

Bubble, Bubble. Toil. No Trouble.  
TTI Researchers Investigate  
Mysterious Pavement Behaviors  
Following Hurricane Harvey

TTI and Texas A&M's  
Zachry Department of Civil  
Engineering Look Toward  
the Future

The Campus As a Classroom:  
TTI Creates Opportunities  
for Texas A&M Engineering  
Students

TEXAS TRANSPORTATION

VOL. 54 | NO. 1 | 2018

# Researcher

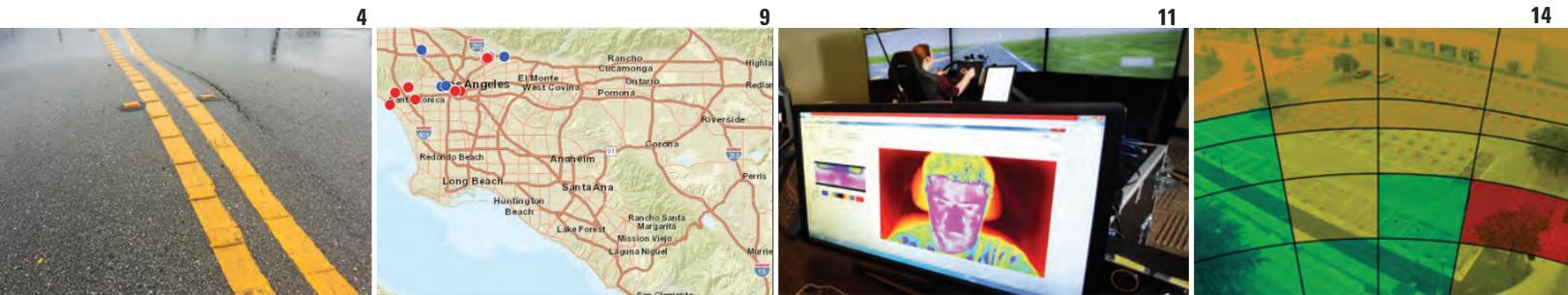
Education, Innovation,  
Implementation



# TEXAS TRANSPORTATION Researcher

VOL. 54 | NO. 1 | 2018

**ON THE COVER:** From its beginnings in 1950, the Texas A&M Transportation Institute has provided a living laboratory for Texas A&M University students to gain real-world experience that complements learning in the classroom.



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# A History of Teaming for Transportation, Education

The Texas A&M Zachry Department of Civil Engineering  
and the Texas A&M Transportation Institute

**AT A GLANCE**

See related story on page 10

**68**  
years  
partnered



**56**  
average number of  
civil engineering students  
employed annually by TTI  
(since 2014)



**268**  
shared  
projects  
(since 2008)



**55**  
shared  
appointments  
(faculty researchers since 2008)



**\$4.5M**  
average shared research  
expenditures per year  
(since 2008)





## Bubble, Bubble. Toil. No Trouble.

### TTI Researchers Investigate Mysterious Pavement Behaviors Following Hurricane Harvey

**H**urricane Harvey's impact on Texas was unprecedented in many ways, including rainfall amounts, property damage and human misery. There was also unprecedented disruption and damage to Texas roadways. About a mile of SH 6 in Harris County, from Clay Road to I-10, was covered with up to 7 feet of water for 14 days. Multiple farm-to-market roads in Brazoria County were also submerged for days by 1 to 7 feet of water.

As a result, many of these roadways exhibited characteristics that Texas Department of Transportation (TxDOT) Houston District personnel had never seen before. In five locations, the pavement bulged 12 inches above the normal road surface. In other locations, continuous streams of air bubbles escaped from cracks or joints in the road. TxDOT was concerned the bubbles might have been from damaged pipelines. When the bubbles were deemed harmless, the question became, "Where are these coming from?"

What was the explanation? Were areas beneath the pavement washed out? Was the pavement structure stable? Had asphalt delaminated from the concrete base? Could the roads possibly collapse? The roads couldn't be opened without answers.

TxDOT asked the Texas A&M Transportation Institute (TTI) Senior Research Engineer Tom Scullion and his team of forensic pavement investigators, Research Specialist Lee Gustavus and Research Associate Jason Huddleston, to survey the affected roadways and assess the damage. Using ground-penetrating radar (GPR), TTI's total pavements acceptance device (TPAD) automated rolling deflectometer and core sampling, TTI evaluated the health of all the affected roadways. SH 6 was first. It carries tens of thousands of vehicles each day, so getting it open was critical.

"TTI has some unique, specialized equipment," Scullion explains. "From the data we collected, we saw no indication of delaminations or washout, voided areas. We recorded deflections every 2 inches down the road. There were no anomalies in those data. After two weeks underwater, the asphalt was still bonded to the concrete, which was attributed to an excellent asphalt rubber seal coat bonding the asphalt and concrete layers together." Following the assessment, SH 6 was reopened to traffic.

Mark Wooldridge, director of maintenance for the TxDOT Houston District, states, "TTI's equipment and support were



*The TPAD is a highly modified geological surveying “thumper” truck designed for seismic testing. It combines rolling dynamic deflectometers with GPR.*

exceptional. The quick, timely response allowed us to verify that damage was not present on the roadways in question and enabled reopening of the roadways to traffic. The special equipment provided a much more thorough and accurate evaluation of the pavement structure than point testing, and the immediate interpretation and availability of data facilitated quick decision making.”

**“TTI’s equipment and support were exceptional. The quick, timely response allowed us to verify that damage was not present on the roadways in question and enabled reopening of the roadways to traffic.”**

*Mark Wooldridge  
Director of Maintenance, TxDOT Houston District*

Scullion and his team moved on to Brazoria County near Angleton. These roads exhibited the strange air bubbles and domes — humped sections of pavement expanding upward as air is forced from beneath the pavement. “I’ve been in this business for a very long time. I had never seen anything like these domes,” says Scullion. “Neither had TxDOT personnel.”

Little is known about the original construction of these old farm-to-market roads. TxDOT wanted to be sure there were no voids under the surface that might collapse. The

TPAD and GPR found no major anomalies beneath the road surface. As flood waters receded, the domes sank back to normal pavement level. Fortunately, TxDOT personnel had marked the locations of the domes.

“When we cored the areas that had risen, we found 8 to 10 inches of asphalt on the surface. Next was an old concrete layer. There had been a number of variable asphalt layers placed on top of this concrete, some exhibiting stripping with a resulting very low density,” Scullion observes.

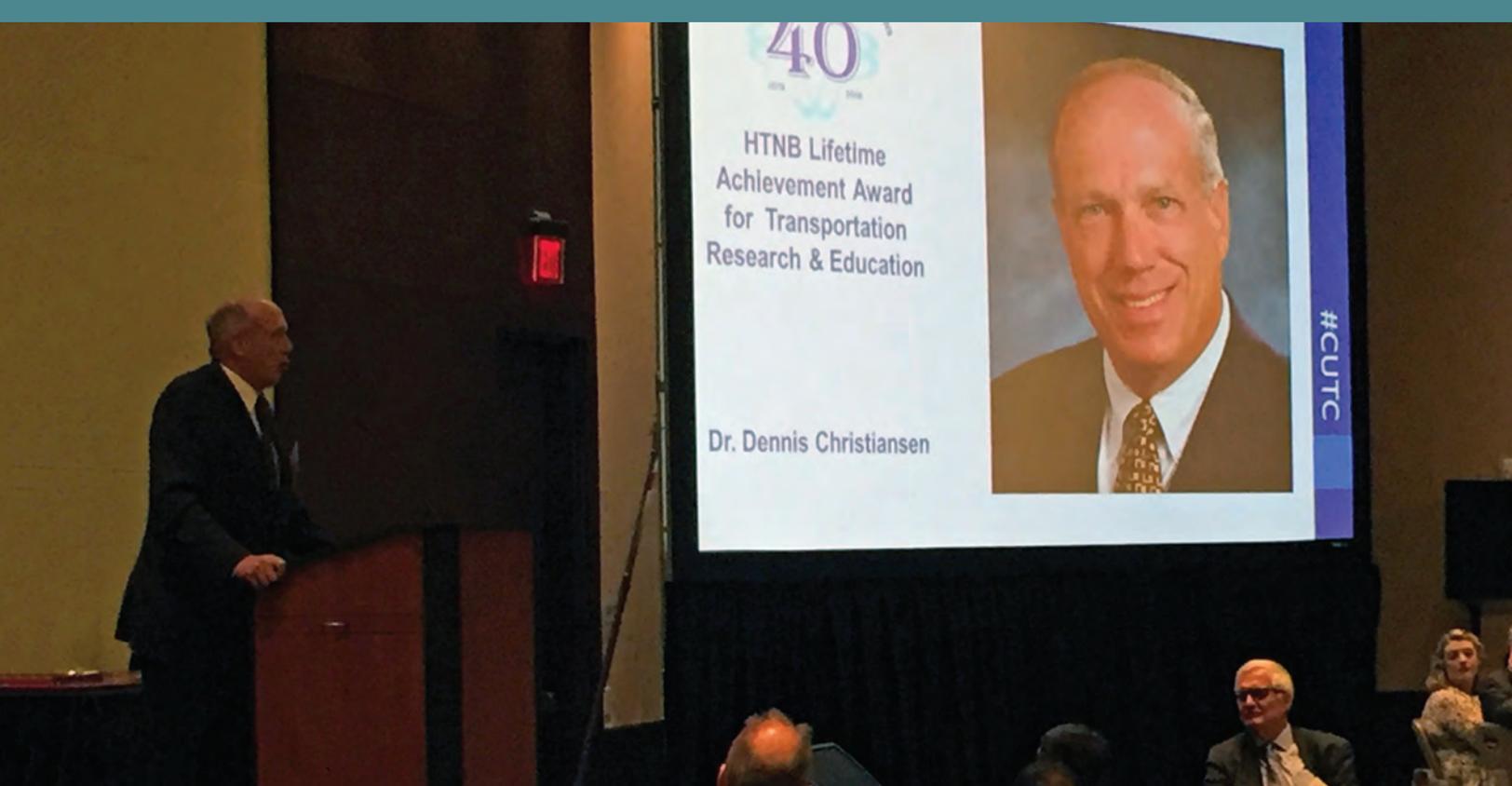
After analyzing the data, Scullion and his team concluded the domes and bubbles were caused by the weight of the flood waters pressing down on the air trapped inside the low-density asphalt layers. Like water being squeezed from a sponge, air was being forced from the voids in the low-density asphalt layer.

“That air had to get out somewhere. If it found a joint or crack, that’s where the bubbles came from. If there was not a crack or joint nearby, the asphalt-concrete bond broke, causing the pavement to rise,” Scullion notes.

After the waters receded, there were no major safety concerns, and the roads were opened to traffic. Scullion says the condition of the roads after the flooding was a tribute to the Houston District’s pavement designs over the past 60 years. ■



*For more information, contact  
**Tom Scullion** at (979) 845-9913 or  
t-scullion@tti.tamu.edu.*



*TTI Director Emeritus Dennis Christiansen receives the HNTB Lifetime Achievement for University Transportation Education and Research Award.*

## TTI Shines at Transportation Research Board 97th Annual Meeting

Numerous Texas A&M Transportation Institute (TTI) researchers and students were recognized during the Transportation Research Board (TRB) 97th Annual Meeting Jan. 7–11 in Washington, D.C. This year’s gathering of transportation professionals from around the globe included more than 5,000 presentations in nearly 800 sessions and workshops.

### Best Paper Awards

The paper “Field Evaluation of Pilot Vehicles and Portable Traffic Control Signals with and Without a Flagger” — based on a Texas Department of Transportation (TxDOT) project and written by TTI Research Engineers Melisa Finley and LuAnn Theiss — won a 2017 TRB best paper award bestowed by the TRB Work Zone Traffic Control Committee. Based on the study that spawned the paper, the Federal Highway Administration will soon issue an interim approval that removes the *Manual on Uniform Traffic Control Devices* requirement for a human flagger at work zones that use pilot vehicles and portable traffic signals.

“Evolution of the Surface Performance-Graded Specification for Chip Seal Binders,” co-authored by TTI Research Engineer Amy Epps Martin, Associate Research Engineer Edith Arámbula Mercado and others, received the TRB Design and Construction Group’s 2017 Practice-Ready Paper Award. The award recognizes nearly 20 years of chip seal research by TTI that developed and



*Left to right: Tim Baughman, chair of the TRB Work Zone Traffic Control Committee; LuAnn Theiss; Melisa Finley; and Wesley Zech, chair of the Best Paper Award Selection Committee.*



*Left to right: Nelson Gibson, TRB senior program officer for materials and construction; Amy Epps Martin; Edith Arámbula Mercado; Swathi Mayi Theeda; and Becky McDaniel, TRB asphalt section chair.*



Left photos (upper and lower): TTI personnel greet TRB attendees at the TTI booth. Lower right: TTI Agency Director Greg Winfree celebrates with Maryam Shirinzad, who won the Safe-D University Transportation Center's Student of the Year award.

Top right photo (left to right): TTI research staff members David Florence, Apoorba Bibeka, Xiaoyu (Sky) Guo, Madison Metsker-Galarza, Xiaoqiang (Jack) Kong and Tracy Zhou; and Yunlong Zhang, professor in the Zachry Department of Civil Engineering.

validated the surface performance-graded specification for chip seal binders now available as a TxDOT Special Provision (SP300-011).

The TRB Air Quality Committee selected "Effectiveness of Idle Reduction Technologies in Reducing Driver Exposure to Diesel Emissions" by TTI Senior Research Engineer Joe Zietsman, Research Specialist Jeremy Johnson, Assistant Research Engineer Tara Ramani and Associate Research Engineer Reza Farzaneh for a best paper award. The paper examines the effectiveness of idle-reduction technologies — auxiliary power units — in reducing truck driver exposure to in-cabin diesel emissions.

### Dwight David Eisenhower Transportation Fellowship

Two TTI researchers, Charles Gurganus and Greg Griffin, received a Dwight David Eisenhower Transportation Fellowship, which is designed to "attract the brightest minds to the field

of transportation, enhance the careers of transportation professionals and to retain top talent in the transportation industry." Gurganus is an associate research engineer in the Institute's Pavement and Materials Division and a Ph.D. candidate in Texas A&M University's Department of Civil Engineering. Griffin is an assistant research scientist in TTI's Planning and Engagement Program and Ph.D. candidate in community and regional planning at The University of Texas at Austin.

### Safe-D University Transportation Center Student of the Year

The Safety through Disruption (Safe-D) University Transportation Center selected Maryam Shirinzad, a Ph.D. candidate at Texas A&M University, as its student of the year. Shirinzad, who works in TTI's Roadway Safety Program, received the award at the Council of University Transportation Centers Award Banquet in Washington, D.C.



### Turnbull Appointed Chair of TRB Executive Committee

TTI Executive Associate Director Katie Turnbull was officially appointed chair of the TRB Executive Committee at the Annual Meeting Chairman's Luncheon. Active in TRB task forces, committees, conferences and projects for the last three decades, she served as vice chair of the executive committee last year.

"It is a great honor and privilege to work with all of you and the TRB Executive Committee and staff. I am looking forward to a great year," Turnbull said at the luncheon. "It's an exciting time to be involved in transportation and TRB." ■

### Christiansen Receives Lifetime Achievement Award

TTI Director Emeritus Dennis Christiansen was honored with the HNTB Lifetime Achievement for University Transportation Education and Research Award during the annual Council of University Transportation Centers Award Banquet. Christiansen, who served as TTI director for 10 years until his retirement in 2016, was selected for the award based on his significant contributions to transportation research and education. ■



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

# BETTER Estimates, SMARTER Development

## Caltrans Adopts TTI's New Smart-Growth Trip-Generation Tool

The goal of the project was to produce a validated and improved estimation method, and as a result, create a user-friendly tool to more accurately estimate trip generation.

**THE TRADITIONAL DATA USED TO ESTIMATE THE TRANSPORTATION IMPACT of urban development are not appropriate for smart growth or infill development,** according to a study conducted by the Texas A&M Transportation Institute (TTI) for the California Department of Transportation (Caltrans). (*Infill development* refers to building on vacant land within a developed area.) As a result of the study, Caltrans is now urging smart-growth developers to use TTI's new vehicle trip-generation tool instead of the traditional suburban rates from the Institute of Transportation Engineers (ITE).

"The ITE rates were developed mainly for suburban sites in single-land-use areas, where most travel is by motor vehicles," explains TTI Senior Research Engineer Brian Bochner. "With these relatively new and growing-in-popularity smart-growth developments in urban areas, there are usually nearby access to transit, more and better pedestrian facilities, and more bike lanes and facilities. So, it makes sense that the number of vehicle trips would be fewer than in traditional suburban areas. Our study showed that there were considerably fewer vehicle trips in smart-growth areas than what would be estimated using traditional vehicle trip-generation rates."

Most agencies that review the transportation impacts of proposed developments require developers to conduct a transportation impact analysis, with a major element being a trip-generation estimate. After all, it's the additional motor vehicle trips to and from the site that contribute to air pollution, traffic congestion, the need for surrounding road improvements (like additional signals or traffic lanes), and the right number of parking spaces for the project.

If impacts are overestimated, state and local agencies might require excessive mitigation measures. Developers are usually required to provide road improvements or charge fees to offset the problems their projects are expected to create. In worst-case scenarios, a planned development might be reduced in size or scope or even scrapped because of the extra costs or anticipated consequences.

Since the TTI project was completed, word is getting out that there's a better way to estimate trip generation for apartment and office smart-growth developments.

The tool is available on the project website at <https://tti.tamu.edu/featured-project/smart-growth-trip-generation-study-in-california/>.

**TTI researchers collected actual trip-generation data from 30 smart-growth sites (e.g., apartments and office complexes) in California and then compared the findings with the estimates generated from traditional suburban data.**

“For some time, we’ve had a pretty good idea that trip-generation estimates were not accurate for our infill areas,” says Marc Birnbaum, Caltrans project manager on the trip-generation study. “Transportation experts and developers speculated that the estimates were too high. Others thought smart-growth areas would somehow generate as little as zero vehicle travel. From an equity perspective, we need to get this right.”

The goal of the project was to produce a validated and improved estimation method and, as a result, create a user-friendly tool to more accurately estimate trip generation. TTI researchers collected actual trip-generation data from 30 smart-growth sites (e.g., apartments and office complexes) in California and then compared the findings with the estimates generated from traditional suburban data.

“On average, we found that there were 44 percent fewer actual vehicle trips for smart-growth apartments and 49 percent fewer actual trips for office buildings,” TTI Associate Transportation Researcher Michael Martin explains.

Using the data derived from the project, TTI developed a spreadsheet estimator tool that automatically computes the trip-generation estimation for smart-growth developments.

“First, the tool allows users to determine whether the proposed development qualifies as a smart-growth site so that the generated trip estimates are appropriate,” Martin says. “After about 20 questions are answered, a one-page report is created that covers site information, eligibility criteria, input data and vehicle trip-generation estimates.”

Since the TTI project was completed, word is getting out that there’s a better way to estimate trip generation for apartment and office smart-growth developments. The tool is available on the project website at <https://tti.tamu.edu/featured-project/smart-growth-trip-generation-study-in-california/>, and the data have been incorporated into ITE’s *Trip Generation Manual*. A possible future next phase of the TTI study could focus on trip-generation estimates for retail and hotel developments.

“We always felt that this project had national implications for smart growth, not only in California,” Birnbaum says. “We are extremely pleased with the results of the study and the simple way developers can now determine accurate trip-generation estimates for apartment and office developments in smart-growth areas.” ■

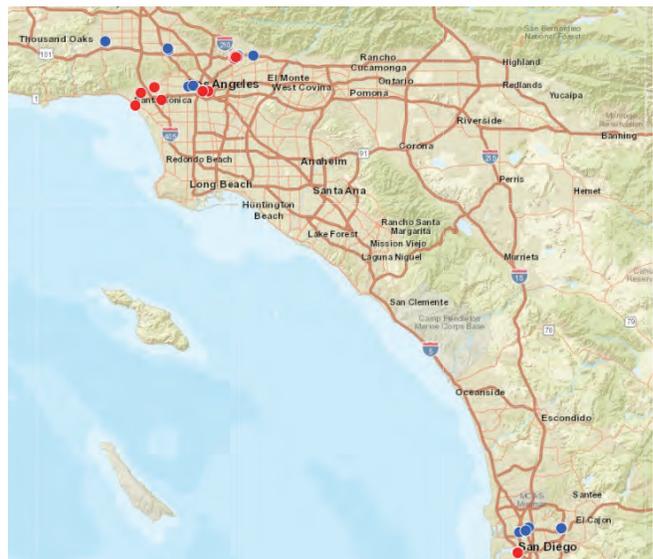


For more information, contact **Michael Martin** at (979) 458-0622 or [m-martin@tti.tamu.edu](mailto:m-martin@tti.tamu.edu).



**“We always felt that this project had national implications for smart growth, not only in California. We are extremely pleased with the results of the study and the simple way developers can now determine accurate trip-generation estimates for apartment and office developments in smart-growth areas.”**

*Marc Birnbaum  
Caltrans Study Project Manager*



Caltrans initiated the Smart Growth Trip Generation project to determine the difference in vehicular trip generation between the suburban-oriented ITE rates and those determined from surveys of California smart-growth developments.

# BUILDING ON A FOUNDATION OF SHARED TRUST, VISION

TTI and Texas A&M's Zachry Department of Civil Engineering Look Toward the Future



In 1950, Texas A&M College already enjoyed a 40-year reputation for innovative road materials research. That, combined with the college's land-grant mission of public service, made it a natural home for the Texas A&M Transportation Institute (TTI).



*Fred Benson*

The shared connection between academic learning and applied research was embodied in TTI's first director,

Fred Benson,

who served as dean of the College of Engineering and as a faculty member in Texas A&M's Civil Engineering (CE) Department. He and TTI's other founding fathers — Gibb Gilchrist, Dewitt C. Greer and Thomas H. MacDonald — recognized that all

Texans could benefit from combining the limitless energy of young minds eager to learn with the Texas Highway Department's need for real-world solutions to the state's transportation problems.

It was perfect timing for the CE/TTI partnership to begin. Texas, like the rest of the nation, was gearing up to modernize its transportation system, an initiative codified into policy in the Interstate Highway and Defense Act of 1957 championed by President Dwight D. Eisenhower. Innovation in transportation became, for the first time, a matter of national policy — and

a source of research funding — aimed at improving not only the nation's defense network, but also U.S. economic competitiveness.

“For nearly 70 years, TTI has worked hand in glove with Texas A&M University — and especially the Zachry Department of Civil Engineering — to provide Texas and the nation with research innovations that increase transportation mobility and safety,” states Greg Winfree, TTI agency director. “Our work together has consistently produced whole solutions greater than the sum of their parts.”

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**“In the history of our partnership with TTI, together we have strived to innovate for a variety of engineering infrastructure challenges. Our collaborations together across specialized research areas have brought countless benefits for infrastructure modernization and society, and are a testament to the value of this partnership.”**

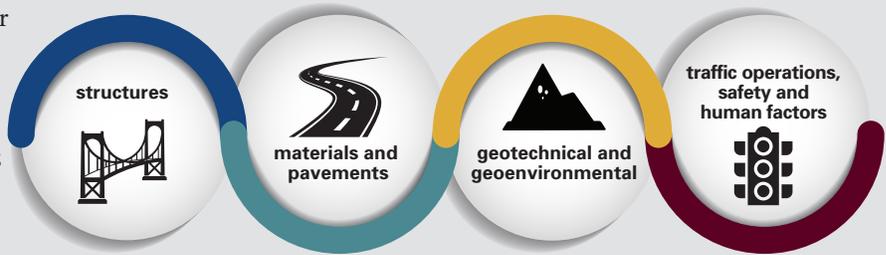
*Dr. Robin Autenrieth  
Department Head and A.P. Florence Wiley Professor  
for the Zachry Department of Civil Engineering at Texas A&M*

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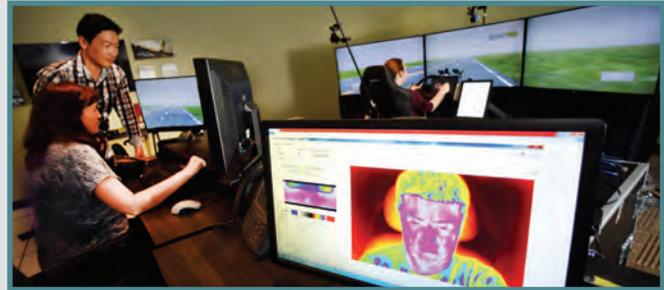
## AREAS OF SHARED RESEARCH EXCELLENCE

Although TTI and CE have worked together across the spectrum of transportation research over the years, four principal research areas came into focus in support of the modernization initiatives: structures; materials and pavements; geotechnical and geoenvironmental; and traffic operations, safety and human factors.



### Structures

In the latter half of the 20th century, the CE/TTI team expanded the knowledge of how to use new materials and designs for bridge structures. Recent research has focused on prestressed concrete bridges and tested the efficacy of a spread-slab beam design for short-span bridges, as well as examined the use of spliced, precast concrete girders to achieve longer spans. CE/TTI experts have also advanced new methods to inspect, evaluate and strengthen existing bridge structures. Through it all, researchers have worked hand in hand with the Texas Department of Transportation to improve construction practices that yield stronger, longer-lasting facilities.



### Traffic Operations, Safety and Human Factors

Experts from CE and TTI have worked together to enhance traffic safety through improving signage and forgiving roadside crash barriers, increasing traffic operations efficiency (via, for example, intelligent transportation systems), and studying human-vehicle interactions in TTI's driving simulator. TTI's current connected-automated vehicle research continues the emphasis on making smarter transportation systems that are also safer and more reliable. In the area of managed lanes (MLs), a research focus harkening back to the 1990s, CE and TTI experts are currently teaming with professors from economics, agricultural economics and phycology in a groundbreaking effort to better understand travelers' use of MLs.



### Materials and Pavements

After establishing the Pavement Test Facility in 1965 at what is now Texas A&M's RELIS Campus, early research leveraged the college's recognized expertise in materials and pavements to improve the quality and consistency of asphalt pavements as major construction on the Interstate Highway System commenced. CE/TTI researchers have since helped set state and national asphalt binder and mixture specification standards; applied technologies like pavement materials recycling, ground-penetrating radar and the total pavement acceptance device to extend roadway life; and trained transportation professionals worldwide to apply best practices.



### Geotechnical and Geoenvironmental

As interstate highway structures built in the latter half of the 20th century began to show signs of wear and tear over time, CE/TTI experts studied issues like slope stabilization on highway embankments, retaining walls for highway overpasses and deep excavations, optimization of large foundation elements, and ways to evaluate and remediate scour on bridges to prevent structural failure. As the effects of climate change become more evident today, ensuring the transportation system is resilient and responsive in extreme weather conditions is a current research imperative for this area.



The Center for Infrastructure Renewal at Texas A&M's RELLIS Campus.

## PUTTING OUR BEST PRACTICES FORWARD

**W**orking together across disciplinary lines has never been more important. Transportation is experiencing a technological revolution with, for example, the advent of unmanned aerial vehicles and self-driving cars. Integrating different technologies and the standards that monitor them — from how autonomous vehicles will talk to the roadside and each other to the policies that protect the driving public — is a current challenge that needs to be met. And yet, autonomous vehicles are coming. In 2017, the U.S. House of Representatives passed the SELF DRIVE Act aimed at encouraging innovation to promote the rollout of self-driving cars more quickly.

To meet this fast-moving future, The Texas A&M University System's RELLIS Campus is creating a new standard for matching applied research with technology development and educational opportunities. Recently opened, the state-of-the-art facilities at the Center for Infrastructure Renewal (CIR) will encourage CE, TTI and Texas A&M Engineering Experiment Station (TEES) researchers to develop advanced and sustainable materials and structural systems to enhance safety, resiliency and durability of infrastructure while extending its life at a reduced cost.

"A unique advantage of the research and training enterprise of CIR is the partnership between TEES faculty and TTI research scientists and engineers," explains CIR Director Zachary Grasley. "This partnership couples the highly specialized research by faculty — assisted by student researchers — with the ability of TTI to take such research and adapt it for real, practical applications."

As Grasley notes, students will continue to work alongside Texas A&M researchers at CIR to find practical answers to research questions TTI Director Benson and his Institute co-founders could never have imagined in 1950. The greatest resource to help us find those answers — kindled by a passion for learning in CE's classrooms and nourished by a need for knowledge in TTI's fieldwork — is the same as it's always been: young minds capable of fresh thinking aimed squarely at troubleshooting the challenges of ensuring mobility, resilience and safety in our nation's transportation system.



M. Katherine Banks

"The successful working relationship between Texas A&M's Zachry Department of Civil Engineering and TTI is indicative of the kind of interdepartmental teamwork that's made the College of Engineering one of the top engineering schools in the country," says Vice Chancellor and Dean of Engineering M. Katherine Banks. "As we explore new applied research opportunities at the A&M System's RELLIS facilities like CIR, I see those Aggie bonds only growing stronger in the future." ■



For more information, contact **Mark Burris** at (979) 845-9875 or [mburris@civil.tamu.edu](mailto:mburris@civil.tamu.edu).



### The Students Speak



"The close ties between TTI and CE were a major factor in my decision to attend

grad school at Texas A&M University. As a graduate student, I developed marketable engineering skills that will serve me well throughout my engineering career."

— Lisa Green, TTI Assistant Research Scientist



"The CE/TTI partnership gave me the opportunity to work at TTI as an

undergraduate and a master's student. I received practical experience while still in school, learned to be a lifelong student, and worked on research projects that have now been implemented in industry. That well-rounded education made me more attractive as a professional and enabled me to hit the ground running when I joined the workforce."

— Cameron L. Williams, Project Manager, Binkley & Barfield, Inc.



## THE CAMPUS AS A CLASSROOM: TTI Creates Opportunities for Texas A&M Engineering Students

In March 2016, the Texas A&M Transportation Institute (TTI) embarked on the Campus Transportation Technology Initiative (CTTI). Supported by Texas A&M University and funded by President Michael K. Young, the project’s vision is to bring transportation innovation to campus to improve safety, mobility and quality of life. TTI Senior Research Scientist Bob Brydia leads the program, which provides students with a living laboratory of learning as they interact with the research community on real-world deployments of new technologies for industry partners.

CTTI projects focus on spot deployments of new technologies within the Texas A&M campus. Student teams from departmentally approved capstone courses participate by evaluating the deployments. For instance, over the course of four semesters, CTTI has inserted 30 projects into the Industrial and Systems Engineering (ISEN) Department’s capstone course, with 16 more projects taking place across five more Texas A&M entities: civil engineering, mechanical engineering, landscape architecture and urban planning, computer science, and

the Bush School of Government and Public Service.

The projects have included such innovations as

- autonomous shuttles,
- geofenced payment options for parking,
- parking lot analytics,
- in-place evaluation and mechanical property testing of solar-luminescent pavement markings,
- evaluation of people-mover options for campus, and
- development of technologies for pedestrian heat maps.

“Having TTI’s Bob Brydia bring his transportation research projects into our capstone course has provided our students with exceptional opportunities to apply their education to significant, real-world problems,” says Mark Lawley, head of Texas A&M’s Department of Industrial and System Engineering.

The results of the project evaluations feed into Texas A&M’s master plan update and the Campus Transformational Mobility Plan, also

### Campus Test Bed Facts

 **5,200**  
acres

 **61,000+**  
students

 **10,000+**  
faculty and staff

 **\$866+**  
million research  
expenditures  
(largest research  
university in the  
southwest United States)

 **53,000**  
daily transit riders

 **36,000**  
parking spaces

 **120,000**  
people on football  
game days  
(4th largest  
downtown in Texas)

 **Bisected**  
by railroad tracks

 **15,000**  
engineering students  
(Texas A&M College of  
Engineering is one of the largest  
in the country)

being conducted by TTI, with the overall goals of moving the campus to a greener, more pedestrian- and bicycle-friendly environment, while accounting for the significant growth and rise in enrollment taking place at the University.

“One such example includes the unique opportunity our students were provided to work on a project involving IBM’s artificial intelligence Watson for autonomous shuttles, which garnered a great deal of enthusiasm and excitement from the group,” explains Associate Vice President Peter Lange, Transportation Services. “This was a first for our campus and a great example of just one of the many opportunities CTTI

offers our community to be part of future transportation innovations.”

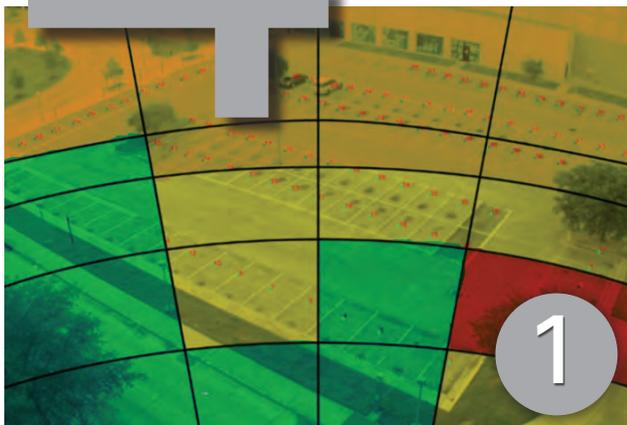
Though the course faculty act as the management team and students have an assigned faculty advisor for technical expertise, the students have a great deal of autonomy in their work. As project sponsors through the campus initiative, researchers from TTI and other departments can actively engage in the undergraduate education process. Texas A&M faculty and TTI researchers work together to

contribute in a very meaningful way to the development of these future professional engineers.

Alejandra Hernandez, a student on the IBM Watson project team, acknowledges the value of this approach to education: “I never expected my capstone project to get the attention it has gotten or provide the experience it has. I am very, very grateful for the opportunities and really surprised by how well our work has been received.”

# 4

## CTTI PROJECTS EDUCATING TEXAS A&M STUDENTS



### Evaluation of Parking Lot Analytics Technology

*Dr. Madhav Erraguntla, Associate Professor of Practice, Department of Industrial and Systems Engineering*

**Technology:** Video analytics monitor parking lots in real time to improve their efficiency and ability to provide accurate, real-time information to people looking for a parking space.

**Student Project:** Using the raw images from cameras and the interpreted data from a video analytics algorithm, students analyzed the overall algorithm performance, cross-tabulated the results by time of day and weather conditions to assess when the algorithm performed well, and produced guidelines for effective coverage of future lots.



### Application Development to Support an Autonomous Shuttle Ecosystem for Texas A&M Focusing on the Mobility Disadvantaged

*Dr. Hank Walter, Professor, Department of Computer Science and Engineering*

**Technology:** Supporting the autonomous shuttle for the mobility-disadvantaged population requires those students to be able to request trips in accordance with their needs.

**Student Project:** Students are designing the functional requirements and first-phase user interface of a ride-request application to enable mobility-challenged students to upload their course schedules and allow for scheduling one-time or recurring trips across the semester. The application must be accessible and usable across all disability types and provide usability features such as trip reminders and late/hold trip requests.

A key intangible benefit of CTTI is vastly strengthened ties, communication and collaboration across the University between the research and academic communities. Texas A&M University Administration has authorized a project continuation through December 2018.

As other signs of success, researchers have given guest lectures in undergraduate courses on specific technology topics brought to campus by CTTI, such as parking lot analytics.

The ISEN student team examining the use of IBM Watson for integration into the autonomous shuttle had a paper accepted on their topic at the Transportation Research Board Annual Meeting this year, the largest peer-reviewed transportation conference in the world, which was a first for the department.

“It’s an incredible opportunity to bring current innovations and engage with the private

sector while also enhancing the student learning experience,” Brydia says. “The entire process has been very rewarding, and I’m very proud of the interaction we’ve had with more than 300 students working on 46 diverse projects in such a short time period.” ■



For more information, contact **Bob Brydia** at (979) 845-9140 or [r-brydia@tti.tamu.edu](mailto:r-brydia@tti.tamu.edu).



## Integration of IBM Watson into Autonomous Self-Driving Shuttle

*Dr. Srikanth Saripalli, Associate Professor, Department of Mechanical Engineering*

**Technology:** Texas A&M is developing an autonomous shuttle to operate in low-speed, urban street and/or college campus settings, with a focus on improving campus access for mobility-disadvantaged populations.

**Student Project:** Students evaluated the IBM Watson integrated services platform for its potential to provide some of the interactive services necessary to support a mobility-disadvantaged population. The team worked with Texas A&M Disability Services to determine that population’s specific needs and with the Texas A&M Mechanical Engineering Department, which is developing the autonomous shuttle, to understand current and future capabilities.



## Evaluation of Luminescent Bicycle Pavement Markings at Dutch Junction Intersection

*Dr. Tom Ferris, Associate Professor, Department of Industrial and Systems Engineering*

**Technology:** The first unsignalized Dutch junction in the nation seeks to provide positive separation and protection of the bicycle traffic stream and reduce conflict by forcing bicycle left turns to occur across the intersection in view of motorists. The design uses a newly developed, bright green, solar-luminescent bicycle pavement marking material to absorb daytime solar energy and release the energy at night to illuminate the bike path.

**Student Project:** Civil engineering students participated in a qualitative survey of users’ perceptions of the intersection and its specialized markings, while the ISEN capstone students performed a quantitative evaluation using video to produce an assessment of the operations within the Dutch junction implementation. Combined, the results indicate areas for educating the users of the intersection on its proper use.

# TTI HEADQUARTERS BUILDING AT REL LIS CAMPUS REACHES MILESTONE



Left to right: TTI Agency Director Greg Winfree; A&M System Chancellor John Sharp; TTI Director of Facilities, Safety and Support Services Holly Crenshaw; and Vice President of Operations for Barlett Cocke General Contractors Marty Garza.



Texas A&M System Chancellor John Sharp signs the highest beam on the TTI Headquarters Building.

**H**undreds of workers, Texas A&M University System dignitaries, Texas A&M Transportation Institute (TTI) leadership and members of the media attended the topping out ceremony for TTI’s new headquarters building Jan. 18. This ceremony occurs when the beam of the building’s highest point is put in place.

“This building is going to help save thousands and thousands of lives,” A&M System Chancellor John Sharp said as he addressed the crowd, thanking the workers in both English and Spanish. Sharp was the impetus behind the A&M System’s REL LIS Campus concept, transforming the 2,000-acre former U.S. Army air base into a modern educational and engineering complex to address critical engineering problems while enhancing education and training opportunities. REL LIS researchers are actively seeking partnerships with private-sector industries involved in connected and automated technologies, infrastructure, and energy, to name just a few.

The REL LIS Campus development is still in its early stages. The Center for Infrastructure Renewal (CIR) building is now open, and the TTI Headquarters Building is scheduled for completion by the end of the year, with occupancy planned for spring 2019. CIR, a facility shared by TTI and the Texas A&M Engineering

Experiment Station, houses researchers dedicated to “developing advanced and sustainable materials and structural systems that will reduce cost and extend infrastructure life, safety, resiliency and durability.”

“We are pleased to be the first of the A&M System to be headquartered here on the REL LIS Campus,” TTI Agency Director Greg Winfree said at the event. “This is a monumental time for us.”

Blinn College has partnered with the A&M System and is building its second local campus at REL LIS. And, in fall 2018, students from A&M System universities will be able to pursue various associate and bachelor’s degree programs through the REL LIS Academic Alliance.

The \$70 million, 179,000-square-foot TTI headquarters will house all the Institute’s local employees and TTI’s Driving Simulation and Visibility Research Laboratories. “When you combine the best agency in the world in transportation research [TTI] with that building over there, the Center for Infrastructure Renewal, you’ll have everything you need to design buildings and infrastructure to make sure they are safe,” Sharp said at the event. ■

**“When you combine the best agency in the world in transportation research [TTI] with that building over there, the Center for Infrastructure Renewal, you’ll have everything you need to design buildings and infrastructure to make sure they are safe.”**

Chancellor John Sharp  
The Texas A&M University System



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

## Henk Appointed Chair of the Texas Teen Safe Driving Coalition



Henk

**T**TI Senior Research Engineer Russell Henk has been named chairperson of Texas' Teen Safe Driving Coalition — a partnership led by the National Safety Council. Henk manages TTI's Youth Transportation Safety Program and created the award-winning Teens in the Driver Seat® (TDS) program in 2002. Celebrating its 15th anniversary

this year, TDS is a peer-to-peer driver safety program that has reached nearly 1,000 Texas schools and has grown to 38 other states.

The National Safety Council has established Teen Safe Driving Coalitions, begun in 2010, in 10 states. The goal of the coalition is "to establish a culture of safe teen driving based on proven principles of graduated driver licensing."

"I have worked with most of the members of the coalition for many years — and they are all dedicated to making teen safety a priority in our state," Henk says. "As chair, I'd like to continue to expand the coalition's membership and further develop a spirit of collaboration among the various traffic safety programs around the state to enhance our collective positive impact." ■

## Winfree Appointed Board Member of ITS America



Winfree

**T**TI Agency Director Greg Winfree has been appointed to the board of directors of the Intelligent Transportation Society of America (ITS America). Winfree joins five other members newly named.

Established in 1991, the organization "promotes public and regulatory policies that advance the development and deployment of intelligent transportation technologies throughout the United States" by supporting research, deployment and public policy related to intelligent transportation systems.

"ITS America has a rich history of providing leadership in the intelligent transportation systems space, and I am honored to be appointed to its board of directors," Winfree says. "I was involved in the organization previously in my role at USDOT, and look forward to representing TTI and helping advance the development and deployment of intelligent transportation technologies throughout the United States." ■

For more information about TTI News, contact **Rick Davenport** at (979) 862-3763 or [r-davenport@tti.tamu.edu](mailto:r-davenport@tti.tamu.edu).

## Energy Secretary Perry Tours RELLIS Campus, Meets TTI Researchers

**I**n introducing U.S. Secretary of Energy Rick Perry during his visit to The Texas A&M University System's RELLIS Campus on Feb. 16, Chancellor John Sharp said Perry, Texas A&M class of '72, is making Aggies everywhere proud.

U.S. Secretary of Energy Rick Perry, the first Aggie governor of the state of Texas, visited The Texas A&M University System's RELLIS Campus on Feb. 16 and spoke at the newly completed Center for Infrastructure Renewal (CIR). Perry toured CIR's laboratories, witnessed TTI crash-testing a roadside safety device, and rode aboard an 18-wheeler in a demonstration of TTI's truck platooning project, sponsored by the Texas Department of Transportation.

"Together we are shaping the country, and we're making the Lone Star State and the United States a better and brighter place," Perry said. "I'm looking forward to learning more about what you have imagined and what you anticipate for this RELLIS Campus. I know it's going to be good; I know it's going to be exciting. I know it has the potential to change the world because that's what Aggies do."

Perry spent some of his time speaking about President Trump's \$1.5 trillion infrastructure plan, announced earlier in the week, but much of his focus was on energy and Texas A&M's role in the future. Perry manages the U.S. Department of Energy National Laboratories.

Many of Perry's comments centered on nuclear energy, which he said had been neglected over the course of decades. Texas A&M's Department of Nuclear Engineering is the largest program in the country and ranked



Energy Secretary Perry inside an autonomous truck.

second in the nation for its undergraduate programs and third in graduate programs among public universities.

"We have the potential and opportunity because of its zero emissions, because of these new fuels and the new safe ways of being able to deal with the development of nuclear power," Perry said. "Texas A&M can be right at the epicenter of this new technology and the innovations on the nuclear side." ■

## TTI's Goodin, Stockton Named Regents Fellows

**R**ecognized 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 Texas A&M University System’s agencies to be designated Regents Fellows for 2016–2017.

“I am really honored to be included in 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.

A&M 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.” ■



*John Sharp, Ginger Goodin, Board of Regents Chairman Charles Schwartz and Board of Regents Vice Chairman Elaine Mendoza.*



*Board of Regents Chairman Charles Schwartz, Bill Stockton and Board of Regents Vice Chairman Elaine Mendoza.*

## TTI Partners with MSU to Study Workforce Changes from Connected, Automated Vehicles

**T**TI is taking part in a workforce study designed to inform policy makers, employers and employees of the inevitable changes connected and automated vehicles (CAVs) will have on the transportation industry, and the potential new business opportunities CAVs will provide. The study will focus on driving-related jobs like professional truck driver, taxi driver and delivery driver.

Michigan State University (MSU) will lead the study, which was commissioned by the American Center for Mobility — a newly formed Michigan-based collaborative designed to enable technology and accelerate the development of voluntary standards to improve transportation systems and ensure U.S.

competitiveness worldwide. TTI is supporting the study with its multi-year truck platooning research.

“Connected and automated technologies have the potential to create a safer and less stressful occupation for platooning truck drivers while creating opportunities to be involved with cutting-edge technologies that will change the way freight logistics will be delivered in the future,” says Christopher Poe, TTI assistant director for connected and automated transportation strategy.

AARP® and Waymo are co-sponsors of the study, which will be completed by the summer. ■



with Greg Winfree, Agency Director

## Investing Intellectual Capital Today in Tomorrow's Transportation System

**One of the most important assets we have in transportation research is intellectual capital.** In the last century, the power of pioneering minds overcame seemingly insurmountable challenges to improve mobility, safety and infrastructure longevity.

Without that systematic application of innovative thinking, roads would have crumbled faster, more system users would have died or been injured, and more hours would have been spent sitting in traffic, undermining economic potential. While we'll never have a perfect transportation system, we can always make it *better* with the thoughtful, practical application of innovative thinking.

This issue of the *Texas Transportation Researcher* examines the three pillars of successful transportation research: education, innovation and implementation. It's through that continuum of technology transfer — from the classrooms of our academic institutions to the sponsored research projects testing new theories and methods to, finally, the implementation of those new discoveries — that we can facilitate improvements in our transportation network. Cut off any one of the three legs of the stool, and the whole thing topples over.

Founded in 1950 as a research support arm of the Texas Highway Department, the Texas A&M Transportation Institute (TTI) has always recognized the potential to both benefit and benefit from student researchers. We've worked closely with Texas A&M University's Zachry Department of Civil Engineering (CE) for nearly 70 years, a relationship fostered by faculty with shared appointments in both organizations. It's maybe a little cliché to describe education as an investment, but like most clichés, that description is based in fact. From traffic operations to safety to materials and structures research, our symbiotic relationship with CE and Texas A&M student researchers — from the classroom to the roadbed — has produced numerous innovations to benefit citizens not only in Texas and the nation, but around the world.

**Our mission as part of Texas A&M's land-grant charter is to enhance the education of Texas A&M's students however we can. Marrying classroom instruction with applied research in the real world, TTI and its academic partners are providing a well-rounded educational experience to tomorrow's transportation professionals.**

TTI shares similar partnerships with other Texas A&M entities, such as the College of Architecture and the Texas A&M Health Science Center School of Public Health. We're currently teaming with the Bush School of Government



and Public Service and Texas A&M's Mechanical Engineering, Computer Science, and Industrial and Systems Engineering Departments, as well as the Texas A&M Engineering Experiment Station, on the Campus Transportation Technology Initiative to develop a smarter transportation ecosystem for the University's main campus.

Our mission as part of Texas A&M's land-grant charter is to enhance the education of Texas A&M's students however we can. Marrying classroom instruction with applied research in the real world, TTI and its academic partners are providing a well-rounded educational experience to tomorrow's transportation professionals. Through state-of-the-art research facilities at The Texas A&M University System's RELLIS Campus, like the now-operational Center for Infrastructure Renewal, students will enjoy more advanced hands-on learning opportunities than ever before. And leveraging their intellectual capital will yield dividends for all of us as we work, together, toward a more connected, smarter and safer transportation network in the decades to come. ■

# 3<sup>rd</sup> Annual Texas A&M **May 7-9** 2018 Transportation Technology Conference



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