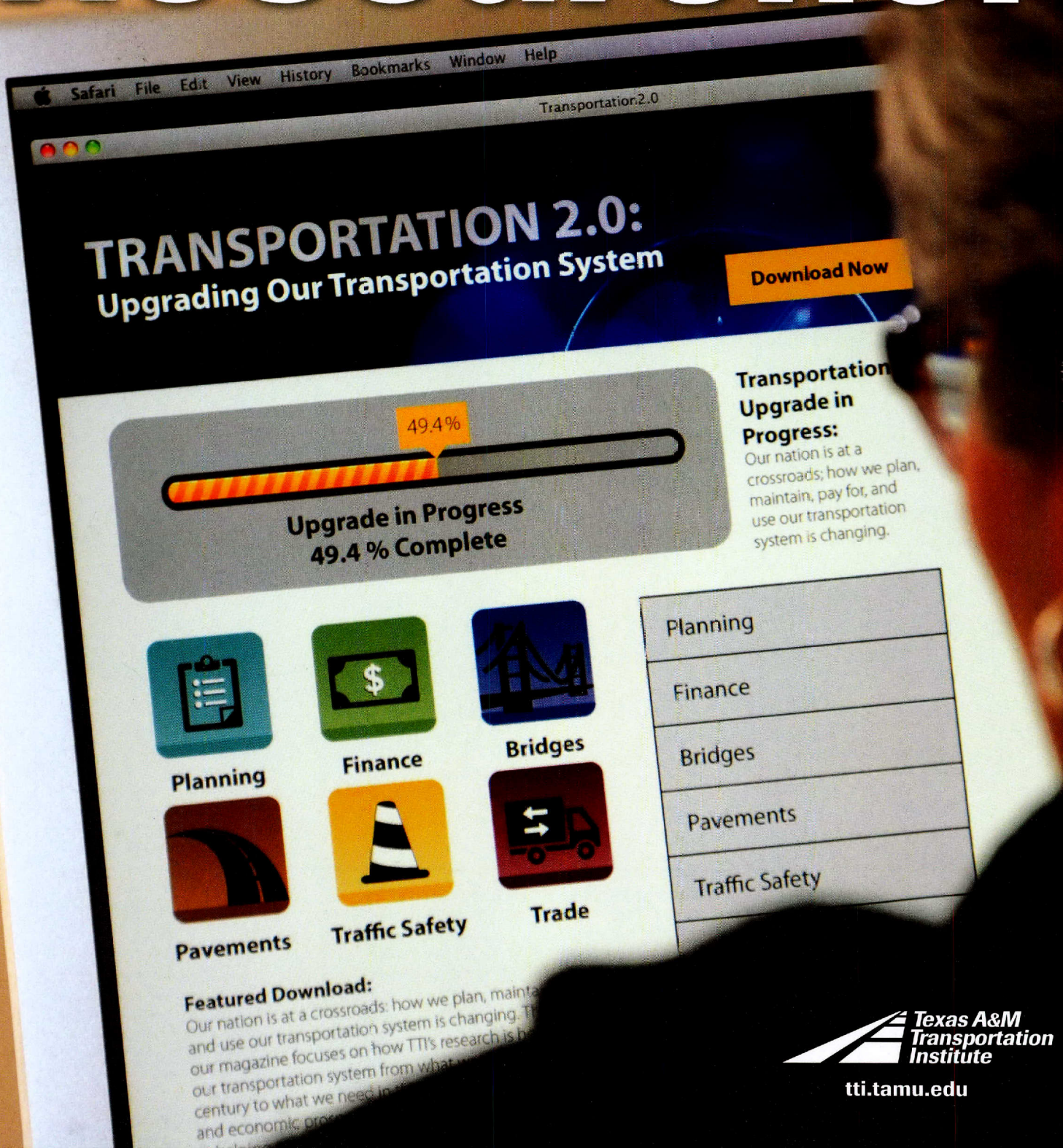
Bridges
Meeting Future Texas Bridge-Building Requirements

Pavements
Using New Technologies to Solve Old Problems

Finance
Estimating Economic Impacts for Policymakers

TEXAS TRANSPORTATION
Researcher
VOL. 49 | NO. 4 | 2013



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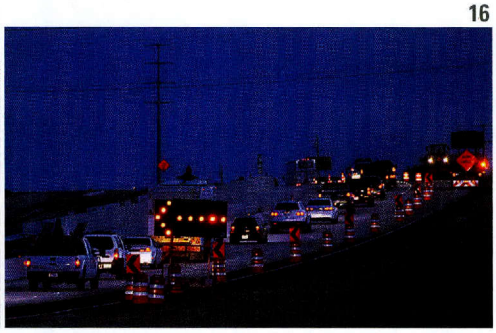
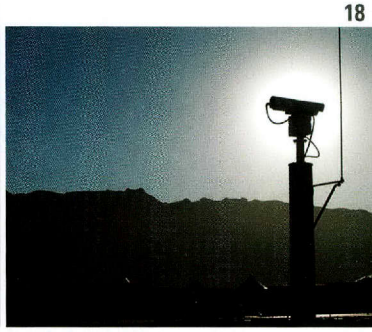

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Transportation 2.0

Upgrade to Avoid System Crashes

Upgrade Now

If you think about it, our transportation system is a lot like a computer system. Both connect users to things they need: goods, services, education, leisure activities, even employment. Both depend on robust technology to facilitate user access. And both are eventually limited by what, at one time, seemed like the most advanced performance possible.

You know it's time to update the old computer when it no longer meets your needs. Traffic congestion, aging infrastructure, high maintenance costs: these are a few characteristics of our current transportation system. If our system were a computer, you might be tempted to say, "It's time for an upgrade."

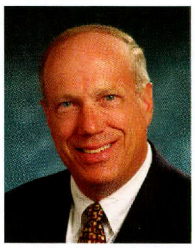
This issue of the *Texas Transportation Researcher* looks at how the Texas A&M Transportation Institute (TTI) is helping upgrade our transportation system to the next level of operability. Whether it's a new invention or a new method for performing an old task, technology is driving that change. Advanced maintenance techniques, innovative applications in traffic safety, longer-lasting construction materials and state-of-the-art planning software are a few examples of how new technologies and tech-dependent applications are essential to making this transition successfully.

TTI research is playing a key role in developing these innovations. We assist local governments with online surveys to capture data detailing how the community is using its transportation system. Our researchers apply advanced modeling software to assist regional planning groups in finding the most effective, cost-conscious solutions to local mobility problems. In the maintenance area, the Institute continues to lead in the development of longer-lasting, better-performing road materials and application techniques. In terms of fostering economic growth, TTI is helping to increase the efficiency of Texas-Mexico border crossings to facilitate international commerce. And to help keep travelers safe, Institute researchers designed and helped deploy a unique warning system to alert travelers of upcoming congestion, thereby reducing the chance for rear-end collisions.

These kinds of advances are important, but without communication, great ideas can die on the vine. The Institute's involvement in the Transportation Research Board (TRB) of the National Academies has helped us share the results of TTI research across the country and around the world. TTI researchers participate in TRB's annual meeting and are members of — and sometimes lead — TRB committees. To honor that long-standing relationship, we profile our association with TRB in this issue.

It's important to realize that nearly every aspect of what makes our transportation system a cohesive whole is at a crossroads: from how we fund the system to how we operate and maintain it to how we interact with our vehicles. (Have you heard of the self-driving car? It's already street legal in California.) The system built over the past 60 to 70 years has done a great job, even with some flaws, like the delays we experience in rush-hour traffic.

But we cannot allow ourselves to surrender to complacency, to the idea



by Dennis Christiansen
Agency Director

that the system we have is "good enough." Our standard of living, our economic well-being, the safety of our loved ones: all are reasons to transform the transportation system we have into the transportation system we need. With the technological tools we have today, we have an opportunity to make "good enough" better. Otherwise, the alternative could be a complete system crash. ■

TTI and TRB: Across the Years

The 2014 Transportation Research Board (TRB) Annual Meeting will be the last gathering at the Connecticut Avenue hotels in Washington, D.C., where the meeting has been held for nearly 60 years. In 2015, the annual meeting moves to the Walter E. Washington Convention Center to bring sessions, committee meetings and displays under one roof.

The 2014 meeting theme — *Celebrating Our Legacy, Anticipating Our Future* — offers an opportunity to reflect on Texas A&M Transportation Institute (TTI) researchers' involvement with TRB over many decades. The missions of TRB and TTI are complementary — providing leadership in transportation research, innovation and education in an objective manner and for all transportation modes.

Today, 81 TTI researchers are members of 128 TRB committees and task forces, and 14 serve as committee chairs. In addition, Paul Carlson chairs the Operations and Preservation Group, and Katie Turnbull chairs the Technical Activities Council.

TTI's groundbreaking research contributions in pavements, mobility, roadside safety, traveler information and many other areas have been advanced nationally through thousands of annual meeting presentations, posters and committee meetings (or simply through conversations with valued colleagues).

The Institute joins with our colleagues at TRB to celebrate that group's strong and enduring legacy. We look forward to many more years of anticipating and shaping the future of transportation at the new annual meeting venue. ■

For more information, contact **Terri Parker** at (979) 862-8348 or t-parker@tamu.edu.

1984

W. N. Carey, Jr., Distinguished Service Award

The W. N. Carey, Jr., Distinguished Service Award recognizes those who have given leadership and distinguished service to TRB. ***TTI Director Emeritus Charley V. Wootan received the award in 1984 in recognition of more than two decades of leadership in TRB.***

2000

K. B. Woods Award

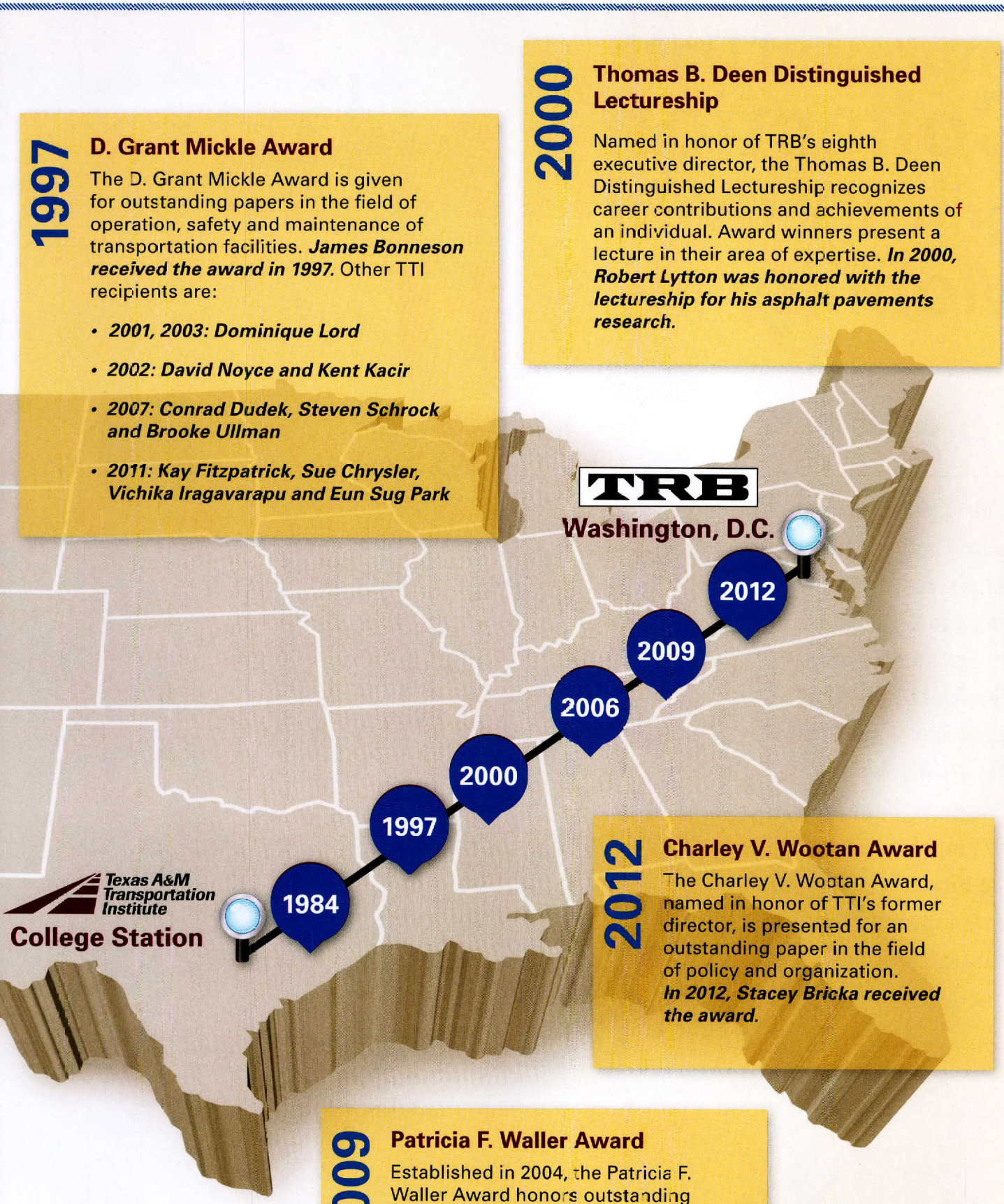
The K. B. Woods Award, named after the 19th chairman of the Highway Research Board, is given for outstanding papers in the field of design and construction of transportation facilities. ***Senior Research Scientist David Newcomb received the award in 2000.*** Other TTI recipients are:

- ***2005: Roger Bligh***
- ***2006: Roger Bligh, Nauman Sheikh, Dean Alberson and Akram Abu-Odeh***
- ***2009: Karen Dixon***
- ***2012: Nauman Sheikh and Roger Bligh***

2006

Roy W. Crum Distinguished Service Award

Named after Roy W. Crum, TRB executive director from 1928 until his death in 1951, this award recognizes outstanding achievements in the field of transportation research. ***In 2006, TTI Director Emeritus Herb Richardson received the award for "outstanding leadership in transportation research and education."***



1997 D. Grant Mickle Award

The D. Grant Mickle Award is given for outstanding papers in the field of operation, safety and maintenance of transportation facilities. ***James Bonneson received the award in 1997.*** Other TTI recipients are:

- ***2001, 2003: Dominique Lord***
- ***2002: David Noyce and Kent Kacir***
- ***2007: Conrad Dudek, Steven Schrock and Brooke Ullman***
- ***2011: Kay Fitzpatrick, Sue Chrysler, Vichika Iragavarapu and Eun Sug Park***

2000 Thomas B. Deen Distinguished Lectureship

Named in honor of TRB's eighth executive director, the Thomas B. Deen Distinguished Lectureship recognizes career contributions and achievements of an individual. Award winners present a lecture in their area of expertise. ***In 2000, Robert Lytton was honored with the lectureship for his asphalt pavements research.***

2012 Charley V. Wootan Award

The Charley V. Wootan Award, named in honor of TTI's former director, is presented for an outstanding paper in the field of policy and organization. ***In 2012, Stacey Bricka received the award.***

2009 Patricia F. Waller Award

Established in 2004, the Patricia F. Waller Award honors outstanding papers in the field of safety and system users. ***In 2009, Kay Fitzpatrick, Eun Sug Park and Sue Chrysler won the award.***

Improved Data Collection for Improved Mobility

Home

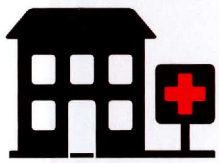
Dining

Shopping

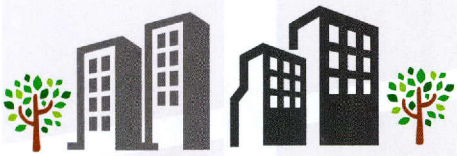
School

"With [Internet-based] advancements, information is easier to collect than using age-old roadside surveys, and the process is less costly and time consuming. It's also a lot safer. As much progress as we've made in using new technologies in collecting travel data, even greater advancements are on the horizon."

Ed Hard, TTI Transportation Planning Program manager

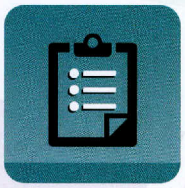


Hospital



Work

Parks and recreation



Planning

Transportation planners have long been surveying motorists about where they were going and why — information vital in determining where the next road should be built or how to improve mobility. Travel-demand models based on that feedback have been used for planning the best locations for new facilities and for prioritizing roadway improvements. However, the way in which that information is gathered is undergoing a radical change. With ever-increasing use of smart phones and vehicles equipped with navigation and diagnostic technologies, traditional methods of collecting data "in the field" are becoming a thing of the past. Texas A&M Transportation Institute (TTI) researchers continue to be at the forefront of using data collected from Bluetooth®, cell phones, GPS and Internet surveys to obtain information on origins, destinations and trip purposes of travelers, as well as travel times and speeds.

Advancing Travel Survey Technology

For decades, transportation planners needed to go directly to the source to find out where people were going and why — and that often meant stopping vehicles to conduct one-on-one interviews with motorists on the roadside. Due to safety concerns and traffic delays, roadside surveys are now rarely used.

"The transition to integrate new technology into travel data collection has been an ongoing process," TTI Transportation Planning Program Manager Ed Hard explains. "Our methods have changed with changes in technology, and I believe TTI is helping to lead the way in how surveys will be conducted in the future."

Hard and his team were among the first transportation planners in the nation to use Bluetooth technology for origin-destination data collection. They completed an extensive travel survey in Omaha, Neb., last spring using a TTI-developed technology called anonymous wireless address matching (AWAM). The Bluetooth-based system was originally developed by TTI's Research and Implementation group in Houston to measure travel times for hurricane evacuation along I-45 in Houston. But Hard and his team devised a way to tailor the technology to gather data needed for travel surveys. AWAM reads the unique addresses from anonymous wireless devices such as cell phones and onboard diagnostic systems.

For the Omaha survey, TTI combined AWAM with automatic license-plate recognition technology (used mostly on toll roads for billing purposes) and a first-ever, community-wide, Internet-based travel survey.

"With [Internet-based] advancements, information is easier to collect than using age-old roadside surveys, and the process is less costly and time consuming. It's also a lot safer," Hard points out. "As much progress as we've made in using new technologies in collecting travel data, even greater advancements are on the horizon."

TTI's AWAM technology is installed inside a box on a utility pole near Hillsboro on I-35, helping agencies measure travel times and improve mobility.

TTI is conducting research to evaluate readily available anonymized origin-destination data from cell phones and onboard navigational devices to study travel patterns at the urban, regional and statewide levels. The research will compare data from cell phones, Bluetooth and mobile GPS devices to determine which technology, or combination of technologies, yields the most accurate results. Hard reiterates that the data are completely anonymized and that they cannot be tied to a person or device.

"The Texas Department of Transportation [TxDOT] is continuously working to modernize and improve our business operations," Bill Knowles, director of TxDOT's Traffic Analysis Section, says. "Part of this effort is to integrate the use of Bluetooth, mobile GPS and cellular technologies into our travel survey program. Initial results of the use of Bluetooth data in lieu of intercept surveys have shown promise. The use of new methods and data from these technologies for travel data collection is an important part of the TxDOT travel survey program's future." ■

For more information, contact **Ed Hard** at (979) 845-8539 or e-hard@tamu.edu.

Estimating Economic Impacts for Policymakers

"TRENDS is designed to provide transportation planners, policymakers and the public with a tool to forecast revenues and expenses for TxDOT through 2040. It forecasts revenues, expenditures and fund balances for each year studied."

Brianne Glover, TTI assistant research scientist

Finance

When it comes to selecting and funding transportation improvements in Texas, communities have a wide array of alternatives, with each having its own advantages and disadvantages. Frequently, vigorous debate occurs about how best to solve traffic problems. The key question is often how best to increase mobility in the most cost-effective way possible. Should we build additional capacity through widening lanes or implementing a toll road? What if we moved freight via barge instead of semi-truck? Texas A&M Transportation Institute (TTI) researchers have been assisting the state with finding the right answers for over 60 years, with each decade of research bringing an added level of automation and sophistication to the modeling and forecasting process necessary to make the right calls.

TRENDS and TREDIS Provide Cost-Benefit Analysis and Revenue Forecasting

Evaluating transportation improvement alternatives in a cost-effective way is essential to choosing the best solution. That's where modeling comes in. The more realistic the model and the more accurate the data, the better informed policymakers are when deciding which solution to pursue.

To that end, TTI researchers are using two advanced models — the Transportation Revenue Estimator and Needs Determination System (TRENDS), developed by TTI, and the Transportation Economic Development Impact System (TREDIS), a product of EDR Group, Inc. — on a project entitled Economic Impact Analysis and Revenue Project Modeling. Under the auspices of the newly created Policy Research Center (PRC), this study will forecast revenues generated under different scenarios using TRENDS and determine the benefits received from a transportation project using TREDIS.

"TRENDS is designed to provide transportation planners, policymakers and the public with a tool to forecast revenues and expenses for TxDOT [the Texas Department of Transportation] through 2040," explains Brianne Glover, TTI assistant research scientist. "It forecasts revenues, expenditures and fund balances for each year studied."

Updated monthly, TRENDS allows the user to see the revenue projection of a funding scenario using input variables like population forecasts, inflation rates and fuel efficiency. Arguably, TRENDS' most powerful feature is a local option sub-model for each of Texas' 25 metropolitan planning organizations (MPOs). This allows MPOs to analyze changes in local revenues by creating or adjusting local fees or fuel efficiency rates so the results generated for their areas are more realistic.

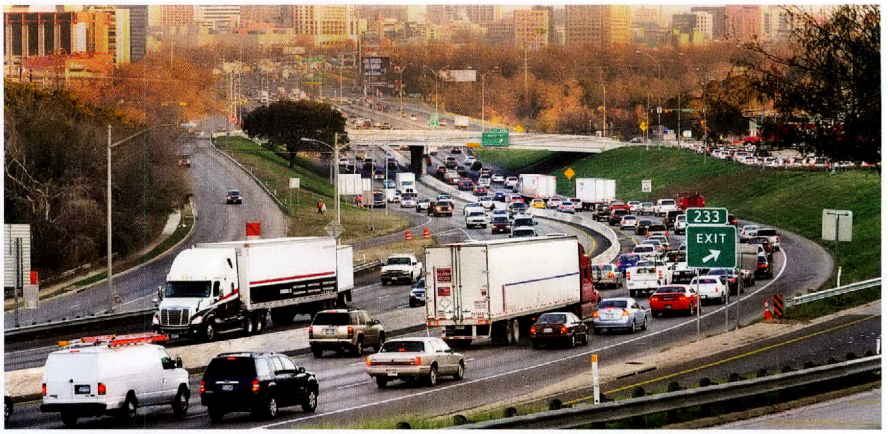
"In the current project, for example, we're expanding TRENDS to add the capability to estimate how alternative fuel vehicles could impact the state's fuel tax revenues," explains Glover. "That result could, in turn, impact transportation funding since the state fuel tax is currently the principal financing method. Knowing how big that impact could be can help guide what funding alternatives policymakers pursue."

Researchers are also using TREDIS, which uses travel patterns, market access and spending data to estimate costs, benefits and economic impacts for a scenario. Using TREDIS, transportation planners can assess the impact of various economic development initiatives and conduct cost-benefit analyses for transportation investments across multiple modes of transportation (e.g., highway, bus, rail, aviation, marine and multimodal projects).

"TREDIS is great for giving a more holistic assessment of public and private investment funds," says Glover. "An improvement at a port could change the modes used to transport goods to and from that port, for example. Being able to look at transport alternatives using multiple modes is a powerful way to determine how one small change in the mode we choose to move goods can have a ripple effect across the local economy."

"Applying the results of these models at the regional level gives us real-world estimates of how changes would impact our citizens without the expense of actually changing the variables involved."

Maureen McCoy, director, Austin's Capital Area Metropolitan Planning Organization



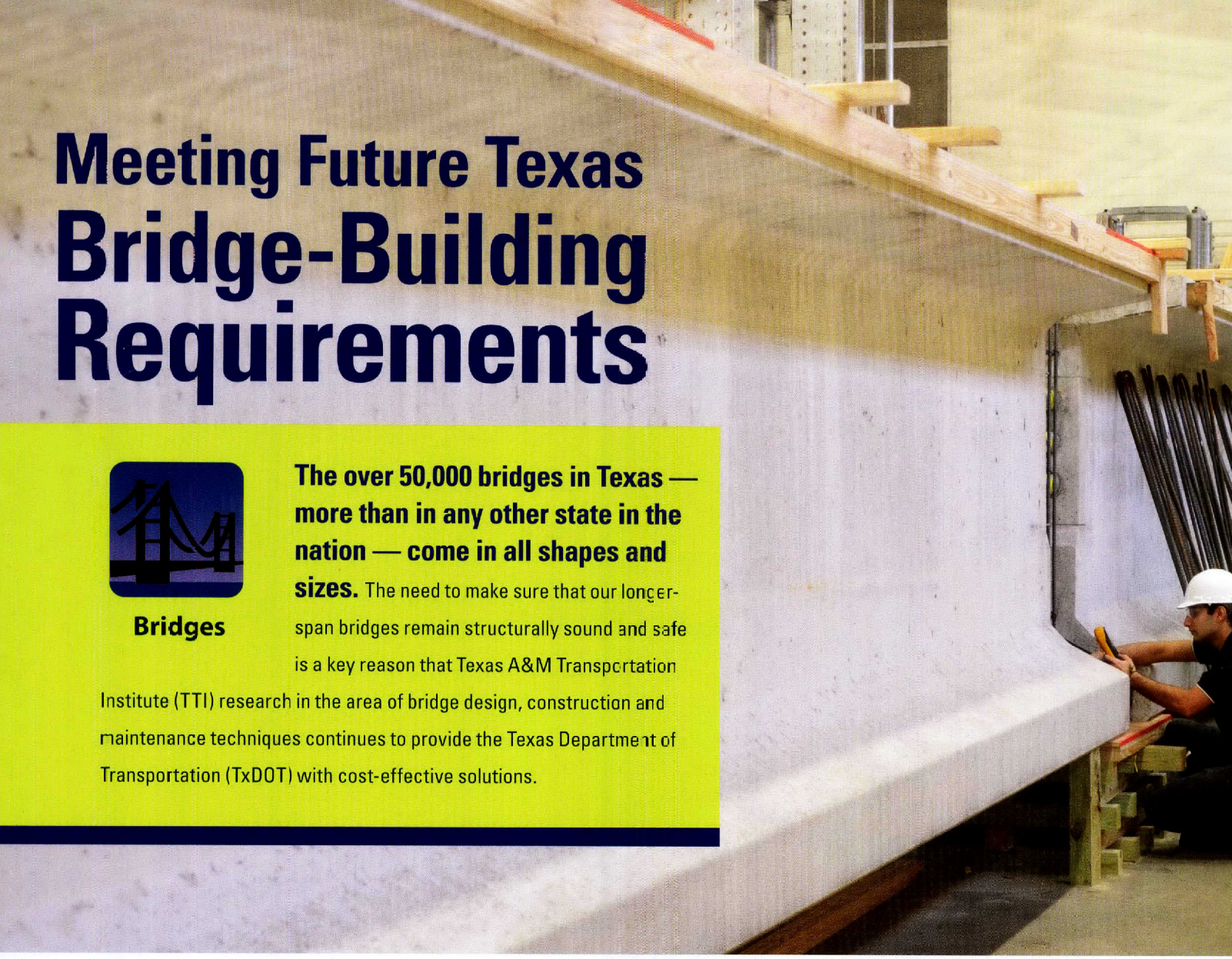
Forecasting revenues and providing cost-benefit analyses for TxDOT and local MPOs can help ensure finite resources are applied as efficiently as possible.

In the current PRC project, Glover and her team are using TREDIS to conduct economic-impact studies for various policy options. As they evaluate planning alternatives, researchers are studying the resulting regional impacts such as changes in business output, increased jobs and increased wage income, for each option.

"Applying the results of these models at the regional level gives us real-world estimates of how changes would impact our citizens without the expense of actually changing the variables involved," says Maureen McCoy, director of Austin's Capital Area Metropolitan Planning Organization. "No pun intended, but it's hard to overestimate the value of that to our regional planning process." ■

For more information, contact **Brianne Glover** at (979) 458-0919 or b-glover@ttimail.tamu.edu.

Meeting Future Texas Bridge-Building Requirements



Bridges

The over 50,000 bridges in Texas — more than in any other state in the nation — come in all shapes and sizes. The need to make sure that our longer-span bridges remain structurally sound and safe is a key reason that Texas A&M Transportation Institute (TTI) research in the area of bridge design, construction and maintenance techniques continues to provide the Texas Department of Transportation (TxDOT) with cost-effective solutions.

John Mander (center, white hard hat) and Mary Beth Hueste (right, yellow hard hat) with graduate student researchers in the High Bay Structural and Materials Testing Laboratory.

"We design for service loads, but we also design for the extreme event. TxDOT wants to look at performance in both ranges. It gives TxDOT confidence in a bridge system where spans can reach 240 feet or longer."

Mary Beth Hueste, TTI research engineer and head of TTI's Construction, Geotechnical and Structures Division

Longer Concrete Girders Could Stretch Construction Dollars Further

Splicing concrete girders is a type of construction used on a limited basis in the United States. TxDOT builds bridges with its own concrete girder specifications. As part of TxDOT Project 0-6651, Continuous Pre-stressed Concrete Girder Bridges, TTI Research Engineers John Mander and Mary Beth Hueste (also head of TTI's Construction, Geotechnical and Structures Division) are investigating techniques to lengthen concrete girders by splicing them together, eventually helping to create some of the first-of-their-kind bridges for Texas roadways.

The maximum length of a concrete girder in Texas varies between 140 and 160 feet. Concrete girders can be fabricated longer, but transportation limitations dictate that a highway load cannot exceed 160 feet. Hueste says the research project is important because, "TxDOT has its own special girder sections. The department wants to investigate specifically how splicing will work for its bridges and to gain more confidence that the splicing system is a reliable approach to build bridges that perform well over the long term."

To date, steel and segmental bridges have been the choices for longer bridge spans. Steel is still the most common choice where there is a curved section. The precast

If splicing allows bridges with longer spans to be designed using less-expensive construction techniques and materials, future highway construction dollars can stretch further.

Researcher testing strain-gauge connections in one of the three spliced sections of the 71-foot concrete girder.

Hueste and a graduate student researcher check project specifications prior to cementing the spliced sections.

concrete industry in Texas creates reliable, economical bridge components. If splicing allows bridges with longer spans to be designed using less-expensive construction techniques and materials, future highway construction dollars can stretch further. "TxDOT believes this will be another economical solution for longer-span bridges. It's a design option TxDOT likes to have in its toolbox when choosing bridge types," Hueste notes.

A 71-foot concrete girder was cast for this research project at the Bexar Concrete Works plant in San Antonio, Texas, and transported to the High Bay Structural and Materials Testing Laboratory at Texas A&M University. This special girder has four different segments, allowing researchers to test three spliced connections. "We will test each of the three connections under different combinations of loading to look at the range of forces that occur in a bridge," Hueste says.

Extensive testing will ensure that the spliced connections meet TxDOT's design requirements. "We design for service loads, but we also design for the extreme event. TxDOT wants to look at performance in both ranges. It gives TxDOT confidence in a bridge system where spans can reach 240 feet or longer," Hueste says.

Hueste summed up the value of this research by saying, "This is going to be another bridge solution that facilitates quicker on-site construction. TxDOT will be able to construct longer-span bridges in a relatively short time with less disruption to the traveling public while providing the safe, durable infrastructure that everyone expects." ■

For more information, contact
Mary Beth Hueste at (979) 845-1940
or mhueste@civil.tamu.edu.

TRANSPORTATION Research Challenges

Traffic Safety

Fatal rear-end collisions nationally in 2012 — **1,933 with 120** of those occurring in highway work zones.

Trade

In 2012, a record **5.1 million trucks** crossed the border. Trucks carry 80% of goods between countries.

Finance

Texas faces a **$170 billion gap** between projected public revenues and infrastructure improvement needs.

casting data, modeling solutions, improving air quality | alternative financing strategies, innovative partners
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oving air quality | alternative financing strategies, innovative partnerships | economical construction, adva
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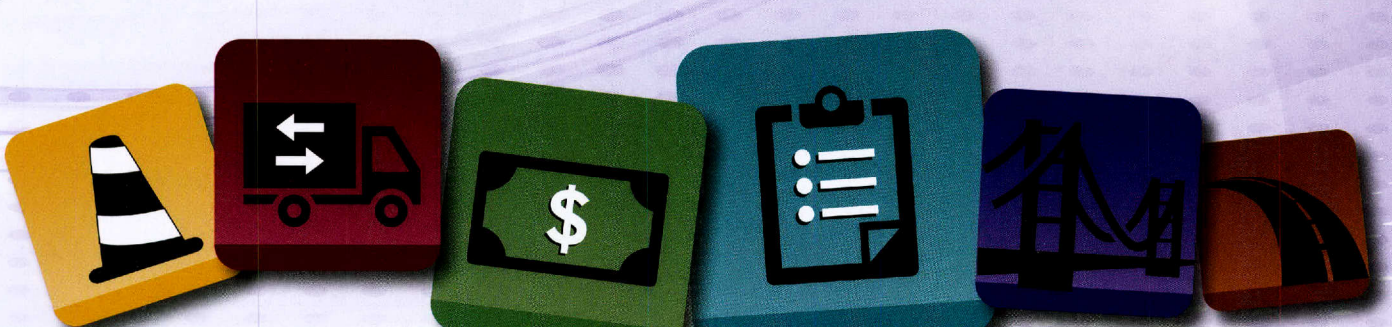


Transportation research is a multi-disciplinary, national effort to identify and solve the challenges we face in planning, building and maintaining the thousands of miles of roadway in this country.

Planning

Texas spends more than **$2 billion** annually to study, prioritize, and develop transportation projects.

Bridges

Texas has more than **50,000 bridges**. The state department of transportation must maintain and ensure the safety of 33,513 of them.

Pavements

There are 80,000 miles of roadways in Texas. The Lone Star State spends about **$1.5 billion** yearly to maintain its roads.

hips | economical construction, advanced repair techniques, innovative prefabricated materials | efficient
ility | incorporating technology, facilitating communication, secure trade | forecasting data, modeling solu
nced repair techniques, innovative prefabricated materials | efficient maintenance, rehabilitation, added ca
ommunication, secure trade | forecasting data, modeling solutions, improving air quality | alternative finar
ted materials | efficient maintenance, rehabilitation, added capacity | automated warning systems, manag
data, modeling solutions, improving air quality | alternative financing strategies, innovative partnerships
ce, rehabilitation, added capacity | automated warning systems, managing incidents, increasing mobility |
oving air quality | alternative financing strategies, innovative partnerships | economical construction, advan

Using New Technologies to Solve Old Problems

Pavements

With close to 80,000 miles of roadways in Texas, maintaining the pavements, whether asphalt or concrete, is a demanding and costly part of city, county and state responsibilities to keep our transportation system among the best in the country. When potholes, cracks and ruts appear and begin to degrade the pavement, it's often too late to prevent costly repairs. Knowing what is going on below the road's surface — during construction, soon after, and before serious damage is obvious — can save millions of dollars in future repair costs. The Texas A&M Transportation Institute's (TTI's) pavement and materials research team consistently implements project findings through cooperative development and testing of pavement rehabilitation technologies with sponsors and industry partners.

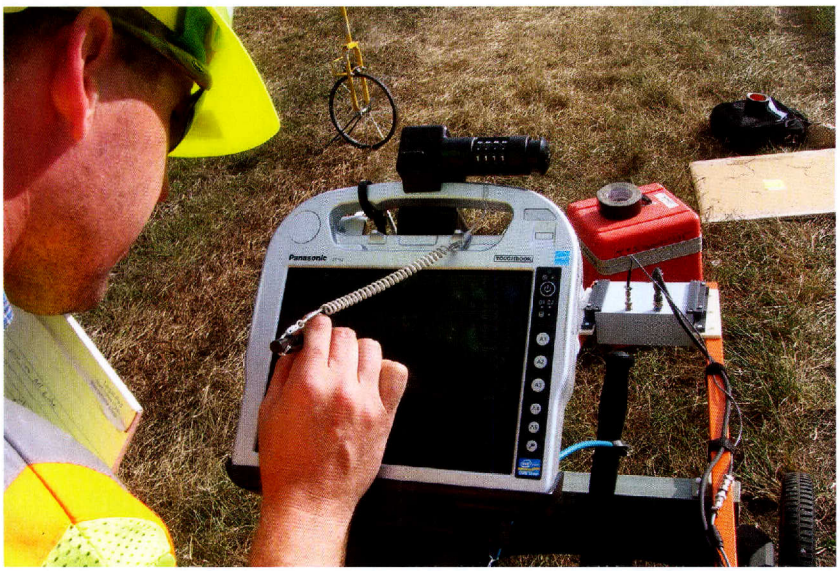
TTI-Developed Rolling Density Meter Detects Mix-Density Problems

Most of the premature failures in asphalt pavement can be traced back to construction problems that resulted in large variations in mix density. Too-low- or too-high-density asphalt mixes can lead to all kinds of problems that are costly to repair.

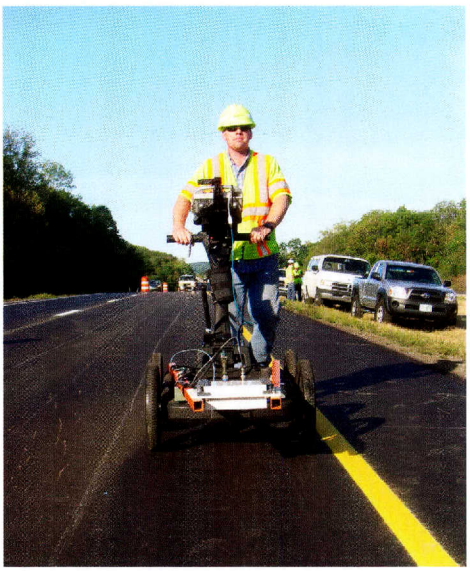
"Historically, the way to test a new pavement for the proper mix density was by using spot-specific measurements. This could be taking localized nuclear density readings or taking core samples and measuring their density in the laboratory. It was very labor intensive," Tom Scullion, manager of TTI's Flexible Pavements Program, explains. "Because samples could not be taken everywhere, we could miss defects, and the roads were failing in places we did not test."

With the goal of building defect-free pavements, TTI researchers needed a way to test the entirety of the newly paved road. Scullion, who advanced the use of ground-penetrating radar (GPR) years ago to determine the hidden causes of road failures, turned to GPR as a way to solve the density-testing dilemma.

"We worked with a GPR manufacturer and told them what we were trying to accomplish," TTI Associate Research Scientist Stephen Sebesta says. "Eventually, they determined a new testing device could be built. The result is what we call the rolling density meter."



A technician evaluates the mix-density data collected from the new TTI-developed rolling density meter.



The rolling density meter is used on a newly paved road to determine if the mix-density levels are within acceptable ranges.

The total pavement acceptance device is now being used to identify defects within concrete pavements.

The TPAD is a very large machine driven along a roadway [at 3 miles per hour] that collects rolling deflection data coupled with GPR readings. The machine is also equipped with a high-definition video camera and GPS.

Joe Leidy, TxDOT pavement structural engineer

Currently the rolling density meter is pushed by hand down the new road, and onboard radar emits an electrical magnetic pulse into the pavement. The mix density is measured instantly in a continuous one-step procedure. Sebesta says several of the rolling density meters can be mounted on a vehicle and simply driven over new sections of pavement in a single pass.

The new rolling density meter device was tested in four states as part of the Strategic Highway Research Program 2 (SHRP2) project titled Using Infrared and Ground Penetrating Radar for Uniformity Measurement on New HMA Layers. Testing showed the device to be accurate and reliable, and it's expected to be showcased at the 2014 Transportation Research Board Annual Meeting. Also, it was ranked this year by the American Association of State Highway and Transportation Officials as the most valuable product of SHRP2.

"Based on its performance thus far, I really expect that rolling density meters could eventually become part of the specifications for road projects across the country," Scullion says.

Innovative Device Identifies Defects Within Concrete Pavement

Another breakthrough in pavement testing has been developed through a joint effort of TTI, the Texas Department of Transportation, the Center for Transportation Research at The University of Texas and Industrial Vehicles International. The total pavement acceptance device (TPAD) — also known as the rolling dynamic deflectometer — is now being used to identify defects within concrete pavements.

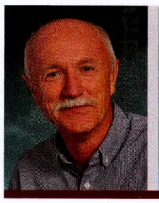
The TPAD integrates a deflection-measuring system with GPR and high-definition video. Deflections are measured by three rolling geophones under a vibratory load applied at a frequency of 30 Hz. Data-processing systems developed by TTI integrate all these data and present designers with deflection data measurements approximately every 2 inches of travel. The TPAD can, therefore, measure the load transfer efficiency of every joint or crack in a concrete pavement as well as the quality of pavement support — critical factors in the pavement evaluation process.

"What we did was combine two very useful technologies on one platform," TxDOT Pavement Structural Engineer Joe Leidy explains. "The TPAD is a very large machine driven along a roadway [at 3 miles per hour] that collects rolling deflection data coupled with GPR readings. The machine is also equipped with a high-definition video camera and GPS."

For the first time, Leidy says, a comprehensive evaluation can be made giving engineers the ability to make relevant decisions about rehabilitation strategies. He says it's possible that the TPAD could be used to detect problems in other types of pavements as well.

Researchers say the TPAD's success has caught the attention of the U.S. government and could soon be used to evaluate military runways.

"The TPAD is a great example of how innovation can help solve problems," Sebesta points out. "It's also an example of how various entities and the private sector can work together to make important improvements where the real winner is the taxpayer." ■



For more information, contact **Tom Scullion** at (979) 845-9913 or t-scullion@tamu.edu, or **Stephen Sebesta** at (979) 458-0194 or s-sebesta@ttimail.tamu.edu.

Getting Information to Drivers to Improve Awareness, Safety

Traffic Safety

It's the 21st century. Every day seems to bring a new advance in technology — the latest smartphone, the fastest tablet, the sharpest HDTV. Advances like these are happening in transportation too, and they're being applied to traffic safety for highway work zones. One day, cars that drive themselves and communicate with the roadside will be the standard. In the meantime, Texas A&M Transportation Institute (TTI) research and implementation of intelligent roadside safety devices are helping reduce the number of crash fatalities on our roadways and especially in work zones.

At night, work zones can be particularly dangerous for both drivers and travelers.

"This system lets motorists know how far in advance there is a slow down. It's part of the overall effort to provide real-time information designed for motorists' safety and the safety of the construction workers, too."

Larry Colclasure, TxDOT director of transportation operations

TTI Leads Deployment of Innovative Warning System

Although a number of advanced transportation technologies aimed at improving traffic safety are on the horizon, some are already here. Recently TTI helped the Texas Department of Transportation (TxDOT) deploy a unique end-of-queue warning system in work zones. TxDOT is expanding a 96-mile stretch of I-35 in Central Texas to relieve congestion and improve safety. The multi-year effort often requires active work zones during heavy travel times. Closed lanes during construction can slow down traffic or bring it to a stop altogether, sometimes resulting in rear-end collisions, especially at night.

According to the National Highway Transportation Safety Administration, 28 percent of all crashes are rear-end collisions. *Risk Management News* ranks them as the second most frequent kind of accident, accounting for 38 percent of dollars paid in automobile insurance claims. It's a no-brainer, really: reducing rear-end collisions can save lives, decrease injuries, and lower societal costs in the form of hospital bills and insurance premiums.

When traffic slows down or stops due to work zone activities on I-35, the end-of-queue warning system developed by TTI for TxDOT informs motorists ahead of time. That means a better chance for drivers to avoid rear-end collisions.

Decreasing the frequency of rear-end collisions during construction along I-35 is the goal of the end-of-queue warning system designed by TTI. So, how does it work?

Decreasing the frequency of rear-end collisions during construction along I-35 is the goal of the end-of-queue warning system designed by TTI.

Radar detection devices are mounted ahead of work-zone lane closures to monitor and measure the speeds of approaching vehicles. Data from multiple sensors are analyzed, and as vehicles slow down, an algorithm triggers a message for display on portable changeable message signs (PCMSs) located a few miles upstream of the construction site.

"These systems are portable and easy to set up on a nightly basis," TTI Research Scientist Bob Brydia says. Brydia is principal investigator on the project that developed the system. "Research indicates that they provide effective communication to drivers."

When traffic slows or stops, the messages on the PCMSs might read "Slow Traffic — 3 miles" or "Stopped Traffic Ahead." Keeping motorists better informed decreases the likelihood of rear-end collisions. In turn, workers in the work zone are safer, and the corridor's overall mobility improves.

TxDOT's Waco District will use this new infrastructure to help manage mobility, reduce congestion, and improve safety in the district along I-35 during construction (scheduled for completion in 2017).

"This system lets motorists know how far in advance there is a slowdown," TxDOT Director of Transportation Operations Larry Colclasure says. "It's part of the overall effort to provide real-time information designed for motorists' safety and the safety of the construction workers, too." ■

For more information, contact **Bob Brydia** at (979) 845-8140 or r-brydia@tamu.edu.

Improving Border-Crossing Wait Times

Trade

Annually, $54 billion worth of goods moves across the U.S.-Mexico border, and wait times at each crossing regularly exceed two hours.

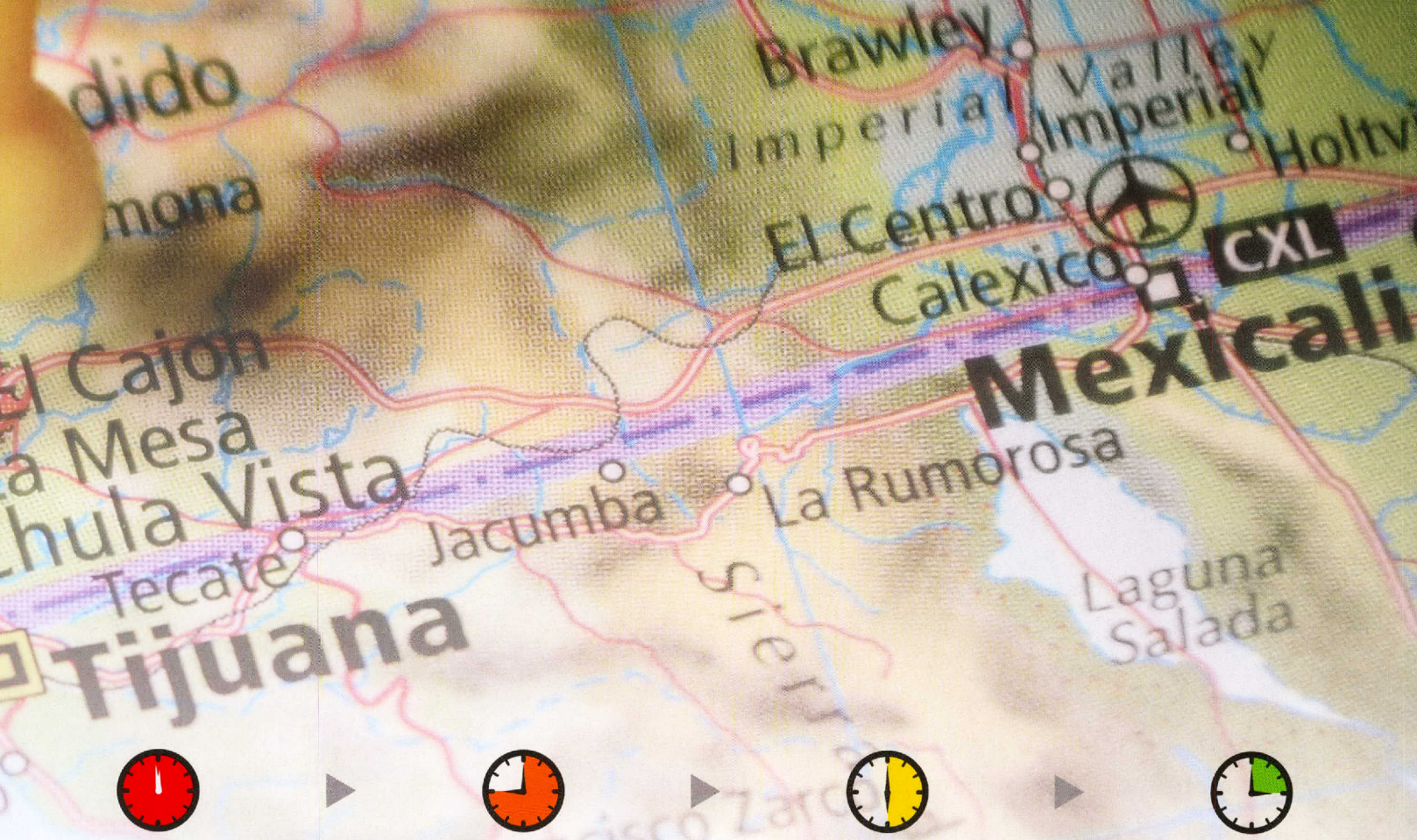
The issues that result are being played out at all the region's crossings — how to efficiently keep the goods flowing without compromising security, while also improving air quality. Reducing crossing and wait times at the borders will help prevent increased trade costs that are eventually passed to the American consumers. The Texas A&M Transportation Institute's (TTI's) work over the past 15 years has supported the creation of smarter border crossings, resulting in the implementation of automated technologies and systems designed to speed up the crossing process for all involved.

Project Designed with ITS in Mind Will Save Time and Money

A diverse group of partners is creating a new, high-tech port of entry and connected state highway in the San Diego/Baja California region. The project represents collaboration between the Federal Highway Administration, the San Diego Association

of Governments, the California Department of Transportation, the U.S. General Services Administration, and U.S. Customs and Border Protection. These partners are designing a new tolled border crossing that will integrate intelligent transportation systems (ITS) from the beginning stages of the project.

Currently, the estimated $650 million project is in the planning stage, which includes an ITS predeployment study led by the IBI Group with support from TTI.



"Our role is to help the different stakeholders identify and develop technologies that can be implemented at the new port of entry — to not only measure the crossing times, but also offer potential approaches to implement dynamic toll pricing models," says Juan Villa, program manager of TTI's Mexico City Office. "Technology plays an extremely important role because by using technology, you can increase the efficiency of both truck and vehicle traffic using the new port of entry."

The ITS predeployment study is assessing innovative operating concepts and technologies that can help to develop a secure, state-of-the-art border crossing. Examples of evaluation areas include:

- traveler notification of border wait times,
- pricing and
- truck segmentation to streamline traffic.

The cross-border ITS revenue collection technologies will provide value to the customer and fund the point of entry through dynamic toll pricing models based on border wait/crossing times. The ITS solution will focus on congestion management to provide predictable wait times for passenger and commercial customers. Because the new crossing will be in proximity to existing nontolled crossings, it will need to provide user value that the current free crossing alternatives do not offer, potentially something above and beyond shorter crossing times.

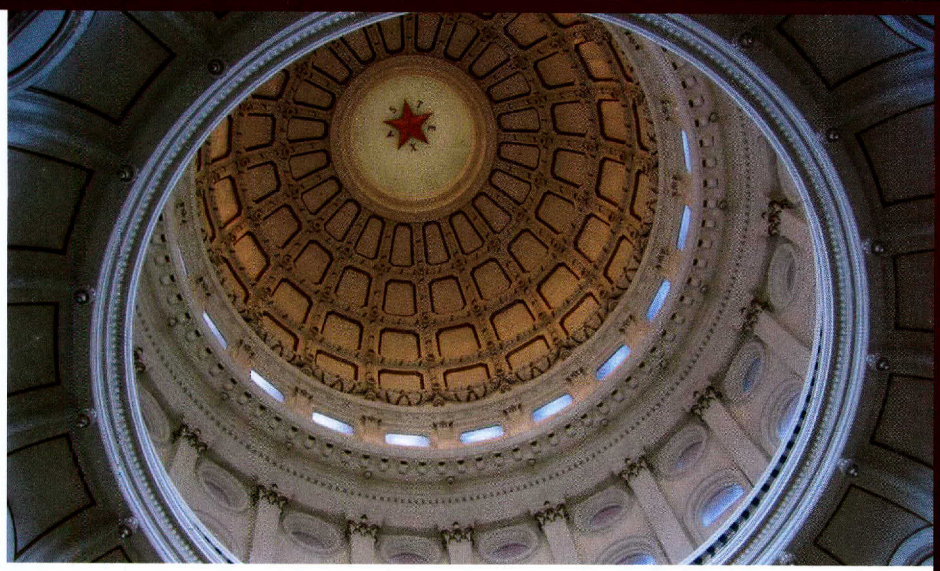
"Our role is to help the different stakeholders identify and develop technologies that can be implemented at the new port of entry — to not only measure the crossing times, but also offer potential approaches to implement dynamic toll pricing models."

Juan Villa, TTI program manager of the Mexico City Office

"This is the first time that ITS has been included in the development of a border crossing project," says Villa. "In the past, ITS technologies had to be retrofitted into an existing port of entry. Since this is a new project, we have the ability to implement and design these technologies from the very beginning. The main benefit to the public is that they may now access information such as crossing wait times that will allow them to make travel decisions in advance, and that could save them time and money." ■

For more information, contact **Juan Villa** at (979) 862-3382 or j-villa@tamu.edu.

TTI's New Policy Research Center to Facilitate Innovation



"Everything about the Texas transportation system is changing," says Ginger Goodin, director of the Texas A&M Transportation Institute's (TTI's) new Policy Research Center (PRC). "The old way of doing things just isn't feasible anymore."

Goodin is essentially referring to the old solution of simply building more roads to meet our state's mobility needs. While adding to infrastructure is part of the solution to systemic issues with the Texas transportation system, constructing our way to greater mobility has become prohibitively expensive in the Lone Star State.

But broadening the set of solutions requires revising legislative, institutional arrangements and public engagement approaches to find that better way. To that end, the Texas Legislature funded the PRC in the last session, and in November 2013, the Texas A&M University System Board of Regents approved designation of the center at TTI. Goodin sums up the purpose, vision and goals of the PRC as aiming to transform transportation in Texas through research, collaboration and policy innovation. The center's team is assessing the big picture of transportation needs and providing information to policymakers within the context of how

- technology and data can facilitate solutions,
- the transportation system can be funded in the face of evolving economic pressures, and
- we can best meet the needs of Texas' rapidly growing population.

To find answers, researchers pursuing PRC projects will focus on six areas: finance, freight, congestion, public engagement, technology and transportation data. While each of the areas has a team leader, the center's strategic approach involves putting together cross-disciplinary teams using the guiding principles of credibility, clarity and creativity. Ultimately, the PRC's research is intended to more effectively inform policy discussions and actions.

In Other News . . . TTI Part Of Three New UTC Centers

TTI will participate as a partner in three new centers awarded by the federal University Transportation Centers (UTC) program: the Center for Advancing Transportation Leadership and Safety, the National Center for Transit Research, and the University Transportation Center for Railway Safety. The lead agencies for each of the initiatives will be, respectively, the University of Michigan Transportation Research Institute, the University of South Florida and The University of Texas-Pan American. The centers were funded for two years. ■

To find answers, researchers pursuing PRC projects will focus on six areas: finance, freight, congestion, public engagement, technology and transportation data.

"The Texas Legislature's reliance on TTI expertise has increased quite a lot over the past few sessions," says Cathy Reiley, the center's associate director. "By funding this research, they're sending a strong message about the high value they assign to the work this agency is doing." ■

For more information, contact **Ginger Goodin** at (512) 407-1114 or g-goodin@tamu.edu.

Advisory Council Meeting Focuses on New Center

2013 TTI Advisory Council annual meeting participants.

The discussion at the Texas A&M Transportation Institute (TTI) Advisory Council meeting held at Circle T Ranch in AllianceTexas (near Fort Worth) in September focused on the work of TTI's new Policy Research Center (PRC), recently funded by the Texas Legislature. TTI Agency Director Dennis Christiansen credited the council with the initial formative ideas for the center.

"All of you have been extremely supportive of TTI's research efforts in the area of transportation policy and funding, and this new center would not have happened without your support," Christiansen said. "With our growing population and changing transportation technology, there is a great need in the state for this kind of effort."

Ginger Goodin, director of the new center, and Cathy Reiley, center associate director, gave the center update. Bill Stockton, TTI executive associate director, led the discussion about the center's focus areas. The PRC's primary purpose is to serve as an independent resource to the legislature, providing analysis of the state's transportation policies and their economic impacts. Center researchers also provide on-call support to the legislature.

State Rep. Larry Phillips, chairman of the Texas House Transportation Committee, gave a summary of transportation legislation during the 2013 legislative session. He recognized TTI for the assistance the Institute provides to legislative members.

"Saving lives, time and resources is what you do," Representative Phillips said. "TTI provides fact- and science-supported information to explain the problems and needs in transportation, which is extremely helpful."

Christiansen gave an update on other TTI activities, and Texas Department of Transportation Executive Director Phil Wilson also provided an update on his agency. The meeting was hosted by Council Member Russell Laughlin of Hillwood Properties. ■

Railroad Pioneer Inducted into Hall of Honor

TTI Agency Director Dennis Christiansen traveled to Texas A&M University–Commerce (TAMU-C) in October to induct Harold J. McKenzie into the Texas Transportation Hall of Honor. The induction ceremony, hosted by BNSF Railway, was held at the annual Cotton Belt Railroad Symposium. McKenzie's career in the railroad industry spanned from 1926 to 1969. He served as president of the Cotton Belt Railroad for 15 years and turned it into one of the country's best-operated railroads. McKenzie's Hall of Honor plaque is on permanent display at the university.

"President McKenzie was one of the most significant figures in Cotton Belt history and a leader who played a tremendous role in shaping the development and growth of our entire region," said Dr. Jason Lee Davis, associate professor at TAMU-C and founder of the Cotton Belt Railroad Symposium. "I am delighted that we were able to host the ceremony at the symposium, which documents and celebrates the legacy of the railroads operating throughout northeast Texas." ■

Photo (left to right): Dr. Grady Price Blount, dean of the TAMU-C College of Science, Engineering and Agriculture; Dr. Dennis Christiansen, TTI agency director; Rollin Bredenburg, vice president, BNSF Railway; and Dr. Jason Lee Davis, associate professor, TAMU-C and founder of the Cotton Belt Railroad Symposium.

SWUTC Director Dock Burke Retires

After a 45-year career with TTI, Senior Research Scientist Dock Burke retired Aug. 31, 2013. Since 1988, Burke has served as director of a consortium of universities known as the Southwest Region University Transportation Center (SWUTC).

During his career, Burke served as principal or co-principal investigator on 55 individual research projects; authored or co-authored 88 technical reports, papers and articles; and conveyed research findings in 65 presentations. Much of this work has been directly for an agency or entity of the people of Texas and has involved the application of transportation economic analysis or transportation policy assessment.

In 2003, Burke was named a Regents Fellow by the Texas A&M University System Board of Regents. In remarks posted on Burke's retirement website, TTI Director Emeritus Herb Richardson noted, "Your most important legacy is your 25-year service as director of the SWUTC. You earned the respect and admiration of all involved. As a result, other centers looked to SWUTC as a model as they developed their own strategies and operational approaches." ■

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

TTI Hosts Infrastructure Maintenance Symposium

TTI recently hosted DBi Services' Ninth Annual Infrastructure Maintenance Symposium Aug. 27–28. The symposium showcased the latest developments and technologies in the fields of infrastructure maintenance, operations and management.

Participants spent an afternoon on field-inspection activities, which included evaluation of high-friction surfacing applications, high-speed braking demonstrations and vegetation management trial plots. At the end of the field trip, there was a demonstration showing the latest in attenuator safety technology through a live crash test performed on a SMART Cushion.

"Hosting the Infrastructure Maintenance Symposium at TTI provided many new and unique opportunities to demonstrate the latest technologies and innovations in the industry," says TTI Senior Research Engineer Paul Carlson. "We were excited to host the event and showcase TTI's research facilities."

DBi Services' Infrastructure Maintenance Symposium participants inspect a SMART Cushion guardrail after a crash test.

Headquartered in Hazleton, Pa., DBi Services is a global provider of infrastructure maintenance, operations and management solutions for government transportation agencies, railways, utilities, industrial sites, private industries and retailers. ■

Briaud Presents Louis Menard Lecture in Paris, France


Briaud

Jean-Louis Briaud, TTI's Geotechnical and Geoenvironmental Program manager, presented the prestigious Louis Menard Lecture in Paris, France, Sept. 2. The annual lecture is part of the International Conference of Soil Mechanics and Geotechnical Engineering and is named for the inventor of the pressuremeter, which allows engineers to design stable foundations based on actual soil conditions. Menard was at the height of his career when he died from cancer in 1978 at the age of 45.

In 1992, Briaud wrote a book, titled *The Pressuremeter*, about Menard's invention, which was the topic of Briaud's lecture before 2,300 geotechnical engineers from around the world.

"It was certainly an honor to be selected to present the Menard Lecture, in part because I was such a fan of his," Briaud says. ■

Tooley Named ARTBA Vice Chairman at Large

Tooley

Melissa Tooley, director of external initiatives at TTI, has been elected vice chairman at large for the American Road and Transportation Builders Association (ARTBA). Results of the nominating process were announced during ARTBA's National Convention in Milwaukee, Wis., Sept. 8–10. Tooley's election represents the first time a TTI employee has been elected to ARTBA's executive committee.

"This is a significant position in a very powerful national organization," states TTI Agency Director Dennis Christiansen.

Established in 1902, ARTBA is the nation's oldest and largest transportation association whose mission is to "aggressively grow and protect transportation infrastructure investment to meet the public and business demand for safe and efficient travel."

"This is a huge honor and responsibility," Tooley notes. "ARTBA is known worldwide for its visionary leadership, and I look forward to the coming year."

Based in Washington, D.C., ARTBA consists of 5,000 public- and private-sector members and is actively involved in all transportation-related issues. The executive committee consists of 15 transportation professionals from around the country, each of whom serves a one-year term. Six of the individuals, including Tooley, were elected to at-large positions and will help determine ARTBA's stance on issues impacting the association. ■

87th Annual Transportation Short Course Highlights TTI-TxDOT Partnership

Every element of Texas transportation was discussed during the 87th Annual Transportation Short Course as nearly 2,000 transportation professionals gathered on the Texas A&M University campus Oct. 15–16. The Short Course is the annual gathering of Texas Department of Transportation (TxDOT) employees in a two-day forum co-hosted by TTI.

"The Short Course is an important and visible indication of the success of our partnership," TTI Agency Director Dennis Christiansen told the crowd during the opening session. "This partnership — now more than 60 years old — remains a model for the rest of the country and has led to innumerable advances and innovations, not only for TxDOT, but implemented throughout the United States and around the world."

"Safety is our first and top priority," TxDOT Executive Director Phil Wilson told attendees, announcing that over the last year, TxDOT achieved the fewest-ever employee injuries in the department's history. ■

Young Professionals in Transportation Leading the Charge in Houston

This past year, young professionals from TTI and other local groups founded the Young Professionals in Transportation (YPT) chapter in the Greater Houston area. Initially begun in Washington, D.C., YPT helps develop the next generation of transportation professionals via regular leadership seminars, networking happy hours and business meetings. There are now over 5,000 members in 18 chapters around the United States. The Houston chapter currently has 130 members and holds monthly events on topics ranging from natural gas infrastructure to sustainable transportation initiatives.

"What sets us apart from the Institute of Transportation Engineers, the American Society of Civil Engineers and other transportation professional organizations is our focus on bringing young transportation engineers, planners and public policy professionals together to talk about transportation as a holistic problem," notes YPT Houston Acting Chair and TTI Assistant Research Scientist Nick Norboge. ■

YOUNG PROFESSIONALS in TRANSPORTATION

HOUSTON

TEXAS TRANSPORTATION **Researcher** 49.4
Texas A&M Transportation Institute/TTI Communications
3135 TAMU
College Station, TX 77843-3135

TEXAS A&M TRANSPORTATION INSTITUTE

PUBLICATIONS

A full catalog of TTI publications and other products is online at http://tti.tamu.edu/publications. You can find the publications by searching for either the title or publication number listed here. Most of these publications are available as free downloads in portable document format (PDF).

Printed, bound versions of these reports are also available through the URL above.

RESEARCH VIDEOS

Access the research topics listed below via the URLs shown.

TTI Research on the U.S.-Mexico Border: **https://vimeo.com/66665274**

TTI and the Mobility Investment Priorities Project: **https://vimeo.com/75786359**

Women Leaders at TTI: **https://vimeo.com/77974866**

Voice-to-Text Study: **https://vimeo.com/64641918**

Mileage-Based User Fees: **https://vimeo.com/71848261**

TTI's Sediment and Erosion Control Laboratory: **https://vimeo.com/74722165**

TECHNICAL REPORTS

Application of a Performance Management Framework for Priced Lanes, by Ginger Goodin, **5-6396-01-1**, November 22, 2013.

Balanced RAP/RAS Mix Design and Performance Evaluation System for Project-Specific Service Conditions, by Fujie Zhou, **0-6092-3**, June 20, 2013.

Characterization and Best Use of Recycled Asphalt Shingles in Hot-Mix Asphalt, by Fujie Zhou, **0-6614-2**, July 25, 2013.

Design and Construction Recommendations for Thin Overlays in Texas, by Bryan Wilson, **0-6615-1**, September 11, 2013.

Development and Testing of a Non-Pinned Low-Profile End Treatment, by Lynn Beason, **9-1002-12-7**, November 13, 2013.

Development of a Statewide Motorcycle Safety Plan for Texas: Technical Report, by Patricia Turner, **0-6712-1**, June 18, 2013.

Evaluation of Skid Measurements Used by TxDOT: Technical Report, by David Newcomb, **0-6798-1**, July 16, 2013.

Evaluation of Traffic Control Devices, Year 4, by Paul Carlson, **9-1001-3**, September 10, 2013.

Executive Report: Toll Roads, Toll Rates, and Driver Behavior, by Curtis Beaty, **0-6737-1**, July 15, 2013.

Guidelines for Freeway Lighting Curfews, by Tracy Zhou, **0-6645-1**, June 20, 2013.

Innovative Finance: Strategic Research Project, by David Ellis, **6-0700-1**, September 5, 2013.

Katy Freeway: An Evaluation of a Second-Generation Managed Lanes Project, by Ginger Goodin, **0-6688-1**, September 18, 2013.

MASH Test 3-21 on TL-3 Thrie Beam Transition Without Curb, by Dusty Arrington, **9-1002-12-3**, July 30, 2013.

New Generation HMA Mix Designs: Accelerated Pavement Testing of a Type C Mix with the ALF Machine, by Lubinda Walubita, **0-6132-2**, July 12, 2013.

New Generation Mix Designs: Laboratory-Field Testing and Modifications to Texas HMA Mix-Design Procedures, by Lubinda Walubita, **0-6132-3**, July 18, 2013.

The Overlay Tester (OT): Comparison with Other Crack Test Methods and Recommendations for Surrogate Crack Tests, by Lubinda Walubita, **0-6607-2**, August 22, 2013.

Prototype Mobile Luminance Measurement System and Level of Service for Evaluating Rural High-Speed Nighttime Delineation, by Jeff Miles, **0-6647-1**, September 17, 2013.

Treatments for Clays in Aggregates Used to Produce Cement Concrete, Bituminous Materials, and Chip Seals: Technical Report, by Anol Mukhopadhyay, **0-6444-1**, July 25, 2013.

PROJECT SUMMARY REPORTS AND PRODUCTS

Briefing Paper: Toward a Best Practice Model for Managed Lanes in Texas, by Ginger Goodin, **0-6688-P1**, September 18, 2013.

Evaluation of the I-10 Katy Freeway Managed Lanes, by Ginger Goodin, **0-6688-S**, August 12, 2013.

Identifying Best Practices for Managing Operating Costs for Rural and Small Urban Public Transportation Systems, by Suzie Edrington, **0-6694-S**, July 12, 2013.

Managing Operating Cost for Rural and Small Urban Transit Systems: Workshop Materials, by Suzie Edrington, **0-6694-P2**, July 5, 2013.

Managing the TDM Process: Developing MPO Institutional Capacity, by Karen Lorenzini, **0-6691-S**, August 19, 2013.

Managing the Travel Model Process: Small and Medium-Sized MPOs, by Karen Lorenzini, **0-6691-P2**, September 12, 2013.

Revised Overlay Design System, by Sheng Hu, **5-5123-03-P2**, August 20, 2013.

Texas-Specific Drive Cycles for Use with EPA's MOVES Model: Database, by Reza Farzaneh, **0-6629-P1**, November 12, 2013.

Texas Strategic Action Plan for Motorcycles 2013 – 2018, by Patricia Turner, **0-6712-P2**, June 18, 2013.

Texas Traffic Thermostat Marketing Package, by Tina Geiselbrecht, **5-6396-01-P2**, November 21, 2013.

Texas Traffic Thermostat Software Tool, by Yatinkumar Rathod, **5-6396-01-P1**, November 21, 2013.

Toward a Best Practice Model for Managed Lanes in Texas, by Ginger Goodin, **0-6688-P2**, September 17, 2013.

TPAD Data Analysis Software and User Manual, by Tom Scullion, **0-6005-P3**, June 18, 2013.

Training Materials for Testing and Mitigation Techniques, by Anol Mukhopadhyay, **0-6444-P1**, June 20, 2013.