

A Partnership in Progress:
TTI, USDOT Celebrate a Half
Century of Research Innovations

TTI Hosts TxDOT for
91st Annual Transportation
Short Course

TTI, ARTBA Celebrate
20 Years of the Work Zone Safety
Information Clearinghouse

TEXAS TRANSPORTATION Researcher

VOL. 53 | NO. 4 | 2017



Connecting
A World of
RESEARCH

TTI's Tradition of Teamwork



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ON THE COVER: For nearly seven decades, the Texas A&M Transportation Institute has conducted research for sponsors that helps innovate and improve planning, funding, designing and operating the world's transportation system to enhance the safe movement of people and goods.



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A PUBLICATION OF



Texas Transportation Researcher is published by the Texas A&M Transportation Institute to inform readers about its research, professional and service activities. Opinions expressed in this publication by the editors/writers or the mention of brand names does not necessarily imply endorsement by the Texas A&M Transportation Institute or The Texas A&M University System Board of Regents.

Texas Transportation Researcher (ISSN 00404748) is a quarterly publication of TTI Communications, Texas A&M Transportation Institute, 3135 TAMU, College Station, Texas 77843-3135. Periodicals postage paid at College Station.

TTI.RESR1802.1217.4500

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3135 TAMU

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20 Years of Partnering with ARTBA on the Work Zone Safety Information Clearinghouse*

AT A GLANCE

See related story on page 12

Celebrating 20 Years of the Work Zone Safety Information Clearinghouse

9.5M
page
views



2M
information
requests
filled



10,000
informational
pages
accessed



400
daily
users
on average



users from
225
countries



users
from
50
states
plus Washington, D.C.,
and Puerto Rico



*Source: American Road and Transportation Builders Association,
Transportation Builder®, Vol. 23, No. 3, pp. 5, 16–22.





A Partnership in Progress

TTI, USDOT Celebrate a Half Century of Research Innovations

For the past 50 years, the Texas A&M Transportation Institute (TTI) has provided assistance to the U.S. Department of Transportation (USDOT) to make the nation's transportation system safer, more efficient and more resilient. Across the DOT's spectrum of modal agencies—air, highways, motor carriers, rail, transit, maritime, traffic safety, and pipeline and hazardous materials—TTI expertise has helped the department conduct cutting-edge research to enhance the movement of people and goods. TTI's efforts have helped improve the country's global competitiveness, as well as provided real-world educational opportunities for university students.

"TTI has been at the forefront of many important research and technology transfer projects for FHWA over the years," notes Michael Trentacoste, former Federal Highway Administration (FHWA) associate administrator for research, development and technology. "TTI researchers bring not only expertise, but creative and innovative problem-solving skills to their work."



Federal Highway Administration

TTI participates or leads teams on numerous Indefinite Delivery Indefinite Quantity contracts and other projects supporting FHWA's offices in the areas of managed lanes, active traffic

management, pricing strategies, performance measures, highway safety visibility, safety data, and bicycle and pedestrian safety. TTI's cutting-edge research efforts include leading the development of an infrastructure interface that enables communication of real-time traffic signals to connected vehicles (CVs). TTI also designed, developed and pilot tested an open-source integrated vehicle-to-infrastructure platform to facilitate the development and deployment of infrastructure-based CV applications.



Office of the Assistant Secretary for Research and Technology (OST-R)

TTI has been an integral part of the University Transportation Centers (UTCs) program since its creation in 1987. With The University of Texas and Texas Southern University, TTI led the Southwest Region University Transportation Center, which provided research, education and technology transfer activities from 1988 to 2016. TTI hosted the UTC for Mobility from 2006 to 2012, providing

pioneering research — including enhancements to the Urban Mobility Report — and expanding academic collaborations across Texas A&M University. Currently, TTI leads the Center for Advancing Research in Transportation Emissions, Energy, and Health — which focuses on the nexus of human health and vehicle emissions — and is part of the Safety through Disruption UTC, which focuses on maximizing the safety benefits of disruptive technologies.

On the research side, the Institute was part of Battelle's team conducting the National Evaluation of the Urban Partnership Agreements and Congestion Reduction Demonstrations for OST-R's Intelligent Transportation Systems Joint Programs Office. Currently, TTI leads the National Evaluation of the Connected Vehicle Deployments in Tampa, New York City, and Wyoming, as well as the Columbus Smart City project.



U.S. Maritime Administration (MARAD)

TTI performed a study co-sponsored by MARAD and the National Waterways Foundation to verify industry assumptions about the benefits of the inland waterway system (specifically related

to cargo capacity, congestion, emissions, energy efficiency, safety impacts, and infrastructure) compared to truck/rail systems. Published in 2007 and amended in 2009, the report (updated twice) continues to be well received and has been cited numerous times as the industry standard on this topic.



Federal Railroad Administration (FRA)

TTI has worked directly with FRA or via joint research initiatives with its USDOT sister agencies to advance rail-related research and practice. From identifying, assessing and testing advanced technologies to preparing rail-related reports for the U.S. Congress to developing guidance related to highway-rail grade crossing safety that underlies state rail safety agency efforts nationwide, TTI has proven itself an industry thought leader across the spectrum of rail research.



Federal Transit Administration (FTA)

FTA has invested billions of dollars in public transportation assets across the United States. Many of these assets are threatened by climate change and extreme weather-related issues, which place substantial

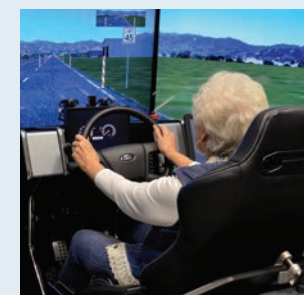
operating and financial burdens on public transit agencies. In 2012, TTI led the Gulf Coast Climate Change Adaption Pilot Study for FTA to document adaptation strategies to minimize the impacts of severe weather events. The research, published by FTA in August 2013, proved prescient given the Gulf Coast hurricanes Harvey and Irma in 2017.



Federal Motor Carrier Safety Administration (FMCSA)

TTI has conducted various FMCSA-sponsored research projects, such as examining weigh-in motion needs of commercial motor-vehicles (CMVs) at the U.S.-Mexico

border. Another recent study evaluated 2,800 CMV crashes in 20 Texas counties to provide operators and agencies with data to help identify risky CMV driving behaviors in the Lone Star State. In 2016, TTI's Teens in the Driver Seat® program conducted its "Respect the Rig" outreach campaign aimed at improving teen driver safety around large vehicles.



National Highway Traffic Safety Administration (NHTSA)

TTI leads NHTSA-sponsored efforts in Texas to improve safety for youth drivers, motorcyclists, bicyclists, and pedestrians. The

Institute conducts programs to reduce impaired driving and help law enforcement with data-driven approaches to crime and traffic safety, and documents behaviors in using seat belts, child passenger safety seats and cell phones. TTI has performed groundbreaking vehicle design and roadside safety research, investigated motivations for speeding, evaluated parent-taught driver education, and assessed driver-vehicle interface best practices and human factor considerations. ■



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Using Big Data to Improve Traffic Counts

For years, Gene Hicks thought there had to be a better way to count the number of vehicles traveling his state's roadways. As director of the Minnesota Department of Transportation's (MnDOT's) Traffic Forecasting and Analysis Section, Hicks oversees the tedious task of laying out road tubes at approximately 33,000 sites (about 12,000 each year) to determine traffic volumes. A traffic tube counter tallies each pulse of air generated when a tire runs over the tube.

Each summer, MnDOT spends about \$500,000 statewide to collect two days' worth of traffic counts at each site. Hicks thinks Big Data can help supply a more efficient, extensive and cost-effective solution.

"The counts we get are very accurate although they only represent two days of traffic for the entire year," Hicks points out. "In this technological age, the way we do it — the way most states do it — seems pretty low tech."

So what's the big deal about Big Data? Numerous transportation data providers collect all kinds of information generated from global positioning system, Bluetooth®, their own subscribers, and supplemental data they purchase from location-based service providers. The companies generate speed data estimates, traffic congestion estimates and origin-destination information.

The question is, can these companies also generate accurate traffic counts for MnDOT and other state departments of transportation (DOTs) from the data they already collect? States need to know precise numbers so they can manage their roadway systems with capacity analysis studies and travel forecasts. Every state is also required to report annual traffic counts to the Federal Highway Administration, so leveraging the power of Big Data can help them meet federal requirements.

"Years ago, I proposed a MnDOT research project to determine whether traffic counts could be gathered from Big Data, but the idea was not taken seriously," Hicks says. "Last year, when I proposed the project again, it was funded. And that's when the Texas A&M Transportation Institute [TTI] joined our project."

Like Hicks, Shawn Turner, head of TTI's Mobility Analysis Division, had often wondered about the possibility of generating traffic counts from the information gleaned from data providers. Turner and his team acted as intermediaries for MnDOT, consulting with companies about the idea.

"Their databases are a gold mine of information. But we wanted to find out if they could dig out traffic count numbers and develop a product from this raw material," Turner explained.



“Ideally, the product would be a web-based, point-and-click interface subscription in which a DOT or municipality could click on a specific roadway to display traffic count information in real and historic time.”

“Their databases are a gold mine of information. But we wanted to find out if they could dig out traffic count numbers and develop a product from this raw material.”

*Shawn Turner
TTI Senior Research Engineer*

As part of the now-completed project, Turner talked to numerous companies about developing a traffic count product and was encouraged when he found out that some of the companies — one in particular — had already been discussing the idea internally.

StreetLight Data, a Big Data analytics company based in San Francisco, began working with TTI and MnDOT and developed a beta version of a product that estimates traffic volumes. TTI then compared the numbers to known Minnesota road volumes to determine accuracy.

“Some of StreetLight Data’s numbers were within acceptable error ranges, but on lower-volume roads especially, the

numbers were not within the acceptable range,” Turner says. “However, for a first try, this is very promising. I’m confident that with some fine-tuning and analytical enhancements, the company will get a lot closer.”

In fact, since the project was completed, Streetlight Data reports there’s been plenty of progress.

“With each iteration, we’ve developed new statistical and optimization techniques that include population adjustment factors and mixes in new data sources,” says Laura Schewel, StreetLight Data’s chief executive officer. “I think we’ll have a final product to offer by the end of the first quarter of 2018.”

Meanwhile, results of the MnDOT study will be published soon. StreetLight Data has unveiled a beta product for evaluation by users, and Turner has been asked to help with a similar project being conducted by the I-95 Corridor Coalition, an alliance of East Coast states and agencies. MnDOT is waiting to see what products will emerge.

“I think our project gave a boost for companies to develop accurate volume-data products. Having something like this will benefit all DOTs,” Hicks says. “Five or six years ago, people thought I was crazy. Now, it looks like it’s going to happen, and they are getting pretty excited.” ■



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TTI, Houston TranStar® Partnership Celebrate 25 Years of Traffic and Emergency Management Service

TTI research and technical support pivotal to development and success over the years

Approaching its quarter-century birthday, the Houston TranStar Transportation Management and Emergency Operations Center (TranStar) has saved Harris County area motorists more than \$5.4 billion in reduced traveler delay and fuel costs since 1997, when benefits were first assessed.

The multi-agency effort uses the partners' collective resources to provide highly effective transportation and emergency management services to maximize safety and mobility for Houston's traveling public. The TranStar partners include the Texas Department of Transportation (TxDOT), the Metropolitan Transit Authority of Harris County, Harris County, and the City of Houston.

The Texas A&M Transportation Institute (TTI) helped conceptualize the TranStar facility in the early 1990s and continues to update system software that allows multiple agencies to share information across jurisdictional and institutional boundaries. One example is the collection and processing of speed and congestion data and the software that converts those values into useful travel-time information.

Those data are distributed to the public through the TranStar website, dynamic message signs along Houston's roadways, subscriber cell phones, and email accounts. TranStar's real-time traffic map is the centerpiece of the website, with close to 800,000 unique users a month visiting in 2016 — a 29.3 percent increase from 2015.

"The software running at TranStar uses data from all the agency partners and provides a central location for providing

traffic and emergency management information used by engineers, the media and the traveling public," explains Mike Vickich, senior systems analyst with TTI's Research and Implementation Office in Houston. "Using the combined resources, we can keep Houstonians better informed so they can make safer, more reliable travel choices."

The sharing of resources — including cameras, networks and data — makes TranStar unique in the United States. For instance, Harris County and TxDOT both have flood sensors that others can access, which proved to be invaluable during Hurricane Harvey. Harris County, TxDOT, and the City of Houston use many of the same types of traffic sensors and cameras, and the partnership allows them to share the software and network resources for using information from each system.

"The TranStar partners rely on TTI to provide innovative and responsive solutions through applied research," says John R. Whaley, TranStar executive director. "The implemented solutions not only provide key information for day-to-day commuters' needs, but also can withstand a crisis, as proven by the more than 3 million web visitors and 30 million accesses during the peak of Hurricane Harvey." ■



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Left: Begun in 1992, TranStar®, the first four-partner agency of its kind, has evolved into a model partnership working together to serve Houston's traveling public. Right: the TranStar control room in 2014.

1993

First four-agency consortium in US, Houston TranStar, begins

1993

Start collecting speed and travel times

1995

Create website and real-time traffic map

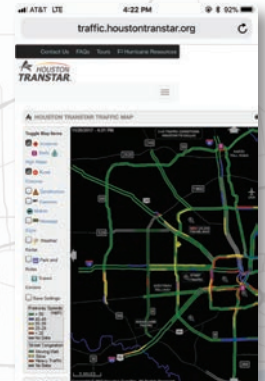
TranStar: A Quarter Century of Keeping Houston Travelers Informed



Original TranStar website in 1995.

2009

Begin using Bluetooth travel-time and speed data collection system to measure traffic flow



TranStar mobile website in 2017.

2003

Begin displaying automated predictive travel times on DMSs



Weather station on the Fred Hartman Bridge, which spans the Houston Ship Channel.

2006

Install hurricane route-monitoring cameras along critical evacuation routes

2012

Enhance TranStar's real-time traffic map with arterial traffic information

2016

Begin developing a mobile app to share traveler information

TTI Expertise Supports TranStar during Hurricane Harvey

If ever there was a test that proved the value of TranStar during an emergency, Hurricane Harvey was it. With the nearly 52-inch deluge of rain pouring down onto the city of Houston and its surrounding areas, the storm left the region's transportation system largely underwater from Aug. 25 to Sept. 5, 2017. TranStar coordinated flood monitoring and traffic management of closed roads during the 10-day extreme weather event. The facility's real-time map updates helped those returning to work navigate the city when many roads remained closed for days after the hurricane.

"The strength of Houston TranStar is never more evident than in times of emergencies such as hurricanes and other disasters, when all the partner agencies and organizations come together to respond to our community's needs," states Harris County Judge Ed Emmett, director of the Harris County Office of Homeland Security and Emergency Management. "We gather at a central point, sharing a common goal to protect lives and property during times of crisis. And on any normal afternoon, Monday through Friday, we also manage the traffic of almost 1 million commuters as they return from Houston to their homes in nearby communities." ■



During Hurricane Harvey, TranStar's traffic management data were vitally important to connecting first responders and rescue teams with people in need. The TranStar website was accessed by 1 million people and countless local and national news media during the extreme weather event.



TTI's Utility Engineering Program Helps Sponsors Avoid Unseen Expenses, Delays

Transportation project design and construction, even under the best of circumstances, are challenging for all concerned — the agency paying for the project, the engineer designing it, the contractor building it, and the travelers waiting on its completion.

Transportation agencies face numerous obstacles regarding utilities, including a lack of accurate information about utility facilities that may cause problems and how to resolve those conflicts. The impacts of these inefficiencies include:

- damage to utilities, along with costly and time-consuming repair;
- delays in project completion, leading to increased project costs;
- unnecessary utility relocations;
- frustration for travelers; and
- overall negative public opinion about the project.

Problems with utilities are among the most common causes of transportation project-cost overruns and schedule delays. However, many agencies are still unaware of the risks of failing to prioritize utility issues properly. To help sponsors navigate utility issues, the Texas A&M Transportation Institute (TTI) has established its new Utility Engineering Program under the leadership of TTI Senior Research Engineer Cesar Quiroga.

“Utility engineering is now a recognized specialty within the civil engineering profession,” says Quiroga, who recently

completed a term on the board of governors of the newly established Utility Engineering and Surveying Institute (UESI) at the American Society of Civil Engineers. UESI boasts close to 3,000 members, several hundred of whom are based in Texas.

“Our goal is to bring about a paradigm shift from treating utilities as an afterthought in project delivery to considering the utility process as an integral component in all phases of project delivery,” Quiroga says. “Our vision is to promote utility engineering through leading-edge research, technology transfer and strategic partnerships.”

TTI’s new program capitalizes on the long history of utility-related projects that Quiroga and other TTI researchers have led over the years. TTI has played a critical role in many influential utility-related initiatives, as well as research and implementation projects, that have taken place at the state and national levels. The Institute has developed and implemented novel ways to manage utility conflicts, conducted technology transfer to professionals and technicians, and developed utility data models and databases, as well as utility permitting systems.

“The return on investment from proactively managing utility issues is huge,” Quiroga says. “By applying what we’ve learned, we can truly transform our practices to save time and money.”

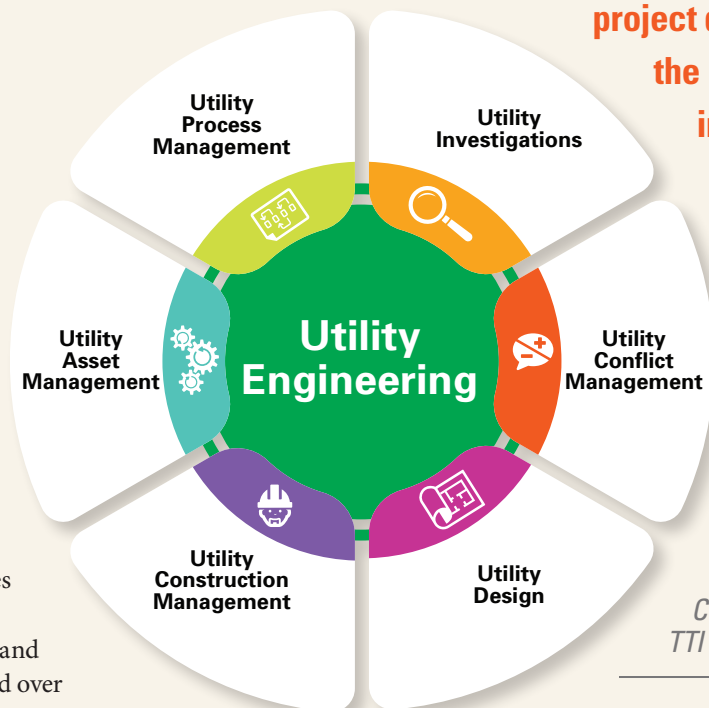
The absence of proactive utility conflict management (UCM) in the past has yielded an abundance of construction site failures. In one case in July 2016, San Antonio contractors drilled into major water lines on two separate jobs on back-to-back days, straining repair crews who narrowly avoided a complete loss of water pressure. The resulting loss of service to 120,000 customers all at once would have been “catastrophic,” officials said.

Conversely, the application of UCM practices can translate into significant savings and disaster prevention. In Maryland, officials were able to avoid relocating a gas line, saving more than \$500,000 and as much as six months in project delivery time.

Officials in Delaware have also seen the benefits of UCM. “Designers, coordinators, utility companies and construction engineers all seem to be onboard,” says Eric Cimo, a utility

“Our goal is to bring about a paradigm shift from treating utilities as an afterthought in project delivery to considering the utility process as an integral component in all phases of project delivery. Our vision is to promote utility engineering through leading-edge research, technology transfer and strategic partnerships.”

Cesar Quiroga
TTI Senior Research Engineer



engineer with the Delaware Department of Transportation. “The utility conflict matrix — paired with utility coordination via our electronic utility permit application and training initiatives geared toward stakeholders — have all added to what I believe are positive developments in the field of utility engineering and utility management.”

The Texas Department of Transportation (TxDOT) has been a leading implementer of Federal Highway Administration-funded utility research, which has helped the department transform how it resolves utility conflicts in its projects. By factoring UCM into its planning process, TxDOT’s San Antonio District avoided relocating an existing water main, saving more than \$1 million.

“The new approach adopted by TxDOT staff, consultants and utility partners consists of early coordination, extensive communication and design to avoid or minimize impacts to our utility partners,” states Anna Pulido, TxDOT’s utility manager for the San Antonio District. “This process produces a successful project that lets on schedule with no construction delay claims related to utilities.” ■



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TTI, ARTBA Celebrate 20 Years of the **WORK ZONE SAFETY INFORMATION CLEARINGHOUSE**



It's now considered the world's largest and most extensive resource for roadway work zone safety. But 20 years ago, the National Work Zone Safety Information Clearinghouse was just an idea — to have one location where practitioners could find information about how to improve work zone safety. It was an idea born from necessity because thousands of motorists, pedestrians and construction workers were being killed or injured each year in highway work zones.

In 1997, the American Road and Transportation Builders Association (ARTBA) and the U.S. Department of Transportation's Federal Highway Administration (FHWA) partnered with the Texas A&M Transportation Institute (TTI) to collect information and operate the clearinghouse, with the goal of significantly reducing work zone safety-related deaths and injuries. The clearinghouse officially became operational in April 1998.

At that time, only about 25 percent of U.S. households had Internet access, and there was relatively little World Wide Web content available. The concept of corresponding by email was still new to many people, and cell phones were only able to make telephone calls. There was no such thing as a mobile browser app.

"The clearinghouse was originally going to operate as a hotline where

work zone professionals and others could call in, fax or use regular mail to ask questions," recalls TTI Senior Research Engineer Jerry Ullman, who manages TTI's Work Zone and Dynamic Signs Program. Ullman is also the principal investigator overseeing the clearinghouse. "But we quickly realized that the Internet was going to dramatically alter information accessibility and how people interacted with each other, so we began developing a website where you could easily find and directly access research, best practices, ideas, products, data, training courses, outreach campaigns and legislation related to work zone safety."

In 2017, after two decades of clearinghouse personnel serving the public, some people still call the hotline number. But most users seeking information simply go to <https://www.workzonesafety.org/>.

"The nascent National Work Zone Safety Information Clearinghouse of 1997 has grown into the world's largest online resource on all topics relating to roadway construction safety in 2017. That success didn't just happen. It is the result of a collaborative partnership and hard work by transportation construction industry leaders, FHWA and TTI."

*Pete Ruane
ARTBA President*



Since going online, the website has received more than 10 million page views, and an average of 10,000 users now access the site each month.

"Safety has been a core ARTBA competency since its founding in 1902," says ARTBA President Pete Ruane. "The nascent National Work Zone Safety Information Clearinghouse of 1997 has grown into the world's largest online resource on all topics relating to roadway construction safety in 2017. That success didn't just happen. It is the result of a collaborative partnership and hard work by transportation construction industry leaders, FHWA and TTI."

Since its humble beginnings, the clearinghouse website has been through several redesigns in order to accommodate and better disseminate

the reams of data its personnel share with users. At the website's helm is TTI Research Librarian Hong Yu, hired by TTI just as the clearinghouse was getting started. After 20 years as the clearinghouse librarian and webmaster, she views the clearinghouse as one of her proudest accomplishments. Over the years, Yu has spoken at conferences, conducted webinars, and collected numerous thank-you notes from appreciative users. She's naturally become very proud of the role she plays in helping save lives.

"I have been touched by many stories users share with me," Yu says. She will never forget what a very grateful California contractor said to her after he received the information she sent him: "If we'd had this information before, my coworker would not have been killed."

"There is no way we could bring back the life of his coworker. But I'm glad what we do here at the clearinghouse has made a difference, and we can help prevent future fatalities," she explains with enthusiasm. "With that in mind, I feel all our hard work day in and day out is paying off."

Although it's difficult to determine how many lives have been saved or how many injuries have been prevented as a result of the clearinghouse, it's clear that work zone safety has now become a national priority.

"The ARTBA-led clearinghouse has become a critical outlet for both the public and private sectors," says Paul Pisano, head of FHWA's Work Zone Management Program. "I have the utmost respect and confidence in ARTBA and TTI, especially in Jerry's and Hong's capabilities, and their exceptional service." ■



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Innovative Data Applications

IMPROVE BORDER PLANNING AND AIR QUALITY

Using GPS Devices to Get Better Emissions Estimates

The World Trade Bridge crossing in the Laredo–Nuevo Laredo region is the most used Texas-Mexico port of entry (POE). The crossing's popularity helps explain the location's relatively high vehicle emissions, caused by high truck volumes and slow speeds as traffic makes its way across the bridge. A recent, innovative pilot program used emerging data gathering and analysis techniques to help reduce those emissions and decrease crossing times.

In freight transportation, *drayage* refers to a segment of the supply chain where goods are hauled within one site (such as a port) or from one local site to another. POEs along the 1,220-mile Texas-Mexico border experience large volumes of drayage activities because Mexican trucks were not allowed to travel long-haul distances into the United States prior to January 2015. This restriction has spurred the growth of a large drayage industry

The pilot program helped researchers determine the most visited trucking facilities and develop maps illustrating the key freight corridors in the region.

at U.S.-Mexico border crossings. Drayage activity is a significant component of total on-road vehicle activity and, as such, a noteworthy source of mobile emissions in the Laredo–Nuevo Laredo air shed. Based on regional travel-demand models, current regional emissions inventories only partially capture the air-quality impacts of drayage trucks.

In a study prepared for the Border Environment Cooperation Commission, Texas A&M Transportation Institute (TTI) researchers fit global positioning system (GPS) units onto a sample of 20 drayage trucks operating in the Laredo–Nuevo Laredo area. They analyzed the resulting GPS data in a GIS environment, producing very specific, trip-by-trip information on truck activity, with each trip defined by its origin, destination, start and end times, and duration.

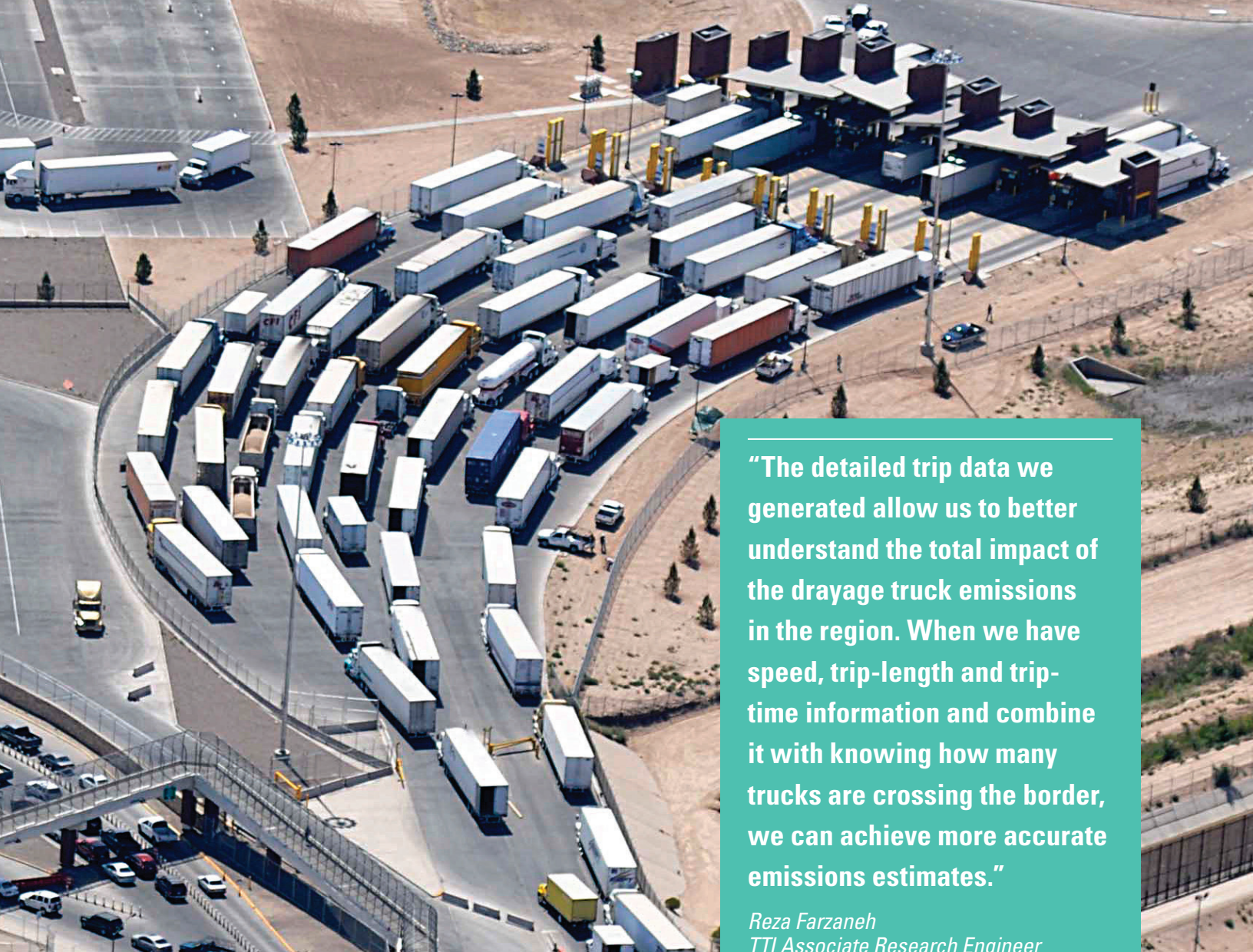
“The detailed trip data we generated allow us to better understand the total impact of the drayage truck emissions in the region,” says TTI Associate Research Engineer Reza Farzaneh, the project's principal investigator. “When we have speed, trip-length and trip-time information and combine it with knowing how many trucks are crossing the border, we can achieve more accurate emissions estimates.”

Those estimates provide important information to regional planners tasked with maintaining the growth of cross-border trade in the region without negatively impacting air quality.

The pilot program helped researchers determine the most visited trucking facilities and develop maps illustrating the key freight corridors in the region. When presented with the results of this study at a workshop in Laredo, border stakeholders worked to develop an action plan based on the data to improve border air quality. ■



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“The detailed trip data we generated allow us to better understand the total impact of the drayage truck emissions in the region. When we have speed, trip-length and trip-time information and combine it with knowing how many trucks are crossing the border, we can achieve more accurate emissions estimates.”

*Reza Farzaneh
TTI Associate Research Engineer*

Applying INRIX Data to Improve Emissions Analysis in MOVES

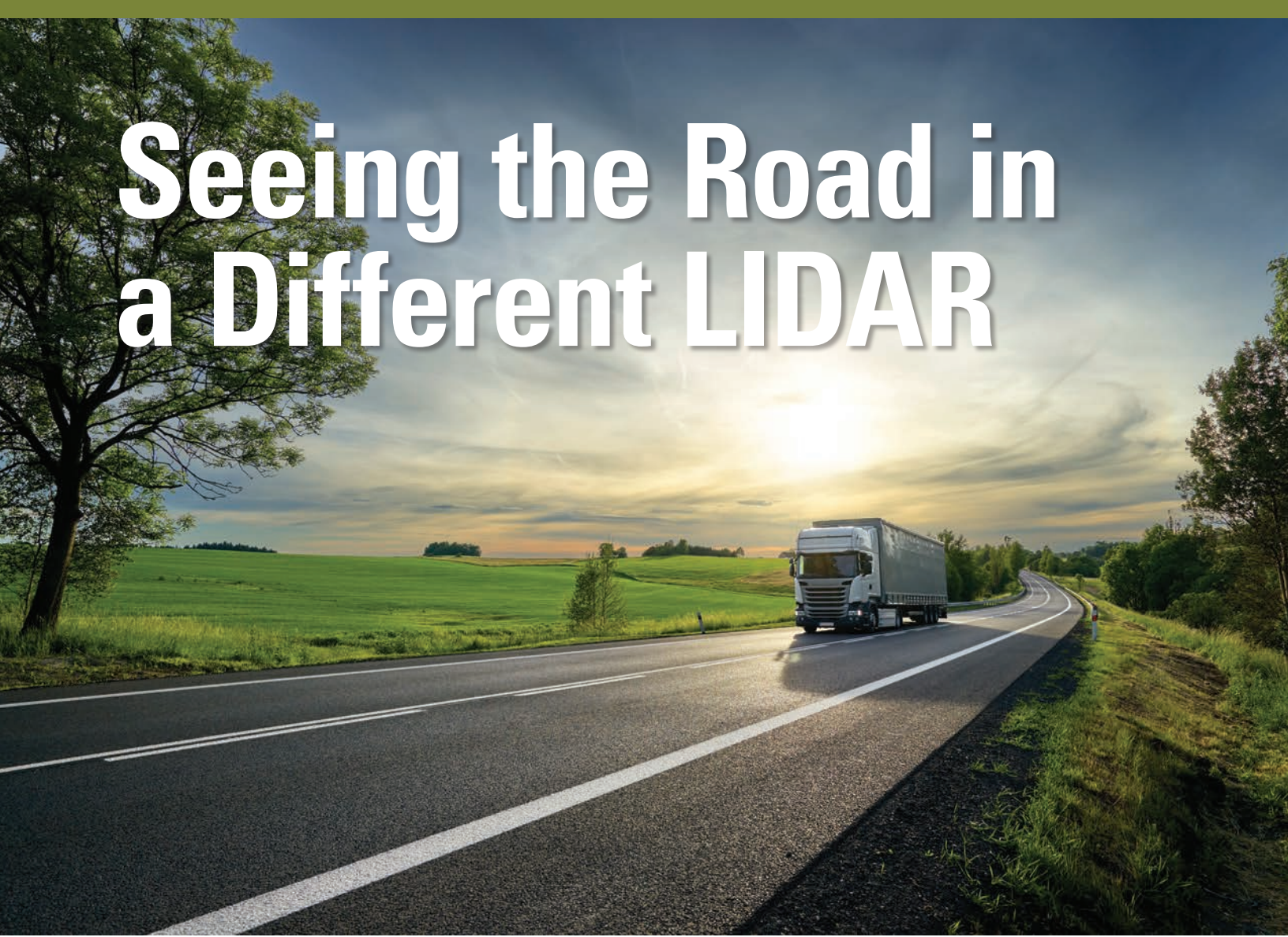
The Environmental Protection Agency uses MOtor Vehicle Emission Simulator (MOVES) to model and estimate mobile-source emissions. TTI’s Strategic Research Program funded a project to examine and better understand how the use of emerging sources of speed and traffic data can potentially improve and supplement the current state of the practice in mobile source emissions modeling. These new and innovative sources of archived data broadly encompass speed and traffic data collected by private companies, such as INRIX and Nokia HERE, and vehicle travel-time data collected using technologies such as Bluetooth®.

Within TTI’s Environment and Air Quality Division, staff from the Air Quality Program worked collaboratively with members of the Transportation Modeling Program, as well as TTI’s Mobility Division, which facilitated the use of sample INRIX data for the case-study analysis.

A case study of one freeway segment and one principal arterial segment in Austin, Texas, demonstrated the benefits of incorporating INRIX speed data into a MOVES-based emissions analysis. The team estimated link-level speed and emissions for both INRIX-based and travel-demand management (TDM)–based speeds. The results indicate that INRIX-based link speeds were lower than TDM-based speed during afternoon peak hours on freeways.

While the results of this single case study must be cited with caution, they demonstrate that archived traffic and speed data can be successfully incorporated into a MOVES-based emissions analysis platform. Such applications can potentially provide improved inputs to the MOVES model by providing more disaggregated and observation-based information. ■

Seeing the Road in a Different LIDAR



When we think of a roadway, most of us think of the asphalt or concrete we're riding on, not the ditches lining the roads or how efficiently water flows off those roads following a rainstorm. The Texas A&M Transportation Institute (TTI) has come up with an automated way of determining whether those ditches are doing their job properly and safely.

The Texas Department of Transportation (TxDOT) maintains an extensive data repository documenting the performance of roadways in the state. Charles Gurganus, associate research engineer in TTI's Pavements and Materials Division, is studying an automated method of providing TxDOT with right-of-way-line to right-of-way-line roadway surface geometric information. The project is called Developing a Surface Drainage Rating for Inclusion in TxDOT's Asset Management System.

Using light detection and ranging (LIDAR) technology, Gurganus can collect extensive roadway geometric data, including roadway cross slopes, super elevations, front slope steepness and drainage areas. The technology can also

determine the depth of a roadside ditch and its offset related to the nearby pavement structure. All data can be collected at highway speeds.

"It's almost like we are proving what has always been intuitive about roadway work," says Gurganus. "We think shallow ditches close to the edge of the pavement may cause pavement problems. We think deeper ditches farther away from the pavement edge with a good longitudinal grade are more desirable. Now we can measure that at a network level and compare it to pavement performance."

The technology is a single, boom-mounted laser device raised 10 feet in the air. It also uses GPS, an inertial measurement unit and a video camera.

Gurganus hopes to link road distress problems to the collected data. "We know this roadway is having performance problems from a distress standpoint," he says. "How does that relate to ditch depth and offset? If a roadway is performing poorly — such as indicated by alligator cracking or rutting — we can now show that it has



“The challenge is how to go from being data rich to being information rich. How do we supply the client with information-rich data that meets their needs?”

*Charles Gurganus
TTI Associate Research Engineer*

a shallow ditch close to the pavement’s edge. If repairs are going to be made, we can deepen the ditch and move it away from the pavement. It’s a more holistic repair approach.”

Data have been collected from roadways in TxDOT’s Austin, Brownwood, Bryan, Atlanta, Tyler and Corpus Christi Districts. The challenge is taking that data and deriving useful information from them. In 12 miles of roadway, the system can generate 25 million data points, and that’s a lot to parse and analyze. As Gurganus notes, “The challenge is how to go from being data rich to being information rich. How do we supply the client with information-rich data that meets their needs?”

The ultimate goal is to enable integration of the information generated by Gurganus’s collection method

into TxDOT’s project development process. Doing so can help the department better refine its project scopes before implementation.

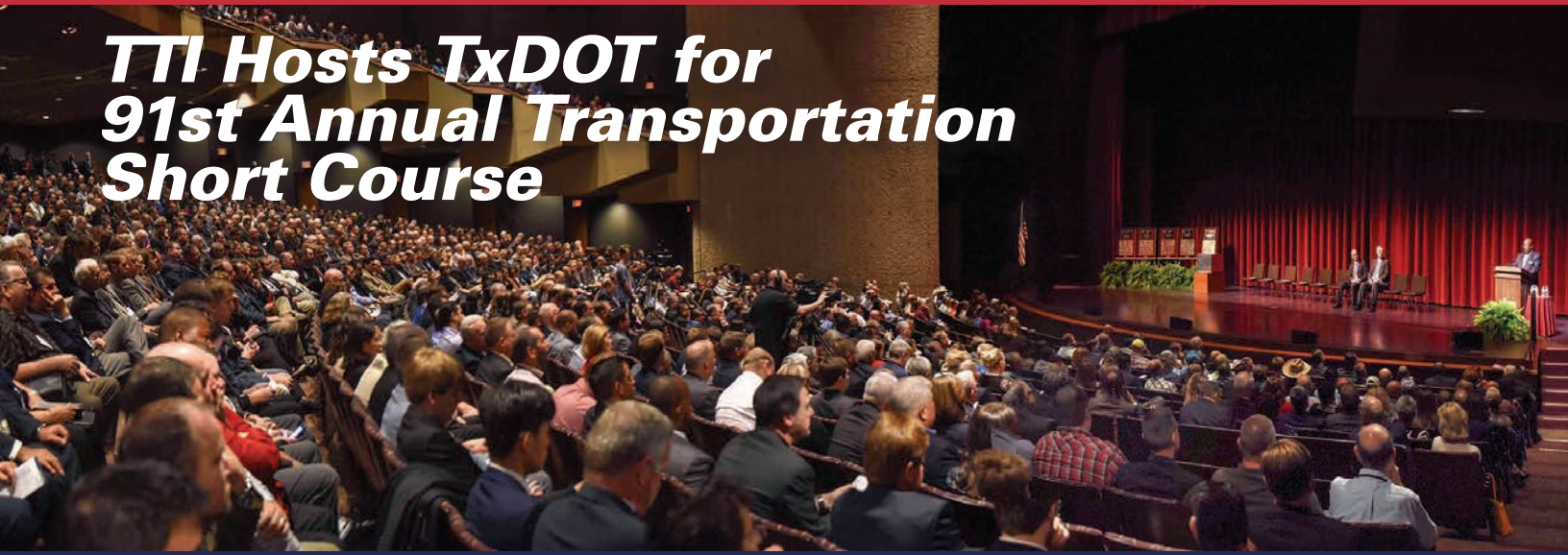
“This should help TxDOT stretch its funds farther and do more lane miles of work every year,” Gurganus says. “Maintenance supervisors will be able to focus on problem spots with measurable data. Time, effort, materials and money will impact roads that really need it.”

“This project has shown us that mobile LIDAR can be an effective tool to capture geometric features from right-of-way line to right-of-way line that can better inform our decision makers and improve how we manage the network,” says Magdy Y. Mikhail, section director of pavement asset management in TxDOT’s Maintenance Division. ■



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TTI Hosts TxDOT for 91st Annual Transportation Short Course



TTI Agency Director Greg Winfree speaking at the 91st Transportation Short Course.

91st TRANSPORTATION SHORT COURSE

With a near record number of attendees, the 91st Annual Transportation Short Course — the Texas Department of Transportation's (TxDOT's) annual employee gathering — was a time of reflection and celebration for a historic and extremely challenging year. TxDOT is 100 years old this year, and dozens of TxDOT employees who went above and beyond to help their fellow Texans during Hurricane Harvey were honored for their humanitarian and lifesaving efforts.

"TxDOT and the universities have laid a solid foundation of trust and teamwork over almost seven decades. Working together, we can be good stewards of our existing infrastructure, while also focusing on developing improved infrastructure going forward when we truly will experience smart transportation in the context of connected and automated vehicles and infrastructure."

*Greg Winfree
TTI Agency Director*

"As we enter this next 100 years of service, let the strength of our diversity, our differences, continue to make us a better agency. Let's continue to look for ways to embrace newcomers to TxDOT, employees that have new ideas, new thoughts, new ways of improving on the business of moving millions of people and products millions of miles across our great state. The future of transportation in Texas — our future — is depending on it."

*James Bass
TxDOT Executive Director*

"By the time we called our initial response and recovery efforts, nearly 4,000 employees from every district and many divisions had participated in the TxDOT response," James Bass, TxDOT executive director, told the more than 2,500 Short Course attendees.

In addition to providing high-water rescues, repairing downed street signs and inoperable traffic signals, reopening many of the 500 flooded roads, and inspecting 4,500 bridges that were impacted by the storm, TxDOT crews have, to date, "removed more than 8.2 million cubic feet of debris from 20 cities and counties," Bass revealed. The cleanup effort alone required more than 600 TxDOT employees.

TxDOT's Short Course has been held on the Texas A&M University campus for 91 years and hosted by the Texas A&M Transportation Institute (TTI) since the Institute's founding in 1950. Short Course reflects a history of teamwork between the two agencies. Its primary purpose is to bring together TxDOT district and division personnel with university researchers to discuss the latest innovations in transportation research. Lessons learned and best practices were shared in sessions ranging from design and environmental concerns to construction practices and pavement maintenance. Researchers also presented findings on advances in traffic operations (via, for example, intelligent transportation technologies), and relatively new topics like alternative delivery methods were discussed.

"This partnership, now 67 years old, remains the model for the rest of the country," TTI Agency Director Greg Winfree said during the opening session. "It will take all of us collectively contributing expertise and resources to get our state's transportation infrastructure recovered, renewed and made more resilient following our recent state of emergency."

Many of Winfree's comments centered on the value of the relationship between the state universities and TxDOT as they both work to improve transportation through the introduction of new technologies.

"TxDOT and the universities have laid a solid foundation of trust and teamwork over almost seven decades," Winfree noted, reminding the crowd of the mission state universities have to help TxDOT implement the next generation of transportation innovations. "Working together, we can be good stewards of our existing infrastructure, while also focusing on developing improved infrastructure going forward when we truly will experience smart transportation in the context of connected and automated vehicles and infrastructure."

Numerous TxDOT employees received Harvey Hero awards in recognition of their work in helping to rescue southeast Texas residents impacted by floodwaters. As it does at every Short Course, the department also recognized employees who went the extra mile



James Bass, TxDOT executive director, addresses more than 2,500 attendees at the 91st Transportation Short Course.

in helping or saving lives of motorists during the last year.

"As we enter this next 100 years of service, let the strength of our diversity, our differences, continue to make us a better agency," Bass said, closing the opening session. "Let's continue to look for ways to embrace newcomers to TxDOT, employees that have new ideas, new thoughts, new ways of improving on the business of moving millions of people and products millions of miles across our great state. The future of transportation in Texas — our future — is depending on it." ■



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TTI Researchers Use Data Visualization to Create Interactive Congestion Strategy Website

In 2016, Texas A&M Transportation Institute (TTI) Associate Transportation Researcher Phil Lasley came to James Moughon, TTI software applications developer, looking for a way to make the congestion-mitigation strategy website, developed for TTI's Transportation Policy Research Center, more user friendly. At the time, the website listed more than 100 congestion-mitigation strategies using static graphics, but Lasley wanted to make it more interactive.

"One thing we realized is that while that first site was great for getting out raw information, it didn't do a very good job of helping users participate in the process — truly get at the interactive nature of our research. So, we developed the second site to be a tool that allows users to immerse themselves in the strategy-selection process," Lasley explains.

The website provides users with a package of strategies to reduce congestion while providing context for those choices that facilitates meaningful discussions of multiple nontraditional approaches.

"Data visualization is important because, when done correctly, it can take complex concepts and make them easier to understand," says Moughon. "If it's something that we've put together for stakeholders or governing agencies, they are then able to advocate for research we're conducting because they better understand it."

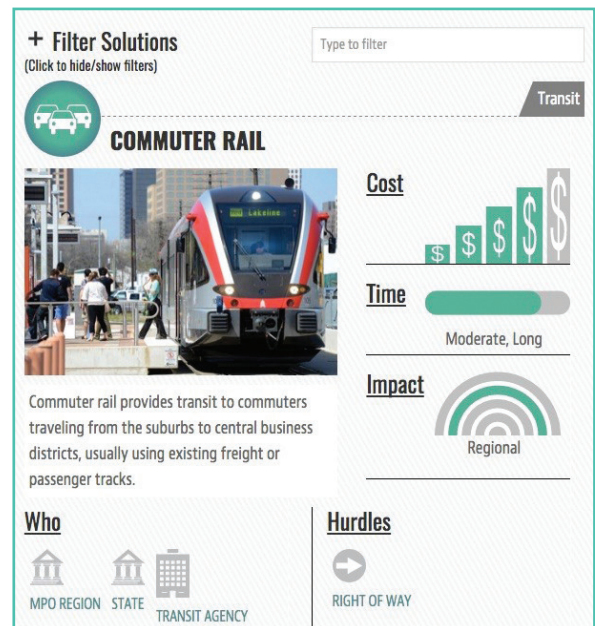
The tool does two different things: It helps narrow down the long list of strategies to a more manageable size while making them more relevant to the area or problem to be solved. Then the tool shows how each strategy is related or interconnected with the others.

Lasley says, "This is important because some strategies work best (or only work at all) when combined with another. The tool first allows users to input the context of the area or corridor, which narrows down the list of strategies to only those that would make sense in that area. Then users can interact with those strategies and see how other strategies might work well with or enhance one another."

The tool also allows users to filter by cost, time to implement, impact, strategy type (e.g., congestion, technology, freight or policy), common hurdles to implementation, and the entity is responsible for

implementing the selected strategy or strategies.

"Transportation funding shortages constitute a reality for cities just as they do for states," says Ginger Goodin, director of TTI's Transportation Policy Research Group. "And no two cities are exactly alike, so it's very important that they have tools like this one to help them address traffic congestion in a way that's both cost efficient and customized to their unique local needs." ■



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TTI Graduate Student Wins Fellowship Award



Wilson

TTI Associate Research Scientist Bryan Wilson was recently awarded the American Society for Nondestructive Testing, Inc. (ASNT) Fellowship Award for proposed research titled Ground Penetrating Radar as a Quality Assurance Tool in Hot-Mix Asphalt Road Construction. The ASNT Fellowship Award helps graduate students defray costs of post-graduate research in nondestructive testing. Wilson began his Ph.D. program in civil engineering at Texas A&M University in 2016, focusing on the design, laboratory testing and field implementation of thin performance and maintenance treatments, primarily thin asphalt overlays.

"Bryan's selection as an ASNT Fellowship Award recipient is a testament to the high quality of students, research, and faculty and staff available at TTI and Texas A&M University," notes TTI Research Scientist Stephen Sebesta, one of Wilson's advisors. ■

TDS Celebrates 15 Years of Success

Teens in the Driver Seat® (TDS), the first peer-to-peer program for teens that focuses solely on traffic safety and addresses all major risks for this age group, recently reached a milestone anniversary of 15 years. This year, according to TDS Director Russell Henk, who founded the program, TDS will help more than 350 schools provide empowering, results-driven community services to make roads safer across the United States. The program continues to leverage positive peer influence to increase awareness of teen driving risks and encourage safer driving behaviors.

"Before our program existed, I can still remember watching news coverage of numerous fatal teen car crashes in our community, and then looking at my own children and imagining how difficult it was for those parents to lose their child so prematurely," says Henk. "Our hope is to continue to leverage the influence peers have with each other to increase awareness of the primary teen driving risks and encourage safer driving behaviors." ■

TTI and 3M Expand Research Partnership at RELLIS Campus

The Texas A&M University System has signed a five-year master agreement with 3M to develop roadway signage and pavement marking technologies. The master agreement will provide for projects that can be awarded by 3M for A&M System research, training and technical assistance. TTI is currently conducting two projects through the agreement: one involves developing roadway signage technology that communicates important infrastructure information to drivers, and the other is evaluating new, innovative pavement-marking technologies readable by connected and automated vehicles in wet road conditions.

"The RELLIS Campus' testbeds and proving grounds are the perfect place for the development of transformational technologies like these, and we are proud that 3M has chosen us as its partner on these important projects," says Associate Vice Chancellor and RELLIS Campus Director John Barton. ■

TTI's Goodin, Stockton Named Regents Fellows



Goodin

Recognized for their "exemplary service to their agency and the people of Texas," TTI Senior Research Engineer Ginger Goodin and Executive Associate Director Bill Stockton were among the 10 people chosen from the A&M System's agencies to be designated Regents Fellows for 2016–2017.

"I am really honored to be included with the ranks of those people named Regents Fellows since the program began in 1998," Stockton says. Stockton serves as chief research officer for TTI and is the principal liaison to the Institute's largest research sponsor, the Texas Department of Transportation.



Stockton

Texas A&M University System Chancellor John Sharp said the Regents Professors and Regents Fellows designees "represent the best of our great A&M System and higher education in Texas. They are true assets."

Goodin, who specializes in transportation planning, intelligent transportation systems and automated vehicles, was most recently the director of the Transportation Policy Research Center at TTI. "It's a very humbling experience and a real honor to be named a Regents Fellow because I never considered that I was qualified for such an award," she says. "I've always had a deep respect for the people of TTI and for those before me that received this designation." ■

Ledé Inducted into Texas Transportation Hall of Honor



Friends and colleagues from TTI, TSU and Houston METRO joined Dr. Ledé and her family for the ceremony.

Dr. Naomi W. Ledé, distinguished professor and founder and executive director emeritus of the Transportation Studies Program and Center for Transportation Training and Research (CTTR) at Texas Southern University (TSU), was inducted into the Texas Transportation Hall of Honor on Nov. 20. The induction ceremony and luncheon, hosted by TTI, took place at The Texas A&M University System's Board of Regents' dining room on the Texas A&M University campus in College Station.

During her 22 years at TSU, Ledé almost single-handedly developed and led CTTR, growing it into one of the strongest and most respected transportation centers in the country at a historically Black university. After retiring from TSU, Ledé served as senior research scientist at TTI for seven years, leading a Summer Transportation Institute for minority students.

"In the view of the board of directors of the Hall of Honor, perhaps what set Dr. Ledé apart from so many other deserving individuals was her unwavering commitment to training the next generation of transportation professionals and encouraging them in their careers," said TTI Agency Director Greg Winfree, who opened the ceremony.

Joining Ledé for the event were a multitude of family members, TSU and TTI colleagues, former and current TSU students, and staff of the Metropolitan Transit Authority of Harris County (Houston METRO), where she previously served as a board member.

In accepting the honor, Ledé thanked TTI for hosting the event and helping open the door for research partnerships at TSU. "If you go and seek the knowledge and work hard, you will see the results," she said. "I will continue to help improve the lives of our students and encourage all of you to keep that up!" ■

TTI Receives Partnership Award from City of Irving

TTI was presented a 2017 Summit Partnership Award by members of the Irving Transportation Investment Summit, held Aug. 15–16.

This was the second year TTI assisted with the long-running Irving transportation gathering to "highlight the growth in Texas' infrastructure market, build partnerships, encourage transit-oriented development, and develop strategies for increasing investment in sectors such as transportation, economic development, smart technology, water and energy."

Among the TTI speakers or moderators for this year's summit were Allan Rutter, head of TTI's Freight Mobility and Infrastructure Analysis Division; Ginger Goodin, senior research engineer; and Christopher Poe, assistant director for connected and automated transportation strategy.

"We are proud to be a partner in Irving's Transportation Investment Summit and the city's forward-thinking approach and leadership role in Texas transportation," says TTI Agency Director Greg Winfree. Winfree attended the summit and accepted the award on TTI's behalf. ■



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At TTI, Research Excellence Is Personal

As I get older, I find myself celebrating milestones more often. Some of those, like my wedding anniversary, are certainly welcome, though at my age, I'd just as soon forget about birthdays. Other folks tend to remind me of those anyway, and that's okay. Celebrating a birthday certainly beats the alternative, right?

We close out this 53rd volume of the *Texas Transportation Researcher* by celebrating a number of milestones the Texas A&M Transportation Institute (TTI) has reached with a wide array of our research sponsors. TTI was founded at Texas A&M University as a research support arm for the Texas Department of Transportation (TxDOT), which remains our principal sponsor. Now, 67 years later, TTI has served sponsors in 50 states and 48 countries, helping to make the world's transportation network safer, more efficient and more reliable.

How did TTI achieve its reputation for research excellence? Innovative approaches fed by the professional curiosity of our transportation experts were essential, to be sure. But there was something else at work too, an element we tend to take for granted as we go about our daily working lives: the personal relationship.

As you've seen in this issue, the Institute has built longstanding relationships with sponsors like the TranStar partnership and the American Road and Transportation Builders Association, and we've expanded our service beyond TxDOT to other state departments of transportation nationwide. As a former assistant secretary of the U.S. Department of Transportation (USDOT), I take particular pride in TTI's 50-year history of supporting the various agencies of USDOT.

So, how did TTI achieve its reputation for research excellence? Innovative approaches fed by the professional curiosity of our transportation experts were essential, to be sure. But there was something else at work too, an element we tend to take for granted as we go about our daily working lives: the personal relationship. When I was at USDOT, we knew we could trust TTI's research results to be truthful and arrived at without bias for one product or procedure over another. We knew that TTI, as part of The Texas A&M University System, brought intellectual independence to the table.

But trust isn't built between agencies. It's built between people. At the end of the day, all business is a "relationship business," even the business of transportation research. In an era of diminishing dollars, government agencies aren't able to invest as much in the research process, so when they do, they want to know what they're getting for their investment. That's why the personal relationships TTI has built over the years working side by side with sponsors matter so much.

Those one-on-one connections between TTI researchers and sponsors will prove even more important in the coming decades. For example, as advanced technologies like connected and automated vehicles come online, we'll have to troubleshoot issues of technology integration, policy formation, and how public versus private responsibilities will shake out, to name a few. The confidence we've built over seven decades enables TTI to have difficult conversations about these complex issues with sponsors and stakeholders alike.

We'll continue to work hand in hand with sponsors in the best interests of our shareholders — you, me and the rest of the driving public. Together, we'll produce the smartest, safest, most reliable transportation network in the history of the planet. ■



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