoma Transportation Center, University of Oklahoma
Area of Research: Focus on the response of integral abutment bridges to thermal loading events, considering soil-structure interaction effects.

Melanie Kueber
University Transportation Center for Materials in Sustainable Transportation Infrastructure, Michigan Technological University
Area of Research: Technologies to allow the use of high carbon fly ash in transportation infrastructure.

Wayne Leighty
UC-Davis Transportation Center, University of California, Davis
Area of Research: Modeling of Energy Production Decisions: An Alaska oil case study.

Juan C. Lopez
Institute for Multimodal Transportation, Jackson State University
Area of Research: Design of road and highway networks and evacuation strategies.

Wesley Marshall
Center for Transportation and Urban Planning, University of Connecticut
Area of Research: Transportation planning, safety, and sustainability.

Hugh Medal
Mack-Blackwell Rural Transportation Center, University of Arkansas
Area of Research: Multi-objective simulation optimization: A comparison of methods.

Sandy Mehlhorn
Center for Intermodal Freight Transportation Studies, University of Memphis
Area of Research: A method for prioritizing highway routes for reconstruction after a natural disaster.

Alberto E. Miranda
Center for Transportation and Materials Engineering, Youngstown State University
Area of Research: New materials for light-weight braking systems in vehicles.

Nadereh Moini
Center for Advanced Infrastructure and Transportation, Rutgers, The State University of New Jersey
Area of Research: Modeling the interrelationship between vessel and truck traffic at marine container terminals.

Michael S. Murphy
Center for Transportation Infrastructure and Safety, Missouri University of Science and Technology
Area of Research: Understanding of fiber reinforced polymer applications for shear strengthening of concrete bridge girders, including: experimental testing of full scale reinforced concrete and prestressed concrete bridge girders.

Lakia Mustipher
James E. Clyburn University Transportation Center, South Carolina State University
Area of Research: Evaluating transportation equity in Orangeburg, SC; understanding the burdens of the disadvantaged.

Michelle Oswald
University of Delaware–University Transportation Center, University of Delaware
Area of Research: Evaluating the current state of BOSFOLK (Boston-Norfolk) transportation corridor and indicators of resiliency.

Brad Peot
National Center for Freight and Infrastructure Research and Education, University of Wisconsin-Superior
Area of Research: Freight logistics, especially mode utilization on the movement of materials for the logging industry.

Scott Porter
Utah Transportation Center, Utah State University
Area of Research: Mode utilization on the movement of raw materials for the logging industry.

Phillip Reich
Center for the Commercialization of Innovative Transportation Technology, Northwestern University
Area of Research: Marketing, as relating to transportation.

Robert Rescot
Mid-America Transportation Center (Region 7), University of Kansas
Area of Research: Highway and work zone operations, traffic flow theory, highway safety, simulation modeling, and roundabouts.

Aaron D. Rodgers
Hampton University Transportation Center, Hampton University School of Engineering and Technology
Area of Research: The implementation of changes that would decrease the rates of accidents and incidents caused by human fatigue.

Heather Rothenberg
New England University Transportation Center (Region 1), University of Massachusetts, Amherst
Area of Research: Transportation safety and transportation policy examining areas such as teen driver policy, older driver safety, injury outcomes from crashes, and commercial vehicle safety.

Raymond Salvano
The Mineta Transportation Institute, San Jose State University
Area of Research: Freeway and local transit improvement projects.

Michael Sawaya
Western Transportation Institute, Montana State University
Area of Research: Evaluating the demographic and genetic benefits of wildlife crossing structures for grizzly and black bear populations in the Bow Valley of Banff National Park, Alberta.

Christian Sax
The Midwest Transportation Consortium, Iowa State University
Area of Research: Urban transportation safety.

Sarah Schafer
UTC at the University of Toledo, University of Toledo
Area of Research: Maritime and intermodal transportation freight flows.

Ben Sperry
University Transportation Center for Mobility, Texas A&M University
Area of Research: An investigation of induced travel at mixed-use developments.

Chad Stripling
Mountain–Plains Consortium (Region 8), South Dakota State University
Area of Research: The structural performance of prestressed self-consolidating concrete bridge girders made with limestone aggregate.

Jim Sullivan
University of Vermont National Transportation Center, University of Vermont
Area of Research: Network robustness and focused on evaluation of an overall transportation system for performance in times of disruption.

Elsa Tedla
UTC for Alabama, University of Alabama, Tuscaloosa
Area of Research: A comparison of AIMSUN and SimTraffic for congested arterial segment.

Laurel VandePutte
Michigan-Ohio Transportation Center, University of Detroit Mercy
Area of Research: Evaluation of the SCATS Control System.

Ivan Vlahinich
Infrastructure Technology Institute, Northwestern University
Area of Research: The behavior of cement-based and other heterogeneous materials.

James Wagner
UTC at the Georgia Institute of Technology, Georgia Institute of Technology
Area of Research: Impact of the location of new schools on transportation infrastructure and finance.

Kari Watkins
Transportation Northwest (Region 10), University of Washington, Seattle
Area of Research: Sustainable transportation and transportation choices.

Cameron Williams
Southwest Region University Transportation Center (Region 6), Texas A&M University
Area of Research: The development of an automated method for identifying no-passing zones on rural highways using GPS.

Felix J. Zuniga
Leonard Transportation Center, California State University, San Bernardino
Area of Research: Technology and transportation in the Inland Empire.

2007 Outstanding Students of the Year

Amanda Gale Adams
Oklahoma Transportation Center, University of Oklahoma
Area of Research: Sulfate induced heave in lime stabilized soils.

Mesgana Ayele
The National Transportation Center, Morgan State University
Area of Research: Traffic engineering.

Gregory A. Barding, Jr.
Leonard Transportation Center at California State University, California State University, San Bernardino
Area of Research: Alternative energies for transportation, specifically, proton exchange membrane (PEM) fuel cells.

Timothy J. Bates
Center for Materials in Sustainable Transportation Infrastructure, Michigan Technological University
Area of Research: The effects of potassium acetate deicer on portland cement concrete airport pavements.

Natalie Beck
Small Urban and Rural Transit Center, North Dakota State University
Area of Research: Evacuation Simulation: Utilizing evacuation behavior models with traffic simulation to more effectively simulate an evacuation.

Shane D. Boone
Utah Transportation Center, Utah State University
Area of Research: Development of an increased understanding of the dynamic behavior of concrete subjected to a variety of loading conditions using new tools and automated techniques.

Andrew F. Braham
FAA Center of Excellence for Airport Technology, University of Illinois at Urbana-Champaign
Area of Research: The use of blended recycled foundry sand in hot mix asphalt.

Brandi Childress
The Mineta Transportation Institute, San Jose State University
Area of Research: Public transportation management.

Samir Dhar
University Transportation Center at the University of Toledo, University of Toledo
Area of Research: Transportation planning/GIS.

Monique Ellis
National Center for Transit Research at CUTR at the University of South Florida, University of South Florida
Area of Research: Public transportation policy issues.

Oren Eshel
Oregon Transportation Research and Education Consortium, Portland State University
Area of Research: Regional planning techniques.

Sean Fergus
National Center for Metropolitan Transportation Research, California State University, Long Beach
Area of Research: Transportation and international trade.

Eric Fitzsimmons
Center for Transportation Research and Education (CTRE) at Iowa State University, Iowa State University of Science and Technology
Area of Research: The effectiveness of Iowa's automated red light running enforcement programs.

Megan Brett Gaudet
New England University Transportation Center (Region 1), Massachusetts Institute of Technology
Area of Research: The harmonization of air navigation user fees in the north atlantic.

Mason Gemar
Mid-Atlantic Universities Transportation Center (Region 3), The Pennsylvania State University
Area of Research: Modeling of the effects of wide edge lines on driver behavior.

Nikolas Geroliminis
University of California Transportation Center (Region 9), University of California, Berkeley
Area of Research: Management of traffic in urban centers.

John Gregory Green
The Transportation Research Center, University of Nevada, Las Vegas
Area of Research: Trip generation prediction in a rapidly-developing metropolitan area with the incorporation of disaggregate accessibility measures.

Karen Greenwalt
University Transportation Center for Work Zone Safety and Efficiency, Cleveland State University
Area of Research: Analysis of work zone crash data to determine contributing factors to crashes occurring in those zones.

Genesis Harrod
Center for Multimodal Solutions for Congestion Mitigation (CMS) at the University of Florida, University of Florida
Area of Research: Transportation and Geographic Information Systems (GIS).

David J. Holdener
Center for Transportation Infrastructure and Safety, Missouri University of Science and Technology
Area of Research: Fiber Reinforced Polymer (FRP) bridge applications.

William A. Holloway
National Center for Freight and Infrastructure Research and Education, University of Wisconsin
Area of Research: Freight transportation and urban planning; low cost strategies for expanded truck parking in major metropolitan areas.

Clifton D. Hulitt
Institute for Intermodal Transportation, Jackson State University
Area of Research: Construction monitoring of fabric systems to reduce reflective cracking.

Eric Jackson
The Connecticut Transportation Institute, University of Connecticut
Area of Research: Improving traffic simulation models and emissions models using on board vehicle dynamics data.

Mary A. Leary
The Center for Transportation and Economic Development, George Mason University
Area of Research: Policy interactions or policy chasms: State elder mobility policy, practice and long-term care reform.

Xiugang Li
The Southwest Region University Transportation Center (Region 6), Texas A&M University
Area of Research: Performance assessment and comparison between fixed and flexible transit services for different urban settings and demand distributions.

Guillermo Madrigal
National Institute for Advanced Transportation Technology, University of Idaho
Area of Research: How cycle failure can be used as a performance measure.

Darren N. Moore
The Ohio Transportation Consortium, University of Akron
Area of Research: Transportation safety.

Kevin D. Moriarty
University of Massachusetts Transportation Center, University of Massachusetts, Amherst
Area of Research: Modeling the impacts of highway work zone strategies along interstates in Massachusetts and Rhode Island.

Jennifer A. Pazour
Mack-Blackwell Rural Transportation Center, University of Arkansas
Area of Research: A national high-speed rail system for freight distribution.

LaTonya Peeples
James E. Clyburn University Transportation Center at South Carolina State University, South Carolina State University
Area of Research: A comparative study on high fatality rate on rural two-lane highways in the states of South Carolina vs. Georgia.

Kelly Pitera
Transportation Northwest (Region 10), University of Washington
Area of Research: Resiliency in the Transportation network of supply chains.

Michael Rakauskas
The National Center for ITS Implementation Research. University of Minnesota
Area of Research: Human factors issues.

Benjamin Reim
University Transportation Research Center (Region 2), City University of New York, Rensselaer Polytechnic Institute
Area of Research: A behavioral investigation on automobile user's response to time of day pricing.

William Rhodes
Alaska University Transportation Center, University of Alaska-Fairbanks
Area of Research: Integrated vegetation management along Alaska's highways.

Craig Schiller
The Mid-America Transportation Center (Region 7), University of Nebraska-Lincoln
Area of Research: Transportation data management in the context of data collection and use.

Christopher Schroeder
The Michigan-Ohio University Transportation Center, University of Toledo
Area of Research: Investigating both experimentally and theoretically the noise and vibration characteristics of hydraulic hybrid vehicles.

Jeffrey Sharkey
Western Transportation Institute, Montana State University
Area of Research: Radio network design for rural intelligent transportation systems using artificial intelligence.

Benjamin Layman Shepherd
The Mountain–Plains Consortium (Region 8), University of Utah
Area of Research: Real-time modeling for training new operators.

Amy E. Thompson
The University of Rhode Island Transportation Center, University of Rhode Island
Area of Research: Extensions of the fuzzy analytic hierarchy process (F-AHP) with applications for global supply chain and logistics designs.

Nathan Tregger
Infrastructure Technology Institute, Northwestern University
Area of Research: Optimization of a minimal compaction energy slipform concrete.

Elaine Wang
University of Vermont National Transportation Center, University of Vermont
Area of Research: Decision-making in public policy processes around energy and transportation policy.

Kyle Warta
University Transportation Center, Kansas State University
Area of Research: Civil engineering.

Stephanie Victoria Watson
University Transportation Center for Alabama–University of Alabama-Tuscaloosa, University of Alabama-Birmingham
Area of Research: Transportation infrastructure resilience and disaster preparedness education in Alabama.

Jonathan Weinert
Transportation Center at the Institute of Transportation Studies, University of California, Davis
Area of Research: The dynamics of markets for electric two wheeled (E2W) vehicles in China.

Sarah Weissman
Center for Advanced Infrastructure & Transportation, Rutgers, The State University of New Jersey
Area of Research: Traffic safety through streamlining transportation systems design.

Jennifer Mae Wieland
Southeastern Transportation Center (Region 4)–University of Tennessee/Knoxville, University of North Carolina, Chapel Hill
Area of Research: The health of bus operators at a regional transit agency in North Carolina.

Meghan Wieters
University Transportation Center for Mobility, Texas A&M University
Area of Research: Integrating walking for transportation and physical activity for sedentary office workers in texas.

Abbreviations and Acronyms

AAA	American Automobile Association
AAAFTS	AAA Foundation for Traffic Safety
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ALEDA	Advanced Loop Event Data Analyzer
APCO	Association of Public Safety Communications Officials International (APCO International)
APC	automated passenger counting
API	application programming interface
APTA	American Public Transportation Association
ARTBA	American Road and Transportation Builders Association
ASM	acoustical signature monitoring
AVL	automatic vehicle location
BRT	Bus Rapid Transit
CABS	Campus Area Bus System
CAIT	Center for Advanced Infrastructure and Transportation
Caltrans	California DOT
CFIRE	National Center for Freight and Infrastructure Research and Education
CID	Controller Interface Device
CIFTS	Center for Intermodal Freight Transportation Studies
CMS	Center for Multimodal Solutions for Congestion Mitigation
CSC	Clean Snowmobile Challenge
CSU-UTC	Cleveland State University Transportation Center
CTIS	Center for Transportation Infrastructure and Safety
CTL	Campus Transit Lab (OSU)
CTME	Center for Transportation and Materials Engineering
CUTC	Council of University Transportation Centers
DCT	Delaware Center for Transportation
DEER	Driving Evaluation, Education, and Research Center
DOT	Department of Transportation
E3	Energy, Environment, and Education
EMC	electromagnetic compatibility
EMS	emergency medical services
ESITAC	Eastern Seaboard Intermodal Transportation Applications Center
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FRP	fiber-reinforced polymer
FTA	Federal Transit Administration

GHG	greenhouse gas
GIFT	Geospatial Intermodal Freight Transportation
GIS	geographic information system
GL MTS	Great Lakes Maritime Information Delivery System
GPS	global positioning system
GTI/UTC	Georgia Transportation Institute, University Transportation Center
HIG	Honda Initiation Grant
HOT	high-occupancy toll
HOV	high-occupancy vehicle
IDOT	Idaho Department of Transportation
IPCs	interpenetrating phase composites
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITI	Intermodal Transportation Institute
ITS	intelligent transportation systems
LPS	Laboratory for Port Security (CAIT)
LTBP	Long-Term Bridge Performance
MDOT	Michigan Department of Transportation
MATC	Mid-America Transportation Center
MBTC	Mack-Blackwell National Rural Transportation Center
M-CASTL	Michigan Center for Advancing Safe Transportation Throughout the Lifespan
MDSS	Maintenance Decision Support System
METRANS	National Center for Metropolitan Transportation Research
Missouri S&T	Missouri University of Science and Technology
MiSTI	Materials in Sustainable Transportation Infrastructure
MIT	Massachusetts Institute of Technology
MPO	metropolitan planning organization
MTC	Midwest Transportation Consortium
MTI	Mineta Transportation Institute
MVTA	Minnesota Valley Transit Authority
NASA	National Aeronautics and Space Administration
NCHRP	National Cooperative Highway Research Program
NCIT	National Center for Intermodal Transportation
NCTR	National Center for Transit Research
NDE	nondestructive evaluation
NEUTC	New England Transportation Center
NIATT	National Institute for Advanced Transportation Technology
NOAA	National Oceanic and Atmospheric Administration
NRI	Network Robustness Index
NTAD	National Transportation Atlas Database
NTC	National Transportation Center
NUF	National Urban Freight
NYCDOT	New York City DOT
NYMTC	New York Metropolitan Transportation Council

OTREC	Oregon Transportation Research and Education Consortium
OSU	Ohio State University
OTC	Ohio Transportation Consortium
PCBs	polychorinated biphenyls
PHEV	plug-in hybrid electric vehicle
PEM	proton exchange membrane
PORTAL	Portland Transportation Archive Listing
RFID	radiofrequency identification
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHM	Structural Health Monitoring
SWUTC	Southwest Region University Transportation Center
STC	Southeastern Transportation Center
STEWARD	Statewide Transportation Engineering Warehouse for Archived Regional Data
SWARM	System-Wide Adaptive Ramp Metering System
TAD	Travel Assistant Device
TDM	Transportation Demand Management
TEA-21	Transportation Equity Act for the 21st Century
TFO	Transportation Funding Options
TOC	Traffic Operations Center
TransNow	Transportation Northwest
TRB	Transportation Research Board
TSA	Transportation Security Administration
TTI	Texas Transportation Institute
UAB	University of Alabama at Birmingham
UMTRI	University of Michigan Transportation Institute
URITC	University of Rhode Island Transportation Center
USDOT	U.S. Department of Transportation
usRAP	U.S. Road Assessment Program
UTA	Utah Transit Authority
UTC	University Transportation Center
UTCM	University Transportation Center for Mobility
UTRC2	Region II University Transportation Research Center
V/C	volume-to-capacity
VMT	vehicle-miles traveled
VOCs	volatile organic compounds
VTRC	Virginia Transportation Research Council
VTS	Vessel Traffic Services
WSU	Washington State University
WTI	Western Transportation Institute