Organized by the Texas A&M Transportation Institute (TTI), the Texas A&M Transportation Technology Conference was held on May 1–3, 2016, at the Annenberg Presidential Conference Center in the George Bush Presidential Library Complex on the Texas A&M University campus in College Station. The conference highlighted transportation technology research under way within The Texas A&M University System, the announcement of a major initiative at the A&M System RELLIS Campus, and the formation of a Texas A&M Transportation Advisory Council. Participants discussed the introduction of connected and automated vehicles (CV/AV) in the marketplace and current activities under way in the public and private sectors at the national, state, and local levels. Opportunities for further collaborative research among Texas A&M and public- and private-sector partners were identified.

Key comments from the speakers are highlighted in this summary. More detailed information on the conference, including videos provided by some speakers, is available at: http://tti.tamu.edu/conferences/ttc16/resources.php.
OVERVIEW AND WELCOME

M. Katherine Banks, Vice Chancellor and Dean of Engineering
Texas A&M University
Dr. M. Katherine Banks highlighted the transportation technology initiative under way within the A&M System. She noted the vast resources, expertise, and innovative thinking available among faculty, researchers, and students within the Dwight Look College of Engineering, TTI, and the Texas A&M Experiment Station. She welcomed conference participants to join with the Texas A&M transportation technology initiative in creative collaboration partnerships to help address the transportation challenges facing Texas and the nation.

Karan Watson, Provost and Executive Vice President
Texas A&M University
Dr. Karan Watson described the interest in testing and deploying innovative technologies to address mobility needs on the Texas A&M campus. She highlighted opportunities for technology innovation collaboration at Texas A&M and some of the unique facilities and capabilities available to the private sector. In coordination with updating the Campus Master Plan with Texas A&M President Michael Young’s leadership and help from TTI, the university is issuing a request for interest for companies to demonstrate technologies on campus and undertaking a Campus Transformational Mobility Plan. These efforts will help advance President Young’s vision to create a more pedestrian and bicycle friendly campus with more transit options, more green space, and less vehicle traffic, as well as a living laboratory.

NEW RELLIS CAMPUS

John Sharp, Chancellor
Texas A&M University System
Chancellor John Sharp announced a $250 million investment to expand the engineering and educational resources at the 2,000-acre RELLIS Campus. The name RELLIS comes from the Texas Aggies’ core values of Respect, Excellence, Loyalty, Leadership, Integrity, and Selfless Services. RELLIS will transform the existing facility, which was an air force base for pilot training during World War II, into a premiere campus dedicated to accelerating the deployment of transportation technologies through advanced research and education, and public/private partnerships.

The current investment will demolish old buildings, reconstruct roads, upgrade utilities, and construct new buildings and training facilities. The runways will be upgraded for multiple uses. The first new building will house the recently established Center for Infrastructure Renewal. A new building will also be constructed for TTI, which will move from its current location on the Texas A&M West Campus. New educational facilities will also be located at RELLIS, including expanding the current partnership with Blinn College.

Sharp welcomed conference participants to consider the opportunities for researching, testing, and deploying a wide range of technologies at the RELLIS Campus. He noted the opportunity for transformational public/private business models in developing and operating the facility, and encouraged conference participants to share their ideas on potential approaches.

TEXAS A&M TRANSPORTATION TECHNOLOGY ADVISORY COUNCIL

David Laney, Chairman
LBJ Infrastructure Group, Council Co-Chair
David Laney invited conference participants to join the newly formed Texas A&M Transportation Technology Council to help develop and implement the vision outlined by Chancellor Sharp of making the A&M System a national leader in transportation innovation. Creating new alliances of traditional transportation providers, transportation researchers, and technology and automotive companies is key to meeting future mobility needs in Texas and the country.

The Texas A&M Transportation Technology Advisory Council will help move these alliances forward. The council will serve as a resource to TTI and the A&M System partners. It will help identify applicable transportation technology opportunities and approaches to move those opportunities forward. The council will also provide real-world input and insight to the innovative work of faculty, researchers, and students, and will advise on the deployment and adoption of those technologies.

Benefits to the private sector from participating in the council include being part of an exceptional public/private collaboration, ensuring the RELLIS Campus meets collective public/private needs, leveraging the strengths of all groups, and accelerating technology deployment to improve mobility and quality of life. Additionally, students involved in research projects will provide companies with outstanding potential future employees. Laney encouraged conference participants to consider joining the council.
for their active engagement in the conference. He highlighted some of the other activities under way, including developing and piloting a smart intersection initiative, a pilot of a collision avoidance system on one Texas A&M University bus, and a truck platooning pilot project. These activities are occurring through partnerships with Texas A&M Transportation Services, the Texas Department of Transportation (TxDOT), and technology companies.

In closing, Christiansen noted that development of the RELLIS Campus, combined with other activities and capabilities at Texas A&M, is creating the most advanced transportation technology research, development, testing, and operations test bed in the world. He encouraged participants from both the public and private sectors to actively engage in opportunities using these facilities and the expertise of researchers, faculty, and students at Texas A&M.

Adler described the mobility and affordability challenges facing Austin. With housing costs continuing to increase, there is a need to keep the city affordable for all income levels. Traffic congestion is a major problem, with the Austin segment of I-35 ranked as the most congested freeway in the state. With projected population increases, the situation will only get worse. Adding capacity in most areas is too expensive and too disruptive, with too many environmental concerns. Combining the existing system and technology in a smarter way can provide faster, safer, and more convenient travel.

In addition, Adler noted that the Smart City Challenge is about more than just transportation. It focuses on key challenges facing the finalist cities, with transportation playing a key role in addressing these concerns. He cited two major reasons why Austin should be selected. First, Austin is a city of early adopters and a city that embraces change. Second, to maintain its character, diversity, and uniqueness, Austin needs to address its mobility and affordability challenges.

Adler also described the interest and excitement that the Smart City Challenge has generated in Austin and in other cities throughout the country. The participation of technology and automotive companies, regional partners, and academia is unique. He suggested that even if Austin does not win, the city, region, and state all have benefited from participation in the challenge. Further, the partners are committed to continue working together and seeking other funding opportunities.

In closing, Peters commented that partnerships with universities and research institutes, as well as traditional transportation agencies, are key to these efforts and will help answer many of the questions associated with deploying CVs and AVs. Being nimble, embracing technological advances, and promoting flexible and adoptable solutions to transportation challenges are also key elements to future success.
COLLABORATIVE OPPORTUNITIES IN COMMERCIAL VEHICLE SAFETY TECHNOLOGY

Steve Boyd, Vice President/Founder
Peloton Technologies

Steve Boyd discussed the rapid changes under way in CV and AV technologies associated with commercial vehicles. He noted that the United States is falling behind other countries in testing and deploying CV and AV technologies that will improve safety and efficiency of commercial vehicles. The recent truck platooning demonstrations across several countries in Europe to the Port of Rotterdam involving seven automobile manufacturers illustrates one example of advances being made outside the United States. Fully automated trucks and three-truck platooning systems have also been demonstrated recently in Europe. In the United States, a demonstration involving single truck automation was conducted at the Hoover Dam in summer 2015.

Peloton is involved in planning the freight operation fleet trial on I-45 in coordination with TxDOT and TTI. Peloton is focusing on developing partial automation, using cooperative adaptive cruise control with the operators of both vehicles steering and engaged in driving tasks. He suggested that deploying this type of approach and technology brings the system to market faster. He noted that other truck platooning projects are under way at TTI and in Texas. Peloton is looking forward to continued opportunities in Texas, working with TTI, TxDOT, best-in-class commercial fleets, and major braking and safety system suppliers. A video on the Peloton truck platooning system was shown during lunch.

AUTOMOTIVE INNOVATION: GLOBAL SCOPE, LOCAL IMPACT

Tom Stricker, Vice President, Technical/Regulatory Affairs and Energy/Environmental Research
Toyota Motor North America

Tom Stricker discussed activities under way at Toyota and opportunities to reimagine transportation using technology to make mobility safer, more sustainable, and more accessible to all groups. He presented videos highlighting new Toyota products and services. Toyota is offering more vehicles with active safety features to prevent or mitigate rear-end collisions using automated emergency braking, keeping drivers in their lanes using lane-keep assist, and enhancing night road safety with advanced headlights.

Toyota is partnering with the city of Grenoble in France to pilot a car-sharing service using the electric iROAD and COMS vehicles, with autonomous vehicles being a long-term goal. Another innovative application of technology is Project Blade, which is developing a wearable device for visually impaired individuals that provides lane-keep assistance and information about their surroundings. A further project, Toyota Connected, provides real-time information on traffic conditions, rerouting vehicles around crashes and automatically alerting others that drivers may be delayed.

Stricker noted that Toyota has been operating as multiple affiliate companies in the United States for almost 60 years. To allow for greater collaboration, faster response, and better customer service, a single unified company, ONE TOYOTA, has been created with a new North America headquarters in Plano, Texas. He noted opportunities to work with the Texas A&M technology initiative to recruit students as future employees and to collaborate on research opportunities as Toyota fulfills its role as a technology company, a sustainability company, and a mobility company.

TOWARD CONNECTED AND AUTOMATED VEHICLES

Allie Medack, Chief of Staff, Global Public Policy
General Motors

Allie Medack described transformational technologies and changes in the automotive industry. She noted the presence of General Motors (GM) in Texas with the assembly plant in Arlington, the GM financial operations headquarters in Fort Worth, a new facility under construction in San Antonio, and the information technology and innovation center in Austin.

Suggesting that the automotive industry will change more in the next 5–10 years than it has in the past 50 years, Medack noted GM’s commitment to offering vehicle-to-vehicle (V2V) connectivity service on more than 75 percent of its global products by 2020. Active safety technologies, such as forward collision alerts, automated breaking, and lane-keeping assistance are already available in many vehicle makes and models.

Medack also described MAVEN, GM’s new brand of its car-sharing efforts, which provide personalized, on-demand mobility services. MAVEN, which has been launched in Ann Arbor and New York City, provides customers with an owner-like experience and the convenience of car sharing. She also highlighted GM’s ongoing commitment to safely deploy technology and to cyber security. She noted possible opportunities to collaborate with the Texas A&M transportation technology initiative.
SMART MOBILITY AND TRANSPORTATION AS A SYSTEM

Reuben Sarkar, Deputy Assistant Secretary for Transportation U.S. Department of Energy

Reuben Sarkar discussed the Transportation-as-a-System (TAAS) initiative at the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE). The EERE conducts applied research on renewable power, energy efficiency, advanced manufacturing, and sustainable transportation. The sustainable-transportation sector includes a diverse research portfolio, ranging from algae to autonomous vehicles. He noted that TAAS focuses on exploring untapped system-level efficiencies at planning and operations timescales.

Sarkar noted that today’s transportation system is characterized by independent, unconnected vehicles that are subject to the behaviors and decisions of drivers. Characteristics of the future transportation system included a system-level focus, and CV/AVs operating in concert across modes, with the potential to manage some behaviors and decisions. He noted that DOE is interested in better understanding the potential energy implications of CV/AVs, and mobility as a service.

Sarkar discussed the DOE’s TAAS-targeted research portfolio, which focuses on automation and connectivity, multimodal transportation choices for people and freight, vehicles and fueling infrastructure, urban systems, and behavior and decision science. He highlighted early research projects and noted that pilots and demonstrations are also being conducted to enhance the ability to predict the energy impact of CVs and AVs.

STEPS TOWARD TRANSPORTATION TECHNOLOGY RESEARCH AND DEPLOYMENT: Collaborative Opportunities — Private-Sector Perspective

Speakers in this panel provided a private-sector perspective on opportunities to pilot technologies in a campus setting and to partner with the Texas A&M transportation technology initiative.

David Agnew, Director of Advanced Engineering
Hyundai MOBIS North America

David Agnew reported that Hyundai MOBIS is working on autonomous technologies and the related safety technologies. He suggested that verification is one of the major challenges with AVs. Verification has to be conducted for both a company’s engineering group to prove that the technology is ready to deploy and to prove to regulators and to society that the vehicle is safe to operate on the roadway, which is a unique challenge.

Agnew suggested that the verification process might be part of the overall deployment of AVs. Rather than mass deployment of AVs, which is typically done in the automotive industry, a staged deployment will probably be necessary to monitor actual use. He suggested the possible opportunity for the Texas A&M campus to be one of the staged deployment locations. He drew a comparison to the safety pilot demonstration conducted in Ann Arbor, home of the University of Michigan, as a possible example of this approach.

Jeff Sass, Senior Vice President
Navistar

Jeff Sass explained that Navistar manufactures, engineers, and designs class 4-8 trucks, as well as school and commercial buses. Navistar is a partner in the TTI and TxDOT truck-platooning project.

Sass noted that Navistar’s technology focuses on advanced driver assistance systems. Examples he cited included communication between a truck and a smartphone via short wave radio capabilities, keeping a distracted pedestrian crossing the street out of harm’s way, and trucks communicating with a smart intersection to increase traffic flow. Advancements in forward-looking cameras and those placed around a truck are also occurring. The cameras also help in training new drivers. With 40 million Class A trucks on the road today, recruiting and retaining drivers is an ongoing concern. Technologies on a truck, such as lane-departure warnings and collision avoidance, enhance safe operations.

Sass suggested that autonomous trucks could assist with addressing the hours of service regulations, which limit Class A drivers to 11 hours a day, by taking over the driving function at a depot, warehouse, or home base. He described the shift in delivery patterns, with the 2016 holiday season recording over 50 percent of total sales from online orders. As a result, truck trips from warehouses or distribution centers to stores are decreasing and trips to residences are increasing. Technology is needed to optimize routes and improve efficiency of trucks serving this new shopping model. He identified topics for a collective university and private-sector research approach including optimizing truck driver productivity within the hours of service requirements, addressing the truck driver shortage, and meeting the needs of the new shipping-delivery model.
Speakers in this panel provided a private-sector perspective on opportunities to pilot technologies in a campus setting and to partner with the Texas A&M transportation technology initiative.

The automotive sector represents approximately 60 percent of TI’s revenues and is growing rapidly. TI’s investments focus on making vehicles safer, greener, and more fun. He described the interaction between the high-technology industry and the automotive industry and suggested that more innovative and creative products and services would emerge from the combined efforts of these two groups.

In using technology to address mobility on the Texas A&M campus, he suggested that providing the community with information when and where they need it is a good approach. The Destination Aggieland app is one example of this approach. He noted that the potential cooperation between the Texas A&M initiative and corporations was especially exciting and motivating. TI believes in that model, and has invested over $80 million in this approach over the past five years. He suggested that addressing mobility concerns represents the perfect storm of where academia, government, and corporations can work together.

Reviewing the technology development and maturity process, Moore suggested that mass deployment of AVs was still a long way away. New technology ideas begin with proofs of concept, move into testing, and then move into deployment. It is a long, expensive, and high-risk process. He noted that most technologies associated with AVs are still in the proof-of-concept stage, with additional questions associated with sensor technology, analytics, deep learning, cyber security, architecture, V2V, and real-time requirements.

Moore noted the opportunities at Texas A&M with the research and academic capabilities, the RELLIS Campus to test ideas, the university campus with a more controlled, real-world environment, and deployment on roadways, coupled with government help and corporate help.

Frank Sgambati, Director of Marketing and Product Innovation

BOSCH

Frank Sgambati reported that BOSCH was a key player in the automotive space, since mobility solutions is BOSCH’s largest business sector. He noted that BOSCH is transforming its entire business to accommodate the mobility solutions offered by connected, automated, and electric vehicles and addressing connectivity within the home, connectivity with a vehicle, and the entire door-to-door spectrum.

He suggested that BOSCH could assist in developing safer and more convenient parking options on the Texas A&M campus. One option, called Community-Based Parking, focuses on on-street and surface parking and the use of ultrasonic sensors that can measure an empty parking space, aggregate that data into the cloud, and provide information to drivers, allowing them to conveniently and safely find a space. Connected Parking or Active Parking Lot Management represents a second approach focusing on parking structures. Embedded sensors are used to monitor available parking spaces and transmit this information to drivers. A next step would be automating the entire parking process, with valet self-parking vehicles. Technologies from BOSCH could support the piloting and deployment of these approaches on the Texas A&M campus.

He noted that the transformation process at BOSCH includes a focus on academic collaboration. These types of partnerships bring the benefits of an innovation-driven company culture and the discovery aspects of a university environment to create a win-win situation. These partnerships enrich the academic experiences of students and allow companies to orient potential future employees toward current issues. There are also economic benefits to the local area. This type of collaboration between industry and universities is critical to accelerating market development in this area.

George Ayres, Associate Partner, Global Business Services

IBM Corporation

George Ayres discussed that IBM currently partners with Texas A&M University in numerous ways. With 430,000 employees in 141 countries, IBM is involved in numerous CV, AV, and Smart City projects, including efforts focusing on smart mobility.

Ayres suggested that the move to a mobility focus is a major change for the automotive industry, as it requires dealing with other transportation infrastructure in an area and developing relationships with new partners. Using the slow market acceptance of electric vehicles as an example, he suggested that deployment of AVs would take time. He noted that Internet of Things—connected homes and connected cities—would help develop many important elements needed for AVs.

Ayres suggested that the RELLIS Campus has the potential for on-site incubators, pilots, and tests. He noted that IBM works with start-up companies and helps them grow. He commented that the RELLIS Campus provides opportunities for Texas A&M, large companies, and start-up businesses to work together.
Jeff Lindley, Associate Administrator for Operations Federal Highway Administration

Jeff Lindley noted that Texas is a microcosm for transportation issues and transportation solutions. The state is known for using innovative approaches to address traffic congestion and mobility concerns. It is also known for partnerships among public agencies and with the private sector. He also noted the working relationship with TTI, with the Institute undertaking timely and innovative research.

Lindley suggested that an important area for research is the transition period when a mix of vehicles will be in operation. Providing a safe system for CVs, AVs, and existing vehicles will be critical. He highlighted the importance of partnerships and collaboration in the development and deployment of CVs and AVs.

Lindley noted that one of the benefits of the Smart Cities Challenge was the partnerships and collaboration that emerged in all cities. An opportunity and a challenge will be continuing to foster these efforts. He also noted that some states will be leaders and early adopters in the technology area, with others following. Texas and Michigan are two of the leading states in this area.

Kirk Steudle, Executive Director Michigan Department of Transportation

Kirk Steudle provided a perspective from the American Association of State Highway and Transportation Officials (AASHTO), ITS America, and the Transportation Research Board (TRB), having served in leadership positions in all three organizations, as well as the activities at the Michigan Department of Transportation (MDOT).

Steudle noted the long-term interest in technology to support transportation in Michigan, including the recent safety-pilot-model deployment in Ann Arbor. In cooperation with the University of Michigan, MDOT helped establish Mcity, a 32-acre test facility for evaluating CV/AV systems. The university also created the Mobility Transformation Center, which is examining a number of potential issues with the deployment of CVs and AVs, including legal concerns.

The new American Center for Mobility, a larger 335-acre test facility, includes capabilities for industry to self-certify that technology is road-ready. He suggested that there are opportunities for collaboration between the Michigan facilities and the Texas A&M technology initiative and activities at the RELLIS Campus.

Steudle discussed the importance of partnerships and the importance of bringing public, private, and academic stakeholders together. He suggested that the interests and excitement among mayors and other elected officials generated by the Smart Cities Challenge would provide long-term benefits.

Phil Caruso, Associate Executive Director for Technical Programs Institute of Transportation Engineers

Phil Caruso provided a perspective from the Institute of Transportation Engineers (ITE), which has approximately 13,000 members, including 40 percent from the private sector, 25 percent from the public sector, 20 percent from academia, and the remainder independent. He described ITE’s role as a platform for the transfer of knowledge, technical tools, and information in the areas of transportation engineering and planning.

Caruso suggested that the profession is going through a paradigm shift, with a new focus on transportation from a holistic point of view and on incorporating technology into transportation engineering practice on a daily basis. ITE has the opportunity to help its members understand how technology can be used in a safe and state-of-the-practice manner. He noted that ITE has a good working relationship with TTI, especially in moving research into practice and creating products that can be used by transportation professionals.

Caruso suggested that the new Texas A&M technology initiatives and the RELLIS Campus provide opportunities to enhance this relationship. He stressed the importance of focusing on using technology and data to achieve the proper transportation engineering solution. He also noted the importance of attracting students to the field and ongoing innovation in the profession, which the Texas A&M initiatives will support. He also noted the importance of sharing information, using the ITE National Operations Center of Excellence as one example for ongoing information sharing. It also reflects a partnership between ITE, AASHTO, USDOT, and ITS America.
Neil Pedersen, Executive Director  
Transportation Research Board

Neil Pedersen reviewed the three major functions of TRB, which is part of the National Academies of Sciences, Engineering, and Medicine. These three functions are convening, contracted research, and policy studies. He noted that TTI researchers and Texas A&M faculty are active in TRB committees, the annual meeting, and the cooperative research programs. He reported that at least 70 of the 200 TRB standing committees have expressed a current connection with CV/AV activities.

Pedersen discussed activities under way at TRB related to transformational transportation technologies. He described the National Cooperative Highway Research Program (NCHRP) Project 20-102, Impacts of CVs and AVs on State and Local Transportation Agencies. The project was approved in December 2014, and $3.5 million has been authorized to date. Additional funding is anticipated in future years. Tasks under way include projects focusing on the implications of automation for motor vehicle codes, the impacts of CVs and AVs on regional transportation planning and modeling, dedicating lanes for use by CVs and AVs, and road markings for machine vision. Other tasks are developing evaluation guidance for AV pilots and demonstrations, examining the societal impacts of CV and AV systems, assessing impacts on transit operations, and CV and AV applications in truck freight operations.

Pedersen also highlighted the recently completed NCHRP Legal Research Digest 69, A Look at the Legal Environment of Driverless Vehicles. Topics addressed include civil liability for personal injury, criminal law and procedure, insurance, and privacy and security laws. He also noted the annual AV Symposium organized by AUVSI and TRB and the Transformational Technologies in Transportation Partners in Research Summit that TRB is organizing for October 31–November 1 in Detroit. The summit will bring together transportation policy and research leaders from public agencies, the private sector, and academia to explore partnering opportunities for identifying research needs and fostering research. He welcomed TTI’s and Texas A&M’s ongoing participation in all these events.