



# INVESTING IN THE TRANSPORTATION LEADERS OF TOMORROW

## *The University Transportation Centers Program*

*Editor's Note: This feature article was assembled by staff at the Research and Innovative Technology Administration, working with staff at competitively selected University Transportation Centers. For acknowledgments of the contributors, see page 10.*

**T**he ATLAS is a massive, 70-ton machine—its name expresses its powerful utility. The Accelerated Transportation Loading Assembly tests the limits of some of the world's strongest, most advanced transportation materials. Pavement systems designed to withstand hundreds of thousands of landings by commercial aircraft or rail ties engineered to carry the massive hauls of freight trains are subjected to immense pressures to gauge their durability. The data from ATLAS help engineers design materials that will define transportation now and in the future.

ATLAS is more than a marvel of engineering—it is an example of the cutting-edge work under way at universities across the country through the University Transportation Centers (UTC) program. Managed by the Research and Innovative Technology Administration (RITA), in partnership with the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), the UTC program has a dual mission:

- ◆ To conduct innovative transportation research and
- ◆ To train and educate transportation professionals.

The ATLAS is located at the University of Illinois' Advanced Transportation Research and Engineering Laboratory facility, 15 miles north of Urbana (1). It

exemplifies the state-of-the-art technology necessary to create a modern, resilient transportation system that will endure for generations.

RITA is working to ensure that U.S. transportation research and education investments effectively address national priorities and produce solid results for all Americans. This effort involves partnering with the academic community at 136 colleges and universities participating in the UTC program, to advance multi-disciplinary transportation research and to educate the next generation of transportation professionals.

"UTCs capture the spirit of ingenuity and innovation that drives American progress," notes RITA Administrator Peter H. Appel—"bright minds working together to find solutions that inspire and change the world for the better."



At the 2011 TRB Annual Meeting, RITA Administrator Peter H. Appel (*left*) held an informal discussion for students interested in transportation careers (*photo above*). Along with developing research across transportation modes, the UTC-RITA partnership also educates and supports up-and-coming professionals.

Researchers at the University of Illinois' Advanced Transportation Research and Engineering Laboratory (ATREL) employ the behemoth ATLAS to conduct strength and durability tests on high-use pavements for airports or railways.



### Encouraging Collaboration

UTCs focus on issues aligned with the priorities of the U.S. Department of Transportation (DOT) and work with regional, state, and local agencies to find solutions to the transportation issues affecting their communities. The project selections and products are peer-reviewed, and the results are shared through the TRID<sup>1</sup> (formerly the Transportation Research Information Services) and Research in Progress<sup>2</sup> databases—housed on the Transportation Research Board (TRB) website—and through other forums that encourage collaboration. During the past three years, UTC colleges and universities have completed a range of activities (see table, below).

<sup>1</sup> <http://trid.trb.org>.

<sup>2</sup> <http://rip.trb.org>.

**TABLE 1 UTC Performance Measures, 2006–2009**

Total number of UTC research projects	1,455
Total number of UTC research reports published	1,267
Total number of UTC presentations on ongoing and completed research	2,212
Total UTC students involved in transportation research	6,730
Total transportation-related master's degrees awarded	4,826
Total transportation-related PhD degrees awarded	489
UTC transportation seminars, symposia, and distance learning classes presented	3,004
Number of transportation professionals participating in UTC transportation seminars, symposia, and distance learning classes	142,272
Number of Research in Progress UTC projects	1,907
Number of UTC TRID entries	1,677
Total dollars of research funded (\$ millions)	\$169.2

U.S. DOT funding for UTC programs represents only a fraction of the financial support received by participating institutions for transportation research and education. Responsible for providing 100 percent matching funds, UTCs are inherently collaborative entities. The centers are encouraged to partner with other transportation stakeholders in pursuing local, regional, state, and national goals. The partnerships ensure that each federal dollar invested in a UTC is leveraged toward the highest possible return in value for the transportation system.

### Partners for Solutions

Each year, state transportation agencies prioritize projects, programs, and services to accommodate budget constraints and limited resources. This balancing act has implications for the operation, development, and maintenance of transportation systems. At the same time, the American Recovery and Reinvestment Act and the Transportation Investments Generating Economic Recovery grants are financing transportation projects nationwide—increasing demand for expertise across transportation disciplines. This challenging environment highlights the relevance of UTCs and the value of state partnerships with universities and colleges.

UTCs offer cooperative research and technology transfer that can help achieve the goals of State Planning and Research programs. Following are examples of UTC collaborations with state transportation agencies to address local and regional issues.

#### Road Safety Resource

The Center for Advanced Infrastructure and Transportation (CAIT) at Rutgers, the State University of New Jersey, has built a strong relationship with New Jersey DOT. For example, CAIT's Transportation Safety Resource Center (TSRC) offers statewide resources, including road safety audits, crash analyses, outreach and marketing materials, and training for traffic safety workers (2). By providing a range of engineering and technical services to state decision makers, TSRC has proved itself an asset in the design and implementation of safety programs.

TSRC has developed a web-based software application, Plan4Safety, to assist safety and law enforcement professionals in analyzing traffic crashes. The software incorporates crash records and related data since 2003 and serves as a tool for identifying dangerous intersections and other elements of the road environment that contribute to vehicle crashes.

Developed and maintained in concert with engineers from CAIT and New Jersey DOT, the partnership has produced data that can improve traffic and roadway safety efforts in other states as well.

Plan4Safety received the FHWA National Road Safety Award in 2009 and was cited in FHWA's High-Risk Rural Road Project as an effective tool for transportation planning.

### Highway Planning for Tribal Agencies

Located at North Dakota State University, the Mountain–Plains Consortium (MPC) includes five universities in North Dakota, Utah, South Dakota, Colorado, and Wyoming, and is working with regional, state, and local governments to address the unique challenges facing transportation planners in the U.S. Mountain West.

Strengthening the highway planning capabilities of tribal agencies is one of the challenges. The geographic region covered by MPC encompasses a significant proportion of the lands owned by the 564 federally recognized Native American tribes in the United States. These holdings include more than 94,000 miles of Indian Reservation Roads (IRR), jointly managed by FHWA's Federal Lands Highway program and the U.S. Department of the Interior's Bureau of Indian Affairs. Extensive modernization, operational improvements, and maintenance are needed to transform these roads into systems that support the safety, livability, and economic needs of Native American communities.

Although the IRR program funds the design, construction, and maintenance of the roadways, the tribes need to be equipped with the planning, expertise, and analytic tools applied by state transportation agencies. A lack of effective tribal outreach and of innovative technology transfer exacerbates the issues. The MPC member universities—Colorado State University, North Dakota State University, South Dakota State University, the University of Utah, and the University of Wyoming—are collaborating with federal, state, and tribal agencies to address barriers to the modernization of the IRR systems and infrastructure across the region (3).

The initial objective is to familiarize tribal planners with the types of highway data and models used by state and federal governments, to improve understanding of the analyses conducted and the data collected. The Highway Economic Requirements System and the Highway Performance Monitoring System were used in analyzing state highways that pass through reservations, and the initial results were presented. As a result, tribal planners can communicate more effectively with state planners and can understand how states analyze the needs of highways.

### Connecting Colonias

Approximately 2,400 colonias—Spanish for neighborhoods—along the Texas–Mexico border are home



PHOTO: CARRISA SESTINO, CALT

to more than 500,000 people. The sprawling rural settlements often lack the basic needs most people take for granted, including running water, sewage systems, and electricity. Most of the residents are economically disadvantaged Mexican-Americans who often do not have ready access to education and medical care. Their isolation is exacerbated by the lack of transportation options.

In 1991, the Texas A&M University Center for Housing and Urban Development (CHUD) began a project to improve the lives of impoverished people in colonias along the Texas border. The Colonias Program sought to promote “community self-development”—that is, involving the residents in activities to improve the social infrastructure. A core need was for transportation to the community centers in the colonias, as well as to other towns.

The Southwest Region University Transportation Center (SWUTC), housed at Texas A&M in conjunction with the University of Texas at Austin and Texas Southern University, joined with CHUD in 1997 and funded a project to explore transportation issues and solutions. After evaluating the needs of the colonias, SWUTC researchers developed a demonstration project, supplying a 15-passenger van for transportation service to and from a community center in El Cenizo, a colonia in Webb County.

Team leader Roden Lightbody calls attention to the retroreflectivity, clutter, and driver visibility of road signs during a road safety audit conducted for New Jersey DOT by the Center for Advanced Infrastructure and Transportation at Rutgers, the State University of New Jersey.



PHOTO: SWUTC

A 15-passenger van that provides transportation for colonia residents in Willacy County, Texas, through a project supported by the State Energy Conservation Office and Texas A&M University.



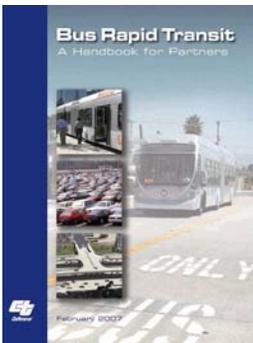
Iowa State University graduate assistant Stewart McCoy describes *Go!* and its mission to then-Governor Chet Culver at the Iowa Science and Mathematics Teacher Educators Summit at Grinnell College.

The success of the pilot program prompted SWUTC and CHUD to approach the State Energy Conservation Office (SECO) to buy additional passenger vans for established centers in the colonias. Through a multiyear SECO contract administered by SWUTC, the pilot project has been replicated many times, and the program has purchased 31 vans (4). The vehicles have provided more than 2 million passenger miles of travel annually for medical and dental care, adult education, infant and geriatric services, recreation, employment, and economic development initiatives for colonia residents.

“Many of these residents who don’t have a vehicle now have the opportunity to become part of the community by being able to make use of some of the community services at the resource centers,” says Robert Otto, a former program administrator with SECO. “The resource centers are a gathering place for the people in each community.” As a result of the program, thousands living in South Texas colonias have greater access to critical services and economic opportunities.

**Facilitating Bus Rapid Transit**

Many consider bus rapid transit (BRT) a key ingredient in future transit system management. BRT applies intelligent transportation systems technology, operational strategies, and innovative transit planning to improve mobility and livability in metropolitan areas. As urban communities seek to develop and deploy BRT systems, research into best practices and lessons learned becomes critical for design, implementation, and operation. The Mineta Transportation Institute (MTI) at San José State University has worked with California DOT (Caltrans) to create a guide for the deployment of BRT systems statewide (5).



The Mineta Transportation Institute at San José State University helped California DOT develop a guidebook on bus rapid transit for its employees.

In April 2005, the Caltrans Division of Research and Innovation asked MTI to assist with the research and publication of a guidebook for Caltrans employees who work with local transit agencies and jurisdictions in planning, designing, and operating BRT systems that involve state facilities. The guidebook, *Bus Rapid Transit: A Handbook for Partners*, assists transit operators, local governments, community residents, and other stakeholders in the development of BRT systems (6). The guidebook draws on active BRT projects in San Diego, Los Angeles, San Francisco, and Alameda County, explores their efforts, identifies changes that are needed in statutes and policies, and outlines other state concerns.

In addition to the case studies of major BRT projects in California, the MTI team examined several other programs in development around the state. The effort clarified issues to be addressed in the guidebook and compiled information that assisted in identifying needs and emerging issues for legislative or regulatory action and for Caltrans to address through district directives or internal measures.

**Workforce Development**

The transportation research at every UTC involves a dedicated group of students and faculty who work on projects across the spectrum of disciplines. UTC students typically are dedicated to finding solutions to transportation issues—they represent the next generation of transportation professionals and decision makers. Reflecting the diversity that characterizes the U.S. population, the students have taken many different paths to arrive at their career choice. Nonetheless, the number of Americans who are choosing careers in transportation or in related fields such as engineering, science, and mathematics is not keeping pace with the nation’s needs.

The U.S. transportation workforce is undergoing fundamental changes. Up to 50 percent of the workforce is expected to retire in the next 10 years; their successors, moreover, need to develop new skills in response to new and emerging areas of expertise.

High-speed rail exemplifies the gap between the nation’s needs and capabilities. In the past four decades, Europe, Japan, and China have invested heavily in high-speed rail; as a result, jobs in designing, building, and operating high-speed rail networks have grown overseas, while similar careers have faded in the United States.

**Expanding Skills and Disciplines**

The initial \$10 billion federal investment in a nationwide high-speed rail network has provided an opportunity to establish a foundational education program to develop the expertise needed for high-speed rail

and other critical elements of the 21st century transportation system. Bringing the transportation infrastructure into a state of good repair and deploying systems crucial to modernization—such as NextGen air traffic control and intelligent transportation systems—is an ambitious undertaking that will demand all of the nation’s knowledge and ingenuity.

“The U.S. transportation system will depend on a highly skilled and multidisciplinary workforce to meet the challenges of the 21st century,” states RITA Deputy Administrator Robert Bertini. “The UTC program has been and will continue to be a key part of our national strategy.”

UTCs are establishing programs and partnerships to spark interest in transportation careers and to support those who choose to enter the field. Since 2008, through a joint initiative of the Council of University Transportation Centers (CUTC) and RITA, individual UTCs have sponsored regional workforce development summits to engage local, regional, and national partners in addressing the transportation workforce challenge (7).

The future transportation workforce will depend not only on efforts to increase interest among students but also on the expansion of outreach to women, people of color, and other groups traditionally underrepresented in the transportation community.

### Magazine for Teens

Encouraging teenagers and young adults to consider a career in transportation requires creative outreaches to raise their awareness, particularly about the importance of transportation to communities; these outreaches are an essential part of the national workforce development strategy. The Institute for Transportation at Iowa State University, for example, publishes a free, online magazine dedicated to making transportation—and transportation careers—relevant to teenagers.

*Go!* magazine features articles on every element of transportation, from profiles and personal experiences of people who design transportation systems to stories about cities developing green transit (8). Published monthly, *Go!* holds contests to encourage young readers to participate and think critically about transportation challenges—such as a “Design your own maglev” contest. In August 2010, *Go!* staff presented the magazine’s mission at the Iowa Science and Mathematics Teacher Educators Summit, hosted by the Iowa Math and Science Partnership at Grinnell College, Grinnell, Iowa (9).

### Assisting Teachers

The University of Nebraska, lead member of the Mid-America Transportation Center (MATC),<sup>3</sup> created the



annual Professional Development Science and Math Summer Technology Institute in 2006 to help teachers foster interest in transportation careers among secondary school students. The Nebraska Department of Education organizes and hosts the summer program.

Teachers are on campus for three days in June and in August for intensive training in engineering concepts and their implementation. At both sessions, faculty from the university’s departments of education and engineering lead workshops on building student awareness of the positive impacts of engineering (10).

The workshop in June introduces teachers to the field of transportation engineering through a variety of presentations, tours, and other activities. In one workshop, teachers develop lesson plans for introducing transportation engineering concepts to students.

<sup>3</sup> Other members are Missouri University of Science and Technology, Kansas State University, University of Kansas, University of Iowa, Lincoln University, and Prairie View A&M University.

The monthly online magazine *Go!*, published by the Institute for Transportation at Iowa State University, introduces teenagers to transportation issues and careers.

Nadia Gkritza discusses the recruitment of female students to the fields of science, technology, engineering, and mathematics at the Midwest Transportation Consortium Workforce Summit.





PHOTO: WIKIMEDIA COMMONS

A sign on westbound I-696 in Michigan uses both the Clearview typeface (for the text) and Highway Gothic typeface (for the shields). Clearview was developed from research performed at Pennsylvania State University's Pennsylvania Transportation Institute.

Before heading back to school, teachers test their lesson plans on junior high and high school students at the August session. In addition to technical assistance and support in creating lesson plans, the institute provides funds for purchasing curriculum-related classroom materials.

Mary Herrington, a science teacher at Culler Middle School in Lincoln, Nebraska, has witnessed how the institute's approach has sparked student interest in transportation. "All the lessons have a real-world connection," Herrington notes. "The curriculum builds interest and excitement about engineering and technology."

Sponsors for the Summer Technology Institute include MATC, Nebraska's Coordinating Commission for Postsecondary Education, U.S. DOT, and the Garrett A. Morgan Technology and Transportation Futures Program.

## Multidisciplinary Research

Robust, multidisciplinary transportation research is a hallmark of the UTC program. Investing in forward-thinking research not only will lead to innovative solutions to critical transportation problems but also will provide crucial experience for the transportation professionals who will grapple with emerging issues in the coming decades.

### Readable Signs

Sometimes the simplest solution is the most practical. An example is the Clearview Typeface System, developed through a decade of research by a multidisciplinary team of psychologists, traffic engineers, type designers, graphic designers, vision experts, and optics engineers at the Pennsylvania Transportation Institute, Pennsylvania State University.

The Clearview font increases the legibility of traffic control signage and devices by 20 percent, compared with the FHWA's standard Highway Gothic font. Clearview employs a special spacing of

letters and mitigates the adverse nighttime effects caused by headlights. The font improves driver recognition of the messages and minimizes distraction—definite safety benefits.

After two studies conducted by the Texas Transportation Institute, FHWA granted interim approval of the Clearview typeface for all public streets, highways, and byways in 2004 (11). Clearview currently is featured on new highway signs throughout Texas and Canada and along Routes 32 and 80 in Pennsylvania.

### Assisting Disabled Riders

Persons with disabilities and the elderly often depend on public transportation and transit. The National Center for Transit Research (NCTR) at the University of South Florida (USF) has developed a travel assistance device (TAD), tested by Hillsborough Area Regional Transit Authority (HART).<sup>4</sup> The TAD applies Geographic Positioning System technology in cell phones to assist cognitively disabled riders and new transit riders with recognizing their stops and exiting the bus at the appropriate time and place (12).

The TAD software is installed on a personal cell phone. The transit rider or travel trainer visits the TAD website, which features a Google Maps-style interface for trip planning, and selects the route, location, stop, and travel times. The trip plan downloads automatically into the user's cell phone.

The software application on the cell phone gives the transit rider two alerts after boarding the bus. The first is a verbal announcement saying, "Get ready," issued a few stops before the destination. The phone also vibrates and displays a text message, to accommodate seeing- and hearing-impaired users. The second alert tells the rider to pull the stop-request cord, issuing the cell phone prompt, "Pull the cord now."

The NCTR team conducted tests with six developmentally disabled 18- to 22-year-old special education transitional students in April and May 2008. The 12 test trips included two different bus routes for each student. The students disembarked at the planned destinations successfully each time.

"Having a travel trainer accompany on the buses creates a sense of security and comfort for a developmentally disabled patron," observes Mark Shepard, a travel trainer with HART. "A TAD in their pocket is the next best thing to having the travel trainer beside them."

USF has licensed the TAD to a Florida company, Dajuta, LLC, which will handle the daily operation and support of the system and will train travel

<sup>4</sup> Editor's Note: Seed funding and advice for the early TAD research were provided through TRB's Transit Innovations Deserving Exploratory Analysis (IDEA) Program (Project 52).



Developed by the National Center for Transit Research at the University of South Florida, Travel Assistance Device software can be installed on a user's cell phone and provides safe transit riding assistance for persons with disabilities and the elderly.

instructors in the use of the TAD. Dajuta officials have stated that the cost savings, increased bus ridership, and ability to empower people to travel independently make TAD a “win-win.”

Sheppard agrees: “The biggest challenge we face in training disabled riders on the fixed-bus routes is their ability to remember when to pull the cord to get off the bus. The TAD solves this challenge by giving riders voice, text, and vibration alerts that remind them when to take action.”

### **Bike Sharing**

As urban communities across the United States grapple with traffic congestion, air quality issues, and eroding livability, many transportation agencies are exploring bike-sharing programs. For example, the Southeastern Transportation Center (STC), working with Tennessee DOT, the University of Tennessee, and Currie Technologies, is seeking to develop and evaluate the nation’s first automated sharing system for e-bikes, or electric bicycles, on the campus of the University of Tennessee, Knoxville (13). E-bikes are powered with a rechargeable battery and electric motor in tandem with the rider’s pedaling and can achieve top speeds of 15 to 20 miles per hour, offering an efficient and environmentally sustainable alternative to automobiles and transit vehicles.

The pilot test in spring 2011 will feature two stations with 20 shared bicycles—a mix of e-bikes and traditional models. The research team consists of faculty and students from the STC and corporate researchers from Biosystems Engineering. The research team is also working with Currie Technologies, makers of IZIP e-bikes, to develop an integrated system.

### **UTC Spotlight Conference**

RITA partners with TRB to sponsor an annual UTC Spotlight Conference, which brings together the UTC community, industry, and federal, state, and local government agencies to focus on a salient transportation issue and identify needed research. The results can inform policy decision making, and the program is intended to facilitate communication and coordination among the academic community, government, and industry.

The 2010 conference focused on Transportation Systems for Livable Communities. Research into the impact of transportation on community livability is under way in many areas and among a diverse array of stakeholders. The diversity of facts and opinions on the topic pose a challenge for all.

Linking transportation to livable communities has become a key national priority for transportation policy. The outcome of the 2010 spotlight conference



PHOTO: UNIVERSITY OF TENNESSEE, KNOXVILLE

will guide related research by universities, U.S. DOT, and industry and through TRB.

### **UTC Program’s Future**

RITA is working to increase the cross-modal focus of the U.S. DOT’s research agenda and to create institutional mechanisms that promote coordination and communication among the modes of transportation, while developing tools to bolster coordination and communication among RITA partners.

These efforts have implications for the UTC program and how research partners inside U.S. DOT and in the transportation community collaborate, share information, and produce tangible solutions to current, emerging, and anticipated challenges that affect national transportation goals.

RITA’s Office of Research, Development, and Technology is developing a web-based platform to facilitate collaborative research among U.S. DOT researchers and partners and to optimize the results of research studies across disciplines. The Web 2.0 platform will support 14 research clusters that will share information and identify areas for collaboration.

RITA has embraced workforce development as a

Chris Cherry, University of Tennessee, Knoxville, shows students from Transportation Academy 2010 how to ride an electric bicycle, or e-bike. The university is piloting an automated sharing system for the battery-powered bicycles.

Rebecca Sanders, University of California, Berkeley, discusses her research on pedestrian and bicyclist safety at the Transportation Systems for Livable Communities Conference at the National Academies’ Keck Center in October.





Beth Osborne, Deputy Assistant Secretary for Transportation Policy, U.S. DOT, spoke about the department's vision for the future of livable communities at the October UTC Spotlight conference.

priority for the transportation system. Working with U.S. DOT modal partners, RITA is developing a focused and data-informed workforce strategy, responding to the needs of current and future employees and of the entire transportation workforce.

The workforce initiative recognizes the uniqueness of specific occupations in each mode and embraces both the short- and long-term workforce challenges, as well as cross-modal, multidisciplinary, and career life-cycle dimensions. The transportation workforce initiative now has representatives from seven operating administrations of U.S. DOT—rail, highways, transit, aviation, maritime, motor carriers, and pipelines—creating a comprehensive effort.

UTCs capture the spirit of enterprise and innovation that has characterized American progress—bright-minded people of all ages working together. The UTC program invests in the ideal that the nation's colleges, universities, and institutes have the capability to create groundbreaking, innovative solutions that inspire and ultimately change the world for the better. In the process, students gain the expertise and experience to effect change as they forge careers as multidisciplinary transportation professionals. UTC programs across the country are an investment that will pay dividends for decades.

The projects and the research cited in this article

are a small sample of the work undertaken in the academic community through the UTC program. More information about institutions supported by the UTC program, including links to projects around the country, can be found at <http://utc.dot.gov/>.

## Acknowledgments

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## UTC Spotlight Conferences at a Glance

2010	Transportation Systems for Livable Communities
2009	Infrastructure Preservation and Renewal
2008	The Impact of Changing Demographics on the Transportation System
2007	Research Issues in Freight Transportation: Congestion and System Performance
2006	Research Opportunities in Radio Frequency Identification (RFID) Transportation Applications



The UTC spotlight conferences offer opportunities to gain and exchange information and to network.