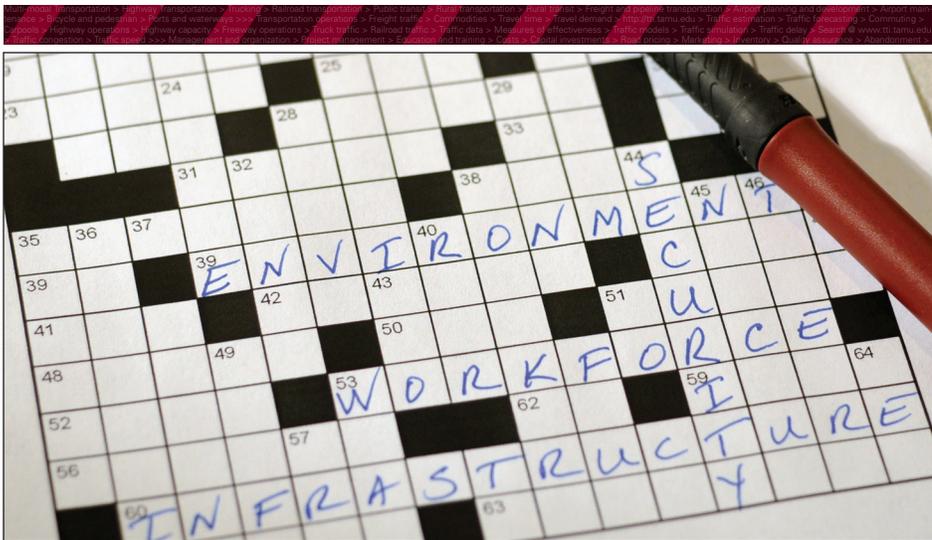


# Researcher

VOL. 46 | NO. 4 | 2010

## Working Across Transportation Solutions

Environment  
Infrastructure  
Security  
Workforce Development



**ON THE COVER:** The Texas Transportation Institute works out solutions to transportation problems through innovative research.



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TEXAS TRANSPORTATION  
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*Texas Transportation Researcher* (ISSN 00404748) is a quarterly publication of TTI Communications, Texas Transportation Institute, The Texas A&M University System, 3135 TAMU, College Station, Texas 77843-3135. For more information or to be added to the mailing list, contact the address below, call (979) 862-6993 or e-mail Susie Catalina at [s-catalina@tamu.edu](mailto:s-catalina@tamu.edu). Periodicals postage paid at College Station.

TTI.RESR1101.1210.5M

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# Making Goode Sense

## The Way Ahead with TTI

Last year the David R. Goode National Transportation Policy Conference published *Well Within Reach: American's New Transportation Agenda*. The bipartisan conference, cochaired by former Secretaries of Transportation Norman Mineta and Samuel Skinner, suggested that without a fundamental change in direction, our nation's transportation system simply will not meet our future needs.

The Goode report recommends 10 principles to guide policy makers, ranging from how to most efficiently fund the system to how to streamline its administration. Some hard decisions will have to be made. For example, according to the report, the gas tax alone cannot sustain the level of investment we need as a nation. Failure to properly maintain and innovate our transportation system will hinder our

Since 9/11, securing our transportation infrastructure has become a national priority, but other factors like construction costs, maintaining traffic flow and privacy issues must also be taken into account. We need to improve maintenance to our infrastructure, but at what cost to the environment? And while the research agenda we're given is often reactive in nature — intended to solve problems reported by current users of the system — we must remember that training tomorrow's experts is at least as important as meeting today's challenges.

productivity, hamper the economic opportunity afforded to rural areas, and compound congestion issues in our larger cities. One way or another, users of our transportation system will pay for it — whether through a user fee (as proposed by the report) applied to improved maintenance and innovative solutions to transportation challenges or through “inefficiencies in time, money and safety,” the results of an underfunded network.

In 1966, when he created the U.S. Department of Transportation, President Lyndon Johnson pointed out that while the U.S. transportation system was the envy of the world at that time, it was already becoming inadequate to the nation's needs. Congestion, urban planning issues, lack of proper maintenance — these he cited as growing problems even then.

These issues are still with us, and they're getting worse. The Goode report says that we need to address these issues honestly, realistically and as a nation. We need policies that facilitate solutions, policies

founded on reliable research data.

In this issue of the *Texas Transportation Researcher*, we profile how the Texas Transportation Institute (TTI) is providing innovative solutions to transportation challenges in four areas: infrastructure, security, workforce development and the environment. If you boil down the Goode report, it's really about adopting a common-sense, balanced approach to meeting our country's transportation needs.



TTI keeps that philosophy in mind when conducting research. Since 9/11, securing our transportation infrastructure has become a national priority, but other factors like construction costs, maintaining traffic flow and privacy issues must also be taken into account. We need to improve maintenance to our infrastructure, but at what cost to the environment? And while the research agenda we're given is often reactive in nature — intended to solve problems reported by current users of the system — we must remember that training tomorrow's experts is at least as important as meeting today's challenges.

At TTI, we're dedicated to the idea of finding reasonable solutions to complicated problems. It just makes good sense. ■



by Dennis Christiansen  
Agency Director



Environment

Erosion and Sediment Control | Vehicle Emissions Testing |  
Air Quality | Fuel Efficiency | Hybrid Technologies | Clean Fuels |  
Vegetation Management | Storm Water Quality | Recyclable  
Pavements | Alternative Transportation | Sustainable  
Transportation | Warm Mix Asphalt

## Keeping Tabs on the Elements

TTI's Environmental Research Focuses on Water, Air Standards

Seeing a smoking vehicle traveling down the highway makes us think about the air we're breathing. When rainfall causes the road to be slick from tire residue and engine spills, we don't often think of what happens when the pollutants wash off the road. But what the roadside does with the polluted water and how well we monitor and curtail air pollution coming from vehicle emissions are two areas very important to Environmental Protection Agency (EPA) regulators, the Texas Department of Transportation (TxDOT) and the Texas Commission on Environmental Quality.

"The roadside is more than just something pretty to look at. It's a mini-ecosystem with environmental functions that provide storm water treatment and habitat that can be maximized through proper design and maintenance activities," says Beverly Storey, associate research scientist.

Off the pavement, researchers consider the right-of-way as green infrastructure with benefits for water quality, vegetation, aesthetics and landscape development. EPA recently implemented new effluent limits that determine how dirty the water can be as it drains from construction sites. In response to the upcoming regulations, Storey's team will work with Texas Tech University and The University of Texas Center for Transportation Research testing roadway construction site storm water discharges to develop site-monitoring protocols for TxDOT.

TTI Associate Research Engineer and Texas A&M Associate Professor of Landscape Architecture Ming-Han Li recently built the first bioretention pond at the corner of State Highways 6 and 21 for a TxDOT field study. This green storm water runoff management practice reduces the size of right-of-way necessary for TxDOT while being more aesthetically pleasing than the traditional, large concrete drainage structures. Based on pilot experiments with vegetation planted in recycled trash dumpsters, researchers believe the field test will show that bioretention ponds effectively remove pollutants — such as copper, zinc and lead — from storm water runoff.

### Cleaning the Air . . . with Earth?

Meanwhile, the dumpsters from Li's pilot test are being reused again for a Southwest University Transportation Center project. The fully vegetated dumpsters will be fitted with lights for photosynthesis and placed in TTI's new Environmental and Emissions Research Facility (EERF; see related story on page 6)



#### FOR MORE INFORMATION

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for a controlled study on how vegetation and soil can remove pollutants and emissions from the air under different temperatures.

Inside the chamber, emissions will bombard the vegetation and soil. Storey's team is excited about measuring how much carbon gets captured and developing protocols for further laboratory tests on specific plant species and soil types. With these protocols, researchers hope to find more green solutions to air quality challenges using vegetated roadsides.

"The roadside is more than just something pretty to look at. It's a mini-ecosystem with environmental functions that provide storm water treatment and habitat that can be maximized through proper design and maintenance activities."

*Beverly Storey,  
TTI associate  
research scientist*

### Modeling: An Air of Refinement

Complying with all state and federal air quality standards requires some detailed analyses that cannot be physically measured. Advanced computer modeling using EPA's emissions estimation software, called Motor Vehicle Emissions Simulator (MOVES), helps metropolitan planning organizations demonstrate that building new transportation structures will conform to air quality standards. TTI's Transportation Modeling Program, led by Dennis Perkinson, approximates

levels of pollutant concentrations by area all over the state. Perkinson's team constantly updates and improves the

MOVES model as new products and variables become available — new measurements that could possibly come from EERF projects.

"The mathematical model takes many variables — emissions from 28 types of vehicles over 25 model years, links of road, every hour of the day, given speed of each

link per hour, types of pollutants and even fuel types," says Perkinson. "If you change a network or build something new, you need to be able to calculate the impact for the regulators. Our group's innovations are extremely efficient protocols and procedures for doing this, for almost the entire state."

As EPA standards evolve, the sophistication of the environmental research methods necessary to test for them also change. More refined measures, new controlled laboratory studies and behind-the-scenes computer modeling make a huge impact. In short, TTI research helps all Texans breathe a little easier. ■

## COMMENTARY on Environment

*David Ekern  
Former Transportation Commissioner/  
Senior Executive — Minnesota, Idaho, and Virginia  
Departments of Transportation*

Establishing a transportation network for economic growth and communication across the country while preserving our environment has a rich tradition in the United States.

Daniel Boone cut the Wilderness Road from North Carolina to Kentucky in 1775, opening the West for expansion. The land was seen as something to meet the people's needs and provide sustenance and economic opportunity.

Much has changed in 200-plus years.

The National Environmental Policy Act (NEPA) of 1969 for the first time clearly stated the nation's dedication to preserving the environment. Since Boone's time, civil engineers, surveyors and road builders have tempered their development of the land for economic benefit with a reverence for what many see as the living history of our national landscape.

As we advance NEPA in the 21st century, it's worth noting how agencies like the Texas Transportation Institute (TTI) are still combining common-sense solutions with environmental sensitivity. First-rate laboratories like TTI's Environmental and Emissions Research Facility; nationally respected expertise demonstrated in publications like the annual *Urban Mobility Report*; and innovative technological solutions, such as recycled asphalt pavement — which reconstitutes old asphalt into new pavement — make TTI a principal partner in creating a sustainable transportation system.

"Sustainability" to me means creating a customer-focused system that's flexible, responsive to needs (both human and environmental), and forward looking. Focusing on the future is fundamental to creating a sustainable transportation system. And any future worth living in must respect our connection to the environment — not just that we're part of that natural system, but that the system itself is part of our national character.

The environment — as much as any road-, rail- or runway — is vital to the economic health of the United States. A healthy environment is a strength we can leverage as a nation to remain competitive in a global marketplace.

The time for renewed and long-term revenue investment in transportation is now. It's good for the economy and critical for the environment. Understanding that can help us see the forest's big picture without losing sight of the trees that make it up.



A work in progress. TTI researchers are planting vegetation to help remove pollutants from storm water runoff.

# The Sky's the Limit



TTI's Environmental and Emissions Research Facility is a humidity- and temperature-controlled drive-in facility for testing technologies to reduce vehicle emissions. The facility, which is large enough to accommodate tractor-trailers and buses, also tests other products for their durability under severe weather-like conditions.

**T**he Texas Transportation Institute's (TTI's) new Environmental and Emissions Research Facility (EERF) is officially open for research. Joe Zietsman, director of the Center for Air Quality Studies, describes this facility as a "researcher's dream come true."

The EERF was made possible by a competitive grant award from the Environmental Protection Agency (EPA) and the Houston Advanced Research Center as well as supporting funds from TTI and The Texas A&M University System. Located on Texas A&M University's Riverside Campus,

the EERF is one of the few drive-in environmentally controlled test chambers based at a university and is, to our knowledge, the largest in the nation. Researchers can control temperature (from -13°F to +131°F), humidity, solar impact and wind speeds. Full-sized 18-wheelers and buses are easily accommodated in the 75-by-22-by-22-foot chamber.

Semi-trucks that idle produce a broad range of pollutant emissions. For the first EERF project, Zietsman's team at TTI's Center for Air Quality Studies is measuring idling emissions and fuel consumption of semi-trucks as well as idling and fuel consumption of auxiliary power units (APUs). APUs are small engines that power auxiliary air-conditioning or heating units on a semi-truck so that the driver does not have to idle the truck's main engine when stopped for the night.

The TTI team is developing a verification protocol for EPA for APUs. This protocol will require the measurement of emissions, fuel consumption and energy usage of these devices. The protocols and data will be available on a center website. These tests and protocols could only be developed in a humidity- and temperature-controlled chamber, such as the EERF, to ensure consistency between tests and accuracy of results.

On Sept. 17, TTI hosted a grand opening and luncheon. Guests were treated to a tour of the facility and happily soaked in the much cooler temperature of the chamber. "The type of research one can do in the EERF is only limited by your imagination," Zietsman said. "It's an exciting new horizon of environmental research for TTI."

Speakers at the grand opening ceremony included Chairman Bryan Shaw of the Texas Commission on Environmental Quality; Region 6 Administrator Al Armendariz of EPA; Chancellor Mike McKinney of The Texas A&M University System; Rick Collins, director of the Research and Technology Implementation Office of the Texas Department of Transportation; and TTI Agency Director Dennis Christiansen. Each speaker praised TTI's state-of-the-art facility and TTI's initiative in pursuing new opportunities in environmental research.

"We have to continue to foster and develop new and better understandings of emissions sources, control strategies, new fuel sources and new energy sources," explained Shaw. "Part of doing that is making sure you have state-of-the-art facilities, state-of-the-art equipment and technical personnel who are properly trained to be able to assess and evaluate new, innovative approaches. I'm excited to see this facility online, to see the good data coming out of it."



Joe Zietsman speaks at the grand opening of the Environmental and Emissions Research Facility. To his left are TTI Agency Director Dennis Christiansen, Chairman of the Texas Commission on Environmental Quality Bryan Shaw and Texas A&M University System Chancellor Mike McKinney.



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## Infrastructure

Transportation Planning ■ Infrastructure Development and Financing ■ Pavement Design and Maintenance ■ Infrastructure Rehabilitation ■ Bridge Design and Maintenance ■ Land Use Planning ■ Roadway Design ■ Pavement Recycling ■ Construction Practices ■ Contracting Methods ■ Pavement Diagnostics and Preservation ■ Soil Analysis

# The Right Time *and* the Right Place

## Taking Care of Our Infrastructure



**T**exas' transportation system has allowed the state to successfully compete in a global market. An efficient transportation network allows companies to move their goods efficiently and effectively, offering just-in-time service to their customers.

In the current economic climate, the agencies that oversee our transportation system must make every dollar count. This renewed focus means using the right maintenance technique on our roadways at the right time. And knowing just what that technique should be takes solid research.

The Texas Transportation Institute (TTI) is finding innovative and cost-effective ways to maintain and rehabilitate our infrastructure. Though cash-strapped agencies are less inclined these days to build new facilities, construction is still underway on some critical projects. With billions of dollars at stake, these agencies need TTI's research to ensure they're spending their dollars wisely.

"Infrastructure" in the context of transportation includes our roadways, bridges, traffic control and information devices, safety hardware, drainage structures, and other structures on the right-of-way. The current shortage of tax dollars to maintain that infrastructure might, on first glance, suggest that we should back off our preventive maintenance and rehabilitation measures until the economy recovers. But the long-term cost to Texas and the nation could be staggering. Reconstruction of infrastructure can cost more than four times as much as preventive maintenance and rehabilitation. When you're looking at dollar amounts in the billions, it's obvious that we can't put off the bill until later.

### Roadways

TTI's research on roadways includes planning, construction and maintenance. "Not only do we need to build new facilities that last longer," says Andrew Wimsatt, head of TTI's Materials and Pavements Division, "we need to improve the life expectancy of existing facilities. One way TTI does this is through helping improve material specifications and practices, optimizing

“Not only do we need to build new facilities that last longer, we need to improve the life expectancy of existing facilities. One way TTI does this is through helping improve material specifications and practices, optimizing the use of what we have and stretching our dollars.”

*Andrew Wimsatt,  
Materials and Pavements Division head*

the use of what we have and stretching our dollars.”

The Texas Department of Transportation (TxDOT) has had an aggressive preventive maintenance program since the 1980s. In 2009, TxDOT spent \$1.2 billion to maintain or rehabilitate 192,150 lane-miles of roadway. With the current budget shortfall, TxDOT may have to make some hard decisions about the level of maintenance it’s able to provide.

In cooperation with The University of Texas at Austin, TTI operates the Pavement Preservation Center, which teaches classes on pavement preservation strategies and how to fix the right road at the right time with the best treatment. Another way TTI is helping TxDOT evaluate its repair and rehabilitation needs is by developing tools to help in that decision-making process. Based on the condition and history of the roadway, software developed by the Institute can suggest the best strategies — ranging from seal coating to full-depth reclamation.

TTI is also helping TxDOT detect what causes deterioration, which helps reduce needed repairs down the line. “If you put a thin hot-mix asphalt overlay on a roadway that has structural defects, the problem will quickly return, and the life-cycle cost will be high,” says Jon

Epps, TTI executive associate director. Preventing deterioration reduces the need for costly repairs later, saving potentially millions of dollars over time.

Over the last 15 years, TTI has developed and improved a wide range of nondestructive testing techniques to predict pavement conditions, such as ground-penetrating radar. More recently, TTI researchers developed the prototype for an infrared temperature bar system called Pave-IR, which allows contractors to correct their construction practices in real time. The technology has been commercialized, and several TxDOT districts have used the system with contractors on construction jobs.

Sustainability is an important area of infrastructure research. As applied to roadways, sustainability can mean many things. It can mean reusing and conserving existing roadway materials through innovative rehabilitation techniques such as full-depth reclamation. It can mean using materials and processes to reduce emissions and greenhouse gases dur-

ing construction (e.g., using warm-mix asphalt rather than hot mix). It can also mean reducing the energy associated with maintenance and rehabilitation projects by doing them less often or selecting more energy-efficient alternatives.

Safety is another key aspect of TTI’s research to improve our infrastructure. According to Wimsatt, dangerous potholes are not the only safety factor we have to worry about on our roadways.

“Skid resistance is also important,” he says. “Our research helps improve skid resistance, keeping cars on the road where they belong. We also aim to design pavement mixes to resist rutting, which will help to keep water off the road. We all know the dangers of hydroplaning.”

## Bridges and Other Roadway Structures

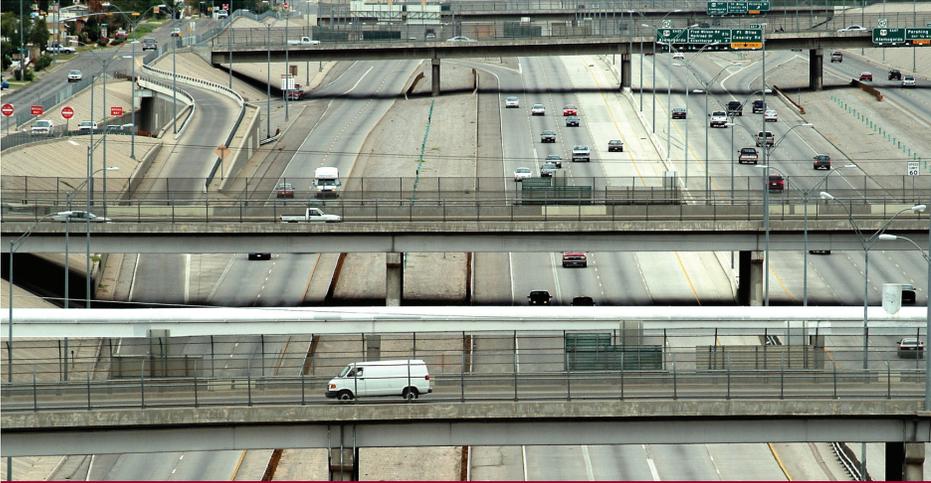
As some of the costlier components in the transportation system, bridges require special attention to maintenance.

“TTI research into bridges and structures focuses on selecting the right maintenance or repair technique,” says Gene Buth, TTI assistant agency director and Texas A&M University senior Research Fellow. “For example, just because a structure has cracking on the surface does not mean that it’s structurally unsound. Conversely, structures that look good on the surface are not necessarily structurally sound.”

Many TTI projects have investigated alkali-silica reactivity and delayed ettr-



The Queen Isabella Causeway links the Texas coast with South Padre Island. Note the reinforcements around the taller columns, put in place following a barge crash in 2001. Repairs and maintenance of this bridge are vitally important to the people of South Texas and South Padre Island’s tourism industry.



Maintaining our nation's infrastructure is key to keeping us connected, economically competitive and moving forward.

ingite reaction, detrimental chemical reactions in concrete, which can cause serious problems for concrete structures. Specifications for materials and methods now prevent or reduce these reactions in concrete, and research is continuing to determine the structural integrity of those older structures that exhibit some cracking. Not all structures will need costly repair or rehabilitation — again, the right technique at the right time can save transportation agencies millions or even billions in unnecessary repair bills.

Rehabilitation techniques also apply to scour, which is the loss of sediment from around bridge abutments or piers. Scour can compromise the integrity of a structure if not remediated.

“Historically, Texas has been overly conservative in estimating bridge scour,” says TTI Research Engineer and Texas A&M Professor of Civil Engineering Jean-Louis Briaud. Briaud also manages TTI’s Geotechnical and Geoenvironmental group. “We have estimated for the worst-case scenario, but scour may be different depending on the type of soil underlying the structure. We are developing techniques to accurately predict scour so that transportation agencies can build more cost-effectively.”

Developed by TTI, the Erosion Function Apparatus (EFA) can accurately measure a soil’s susceptibility to scour. Not only does this information go into design and maintenance

planning, but tools like the program MEANDER use this information to predict how rivers migrate and how we need to react to the shift.

For new construction, TTI is helping develop and test new, lower-cost techniques. Splicing prestressed beams may cost less and allow concrete structures to compete with steel over longer spans. Precasting panels for bridge overhangs is also a quicker, low-cost technique and eliminates the safety issues of installing overhangs cast in place.

“The cooperative relationship we have with our sponsors is what gives our research impact,” says Paul Krugler, TTI research engineer. “For example, transportation agencies don’t have the time and personnel to try out and fully evaluate many of the new techniques developed elsewhere in the United States and the world. TTI serves that purpose. We listen to what they need, whether it’s to evaluate a new technology for application in Texas or to develop a brand new technology. We apply sound technical principles and methodologies, and then we give a high return on invested research dollars. About 10 years ago TxDOT estimated their rate of return on research at five times what the department spends. I think that’s a conservative number.”



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## COMMENTARY on Infrastructure

*Charles F. Potts*

*Past Chairman of the American Road and Transportation Builders Association and CEO, Heritage Construction and Materials*

Abraham Lincoln famously said, “A house divided against itself cannot stand.” Lincoln’s words heralded the American Civil War, of course. He spoke of a nation splintered by political differences and destined for dissolution if those differences couldn’t be resolved.

Though we have our own political strife some 150 years later, a much more present crisis looms for our nation. Our transportation infrastructure is crumbling. In his speech, Lincoln focused on political fractures among states. Today, literal fractures split the roadways connecting us across state lines. We face collapsing bridges in Minnesota, failing pavements in Texas and debilitating congestion in California.

The Interstate Highway Act of 1956 connected our nation in a way never before achieved. At the time, some naysayers claimed that four- and six-lane roadways were extravagant, that we’d never fill that capacity with traffic. How accurate were they at predicting the future?

According to the Texas Transportation Institute’s (TTI’s) *Urban Mobility Report*, the United States spent \$87.2 billion, burned 2.8 billion gallons of gasoline and wasted 4.2 billion hours stuck in traffic in 2007. That’s \$750 and nearly one full work week per U.S. traveler. Those numbers not only represent waste — they’re a missed opportunity.

China and India, for example, are investing in their own transportation infrastructure, the backbone of any nation’s economy. Our international competitors are coming up on the outside in the race for economic dominance. To compete effectively, we simply must recommit to rebuilding our national transportation network. Current infrastructure needs to be repaired. And we should design future infrastructure with an eye toward intermodalism, leveraging the strengths of air, rail and roadways.

Lincoln’s analogy is as relevant today as it was in 1858, if for different reasons. When we started building this house in the 1950s, it was the envy of the world. The timbers were firm. The paint was fresh. The foundation was strong. Now, the house needs work. TTI research in mobility assessment, structural design and roadway maintenance is vital to this effort.

The house is still standing. Let’s repair it while it is.

**Security**

Homeland Security | Antiterrorist Perimeter Security Devices | Border Security | Port Security | Emergency Planning and Response | Hazardous Materials Transport | Transit Security | Airport Security | Customs and Border Protection



# Security Is More Than a State of Mind



## “9/11 changed everything.”

Nearly a decade after the deadliest foreign attack on American soil in our nation’s history, that phrase is almost a cliché. Unfortunately, that doesn’t make it any less true.

In medieval times, the main gate, or portcullis, was the most important part of a castle’s security. If the gate was breached, enemy forces would pour in.

“While our technology has become more sophisticated, the basic strategy for defense hasn’t changed,” explains Texas Transportation Institute (TTI) Assistant Agency Director Dean Alberson, who manages TTI’s Crashworthy Structures Program. “Keeping an enemy from getting close enough to do harm is still the best way to ensure the safety of U.S. citizens, both at home and abroad.”

### Protecting Our National Assets

To that end, in August 2010, the U.S. Department of State’s Bureau of Diplomatic Security awarded TTI a contract for up to \$7 million over a five-year period to design, analyze and test perimeter security devices. TTI began work with the State Department in 2002, conducting dozens of tests intended to increase security for American embassies and other posts around the globe.

The first project under the new contract involves crashing various vehicles into an instrumented pier designed to measure the impact of the collisions. These tests will help researchers design various future devices that will meet U.S. security standards.

The State Department’s 2003 anti-ram barrier standard, which limited barrier penetration to 3 feet, acknowledged the “tight quarters” reality of embassy placements but didn’t address some

of the needs of military bases, which are typically surrounded by wide-open spaces. The more space between buildings, the longer the stopping distance needed to prevent enemy vehicles from getting too close. The safety of building occupants is enhanced with every foot of space between the facility and a terrorist’s bomb. The 2003 standard also assumed a 2.5-ton diesel truck as the method for bomb delivery, whereas recent experiences in Iraq, Afghanistan and other countries make it clear that practically any vehicle will do for delivering destruction.

Acknowledging this reality, the U.S. Army Corps of Engineers demanded a more flexible standard, so ASTM International created a working group, chaired by Alberson, to develop it. The new ASTM F2656-07 Standard Test Method for Vehicle Crash Testing of Perimeter Barriers adds more penetration ratings, incorporates design flexibility to cover a wider range of vehicles, and specifies different impact velocities for some vehicle



Shallow bollards like this one help keep U.S. facilities and their personnel safe abroad.

categories. The State Department officially adopted this standard in October 2008.

Speaking of security concerns around the world, the United Kingdom's Center for the Protection of National Infrastructure has contracted with TTI to help translate between U.K. and U.S. standards. The British version of ASTM F2656-07 is called BSI PAS 68, but its requirements don't match up exactly with its American counterpart.

"TTI's job is to help harmonize the testing for these two standards," says Alberson. "Making them more compatible will improve structural defense by limiting the opportunity for confusion or miscommunication among those trying to use them."

### Securing Our Borders

TTI researchers have completed two projects with the National Center for Border Security and Immigration, funded through the Department of Homeland Security's Center of Research Excellence Program, to assess and improve security at the U.S.-Mexico border. One project analyzed technology and processes at land ports of entry (POEs), and the second one analyzed how technology can be used to improve security at land POEs. Technology, layout and process need to be coordinated, so the second phase of the project identified improvements that could be implemented to further increase security at POEs.

"It's a tricky thing to balance security with the need to keep things moving," explains TTI Research Scientist Juan Villa, currently managing TTI's Mexico City office. "There are trade-offs to be

evaluated, including safety, efficiency and economic considerations, not to mention right to privacy."

### Hazardous Materials Tracking

Transport of hazardous materials has both security and freight safety concerns. Terrorists, for example, might try to conduct a catastrophic attack using a planned release of hazardous materials. Transportation accidents can also expose people and the environment to these materials.

TTI will soon be working with Texas Southern University to validate new tools for measuring and tracking hazmat movements on Houston's industrial corridors. The Institute has also worked with the Texas Division of Emergency Management and Texas counties to evaluate hazmat movements. TTI and Texas A&M University's Hazard Reduction and Recovery Center researchers have co-authored a hazmat commodity flow study guidebook to be published by the Transportation Research Board in 2011.

TTI Research Specialist Debbie Jasek and Associate Research Scientist David Bierling explain that these studies are different from a lot of traditional traffic evaluations. "TTI works with community officials and volunteers to figure out where, when and how hazmat is transported. We can also help evaluate their chemical transport risks," says Bierling. ■



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## COMMENTARY on Security

*D'Vetrio Baugh  
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At the U.S. Department of State (DOS), we are the face of the United States to the rest of the world. Our embassies and consulates represent a hand of friendship to other nations. Some return that friendly handshake; some don't.

Securing our diplomats abroad is one of the toughest challenges we face. Not only is it a practical matter of ensuring their safety; it's also a political matter of establishing an open, welcoming presence in a foreign land.

Striking that balance between protecting our facilities (and the officials within them) and presenting a welcoming face can be difficult at times. Do we need a 10-foot reinforced concrete fence to keep a potential car bomber away from our facility? If the answer is "yes," how can we maintain that secure perimeter while still showing that we really are there to help?

The engineers at the Texas Transportation Institute's (TTI's) Proving Ground are the perfect partners to help us find that balance. For six decades, TTI has excelled at keeping people safe, which is why the State Department has chosen to contract with them for the next five years. TTI's expertise in testing roadside devices helps us evaluate DOS designs for bollards and other anti-ram devices that keep our citizens and foreign friends safe wherever we have an official presence abroad.

TTI's connection to Texas A&M University is also important. Hands-on training with the Institute gives new transportation engineers graduating from Texas A&M the real-world experience they need, and that, in turn, gives us an edge in establishing safe facilities. Young minds create innovative ideas, which invigorate our approach to security. That, perhaps, is the single most important advantage TTI and DOS have as we team up to protect U.S. diplomatic facilities around the world.

**Workforce Development**

Undergraduate and Graduate Education | Multi-Disciplinary Transportation Certificate Program | Transportation Career Development | Summer Transportation Institute | Technology Transfer | Graduate Research | Professional Development | Guidebooks and Course Materials



# Learning by Teaching:

## Developing Transportation Professionals for Today and Tomorrow

**A** proverb says that by learning you will teach, and by teaching you will learn. In its mission to educate transportation professionals, the Texas Transportation Institute (TTI) has certainly learned from its students. What we take away is that together we can improve the transportation industry — a vital part of everyday life that touches every facet of society — and thereby improve life for all of us.

“We’re not just training researchers,” says Tim Lomax, TTI research engineer and associate director for the Southwest Region University Transportation Center (SWUTC). “We’re teaching people to think. We show them how to approach a problem and organize their efforts. Then we show them the tools and procedures they can apply to that problem.”

Workforce development at TTI encompasses a broad range of ages and transportation fields. We educate

the current workforce by offering seminars and workshops. We educate the future workforce by sponsoring students and their research projects. We educate the very youngest of our future transportation professionals by showing students the many opportunities that await them as engineers and planners. And through our efforts we learn — what the community needs, what we can provide and how we can work together to get it done.

### Current Workforce

TTI performs valuable research for the transportation industry, but without implementation, that research could sit on a shelf and collect dust. The seminars and workshops TTI conducts, most notably for the Texas Department of Transportation and the National Highway Institute, are one way to get the word out. Recent topics have included designing and operating intersections for safety, freeway management and operations, traffic signal design and operations, work zone management and design, new approaches to highway safety analysis, and state and metropolitan transportation planning.

“The people we teach aren’t just students,” says Gary Thomas, director of the Center for Professional Development. “They have life experiences that they bring to the classroom, and we always learn something from them. We incorporate that valuable information into the next workshops we teach.”

TTI’s reach extends internationally as well. Recently, Institute instructors traveled to Thailand and the Middle East to share their expertise — again learning from their students’ different worldviews and perspectives.

### Future Workforce

As part of The Texas A&M University System, TTI has strong ties to the education of undergraduate and graduate students. TTI researchers teach university courses and offer classroom lectures. They may also be official or unofficial members of a student’s thesis or dissertation committee. And often Texas A&M professors work on TTI projects.

“It’s important for faculty to be involved in professional activities,” says TTI Research Engineer and Texas A&M Associate Professor of Civil Engineering Gene Hawkins. “Faculty become better at teaching if they’re practicing. They become more knowledgeable about the leading edge and can share the state of the practice with students who will soon enter the workforce.”



TTI researchers support and enhance the undergraduate and graduate educational experience by helping prepare students for transportation careers.

## COMMENTARY on Workforce Development

*Robert C. Wunderlich, P.E.  
International President-Elect  
Institute of Transportation Engineers*

The fundamentals of how we teach our engineers have changed over the last few decades.

In 1980, an engineering student sat in a classroom and absorbed the wisdom of a professor who'd been trained in that same, traditional learning environment. Classroom lecture and formal examination were the "language" by which we learned, using materials supplied by the professor.

Today, that language is changing. If we want to encourage young minds to embrace transportation engineering as a career, we have to do so on their terms. Learning in virtual environments and in convenient locations (defined as anywhere with a WiFi connection these days) is one way to do that.

Beyond the technological approach we take, we also have to create a meaningful message for the audience. Most young people today want to make a difference. Our challenge is to show them just how vital their contribution can be to the quality of life achievable through building a sustainable transportation system — one that respects the environment while meeting the needs of consumers.

That idea of "consumers" is worth noting as we consider how best to reach today's students. In our 1980 example, professors were the "suppliers" of knowledge. Today, the Internet has become a fire hose of information. Unlike our traditional classroom, however, not all that information is reliable and well researched (see: Wikipedia). Teaching students how to become good consumers of knowledge is, perhaps, the most important role we have. To that end, first and foremost, we must train them to think.

The Texas Transportation Institute, through its close relationship with Texas A&M University, does just that. Students work directly in the field on transportation-related projects, gaining knowledge that only hands-on experience can teach them. They learn how an analytical process works, not merely how a product is made. They learn how to define a problem and develop and evaluate alternatives; they learn how to think critically and make decisions based on sound analytical methods.

Reaching young minds through innovative teaching methods . . . firing their imaginations with what they can accomplish . . . and teaching them how to analyze problems and make decisions — these are the keys to success for training an effective workforce. The real question then becomes: can we, as educators and stewards of the future, apply that lesson inside — and outside — the classroom?



One of the most popular exercises of the STI is building balsa-wood bridges.

Undergraduate and graduate students are an asset to TTI. They work on research projects as student workers or research assistants, bringing different perspectives and focus to their projects. The students themselves learn from transportation professionals, put their learning into practice, and get a jumpstart on their careers, bringing practical experience into the workforce.

The University Transportation Center for Mobility (UTCM) and SWUTC, led by the Institute, are another way TTI supports students. The UTCM and SWUTC fund transportation research but also sponsor student education. With this funding and awards like UTCM Student of the Year, which carries a stipend, students can pursue innovative research that puts another top performer into the transportation industry.

"Our students become consultants, professors and government officials," says Lomax. "Their shared experiences in the lab give them a better appreciation of how different people think and approach a problem. A shared problem-solving opportunity teaches people how they can benefit from working together."

### Far Future Workforce

TTI casts an eye far down the road — to the transportation industry 15 to 20 years in the future. Who will our transportation professionals be? They're probably sitting in junior high school right now.

"Grades six, seven and eight are crucial years for children," says Debbie Jasek, research specialist with the Center for Professional Development. "That's the age when children figure out what career they're interested in. Most children know nothing about engineering, and we need to show them what an exciting field transportation is."

In addition to outreach at schools, Institute professionals attend a variety of events. They demonstrate gadgets, show videos and engage children in fun, creative exercises using science and math. TTI works with the Girl Scouts and Boy Scouts, creates resources for teachers, and partners with other organizations to encourage children to consider transportation as a career.

TTI also hosts the Texas Summer Transportation Institute, funded by the Federal Highway Administration and other sponsors. The program introduces students to the field of transportation through fun activities during two weeks at Texas A&M, Prairie View A&M University or Texas A&M University-Kingsville. Of the students who attend the event, more than 40 percent go into science or engineering fields. ■



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## TTI in the Media

Over the past year, TTI experts answered tough questions on a variety of state and national transportation issues. Over 2,500 newspaper articles, broadcast television spots and professional journals — with a potential reach of over 725 million readers and viewers nationwide — mentioned the Institute or its experts. Here are a few excerpts of TTI's media coverage over the last fiscal year.

For more information, please contact Rick Davenport at (979) 862-3763 or r-davenport@tamu.edu.

### The Wall Street Journal

*Sept. 10, 2010, "Deaths in crashes decline amid gains in car safety"*

"The focus on engineering and enforcement has taken us to this point," said **Quinn Brackett**, a safety researcher with the Texas Transportation Institute. Now, he added, "We need to focus on a paradigm shift away from occupant protection toward crash avoidance."

### Kansas City Star

*Aug. 14, 2010, "Wrecks point up work-zone risks"*

About a third of all work-zone crashes in Missouri can be attributed to inattentive driving, and the second-leading contributing factor is following too closely. Both were cited in last week's bus crash. . . . "It's one of the very reasons that it's hard to guard work zones against serious crashes," said **Gerald Ullman**, senior research engineer at the Texas Transportation Institute. "We can put up all the signs we want, and all the bells and whistles," Ullman said. "What we can't control is did they see it. That's why we're so concerned about distracted driving in work zones."

### The Washington Post

*Feb. 7, 2010, "Racking up miles? Maybe not."*

Within a few years, a driver who pulls up to the gas pump may pay two bills with a single swipe of the credit card: one for the gas and the other for each mile driven since the last fill-up. . . . But getting the public and its elected officials to accept that idea maybe a tough sell. . . .

"Technology is not the limiter," said **Ginger Goodin**, a senior research engineer at the Texas Transportation Institute who did a major study on pricing. "The decision is in the policy arena. It's entirely up to lawmakers and their constituents."

### Austin-American Statesman

*June 13, 2010, "Going, going, going, going green: Impact is multiplied when entire fleets embrace alternative fuels, improved efficiency"*

"Due to economic competition and the perpetual drive to reduce operating costs, freight shippers and carriers already have significant incentive to minimize fuel costs and thereby (greenhouse gas) emissions, which are second only to labor costs and increasingly volatile," said **Annie Protopapas**, an associate research scientist with the Texas Transportation Institute at Texas A&M University. "In the long term, they do realize substantial cost savings."

### Reader's Digest

*Oct. 1, 2009, "Unlocking gridlock"*

"We can't get rid of traffic, but we can shorten commutes by operating our roads better — clearing wrecks faster and timing lights more efficiently."

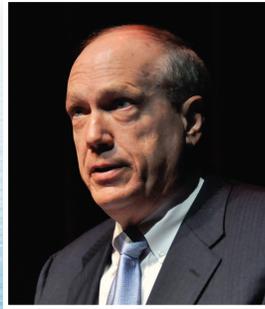
*Tim Lomax,  
Texas Transportation Institute*

### The Arizona Republic

*Aug. 19, 2010,  
"HAWK lights to help  
reduce pedestrian deaths  
in metro Phoenix"*

The Texas Transportation Institute has done two studies of the HAWK (High Intensity Activated Crosswalk) system and found they work. Last year, the institute studied Tucson HAWK lights and found there were 69 percent fewer accidents involving pedestrians and 29 percent fewer crashes overall at the HAWK sites, said **Kay Fitzpatrick**, a senior research engineer with the institute.

Individual photos, clockwise: Amadeo Saenz, TxDOT executive director; Dennis Christiansen, TTI agency director; and R. Bowen Loftin, president of Texas A&M University.



Group photo, from left to right: John Barton, TxDOT assistant executive director for engineering operations; David Casteel, TxDOT assistant executive director; James Bass, TxDOT chief financial officer; Ned Holmes, TxDOT commissioner; Fred Underwood, TxDOT commissioner; and Ted Houghton, TxDOT commissioner.

# Short Course Long on History, Achievements



**W**ith the theme “one DOT,” the 84th Annual Transportation Short Course attracted more than 1,800 professionals for the two-day event at Texas A&M University Oct. 12–13. Rich with history — the first Short Course occurred when President Calvin Coolidge occupied the White House — Short Course is cosponsored by the Texas Department of Transportation (TxDOT) and the Texas Transportation Institute (TTI).

“It’s fascinating to think of the knowledge that has been disseminated here, the networking that’s taken place, the decisions that have been made, and the impacts they’ve had on transportation in this state and this country over the last eight-and-a-half decades,” TTI Agency Director Dennis Christiansen told the crowd during the opening session. “TxDOT has always been our most important customer, our most valued partner.”

Texas A&M University President R. Bowen Loftin — introduced as being part of the TxDOT family because his father worked 40 years for what was then called the Texas Highway Department — welcomed the attendees.

“Many of our faculty work jointly with TTI and the department so we can educate the next generation of civil engineers [and conduct] the kind of research TxDOT needs to make our highways better, cheaper and safer over time,” Loftin said. “We are all here today to celebrate the partnership between TxDOT, TTI and Texas A&M.”

Many of the opening session comments centered on the recent challenges at TxDOT, including the Sunset Review, funding concerns and several substantial new projects. Much of Short Course focused on teamwork and all that has been accomplished.

“It’s been frustrating at times, but success is here,” TxDOT Executive Director Amadeo Saenz told the crowd. “In spite

of all you have been asked to do, you’ve done it. In spite of the changes you’ve been asked to make, you’ve made them. I’ve never been more proud of the people in this department.”

Similar sentiments were expressed by members of the Texas Transportation Commission.

From Chair Deirdre Delisi: “It’s not easy to hear or read the criticisms that come our way. You continue to surprise me every day by standing up and accomplishing the tasks and any challenges brought before you. As a result we are considered the model for the rest of the country.”

From Commissioner Fred Underwood: “Let’s not get discouraged by this process. Regardless of what happens during the legislative session, we need to stay focused on doing the right thing. In part, that’s improving the lives of the men and women around us.”

As part of the proof that TxDOT has made a difference, Saenz pointed to last year’s fatality statistics showing that “388 fewer Texans died on our highways.” He told employees that the 11 percent decline was due, in part, to the work they did.

As part of each Short Course opening session, TxDOT highlights employees who risked their own lives to save others. This year, five employees received an Extra Mile Award in cases that involved a car crash explosion, a high-water rescue and the subduing of a suspect who attacked a state trooper. ■



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# Texas Transportation Pioneer Inducted into Hall of Honor

With a long list of Texas and national transportation accomplishments to his name, the former chairman of both the Texas Transportation Commission and the National Rail Passenger Corporation (Amtrak), David Laney, was inducted into the Texas Transportation Hall of Honor Oct. 6.

With numerous colleagues and well-wishers in attendance, the induction ceremony took place at the Texas Department of Transportation's (TxDOT's) Dewitt Greer Building in Austin. Laney, a Dallas attorney, becomes only the 32nd member of the Hall of Honor.

"David Laney's contributions to the transportation system are immeasurable," says Texas Transportation Institute (TTI) Agency Director Dennis L. Christiansen. "The indelible mark he has made on transportation has made a positive impact not only in Texas, but throughout the nation. We owe him a great debt of gratitude for his service."

TxDOT Executive Director Amadeo Saenz welcomed the audience and noted that the TxDOT staff had counted 59 commission meetings that Laney had attended as a commissioner. Several of Laney's professional colleagues and personal friends provided reflections on his leadership and personal attributes that earned him this honor. The speakers included Wes Heald, TxDOT executive director (retired), who headed the agency when Laney served on the commission; Michael Morris, director of transportation for the North Central Texas Council of Governments; Jere Thompson, CEO of Ambit Energy; and Donna McLean, vice chair of the Amtrak Board of Directors.

"David essentially turned around Amtrak," said McLean. "It was not an easy job; it was a 'turnaround' job. Our revenues and

ridership went up, and we laid a partnership with the states for intercity passenger travel. We're building on his contributions every day."

Morris noted that Laney could be the secretary of transportation for the United States. "He has that quality of leadership," Morris said.

Ronald Marino, managing director of municipal securities of CitiGroup, spoke at a dinner in Laney's honor following the ceremony, which was hosted by the Associated General Contractors of Texas.

Laney chaired the Texas Transportation Commission from 1995 to 2000. His list of accomplishments includes increasing highway construction contracts from \$1.9 billion to \$3.1 billion annually, establishing TxDOT's toll division and initiating TxDOT's shift toward innovative methods of highway finance, implementing a \$2.8 billion Rio Grande border infrastructure program and re-establishing the North Texas Tollway Authority.

He was appointed to Amtrak's board of directors by President George W. Bush, where he served as chairman from 2003 to 2007. Laney aggressively rebuilt the organization, reduced its debt, increased ridership and revenue, and for the first time achieved important on-time performance targets.

A 1971 graduate of Stanford University and a 1977 graduate of Southern Methodist University School of Law, Laney is currently a practicing Dallas attorney and a leader in many civic and transportation-related activities. He has held numerous board positions, including serving on the Stanford University Board of Trustees.

The Texas Transportation Hall of Honor was established in 2000 by TTI as a way to recognize the select individuals who played pivotal roles in the advancement of transportation in Texas and the nation. Each individual inductee is recognized by a plaque on permanent display in the Hall of Honor. ■



David Laney thanks the crowd of well-wishers for his selection for the Texas Transportation Hall of Honor.



Among those attending the induction ceremony of David Laney (second from left) were TxDOT Executive Director Amadeo Saenz (center) and former TxDOT executive directors (from left to right) Arnold Oliver, Michael Behrens and Wes Heald.



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# Advisory Council Addresses Challenges of Texas Transportation



**W**ith the state's transportation concerns a main focus of their annual gatherings, members of the Texas Transportation Institute (TTI) Advisory Council had much to consider when they met in College Station Sept. 16. Discussions centered on a number of tough issues, including the lack of federal and state funding for road projects and the impact of congestion on the Texas economy.

The members of the Advisory Council are familiar with such dilemmas — they are professionals from across the state and from every sector of the transportation industry. Their input helps guide TTI in its efforts to address the state's needs.

"I think we are at a critical crossroads...and if we don't make the right transportation decisions in the next five to 10 years, the opportunities that this state now has will not be there," Rep. Larry Phillips, chair of the House Select Committee on Transportation Funding, told council members during their luncheon. "What you do is important and worthy of your efforts...Texas and our families need you to stay at it."

As part of their meeting, council members celebrated TTI's 60th anniversary and heard about major developments at TTI during the last year. Topics discussed included the TTI-developed freight shuttle, which has the potential

for revolutionizing freight transport; a new aviation initiative; a recent contract from the U.S. Department of State to design and test perimeter security devices (see related story on page 10); and a TTI-developed, interactive planning tool called the TRENDS model, which is designed to forecast transportation revenues and expenses through 2035.

"We continue to grow the research program in a very tough environment," TTI Agency Director Dennis Christiansen said. "Although we continue to do very interesting things with the Texas Department of Transportation, essentially, all the growth is coming from new non-TxDOT research. In the past year, we've opened an office in both Qatar and Mexico City." Christiansen further noted that 5 percent of the Institute's work comes from international sponsors.

Following the TTI project presentations, a round table discussion took place

"I think we are at a critical crossroads...and if we don't make the right transportation decisions in the next five to 10 years, the opportunities that this state now has will not be there. What you do is important and worthy of your efforts...Texas and our families need you to stay at it."

*Rep. Larry Phillips,  
chair of the House Select  
Committee on Transportation Funding*

among Advisory Council members. Topics highlighted included all aspects of transportation including congestion and managed lanes, rail and transit, teen drivers, headlight illumination and the potential impact on Texas of the changes at the Panama Canal.

TTI Advisory Council Chair David Cain thanked the members and the Institute. "It is great to celebrate the TTI 60th anniversary," he said. "You do us proud, and you do our state a great service." ■



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## TDS Honored by National Safety Council, Gains Partner

The National Safety Council (NSC) has recognized the Teens in the Driver Seat (TDS) program with its Teen Driving Safety Leadership Award. This is the fourth national award the TDS program has received.

For most of its nearly 100-year history, NSC has focused on workplace and transportation safety, but the organization did not begin to honor specific teen driving safety efforts until last year.

"These honorees were selected from nominees across the nation based on their demonstrated commitment and the measurable impact they had changing behaviors, enhancing public understanding of the issue and advocating proven prevention strategies," NSC President Janet Froetscher said in announcing the TDS award.

As part of its announcement, NSC noted how TDS "has reached more than 400,000 young drivers and passengers, and has achieved measurable behavior changes and crash reductions." The announcement also noted that TDS assisted in improving the state's graduated driver license law during the last session of the Texas Legislature.

In another form of recognition, on July 14, AT&T donated \$10,000 to support the continued expansion of TDS efforts. AT&T joins other TDS supporters, the Texas Department of Transportation and State Farm Insurance of Texas.

"We appreciate the generous support and are happy to have a new partner from the telecommunications industry," said TDS Director Russell Henk.

AT&T's involvement is especially encouraging, given the danger of distracted driving and the rapid growth in the number of teens with cell phones. ■

## Drink. Ride. Lose. Addresses Motorcycle/Alcohol Issue

The Texas Department of Transportation's (TxDOT's) Traffic Safety Section launched a new motorcycle rider impairment campaign Oct. 1 at LookLearnLive.org. The *Drink. Ride. Lose.* anti-impaired riding campaign aims to bring awareness about the significance of the impaired rider crash problem in Texas and encourage safe motorcycle-riding practices.

The LookLearnLive.org website features *Drink. Ride. Lose.* campaign logos, billboards and links to testimonials about the dangers of drinking and riding. Other promotional items are available for events to help get the word out about the dangers of drinking and riding.

"With *Drink. Ride. Lose.*, we're focusing on the primary and most preventable cause of motorcyclist fatalities, alcohol use while riding," says TxDOT Traffic Safety Motorcycle Program Manager Gonzalo Ponce.

"In order to make a significant impact, we realize that there first must be a change in rider behavior, and that is really our main goal."

According to the National Highway Traffic Safety Administration, motorcyclists involved in fatal crashes are 2.5 times more likely to have consumed alcohol than passenger-vehicle drivers. In 2008, 46 percent of riders killed in Texas had some level of alcohol in their system at the time of the crash. More than one out of three fatally injured riders were legally intoxicated (blood alcohol content 0.08+).

"These numbers are staggering and just not acceptable," says Patricia Turner, research scientist with the Texas Transportation Institute, who manages the safety campaign. "We have to do more to communicate how serious this problem is and the effect of alcohol and drugs on riding ability." ■



The *Drink. Ride. Lose.* anti-impaired riding campaign aims to bring awareness about the significance of the impaired rider crash problem in Texas, as well as encourage safe motorcycle-riding practices.

## Beijing Visitors Boost TTI-BTRC Association

The relationship between the Texas Transportation Institute (TTI) and the Beijing Transportation Research Center (BTRC) was strengthened this summer as representatives from the Chinese facility visited the Institute in July.

The two-day visit included tours of the Environmental and Emissions Research Facility, Translink®, the TTI driving simulator and Houston's traffic management center, TranStar.

"Traffic congestion and air quality are our two biggest areas of concern," says Huimin Wen, BTRC's deputy chief engineer. "What you have here is very impressive...we have numerous common research interests."

TTI and BTRC began working together in 2006. Two years ago, TTI hosted a visiting scholar from BTRC for three months. Xiaoyong (Felix) Deng, senior engineer and director of the ITS Division of BTRC, was a visiting scholar at TTI this fall. ■



Visitors from China tour the Environmental and Emissions Research Facility.



For more information about these news items or other media inquiries regarding TTI research, please contact Rick Davenport at (979) 862-3763 or r-davenport@ttimail.tamu.edu.

## Anderson Joins Elite Construction Organization



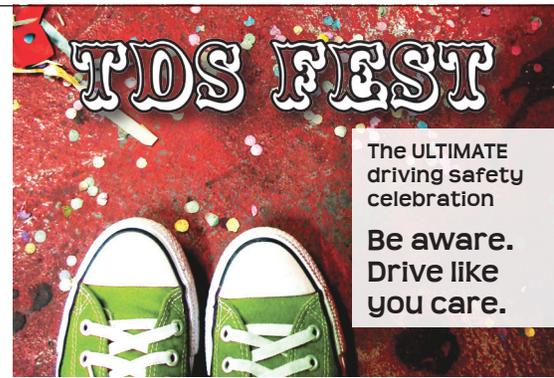
Stuart Anderson

Stuart Anderson, Zachry Professor in Design and Construction Integration II in the Zachry Department of Civil Engineering and manager of TTI's Construction Engineering and Management Program, was inducted into the National Academy of Construction (NAC) in ceremonies held recently in New York City.

Following nomination by Anderson's peers, his election was confirmed by the academy's 119 members, who are made up of "industry leaders whose present or past professional career, over a period of years, demonstrates outstanding contribution to the effectiveness of the engineering and construction industry."

"Membership into the academy will stand out as a pivotal moment of my career," Anderson said. "Including me in the same group of people I admire — senior members of academia and national-level leaders in the design and construction industry — is truly an honor that I will always be thankful for."

Anderson says he looks forward to working with NAC on future endeavors as it strives for a more proactive and influential impact on the construction industry. ■



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## TTI Plays Vital Role in Hurricane Evacuation

A patent-pending system developed by the Texas Transportation Institute (TTI) used to monitor travel times could be put to the test if Houston has to evacuate due to a hurricane.

The new travel-time monitoring system has been installed along Interstate 45 (I-45) from north of Houston to Huntsville. The system will also reach over 200 miles into Dallas County, providing current travel-time monitoring capability and the ability to determine traffic speeds along I-45.

"The data that our system provides will help determine when contraflow lanes should be opened during an evacuation event," says Research Engineer Tony Voigt, who is the program manager for the Houston Research and Implementation Office. "Everyone remembers the evacuation issues in advance of Hurricane Rita in 2005. The new TTI travel-time monitoring system, in addition to five years of detailed evacuation planning, should facilitate much smoother future evacuations."

The Institute's patent-pending software is called AWAM, which is an acronym for Anonymous Wireless Address Matching. When Bluetooth®-equipped cell phones or other electronic devices inside vehicles pass monitoring stations, average travel times are calculated and mapped.

The AWAM software system and hardware technology were largely developed by TTI Senior System Analyst Mike Vickich and Research Scientist Darryl Puckett. Other TTI staff members, including Leonard Ruback, Rajat Rajbhandari and Swapnil Samant, have made and continue to make contributions to the technology.

"AWAM is an extremely efficient system that has numerous other applications — at a fraction of the cost of other traffic monitoring systems," Voigt says. "It really opens the door for travel-time-related research and implementation on all types of roadways, especially in rural areas and on arterial roadways." ■



A travel-time monitoring station using TTI-developed software is mounted on a light pole along I-45.

**»» TEXAS TRANSPORTATION INSTITUTE  
Publications****TECHNICAL REPORTS**

"Alternative Methods for Developing External Travel Survey Data," by Steve Farnsworth, **0-6583-1**, October 15, 2010.

"Analysis and Recommendations on Protecting Waterways from Encroachment," by Joan Mileski, **0-6225-1**, July 30, 2010.

"Bioretention for Storm Water Quality Improvement in Texas: Pilot Experiments," by Ming-Han Li, **0-5949-2**, July 28, 2010.

"Development, Calibration, and Validation of Performance Prediction Models for the Texas M-E Flexible Pavement Design System," by Paul Carlson, **0-5235-1-VOL1**, October 5, 2010.

"Development of a Model Performance-Based Sign Sheeting Specification Based on the Evaluation of Nighttime Traffic," by Fujie Zhou, **0-5798-2**, August 13, 2010.

"Development of a Model Performance-Based Sign Sheeting Specification Based on the Evaluation of Nighttime Traffic Signs Using Legibility and Eye-Tracker Data: Data and Analyses," by Paul Carlson, **0-5235-1-VOL2**, October 5, 2010.

"Evaluation of Potential Benefits of Wider and Brighter Edge Line Pavement Markings," by Jeff Miles, **0-5862-1**, August 3, 2010.

"Field and Laboratory Investigation of Warm Mix Asphalt in Texas," by Cindy Estakhri, **0-5597-2**, August 11, 2010.

"Geometric Design and Operational Factors that Impact Truck Use of Toll Roads," by Chris Poe, **0-5377-1**, September 3, 2010.

"Highway Safety Design Workshops," by James Bonneson, **5-4703-01-1**, November 16, 2010.

"Improving Stop Line Detection Using Video Imaging Detectors," by Dan Middleton, **0-6030-1**, November 23, 2010.

"Investigation of Rainfall and Regional Factors for Maintenance Cost Allocation," by Emmanuel Fernando, **5-4519-01-1**, September 1, 2010.

"On-Going Evaluation of Traffic Control Devices," by Paul Carlson, **0-6384-1**, September 1, 2010.

"Quantifying the Purchasing Power of Public Transportation in Texas: Technical Report," by Linda Cherrington, **0-6194-1**, August 3, 2010.

"Texas Perpetual Pavements: Experience Overview and the Way Forward," by Lubinda Walubita, **0-4822-3**, August 17, 2010.

**PROJECT SUMMARY REPORTS  
AND PRODUCTS**

"Aggregate Resistance to Polishing and Its Relationship to Skid Resistance," by Eyad Masad, **0-5627-S**, November 11, 2010.

"Develop Guidelines for Effective Prime Coats," by Tom Freeman, **0-5635-S**, September 10, 2010.

"Estimated Impacts of the 2010 Census on the Texas Transit Funding Formula: Project Summary Report," by Linda Cherrington, **0-6199-S**, June 14, 2010.

"Estimated Impacts of the 2010 Census on the Texas Transit Funding Formula: Summary Report on Findings," by Linda Cherrington, **0-6199-P1**, August 11, 2010.

"Existing Regional and Rainfall Factors," by Emmanuel Fernando, **5-4519-01-P1**, August 12, 2010.

"Feasibility and Applications of RFID Technologies to Support Right-of-Way Functions," by Gene Hawkins, **0-6142-S**, June 17, 2010.

"Guide for Geometric Design and Operational Factors that Impact Truck Use of Toll Roads," by Chris Poe, **0-5377-P2**, November 2, 2010.

"A Logical Guideline for Super-heavy Load Review Policy," by Jeongho Oh, **0-5270-S**, July 23, 2010.

"Methods for Developing External Travel Survey Data," by Steve Farnsworth, **0-6583-S**, June 18, 2010.

"Operational Factors that Impact Truck Use of Toll Roads," by Chris Poe, **0-5377-S**, June 23, 2010.

"Proposed Test Protocol for Video Imaging Detection at Intersection Stop Lines," by Dan Middleton, **0-6030-P2**, September 2, 2010.

"Super Heavy Load Database Information," by Jeongho Oh, **0-5270-P1**, September 15, 2010.

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