

Policy Implications  
TTI Study Examines Policy  
Implications of Automated Vehicles

New Test Bed  
TTI Developing New Automated and  
Connected Transportation Test Bed

TEXAS TRANSPORTATION

VOL. 50 | NO. 2 | 2014

# Researcher



*Connected Cars,  
Smarter Roads,*  
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Texas A&M  
Transportation  
Institute

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# TEXAS TRANSPORTATION Researcher

VOL. 50 | NO. 2 | 2014

**ON THE COVER:** In the next few decades, our transportation system will increasingly rely on vehicle-to-vehicle and vehicle-to-infrastructure communication. TTI research today will prove vital to successfully connecting our transportation network tomorrow.



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# An Old Notion, A New Future:

WE'VE BEEN AUTOMATING VEHICLES RIGHT FROM THE START

## When we talk about automating vehicles today, it sometimes sounds very futuristic.

Relinquishing driving duties to a computer is a scary thought for some. But one thing to remember is that automating vehicles isn't a new idea. It began over a hundred years ago with the notion of tying automation to safety.

You probably know that motorists used to start their cars with a crank inserted into the engine block and turned by hand. Then the electric starter came along. These days, cars start with the push of a button; you might even start up from a distance, before you're even in the vehicle.

But do you know why the electric starter was invented? The story goes that in 1908, a good Samaritan named Byron Carter stopped to help a stranded female motorist. Carter offered to turn the hand crank to get her car started again. The crank kicked back (a common problem at the time) and broke Carter's jaw. Eventually, his injury led to pneumonia and the illness killed him. His good friend, Cadillac founder Henry Leland, was devastated by the loss.

Leland vowed that simply starting a car would never kill another man. He hired Charles Kettering, who invented the first electric starter in 1911. The concept of marrying vehicle automation with safety was born.

The process of automating vehicles has accelerated significantly since then: power steering; automatic cruise control; automated braking systems. Besides making driving more convenient and efficient, these innovations have another, historically significant purpose: to improve safety for the vehicle's occupants.

The private and public sectors are now working together to make connected transportation a reality in the very near future. In Michigan, for example, we're enhancing technology in over 500 intersections in the southeast portion of the state to improve safety and operational reliability. That initiative demonstrates the essential equation of connected transportation: public agencies deploying privately developed technology for the public's benefit.

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## The essential equation of connected transportation: public agencies deploying privately developed technology for the public's benefit.

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A completely connected transportation network won't happen overnight. But in the next decade, I see a dedicated freeway lane reserved for self-driving cars (similar to how high-occupancy vehicle lanes have developed). Eventually, that innovation will spread to all lanes, seamlessly connecting vehicles to infrastructure via constant communication. Once the network is completely automated, lane specifications — originally developed

60 years ago when cars had manual steering and motorists needed more time to make adjustments — will shrink, adding capacity without widening the roadway. And that will mitigate ever-worsening congestion and increase mobility. Safety will also improve as vehicles coordinate with each other and the roadside to avoid crashes often resulting from human error.

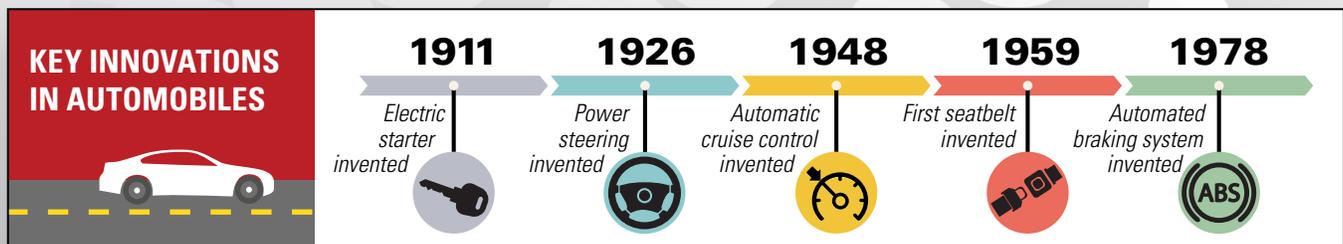
There are a number of challenges to getting us there. Policies that balance privacy with public good must be developed. Questions about how to secure data passed between vehicles and infrastructure against hackers must be answered. And how do we pay for the massive infrastructure refit to make it all work? Arguably, that's the stickiest question of all.

Agencies like the Texas A&M Transportation Institute (TTI), with its international reputation for innovating infrastructure safety, are at the forefront of this process. It's from the research findings and test beds of institutions like TTI that connected transportation will spring.

Our future — whether we're speaking of transportation or anything else — is driven forward by innovation: in vision, in applying new technology and in the desire for progress. Whatever you think of your car driving you to the store, that reality is just around the corner. Getting us safely there by maximizing benefit of society is incumbent upon all of us in the transportation industry — public and private sector alike. ■



**Kirk T. Steudle, P.E.,** is state transportation director for the Michigan Department of Transportation and a national leader in the development of connected-vehicle technologies.



# TTI Study Examines Policy Implications of Automated Vehicles

## The widespread presence of self-driving vehicles is still many years away.

To manufacturers, those years represent a long and anxious wait to get their products to market. Government decision-makers, on the other hand, might view the wait as a good thing, since they will need all the time they can get to work through the public policy aspects that go along with such a dramatic change in the way we get around.

Researchers at the Texas A&M Transportation Institute (TTI) recently examined those aspects in a study funded by the Southwest Region University Transportation Center — Automated Vehicles: Policy Implications Scoping Study. The work was conducted by TTI researchers Jason Wagner, Trey Baker and John Maddox, along with Ginger Goodin, director of TTI's Transportation Policy Research Center. As part of the study, researchers interviewed both transportation agency representatives and vehicle manufacturers. Each party brings unique perspectives and responsibilities to the emerging world of automated vehicles.

“The private sector is responsible for developing automated vehicles, and the public sector has a part to play in making sure those vehicles operate safely on our infrastructure,” Goodin says. “At the intersection of those two roles, we have a number of policy-related questions that we need to answer.” In each case, those questions are directly tied to the substantial benefits that both industry and governments are counting on.

- If more sophisticated automated-vehicle (AV) infrastructure requires higher levels of maintenance, how can that cost be justified when agencies are already short on resources?



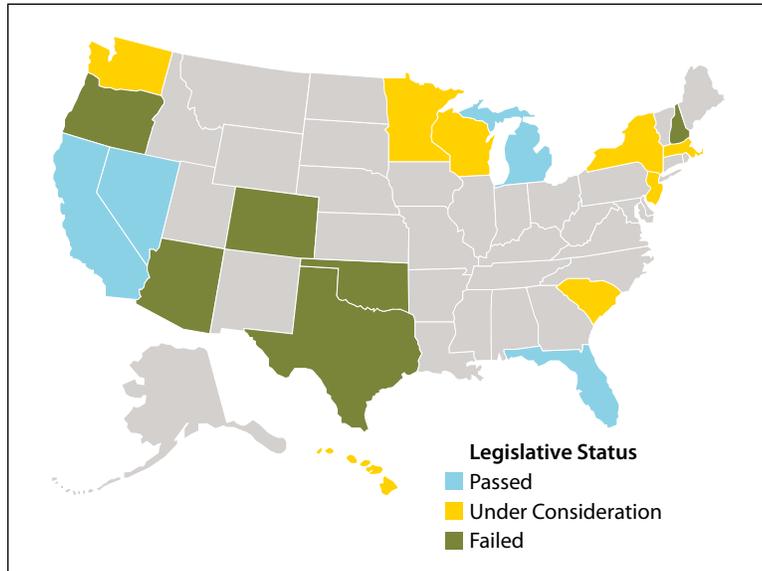
Lidar and GPS hardware on one of Google's self-driving cars.

- If fully automated vehicles will require no driver involvement, how will traffic laws change, given that the laws are predicated on a fully engaged operator behind the wheel?
- If a vehicle operating in fully automated mode crashes, who assumes the liability — the operator or the equipment manufacturer? What is the infrastructure operator's risk?
- What are the privacy, data ownership and security-related concerns associated with vehicle-generated data — which could be used for commercial or public purposes — including managing system congestion?

Benefits from AVs are possible but less certain. For instance, AV technology can allow vehicles to move more closely together in platoons, potentially reducing gridlock and improving safety. And if cars aren't crashing, some safety features that we design into our roads — standard lane and

**“The private sector is responsible for developing automated vehicles, and the public sector has a part to play in making sure those vehicles operate safely on our infrastructure. At the intersection of those two roles, we have a number of policy-related questions that we need to answer.”**

*Ginger Goodin, TTI Research Engineer and director of TTI’s Transportation Policy Research Center*



AV legislative actions in the United States (<http://tinyurl.com/onq5o75>).

shoulder widths, for instance — are no longer required, allowing agencies to reconfigure the right of way for more lanes. At the same time, AV technology may motivate travelers to make more frequent trips, which could actually increase roadway congestion.

No matter what, further study is needed to fully understand and measure AV benefits due to the high level of uncertainty surrounding the deployment of the technology.

“In an era of fiscally constrained public institutions, there’s a lot of pressure to justify the expenditure of public dollars,” Wagner says. “Without being able to quantify the benefits of AVs, public agencies will be less likely to invest in them.” ■



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For more information about the PRC’s assessment of how technology will impact the future of transportation, see <http://tti.tamu.edu/policy/technology/>. To download a copy of the report profiled in this story, see <http://swutc.tamu.edu/publications/technicalreports/600451-00029-1.pdf>.



## Examining New Approaches to Transportation Management in Texas

**C**ongestion continues to increase in Texas and the United States, leading to longer delays, higher fuel consumption and related crashes. Adding capacity to existing systems isn’t easy, so transportation agencies are relying on operations and maintenance strategies like active traffic management (ATM), a common strategy in Europe, to help manage congestion. In recent years, ATM in the United States has evolved from more traditional strategies to those using technology to manage traffic flow in this country.

ATM strategies combine integrated systems with new technology and techniques, including comprehensive sensor systems, real-time data analysis, and automated deployment of necessary actions. This helps optimize system performance quickly and without the delay that occurs when operators have to manually deploy operational strategies. When various ATM strategies are implemented together, they can help fully optimize a facility and provide measurable benefits to both the transportation network and the traveling public.

“We’re currently studying emerging ATM strategies in the Policy Research Center to determine which can be most useful in Texas,” explains Beverly Kuhn, head of TTI’s System Reliability Division. “As part of that effort, we plan to highlight related technology and policy implications to hopefully facilitate the successful use of ATM in Texas.” ■



# TTI Successfully Tests Algorithm as Part of USDOT Prototype Development Project

## **Thanks to a successful prototype demonstration, researchers with the Texas A&M Transportation Institute (TTI)**

contributed to the growing evidence that a roadway can indeed become one big communications system. Vehicles, the roadside and traffic management centers (TMCs) can communicate with one another, seamlessly and nearly instantaneously.

The demonstration was conducted May 6–7 in Columbus, Ohio, the hometown of the Battelle Memorial Institute. Working collaboratively, Battelle integrated TTI-developed algorithms into a vehicle-based system and corresponding display. TTI then produced simulated traffic data that were fed into the system, resulting in the successful display of simulated warnings and speed recommendations as generated by the algorithms, just like the messages that would be sent in an actual connected transportation system.

Analysts believe that within the next 20 years — when all vehicles, roadside infrastructure and TMCs are able to communicate with each other — crashes, congestion and fuel consumption will all be significantly reduced.

“For this project, we developed what’s called a queue-warning algorithm, which is used to send a wireless, queue-warning message from a TMC to vehicles on the roadway,” explains TTI Research Engineer Kevin Balke, who led the TTI effort. (A queue refers to stopped or slowed vehicles, the main culprit of urban crashes and congestion.) “In a real application, drivers approaching a highway incident will be warned by the TMC of the danger ahead in time to avoid a collision or take an alternate route,” says Balke.

TTI has worked with Battelle since last year on one of the U.S. Department of Transportation’s Dynamic Mobility

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*Kevin Balke, TTI research engineer*

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Applications programs called Intelligent Network Flow Optimization (INFLO). Like the name implies, INFLO seeks to optimize mobility through a beefed-up intelligent transportation system, in this case with connected vehicles.

The INFLO project bundles three applications: queue warning, speed harmonization (recommending upstream vehicle speed based on downstream congestion or other road conditions) and, eventually, cooperative adaptive cruise control (ACC). With cooperative ACC, the speed of vehicles would be

automatically controlled based on the speeds of surrounding vehicles, with drivers simply steering their vehicles.

Using TTI's vehicle-based queue-warning algorithm for providing alerts to upstream vehicles when queues exist, the team was also able to send queue-warning messages between vehicles and from vehicles back to the TMC.

"I believe this is the first bidirectional communications effort that has been undertaken," Battelle's Tom Timcho, INFLO principal investigator, says. "With this successful demonstration, we've shown that the technical pieces are now in place for the next phase of connected-vehicle research."

Based on the Columbus, Ohio, demonstration, a field test where actual messages pass between vehicles and a TMC is a likely next step. ■



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# TESTING CONNECTED TRANSPORTATION INNOVATIONS

## Starts with First Creating the Test Itself

**BEFORE** the new era of connected vehicles can become a reality, researchers must first find a way to test each proposed component and application under a variety of conditions that mimic real-world scenarios.

For example, can the hardware inside a connected vehicle successfully receive and correctly interpret a queue warning, even with driving environments that include mountainous terrain or signal-blocking skyscrapers? And assuming the warning message is received, what impact will it have on the overall traffic situation? Did the vehicles upstream from the queue slowdown, and did that warning signal alleviate congestion?

To find the answers, researchers are turning to computer simulation using actual hardware. This technique is known as hardware-in-the-loop simulation.

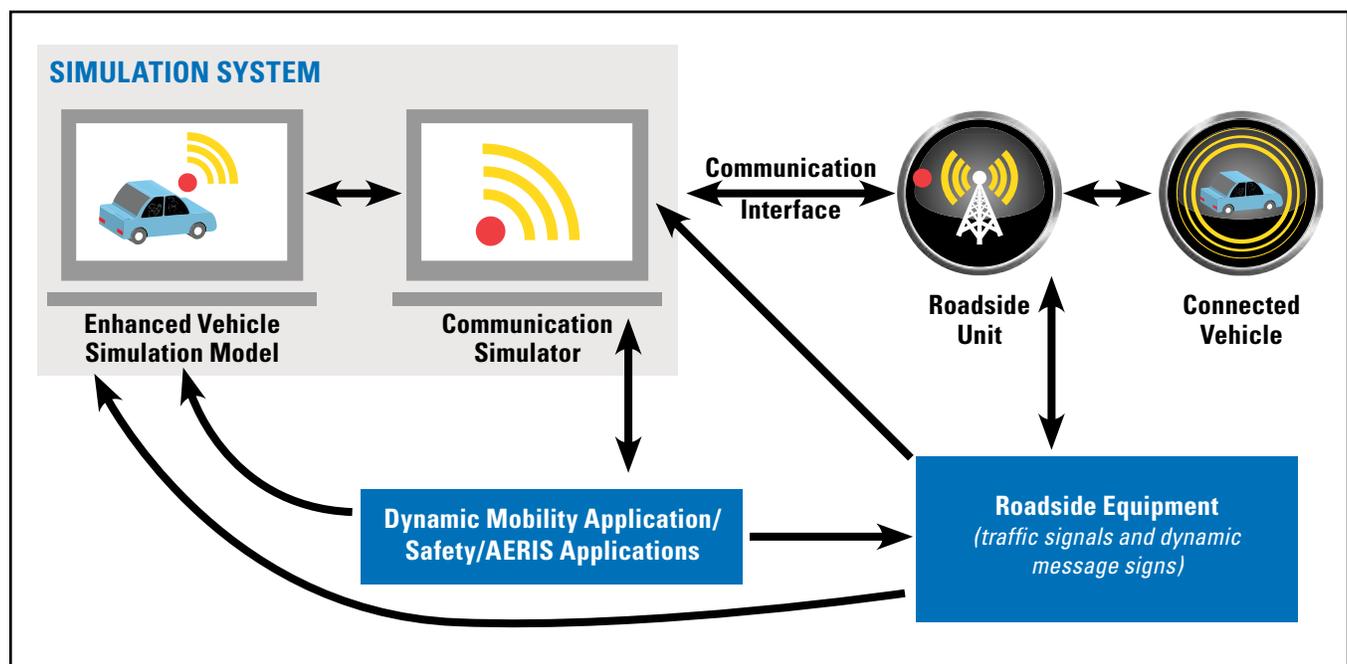
“Our objective is to build a reliable computer platform in which connected-vehicle applications and hardware can

be tested,” explains Research Engineer Srinivasa Sunkari of the Texas A&M Transportation Institute (TTI). Sunkari is the principal investigator on the Federal Highway Administration (FHWA) project titled New Approaches for Testing Connected Vehicles and Highway System. The study is part of FHWA’s Exploratory Advanced Research Program. In addition to TTI research scientists and engineers, other computer programming experts from Siemens Corporation and Battelle are working on the multi-year project.

Ideally, the comprehensive evaluation platform will become the basis for all connected-vehicle application testing. FHWA’s vision includes a realistic platform and contains four environments: traffic simulation, hardware testing, communication simulation and connected-vehicle applications testing.

“This is a very challenging project,” FHWA’s Peter Huang, highway research engineer, says. “Traffic simulation software is not new, but those existing programs are not designed for connected-vehicle communication. We’re building a foundation on which all connected-vehicle scenarios can be tested.”

Engineers have to rewrite and modify existing traffic simulation software in order to replicate all the scenarios



The simulation system will generate traffic data and simulate wireless communications characteristics based on data from connected vehicles and traffic systems via TTI-developed technology. It will handle various types of connected-vehicle applications such as safety, dynamic mobility, and AERIS (Applications for the Environment: Real-Time Information Synthesis).

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*Peter Huang, FHWA highway research engineer*

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needed to determine the impact of each vehicle communication application. It’s a complex process. One of the key scenarios is to integrate the behavior of an actual vehicle in a simulation model. If that can be done, researchers will use the platform to test new applications developed in the future.

“The final product will help us determine which applications have the most influence on safety, congestion and the environment,” Huang explains. “The platform is critical for us to make the decision about which applications should be pursued first.” ■



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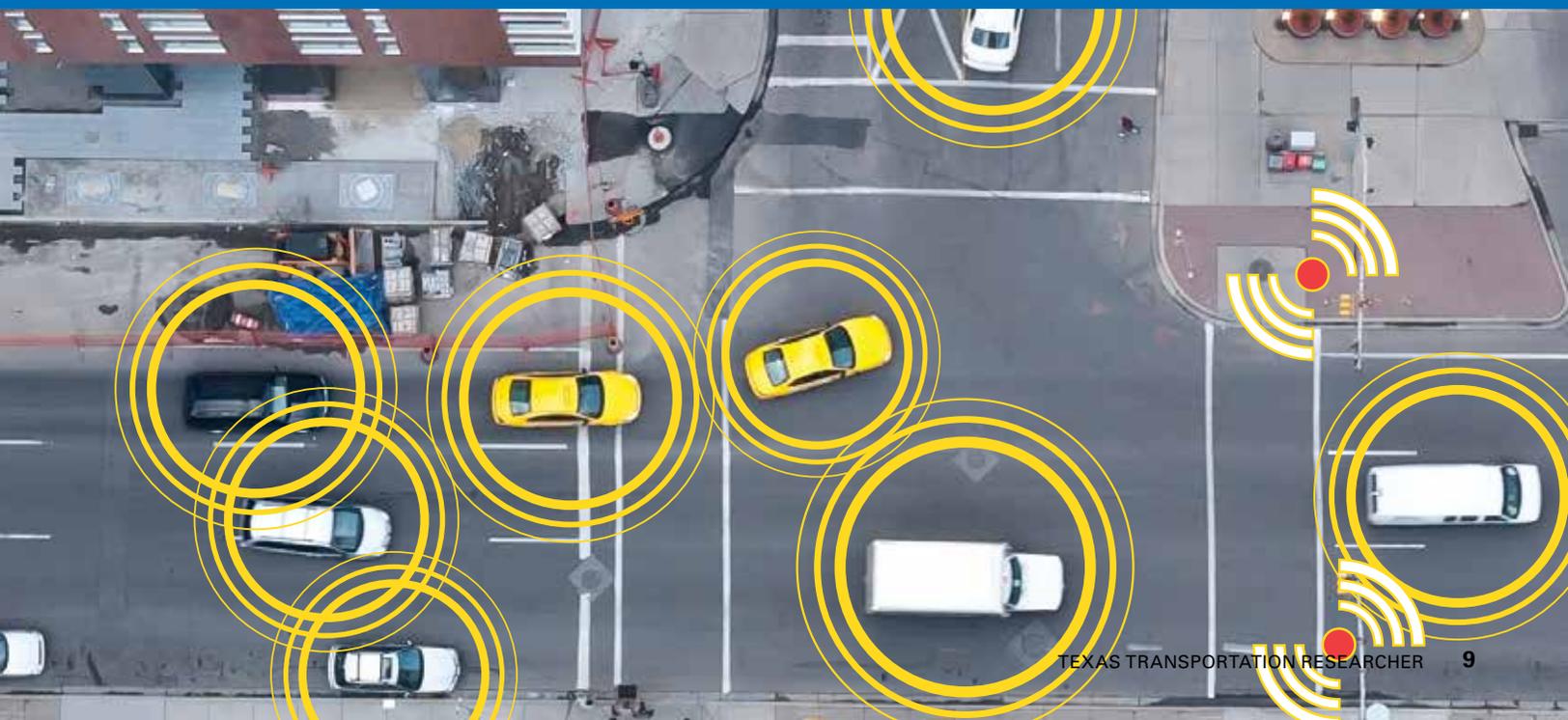
## SPaT: The Building Block of Connected-Vehicle Research

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One of the earliest success stories in connected-vehicle research began in 2011, when Battelle Memorial Institute, the Texas A&M Transportation Institute (TTI), and traffic control equipment manufacturers Econolite and Siemens began working on a Federal Highway Administration project involving communication between traffic-signal controllers and connected-vehicle mobile devices. When it was completed in 2013, researchers were able to show that the two — despite speaking in different languages — could really talk to each other. Signal controllers operate under National Transportation Communications for ITS Protocol standards, while mobile devices operate under Society of Automotive Engineers Dedicated Short Range Communications standards.

The success of the project, titled Signal Phase and Timing (SPaT) and Related Messages for V-I Applications, was critical in order for many other vehicle-to-infrastructure applications to proceed. As part of the project, TTI researchers helped develop and build a prototype interface device that converts a signal-controller message to a format that connected-vehicle devices can understand. The biggest challenge, according to researchers, was figuring out how to make it work for actuated, as well as pre-timed, traffic signals.

The signal conversion means that vehicles approaching an intersection can be alerted about the status of the traffic light (whether it’s red, yellow or green) and how long it will be before the current phase changes. ■





# INTO THE Accelerating Texas Future

DEVELOPMENT OF **SMARTER** TRANSPORTATION IS A CRITICAL COMPONENT OF THE 21ST CENTURY SYSTEM

**The ever-changing landscape** of transportation needs and new technologies — as well as funding issues and a rapidly growing population — have created a complex set of transportation issues for the state of Texas. The future of the transportation system is rooted in the effective development and use of technology, which can greatly enhance system capacity and safety, better control demand and reduce the need for additional infrastructure.



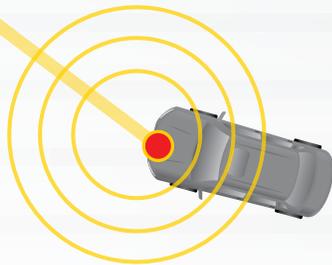
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TTI's Accelerate Texas Center is a public-private collaboration established to help position Texas to become the leader in the commercialization of automated-vehicle (AV) technology.

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The Texas A&M Transportation Institute (TTI) has recently joined forces with the Texas Department of Transportation to form the Accelerate Texas Center. The center is a public-private collaboration established to help position Texas to become the leader in the commercialization of automated-vehicle (AV) technology. The center will also serve as a catalyst for the development, testing and implementation of these technologies, with the goal of attracting substantial economic development to Texas. The owners of the Circuit of the Americas Formula One race track in Austin are also in discussions with Accelerate Texas regarding ways the track can support the initiative.

“Automobile manufacturers are already installing automated features into new car models, and many applications have been developed,” says TTI Associate Agency Director Ed Seymour, who directs the center. “With features like automatic cruise control, wipers that engage when the windshield detects water, and other technologies, AV applications promise



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**“With features like automatic cruise control, wipers that engage when the windshield detects water, and other technologies, AV applications promise to make our roadways both safer and more efficient in the long run,” says Ed Seymour, director of TTI’s Accelerate Texas Center.**

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to make our roadways both safer and more efficient in the long run.”

AV technologies have been the subject of both public and private research for some time, since the promise of safer, more efficient use of the existing transportation network has positive implications for almost every sector of the economy, national defense and society as a whole. The National Highway Traffic Safety Administration announced a decision on Feb. 3, 2014, that it will begin rulemaking to require vehicle-to-vehicle communication technology for light vehicles (cars). Rulemaking for

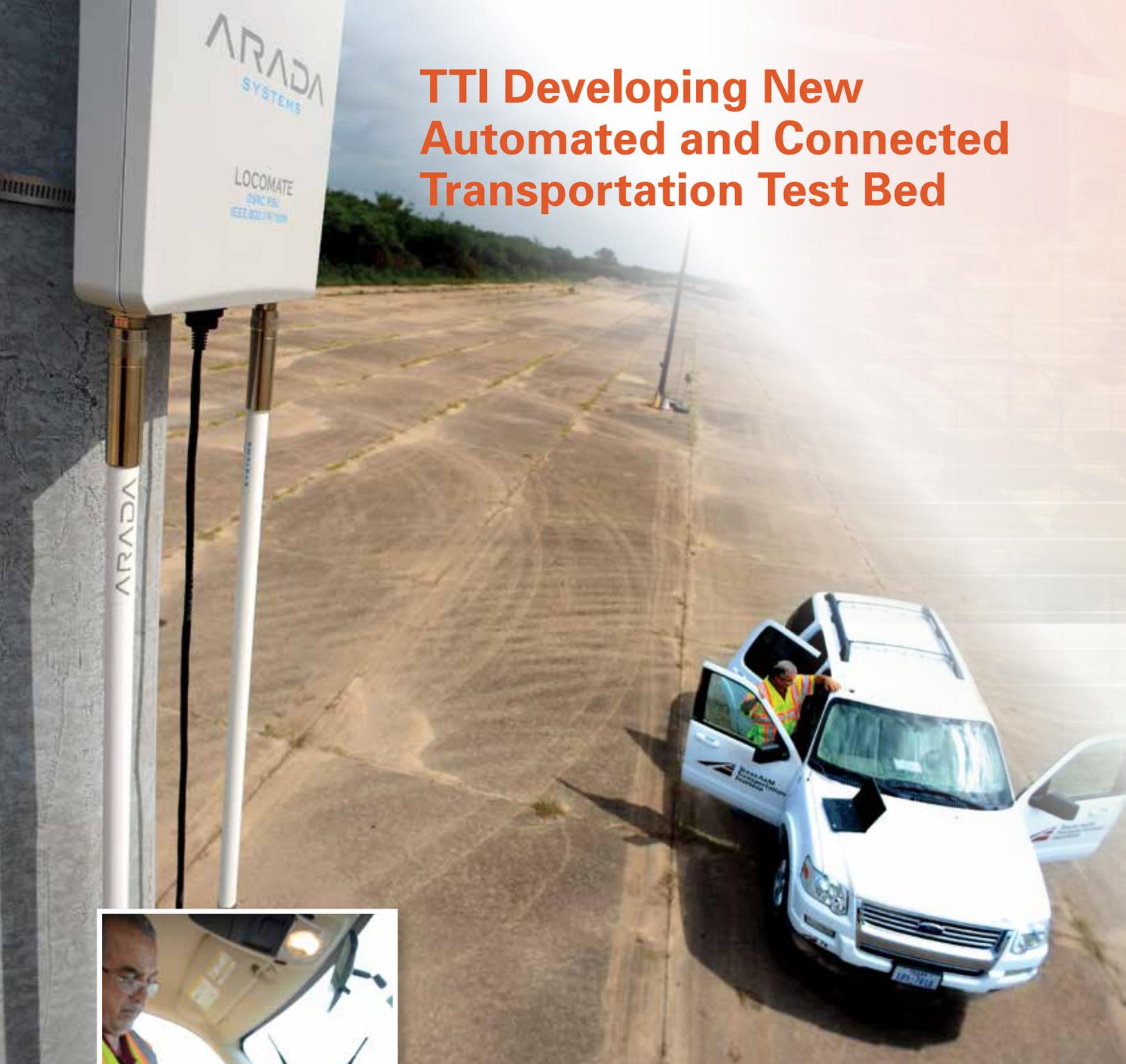
this technology will commence later in 2014, with final rules in place by 2018 and marketplace requirements arriving in 2020. Both connected- and AV market forces are converging on the 2020 time frame. Accelerate Texas will seed the marketplace to encourage deployment in that same five-year window.

“Commercialization will create new economic activity, yielding millions of dollars in revenue and thousands of high-quality jobs,” explains Seymour. “Taken together, the benefits to Texas will rival any similar initiative in recent memory.” ■



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# TTI Developing New Automated and Connected Transportation Test Bed



**The Texas A&M Transportation Institute (TTI) shares an industry vision where vehicle collisions are eliminated.**

Vehicles will interact — through technology — with other vehicles, drivers, the infrastructure, pedestrians and bicyclists to prevent crashes. The entire transportation system will be connected in a way that transforms how people live, work and interact. Achieving this vision requires research, development and testing on how vehicles, users, telematics and infrastructure all work together via vehicle-to-infrastructure or infrastructure-to-vehicle communication.

Along with the Accelerate Texas Center, TTI's Connected Transportation Initiative will include a world-class automated and connected transportation system testing facility at Texas A&M University's Riverside Campus. The test bed is an initial step in TTI's goal to build awareness and will ensure the Institute can develop the necessary firsthand experience in integrating field infrastructure and vehicle components, as well as specific applications for both technologies. Lessons learned and success in developing applications in the test bed environment will facilitate the implementation of pilot deployments on strategic roadway corridors, showcase TTI's capabilities to potential sponsors, and help obtain new funding for full deployments. Early efforts in designing, installing and testing some technologies on the test bed are already resulting in promising developments.

### Concept of Operations and Equipment Installation

Leading the development effort, TTI Associate Research Engineer Rajat Rajbhandari and a multi-program research team have purchased the necessary dedicated short-range communication equipment, which consists of onboard radios used to retrofit test vehicles and roadside equipment so that they communicate with each other and with drivers. According to Rajbhandari, "Once we get the equipment installed at the Riverside Proving Grounds, we will test three work-zone applications that send motorists in-vehicle alerts of upcoming lane closures, queue warnings and other hazardous situations. We will also better understand how to get this technology into real-world deployments, the technology's strengths and limitations, as well as requirements for integrating with roadway infrastructure."

The next phase of test bed development is to finalize the concept of operations document, including a high- and mid-level conceptual architecture based on the U.S. Department of Transportation's Connected Vehicle Reference Implementation Architecture. "This will allow us to develop and test more extensive connected- and automated-vehicle applications inside and outside the Riverside Campus," says Rajbhandari.

### Creating "Smart" Pavement Markings

TTI Operations and Roadway Safety Division Head Paul Carlson and TTI Research Scientist Mohammad Poorsartep, project manager for the Institute's Connected Transportation Initiative, have consulted with various car companies, tier one suppliers, state departments of transportation and pavement-marking industry professionals to discuss the current camera-based technologies used in vehicle-lane keeping and lane-departure warning systems.

TTI is already recognized as one of the premier university-based research organizations regarding pavement-marking materials, visibility and performance. This project is focused on expanding the traditional infrastructure-oriented pavement-marking research to include enhanced pavement markings that will support automated vehicle deployment and identify possible limitations, areas for further research and new applications.

Researchers are using TTI's one-of-a-kind Visibility Research Lab to test the performance of various camera-based systems in detecting existing and prototype pavement markings. The testing will include low-visibility conditions simulating heavy rains, thick fog and low sunlight, which cause high

## TTI Leads AV Discussions at TRB in July

**P**aul Carlson will lead a breakout session, titled Infrastructure Needs of Connected-Automated Vehicles, at the Transportation Research Board's Automated Vehicles Symposium in July. The symposium provides an opportunity to engage the industry in a public forum. Also at the event, TTI Senior Research Engineer Ginger Goodin, director of the Institute's Transportation Policy Research Center, will co-lead a breakout session on Near-Term Deployment Opportunities and serve as a panelist at the Societal Issues and Non-Technical Challenges Panel Session. TTI Senior Research Scientist Mike Manser will co-lead the breakout session on human factors, and TTI Research Scientist Mohammad Poorsartep will lead the session on freight and trucks. ■

glare. Additionally, researchers will investigate new sensing technologies to further enhance pavement-marking detection. Promising technologies will then be evaluated at the new Riverside test bed.

"The goal is to work with both infrastructure owners/operators and vehicle manufacturers to overcome the limitations that currently exist with today's camera-based systems," says Carlson. "In terms of priorities, vehicle manufacturers have repeatedly identified pavement markings as the most valuable infrastructure element to promote automated-vehicle deployment."

Following the arrival and installation of various pavement-marking samples and camera systems, evaluation at the Riverside test bed will begin. ■



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# TTI Develops Advanced Traveler-Information Map for I-35 Expansion Project

**It's being called** the most advanced traveler-information map in the nation. And it was made possible thanks to feedback from motorists who travel Interstate 35 (I-35) in the Texas Department of Transportation's (TxDOT's) Waco District. The new map went live Feb. 17, 2014, and vastly improves the information drivers can access before traveling the corridor. It's part of a larger effort in which the Texas A&M Transportation Institute (TTI) is supporting TxDOT as it expands a 96-mile stretch of I-35 in Central Texas.

"Users can tailor the map to fit their needs and plan for future trips," explains TTI Research Scientist Bob Brydia, principal investigator on the traveler-information project. "The map is responsive and presents information in the best format for the screen size of the device accessing it."

I-35 travelers played a significant role in creating the new map. More than 900 people answered questions about the information they'd like to see in the map.

## The top suggestions for additions were

- expected delays between major points along I-35,
- current travel times between major points along I-35,
- current locations of incidents,
- locations and times for freeway lane closures,
- projected travel times between major points,
- detour routes/maps and
- current speeds on each segment of I-35.

"We were able to build the new map with all these improvements," Brydia says. "It now displays, in real

time, the information on each of the dynamic travel-time message signs in the Waco District. You can also customize the map based on direction of travel or how much information you want displayed, including traffic incidents, closures or travel times between locations." Also, he says, the speeds motorists are currently traveling in each section of I-35 automatically display with different colors, allowing the user to quickly identify any areas of slowed traffic.

The new map organizes information into tabs: closures, alerts, signs, trip planner and weather. (Smartphone users will also have a map tab as part of the design being responsive to their devices.) Brydia is planning more enhancements based on the survey. In the future, users will be able to view current snapshots from the cameras, which are being installed along the corridor.

"I suggest getting on the site and spending a few minutes becoming familiar with all the enhancements," Brydia says. "Once you see all the information that's available, I think the site will become a valuable tool each time you need to travel the interstate."

Visits to the map continue to grow each month. Even before the enhancements, more than 12,000 visits were made to the map in January.



# SIGN UP! For Daily Email Closure Updates

# 12,000

were made to the map in January

# VISITS

“Keeping motorists moving and safe is our primary concern during the reconstruction of I-35 through the Waco District,” explains District Engineer Bobby Littlefield. “Providing consistent and complete information about lane closures and emergency situations is a key element to making that happen. On behalf of TxDOT, I want to thank Bob Brydia and the staff at TTI for not only developing but continuing to enhance the valuable tools that are delivering outstanding benefits to the traveling public, all of which have been designed from the responses and requests received from previous surveys.” ■

**Traveler Information - I-35 Waco District**

CLOSURES ALERTS SIGNS TRIP PLANNER WEATHER

Click on a heading below to begin planning your trip.

- EBWB HCR 3102 at I-35, South of Abbot**  
ROADWAY HCR 3102  
CLOSED All lanes closed  
TIME Continuously, Ends 8:00 @ 7AM  
ACTIVITY Work on FM 3102 bridge.
- EBWB FM 3146/Tours Rd at I-35, Rose**  
ROADWAY FM 3146/Tours Rd  
CLOSED All lanes closed  
TIME Continuously, Ends 8:00 @ 7AM  
ACTIVITY Tours Road bridge reconstruction.
- EBWB Rose Rd at I-35, Rose**  
ROADWAY Rose Rd  
CLOSED All lanes closed  
TIME Continuously, Ends 10/1 @ 7AM  
ACTIVITY Construct the frontage roads.
- US 84 to Forest St, Bellmead**  
ROADWAY I-35 Mergennes (starting at MM 327.0)  
CLOSED Right lane  
TIME 6:12 - 6:13, 8PM - 7AM  
ACTIVITY Pavement repair.
- W FM 2827 - Old Lorena Rd to E FM 2827 - Rosemead Rd, North of Lorena**  
ROADWAY I-35 Mergennes (starting at MM 323.0)  
CLOSED Left lane  
TIME 6:12 - 6:13, 7PM - 10PM  
ACTIVITY Move portable concrete barrier.
- E FM 2827 - Rosemead Rd to Phoebe Area, Lorena**  
ROADWAY I-35 Frontage Road (starting at MM 322.0)  
CLOSED Various lanes closed  
TIME Continuously, Ends 8:00 @ 7PM  
ACTIVITY Switch southbound frontage road to one-way operation, southbound only, and permanently close R&T #9865.
- EBWB Old Blvinia Road at I-35, South of Eddy**  
ROADWAY Old Blvinia Road  
CLOSED All lanes closed  
TIME Continuously, Ends 11:00 @ 7AM  
ACTIVITY Old Blvinia Road crossing will be closed until the new I-35 bridges are completed.
- I-35 At Falls County Line, South of Eddy**  
ROADWAY I-35 Entrance Ramp (starting at MM 314.0)

## Trip Planner

**Traveler Information - I-35 Waco District**

CLOSURES ALERTS SIGNS TRIP PLANNER WEATHER

Lane closure and delay information are generally available for the next 7 days and may change frequently. Trip times do not include incident delays. Please consider all information sources in your trip planning.

From Hillsboro To Salado

June 2014

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

7PM

Estimated Delay: **30** Minutes

Estimated Total Trip: **115** Minutes

“Users can tailor the map to fit their needs and plan for future trips,” explains Bob Brydia, principal investigator on the traveler-information project. “The map is responsive and presents information in the best format for the screen size of the device accessing it.”



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

To access the traveler-information map, go to <http://i35-maps.tti.tamu.edu/>.



# ATLAS Center Created with \$1.4 Million Grant from USDOT

## The nation's two largest

university-based transportation research institutes have joined forces to form a unique university transportation center (UTC) designed to improve safety through a multidisciplinary system approach to research. The Texas A&M Transportation Institute (TTI) and The University of Michigan Transportation Research Institute (UMTRI) — which leads the effort — form the UTC, called the Center for Advancing Transportation Leadership and Safety (ATLAS).

ATLAS's funding has been initiated with a first-year, \$1.4 million grant from the U.S. Department of Transportation and the expectation of continued funding over the next three to five years.

"We are very pleased to be given the opportunity for two of the largest transportation safety research institutes to work together to solve the most pressing transportation problems facing our nation," says ATLAS Director David Eby, who is a research professor and head of the Behavioral Sciences Group at UMTRI.

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**"This is a terrific opportunity for TTI to strengthen our ties with UMTRI and also conduct research in areas that have not been our primary focus in the past,"**  
**Robert Wunderlich, ATLAS associate director, says.**

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Robert Wunderlich, TTI's Center for Transportation Safety director, will serve as associate director for ATLAS. "This is a terrific opportunity for TTI to strengthen our ties with UMTRI and also conduct research in areas that have not been our primary focus in the past," he says.

In one of the first ATLAS research projects now underway, experts from both universities will examine heavy-truck crashworthiness and the potential of occupant protection systems in "reducing deaths, injuries and societal costs associated with

heavy-truck crashes." The project will include the mining of crash data and statistical simulation. Students at both universities will take part in the research.

Two other early ATLAS projects involve alcohol-impaired nighttime driving and child safety in cars. In addition to collaborative research projects, ATLAS's mission involves the promotion of technology transfer and workforce development that includes a summer intern program. ■



*For more information, contact*  
**Robert Wunderlich** at  
(979) 845-2095 or  
[r-wunderlich@ttimail.tamu.edu](mailto:r-wunderlich@ttimail.tamu.edu).

# TTI ADVISORY COUNCIL

The Texas A&M Transportation Institute (TTI) Advisory Council is comprised of a small group of high-level transportation professionals from across Texas and every sector of the transportation world. The council, which meets annually, offers a tremendous service to the Institute by advising on transportation issues and trends and supporting TTI's research programs and initiatives. TTI profiles several council members in each issue of *Researcher*. ■



**Perri D'Armond**  
*President and CEO,*  
*West Houston Association*  
Houston, Texas

Perri D'Armond leads an organization of major developers, landowners, employers and service firms dedicated to quality growth in fast-growing Greater West Houston. The organization promotes sustainable growth-oriented projects and addresses public policies and regulations on major infrastructure issues, land use, environment and education.

Prior to joining the West Houston Association, D'Armond was vice president of government relations for the Greater Fort Bend Economic Development Council for over 15 years. D'Armond serves on the board of the Texas Good Roads and Transportation Association and on the Houston-Galveston Area Council's technical advisory committees for citizen and business interests and transportation air quality.



**Chuck Ellison**  
*Founder and Principal,*  
*The Ellison Firm, Attorneys at Law*  
College Station, Texas

Chuck Ellison serves clients in areas of business, real estate, banking, municipal law, estate planning and probate. He is being recognized in 2014 as a Distinguished Alumnus of Texas A&M University.

Ellison is active in the community on a number of boards, including the A&M Political Action Committee; Brazos Valley Community Foundation; United Way of the Brazos Valley; Texas A&M University Association of Former Students; Texas A&M University Corps Development Council; Texas A&M University System Chancellor's Century Council; and the Bush School of Government and Public Service Development Council.



**Kris Heckmann**  
*Partner, Granite Public Affairs*  
Austin, Texas

Kris Heckmann is a public affairs expert who has served as former deputy chief of staff for Texas Gov. Rick Perry. He specializes in governmental and media relations; grassroots, alliance development and third-party outreach; crisis communications; and strategic research and communications.

Heckmann has held several other positions in the Office of the Governor, including advisor in the areas of legislative and communications strategy, and political and legal counsel. He also has served as deputy legislative director and transportation policy advisor, and was instrumental in helping pass and implement comprehensive transportation legislation.

## Briaud Elected President of FedIGS



Briaud

**J**ean-Louis Briaud, the Buchanan Chair of the Zachry Department of Civil Engineering at Texas A&M University and

manager of TTI's Geotechnical and Geoenvironmental Program, has been elected president of the Federation of International Geo-engineering Societies (FedIGS). The four-year term lasts through 2018. FedIGS was formed 10 years ago in an effort to enhance the cooperation among four separate international geoenvironmental societies. Briaud says he will work closely with the leaders of each society to coordinate the efforts of each group. Briaud becomes the third president of FedIGS, which represents 45,000 members worldwide. ■

## Qu and Students Win National AICP Award



Qu

**T**TI Associate Research Engineer Teresa Qu and the students in her class in the Texas A&M Landscape and Urban Planning Department were recognized during the American Planning Association National Conference in Atlanta, Ga., April 26–30, 2014.

The 2012 graduate class in Transportation System Analysis conducted a study of a bike-sharing program for the Texas A&M University campus. The report won a Student Project Award sponsored by the American Institute of Certified Planners (AICP). This is the first time Texas A&M has won the award in AICP's annual nationwide contest, which recognizes outstanding class projects in planning programs.

As part of the class project, the students worked with Texas A&M Transportation Services to determine the level of interest in a bike-sharing program, estimate how many bikes would be needed and recommend locations for the various bike-share stations. With the help of information from the students' analysis, a bike-sharing program began on campus last year. ■

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

## Carpool Ridesharing App Project Underway

**T**TI, with support from the Federal Highway Administration's Value Pricing Pilot Program, recently began a multi-year study to test the use of real-time ridesharing technology to verify the occupancy of a vehicle and evaluate the effects of toll discounts. The project is being conducted jointly with the Central Texas Regional Mobility Authority (CTRMA) and Carma, a real-time ridesharing vendor.

"Real-time ridesharing differs from old-style carpooling in that it allows people to find rideshare matches for carpools any time they want," says TTI Associate Transportation Researcher Greg Griffin. "It also helps people arrange trips that are outside their regular commute schedule."

According to Griffin, the technology works by users accessing a smartphone app to match drivers and potential riders. So far, nearly 700 Austin-area residents have downloaded Carma, which is available in the Apple App Store using "Carma Carpooling" as a search term. ■



## Educating College Students on Preventing Impaired Driving

The U in the Driver Seat program and the Texas Department of Transportation teamed up March 28–29 for the inaugural Peer-to-Peer Impaired Driving Prevention Symposium at Texas State University. The event aimed to educate college-aged students about the impaired driving problem and introduce peer-driven efforts for colleges and universities to use in addressing such problems. U in the Driver Seat was created to promote peer-to-peer education on the risks of impaired driving.



Representatives from Concordia University, Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, Texas State University, The University of Texas-Pan American, The University of Texas at Brownsville, the University of Houston, Huston-Tillotson University and the University of the Incarnate Word attended the event.

The two-day symposium had 12 breakout sessions, including sessions on peer-to-peer strategies, driving-while-intoxicated laws and using social norms and marketing to prevent driving while intoxicated. A second symposium will be held Sept. 11 and 12 at Southern Methodist University.

“The goal for the weekend was to create awareness about the dangers of impaired driving, empower the students with ideas and resources to combat this issue, and have the students take that knowledge back to their campuses,” says TTI Senior Research Engineer Russell Henk, director of the U in the Driver Seat program. ■

## Li Accepts Leadership Role in Landscape Architecture Association



Li

Ming-Han Li, TTI associate research engineer and associate professor in Texas A&M’s Department of Landscape Architecture and Urban Planning, has been elected vice president of the Council of Educators in Landscape Architecture (CELA), an international association that advances education, research and outreach. CELA was formed in 1920 and “is composed of virtually all the programs

of higher learning in landscape architecture in the United States, Canada, Australia and New Zealand.”

Li was named to the position at CELA’s national conference in Baltimore, Md., March 26–29. Li has served in leadership positions for the council since 2007. ■

## Goodin Appointed to Federal ITS Advisory Committee



Goodin

Texas A&M Transportation Institute (TTI) Senior Research Engineer Ginger Goodin was recently appointed to the

Intelligent Transportation Systems Program Advisory Committee (ITS PAC). Goodin was invited to join the committee by U.S. Department of Transportation Secretary Anthony Foxx.

The role of the ITS PAC is to act in an advisory capacity to the secretary of transportation on matters relating to the study, development and implementation of ITS.

“I think it’s a great opportunity to work with an impressive group of individuals from a diverse range of organizations,” said Goodin, who is also the director of TTI’s Transportation Policy Research Center (PRC). “It is an exciting time to be working in the ITS field. The fact that we are doing more work in the technology policy area is one way in which I can contribute to this committee. The PRC supports state and local policy for various types of ITS applications such as those involving vehicle technologies, transportation systems management and data sharing. My hope is that we can positively add to the ITS strategy discussion at the federal level.”

Goodin’s term begins immediately and lasts two years. ■

TEXAS A&M TRANSPORTATION INSTITUTE  
**PUBLICATIONS**

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

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

**RESEARCH VIDEOS**

Access the research topics listed below via the URLs shown.

*Connected Cars, Smarter Roads, Safer Texas:*  
<https://vimeo.com/97270483>

*Research Into New Rapid-Flash Beacon Shows Positive Results:* <http://vimeo.com/98577802>

*TTI's Center for Railway Research Studies Our Country's Aging Railway System:*  
<http://vimeo.com/96822544>

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

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

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

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

**TECHNICAL REPORTS**

*ASR Testing: A New Approach to Aggregate Classification and Mix Design Verification: Technical Report*, by Anol Mukhopadhyay, **0-6656-1**, May 28, 2014.

*Characteristics of Texas Pedestrian Crashes and Evaluation of Driver Yielding at Pedestrian Treatments*, by Kay Fitzpatrick, **0-6702-1**, May 2, 2014.

*Developing Guidelines for Repairing Severe Edge Failures: Technical Report*, by Stephen Sebesta, **0-6271-2-1**, May 8, 2014.

*Evaluating the Need for Surface Treatments to Reduce Crash Frequency on Horizontal Curves*, by Mike Pratt, **0-6714-1**, May 29, 2014.

*Evaluation of Binder Aging and Its Influence on Aging of Hot Mix Asphalt Concrete: Technical Report*, by Charles Glover, **0-6613-1**, May 8, 2014.

*Evaluation of Innovative Devices to Control Traffic Entering from Low-Volume Access Points within a Lane Closure*, by Melisa Finley, **0-6708-1**, May 2, 2014.

*Field Performance of RAS Test Sections and Laboratory Investigation of Impact of Rejuvenators on Engineering Properties of RAP/RAS*, by Soohyok Im, **0-6614-3**, May 2, 2014.

*HMA Shear Resistance, Permanent Deformation, and Rutting Tests for Texas Mixes: Year-1 Report*, by Lubinda Walubita, **0-6744-1**, May 2, 2014.

*Implementation of Curing, Texturing, Subbase, and Compaction Measurement Alternatives for Continuously Reinforced Concrete Pavement*, by Andrew Wimsatt, **5-6037-01-1**, May 7, 2014.

*Incorporating Greenhouse Gas Emissions in Long Range Transportation Planning – Final Report*, by Megan Kenney, **0-6696-1**, May 7, 2014.

*Laboratory Evaluation of Asphalt Binder Rutting, Fracture, and Adhesion Tests*, by Fujie Zhou, **0-6674-1**, May 2, 2014.

*Literature Review: Performance of RAP/RAS Mixes and New Direction*, by Fujie Zhou, **0-6738-1**, May 2, 2014.

*Maximizing Mitigation Benefits – Making a Difference with Strategic Inter-Resource Agency Planning: Year One Technical Report*, by John Overman, **0-6762-1**, May 6, 2014.

*Performance Testing of Coagulants to Reduce Stormwater Runoff Turbidity*, by Jett McFalls, **0-6638-1**, May 28, 2014.

*Research to Develop an ITS Strategic Plan for Texas*, by Ed Seymour, **0-6672-2**, May 7, 2014.

*Temporary Large Guide Signs*, by Roger Bligh, **0-6782-1**, May 6, 2014.

*Texas-Specific Drive Cycles and Idle Emissions Rates for Using with EPA's MOVES Model – Final Report*, by Reza Farzaneh, **0-6629-1**, May 8, 2014.

**PROJECT SUMMARY REPORTS AND PRODUCTS**

*ASR Testing: A New Approach to Aggregate Classification and Mix Design Verification*, by Anol Mukhopadhyay, **0-6656-S**, May 16, 2014.

*Development of Pedestrian Crash Countermeasures and Appropriate Crash Reduction Factors (CRFs)*, by Kay Fitzpatrick, **0-6702-S**, May 8, 2014.

*A Generic Mode Choice Model Applicable for Small and Medium-Sized MPOs*, by Chandra Bhat, **0-6766-S**, May 23, 2014.

*Implementation of a Texas Mechanistic-Empirical Thickness Design System (TxME)*, by Fujie Zhou, **0-6622-S**, Feb. 10, 2014.

*Improving DMS 9210 Requirements for Limestone Rock Asphalt*, by Cindy Estakhri, **0-6686-S**, May 29, 2014.

*Incorporating Greenhouse Gas (GHG) Emissions in Long Range Transportation Planning*, by Joe Zietsman, **0-6696-S**, May 7, 2014.

*Rapid Field Detection of Moisture Content for Base and Subgrade*, Stephen Sebesta, **0-6676-S**, May 8, 2014.

*Review of Tolling Approaches for Implementation within TxDOT's Travel Demand Models*, by Kevin Hall, **0-6754-S**, May 22, 2014.

*Use of Recycled Asphalt Shingles in HMA*, by Fujie Zhou, **0-6614-S**, May 8, 2014.

