



VirginiaTech[®]
Transportation Institute

annual report


2016






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MISSION VISION



The Virginia Tech Transportation Institute (VTTI) conducts research to save lives, save time, save money, and protect the environment. Researchers and students from multiple fields are continuously developing the techniques and technologies to solve transportation challenges from vehicular, driver, infrastructure, and environmental perspectives.



As one of seven premier research institutes created by Virginia Tech to answer national challenges, VTTI has effected significant change in public policies for driver, passenger, and pedestrian safety and is advancing the design of vehicles and infrastructure to increase safety and reduce environmental impacts.

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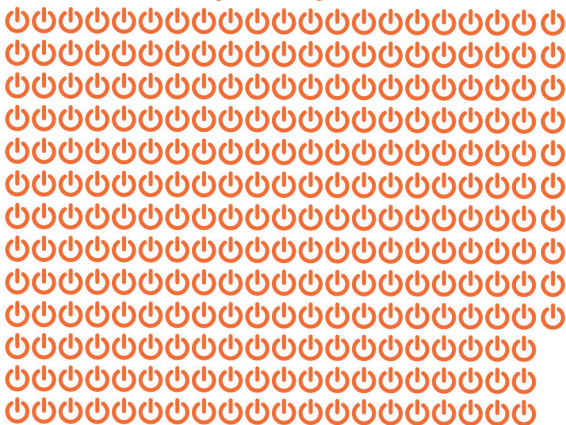
We house
90%
of the naturalistic
driving data in the
world
[2.5 petabytes]

which is more than **40** million miles of data
enough to drive from Earth to Mars at their closest point

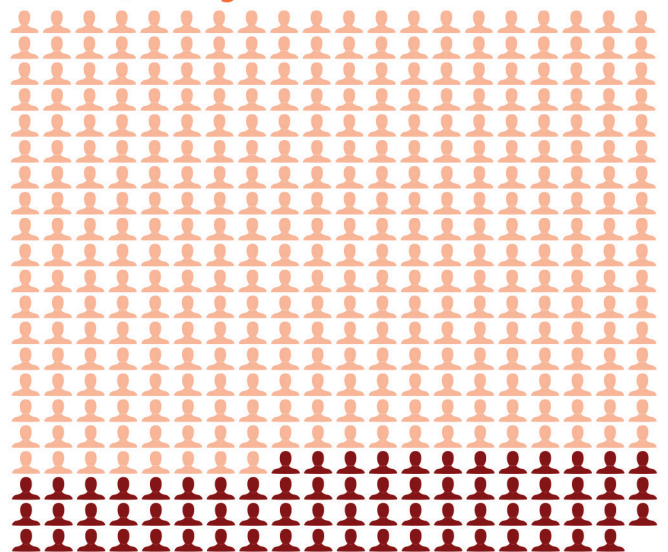
creating
automated-vehicle
systems with more than **50** collaborators



350+
active projects



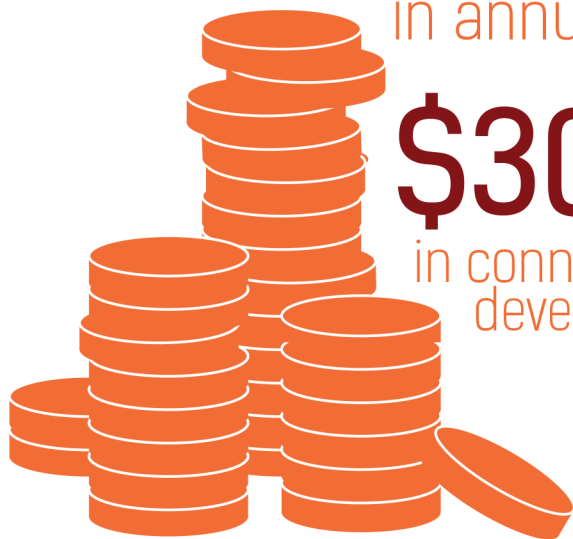
475 [368 in 2013]
employees




at a glance



~\$40,000,000+
in annual sponsored research
[includes VTT, LLC]



\$30,000,000+
in connected-vehicle research and
development conducted to date

78  **vehicles**
in the VTTI fleet
covering more than
miles
of research
in FY2016

200000



Institute Infrastructure

VTTI has an infrastructure worth more than \$110 million that includes four test beds used extensively for real-world, impactful transportation research; more than 90,000 square feet of building space located on-site in Blacksburg, Va.; and more than 60 owned and leased instrumented vehicles, including connected-automated Cadillac SRXs and an International Lone Star tractor-trailer that will soon be instrumented for automation research.

01. Test Beds

Headquartered at VTTI, the Virginia Smart Road is a 2.2-mile, controlled-access facility managed by the institute and owned and maintained by the Virginia Department of Transportation (VDOT). The road itself is built to Federal Highway Administration specifications and features seven roadside equipment units and two mobile roadside equipment sites that facilitate connected-vehicle communications; an optical fiber communication system; Ethernet fiber transceivers and Ethernet switches; a connected-vehicle-compatible intersection controller model; varying pavement sections and in-pavement sensors; 75 weather-making towers capable of producing snow, rain, and fog; a differential GPS base station for precise vehicle locating; a signalized intersection with complete signal phase and timing control; a wireless mesh network variable control system; and variable pole spacing designed to replicate 95 percent of national highway lighting systems.

In 2014, VTTI partnered with VDOT to unveil the Virginia Connected Corridors (VCC), which comprise the Smart Road and Interstates 66 and 495, as well as U.S. 29 and U.S. 50 (one of the most congested corridors in the U.S.). The VCC is facilitating the real-world development and deployment of connected-vehicle technology via dedicated short-range communications and cellular technology. Using more than 60 roadside equipment units (RSEs) located along the corridors, VDOT and researchers from multiple institutes across the Commonwealth are already implementing connected applications that include traveler information and work zone and incident management. Under the umbrella of the Tier 1 U.S. Department of Transportation Connected Vehicle/Infrastructure University Transportation Center, VTTI, the University of Virginia, and Morgan State University are conducting more than 20 connected projects along the VCC.

In 2015, VTTI partnered with VDOT, Transurban, the Virginia Department of Motor Vehicles, and HERE (a high-definition mapping business) to unveil the Virginia Automated Corridors (VAC). This new initiative will provide an automation-friendly environment that government agencies, auto manufacturers, and suppliers can use to test and certify their systems, providing a system migration path from test-track to real-world operating environments. The VAC will leverage extensive experience in on-road safety research to provide efficient solutions to automated-vehicle testing. The VAC was developed in answer to the Virginia governor's 2015 proclamation declaring Virginia "open for business" in the realm of automated vehicles.

The Virginia International Raceway in Alton, Va., was established as a cooperative agreement through which VTTI can conduct connected and automated projects in a multi-use testing environment that includes both closed-course and open traffic conditions. On site at the raceway is a resort that features a 12-unit complex of residential villas, a lodge, a club house, a full-service restaurant and tavern, administrative offices, and a spa. The raceway track can be configured to five different courses ranging from 1.1 miles to 4.2 miles and includes such topography as hairpin curves and blind passes. The Virginia International Raceway is also home to the Virginia Motorsports Technology Park, which contains the Global Center for Automotive Performance Simulation, an affiliated company of VTTI that features the globe's premier force-and-moment tire test facility.



The Institute is now working towards the creation of a new Virginia Smart Village, which will eventually cover more than 300 acres—including the Smart Road—that will facilitate multiple testing scenarios across numerous automated-vehicle platforms. The village is envisioned to encompass a residential/suburban layout that features real buildings and reconfigurable buildings, roundabout/stop-controlled intersections, automation-compatible pavement markings, hills and curves, and connectivity to the Smart Road. The village will be developed in consultation with campus representatives and industry stakeholders.

02. Blacksburg Facilities

The traditional laboratories at VTTI are housed in two buildings totaling more than 52,000 square feet. Building I is 30,000 square feet and houses office, laboratory, and garage facilities. Low-service laboratories include facilities dedicated to driver interface development, eye-glance data reduction, lighting research, accident analysis, accident database analysis, pavement research, and traffic simulation. The National Surface Transportation Safety Center for Excellence building comprises 22,000 square feet of office and laboratory space and was occupied in July 2006. VTTI expanded its on-site capacity by 7,000 square feet of warehouse space and housing for a shock tube lab, a paint booth facility, and a lighting lab. An additional 24,400 square-foot annex was opened during August 2013.

To supplement and support the focused transportation research of the institute, facilities feature a fully staffed garage and machine shop to instrument experimental vehicles. Technicians and engineers use full-scale machine and welding shops, electronics laboratories, and garage facilities to customize transportation hardware and software designed to collect large amounts of data. These facilities are also used to support the maintenance and expansion of the Smart Road systems and capabilities. Additionally, VTTI occupies an adjacent four-bay, 7,200-square-foot garage. This facility is used to store the VTTI instrumented vehicle fleet and the equipment necessary for research and Smart Road operations.

During FY16, VDOT and VTTI launched the accelerated pavement testing program. The program features a heavy-vehicle simulator—which is housed at VTTI—to continuously apply a weighted load to test pavements. Such testing is conducted across several months and simulates the wear and tear placed on road surfaces. The program is expected to result in cost savings and will enable VDOT to determine how different pavement designs and materials respond to load testing prior to integration on roadways.

03. VTTI Vehicle Fleet

The VTTI vehicle fleet is uniquely instrumented for specific experiments. Researchers use the vehicle fleet for Smart Road tests, and experimental test vehicles are used to develop new instrumentation packages and complement research endeavors. Several of the vehicles are long-term loaners from vehicle manufacturers, VDOT, and other partnering organizations. All vehicles are maintained in-house when possible with fully functional garages and a machine shop. Loaned vehicles are maintained in cooperation with the organization that provided the vehicle. During FY16, VTTI exceeded 200,000 miles across its fleet of 78 motorized, road-legal vehicles (owned, leased, and loaned).

VTI PROJECT HIGHLIGHTS



Groundbreaking Studies

1. Under sponsorship of the National Academy of Sciences (NAS), VTTI continued to work with researchers across the transportation industry on projects using the Second Strategic Highway Research Program Naturalistic Driving Study (SHRP 2 NDS) data sets. The data continue to be used by internal and external clients to answer the greatest transportation challenges of today and into the future, with VTTI managing more than 100 active data use licenses with researchers around the globe. These licenses, along with analysis projects performed with VTTI as the primary contractor, have generated more than \$1 million in research contracts for the institute.
2. VTTI continues to provide SHRP 2 NDS training, data support, and data access to the Federal Highway Administration (FHWA) in support of its Safety Training and Analysis Center. This center will provide training and assistance to state departments of transportation (DOTs) and other federal partners related to the SHRP 2 NDS database.
3. VTTI researchers recently completed a \$4 million congressionally mandated study for the Federal Motor Carrier Safety Administration (FMCSA). The study, which is currently under agency review, assessed the impact of the 34-hour restart provision under naturalistic driving conditions.
4. The FMCSA awarded \$2.5 million to VTTI to demonstrate how hours-of-service regulatory flexibility for sleeper berth use in conjunction with fatigue management

program training could be used to improve driver rest and alertness.

5. Researchers from the institute performed the Google-sponsored Automated Vehicle Crash Rate Comparison using Naturalistic Data study to investigate whether or not self-driving cars are more prone to crashes. The study first examined national crash data and data from NDSs to provide a better estimate of existing crash rates; this information was then compared to data from the Google Self-Driving Car program. Current data suggest that self-driving cars may have low rates of more severe crashes when compared to national rates or rates from naturalistic data sets, but there is too much uncertainty in self-driving rates to draw this conclusion with strong confidence. As self-driving cars continue to increase exposure, it is expected that the uncertainty in their event rates will decrease.
6. VTTI was awarded the Mixed-Function Automation NDS project under the National Highway Traffic Safety Administration (NHTSA) Vehicle Electronic Systems Safety Indefinite Delivery/Indefinite Quantity contract, with funding from the Intelligent Transportation Systems Joint Program Office (ITS JPO). This \$1.5 million project will investigate real-world driver interactions with market-ready mixed-function automation through an NDS. Driver interactions with mixed-function automation features will be observed in operation during mixed traffic under a variety of roadway types, driving conditions, and speeds. The study will involve 120 drivers in

The following are highlighted achievements of the VTTI community during **FY16.**



the Northern Virginia/Washington, D.C., area and will run through November 2017.

7. VTTI researchers were part of a successful team led by the Palo Alto Research Center (PARC) that was awarded a \$3.68 million project aimed at developing a novel traveler signaling system to reduce the transportation network-wide energy consumption.

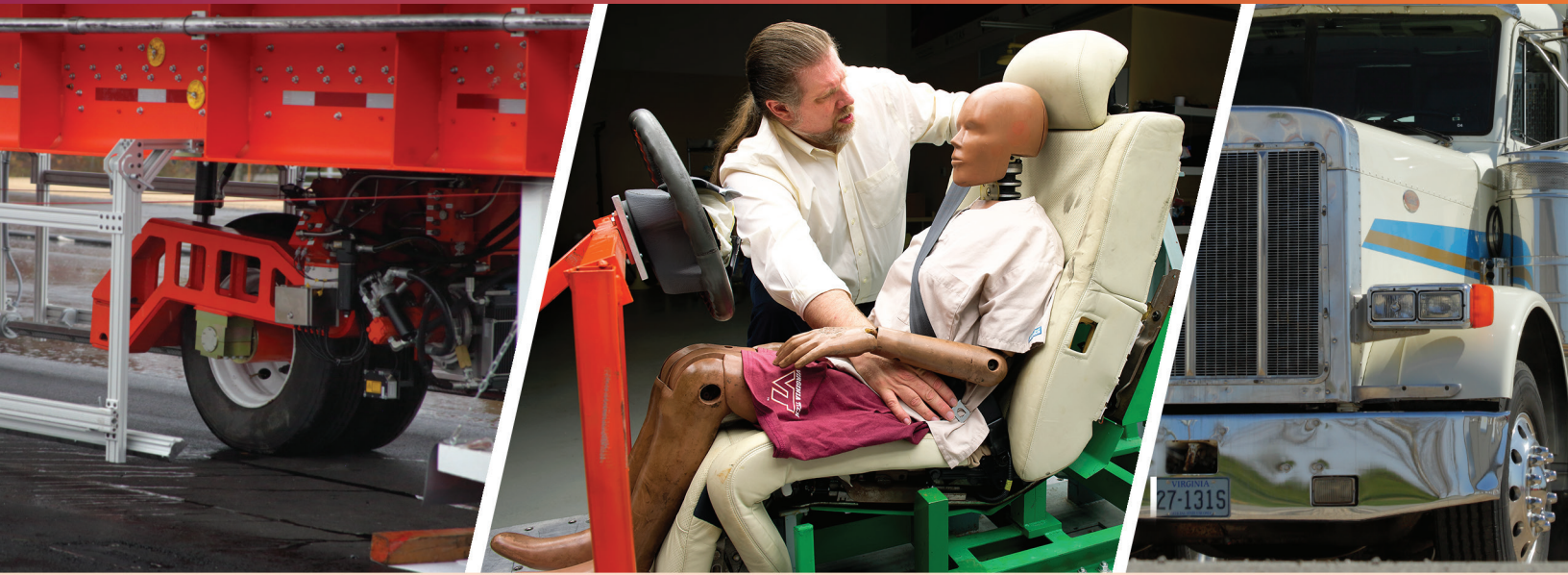
8. VTTI researchers were awarded several competitive projects as part of the Mid-Atlantic Transportation Sustainability (MATS) University Transportation Center (UTC). These projects include developing novel variable parking charging strategies and eco-cooperative adaptive cruise control (Eco-CACC) in the vicinity of signalized intersections for buses and hybrid electric vehicles.

9. NHTSA awarded VTTI with one of several Broad Agency Announcement (BAA) contracts to apply the crash tripartite model to an analysis of crash hotspots in the SHRP 2 NDS database. If successful, Phase II funding could be provided up to \$750,000.

10. VTTI completed a project (C-22) for NAS through the Transportation Research Board (TRB) Transit Cooperative Research Program (TCRP). Entitled Bus Operator Workstation Design for Improving Occupational Health and Safety, this investigation into transit bus design resulted in the production of practical guidance documents and tools applicable to the procurement process and bus design. The guidelines will assist transit agencies and bus manufacturers in integrating improved and emerging technologies, with a focus on the integration of such key stakeholders as bus operators.

11. VTTI continued its strong support of FMCSA research goals by completing the first five-year period of on-road evaluations of technologies that can increase safety and efficiency in the FMCSA Advanced System Testing utilizing a Data Acquisition System (FAST DASH) program. In the second of three evaluations, VTTI measured the performance of an onboard monitoring system that tracks aggressive driving, speeding activity, and safety-belt usage. In the third

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evaluation, VTTI performed a pre-market evaluation of a novel convex mirror design to determine indirect visibility performance and driver acceptance for application among heavy-vehicle mirrors that are essential to vehicle operations, though they are not required by Federal Motor Vehicle Safety Standards (FMVSS).

12. VTTI is leading a study sponsored by the AAA Foundation for Traffic Safety to estimate the societal benefits and costs of heavy-truck advanced safety technologies, including: automatic emergency braking, lane departure warning, video-based onboard safety monitoring, and air disc brakes. The results of this study will provide new data related to the benefits and costs associated with implementing advanced safety technologies on large trucks.

13. The Supervised Practice Driving and Driver Coach databases at VTTI continue to be analyzed, with several publications in process. Several new proposals have also been submitted to further investigate the supervised practice driving period of the graduated driver's licensing process, international teenage NDSs, and teenage risky driving behavior using the Naturalistic Teenage Meta-Database. The meta-database comprises previous teen NDSs conducted at the institute and teen drivers within the SHRP 2 NDS database. Collectively, the meta-database covers 380 16- and 17-year-old drivers, 12 to 24 months of continuous driving data per teen, 321 crashes and 675 near-crashes, and more than 700,000 trips and 200,000 hours traveled.

14. VTTI began a new project sponsored by Clear Roads and the Minnesota DOT to study snowplow equipment causing operator fatigue during winter maintenance operations. This project will result in cost-effective, actionable recommendations to reduce, or eliminate, fatigue caused by snowplow equipment during winter operations.

15. The Commercial Driver Individual Differences Study research team at VTTI finalized recruitment in February 2016, reaching its goal of 21,000 commercial drivers during a 33-month effort.

16. VTTI researchers conducted a SHRP 2 NDS data analysis to examine relationships between crash risk and chronic health conditions.

17. The VTTI-affiliated Global Center for Automotive Performance Simulation (GCAPS), which encompasses the National Tire Research Center (NTRC), the Southern Virginia Vehicle Motion Lab (SoVa Motion), and the Virtual Design and Integration Laboratory (VDIL), continues to provide revolutionary services for both vehicle and tire, including testing, simulation, and modeling. NTRC has achieved significant expansion into new global markets supporting both tire testing and modeling, while SoVa Motion has seen great success supporting teams from multiple racing series. VDIL has developed new modeling and data analysis tools that are being heralded as tremendous steps towards making data analysis and manipulation simple and affordable.

18. VTTI researchers completed the first phase of an investigation into the visibility of police vehicles based on alternatives for lighting and markings. The institute will now embark on a field operational test of the investigated systems.

19. VTTI completed a two-year evaluation of work zone lighting, considering the possible safety implications of glare from work zone lighting and maintenance vehicles. Limits to lighting within the work zone were developed.

20. Through the support of the National Surface Transportation Safety Center for Excellence (NSTSC), VTTI completed a project considering the use of active delineators in a roadway during adverse weather conditions.

21. VTTI and partners were awarded a project that

PROJECT HIGHLIGHTS



considers the impact of roadway lighting on soybean growth and maturity.

22. VTTI researchers completed a second phase of work focused on assessing winter roadway conditions using intrinsic onboard sensors. This information will be shared via connected vehicles to enhance both winter driving safety and winter road maintenance operations of agencies.

23. In collaboration with the Crash Avoidance Metrics Partnership (CAMP; a consortium of auto manufacturers), VTTI researchers worked on a cooperative agreement with the FHWA to identify vehicle-based data that may be shared via connected vehicles to enhance safety applications.

24. The VTTI Center for Injury Biomechanics saw more than \$3 million in expenditures, \$1.5 million in awards, and submitted proposals totaling nearly \$3 million from such sponsors as NHTSA and original equipment manufacturers (OEMs). The center continues to perform innovative research investigating human tolerance to impact loading, with applications in automobile safety and military restraints.

Expanding Collaborations

1. VTTI is a partner on a multidisciplinary VT team that was awarded a \$1.1 million grant from the National Science Foundation (NSF) to develop a framework that integrates techniques from various areas (e.g., network science, machine learning, wireless communications, power systems, and psychology) to develop processes that can provide smart city systems the resiliency to recover from failures that may occur, such as natural disasters or malicious attacks. The team will be focused on designing resilient techniques that consider technologies and the humans who use them. This grant is part of the NSF initiative known as Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP).

2. VTTI researchers continue to collaborate with 34 organizations that include Booz Allen Hamilton, Denso, Google, General Motors (GM), Mercedes-Benz, Volkswagen, and Bosch under the NHTSA Vehicle Electronic Systems Safety Indefinite Delivery/Indefinite Quantity contract. This team was organized to answer all aspects of the NHTSA project, including electronics safe reliability, cybersecurity, vehicle automation, and related human factors considerations.

3. The Virginia DOT (VDOT) and VTTI launched an accelerated pavement testing program, which uses a heavy-vehicle simulator that continuously applies a weighted load

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to test pavements for several months. This testing simulates the natural wear and tear caused by heavy trucks on road surfaces. The program is expected to result in cost savings in road maintenance and will enable VDOT to determine how different pavement designs and materials respond to load testing prior to integration on the road.

4. VTTI continues to propose task orders released under a contract from TRB of NAS worth an initial potential of \$2 million, with the possibility of additional funds, to: 1. Identify critical issues associated with connected and automated vehicles that state and local transportation agencies and the American Association of State Highway and Transportation Officials (AASHTO) will face; 2. Conduct research to address those issues; and 3. Conduct related technology transfer and information exchange activities.

5. In partnership with VT electrical and computer engineering faculty, VTTI continued development of a wearable roadside worker safety system (vest and hard hat) that warns workers and drivers of impending conflicts in highway work zones and other areas.

6. VTTI continued to work with FHWA and AASHTO to provide data sets and support to nine state DOT research teams working on Phase II Implementation Assistance Program projects. The goal of these efforts is to identify safety problems and generate countermeasures that reduce risk and prevalence.

7. VTTI worked with FHWA to provide data sets to six research teams working in their respective BAA efforts. These efforts are targeted towards the generation of safety interventions that reduce the incidence and severity of vehicular crashes.

8. In collaboration with the University of Utah, VTTI submitted a National Institutes of Health (NIH) R21 proposal to estimate the overall prevalence of obesity, diabetes mellitus and medication use, kidney disease, dipstick urinalysis results, and hypertension in a large cohort of truck drivers.

9. VTTI submitted a National Institute of Occupational Safety and Health (NIOSH) R21 proposal to assess the prevalence of mental disorders on long-haul truck drivers.

10. Institute researchers submitted an internal NIOSH proposal (i.e., acting as a subcontractor for NIOSH) to evaluate a fatigue management program in commercial trucking operations.

11. VTTI is collaborating with NSTSCE and the National Occupational Research Agenda (NORA) Oil and Gas Extraction Sector, through affiliates within the Center for Disease Control (CDC) and NIOSH, to investigate factors among oil and gas service fleets (e.g., shift, roadway, and driver performance) that are associated with a high number of vehicle-related fatalities. A pilot study has been completed, and new efforts are underway to identify good practices among large fleets and distribute them among small fleets while collecting naturalistic driving and in-vehicle monitoring system data.

12. VTTI is continuing its collaboration with Intelligent Automation, Inc. (IAI) to develop a robust Multi-modal Driver Distraction and Fatigue Detection/Warning System (MDF) for commercial vehicle operations. This FMCSA-sponsored Small Business Innovation Research (SBIR) project was recently awarded Phase II funding. VTTI is providing expertise in the areas of driver fatigue, drowsiness, and distraction; access to its large naturalistic collection of approximately 10 million commercial vehicle miles; and testing of the MDF system with drivers on a heavy-vehicle/commercial vehicle simulator.

PROJECT HIGHLIGHTS



13. VTTI researchers reached out to the Federal Transit Administration (FTA) in an effort to collaborate on a fatigue management program for the transit industry. A proposal was submitted to design and implement a fatigue management program for transit operators.

14. VTTI researchers met with a representative of the VT Department of Human Nutrition, Foods, and Exercise to initiate collaborative work targeting commercial drivers and behavioral health interventions.

15. VTTI collaborated on a recent proposal effort with Transit Resource Center, a consulting and management organization dedicated to serving bus transit systems, school bus operations, and privately owned fleet operations. Although the proposal was not funded, a relationship for future collaborations was established.

16. VTTI researchers hosted several meetings with potential collaborators, including: 1. Trucking representatives from the Old Dominion Chapter to discuss driver health and sleep apnea; 2. Health Promotion Solutions to discuss opportunities within the areas of health and commercial motor vehicle safety; and 3. Volvo truck group representatives to be considered for priority university status.

17. VTTI researchers completed a study with NIOSH that assessed sleep patterns of truck drivers; the results were recently published in Accident Analysis and Prevention.

18. VTTI began a collaboration with the VT Extension Service and the Illinois DOT for a study about the impact of roadway lighting on the growth of soybeans.

19. VTTI has partnered with Texas Transportation Institute for an FHWA Office of Safety Indefinite Delivery/Indefinite Quantity contract.

20. VTTI researchers met with Liebherr Mining to discuss collaborative research opportunities.

21. The I-81 Corridor Coalition at VTTI recently finished a project focused on providing information to heavy vehicles for overnight parking. A framework for a commercial mobile application system was developed for locating and reserving parking spaces.

22. VTTI researchers have submitted a proposal to the Intelligent Transportation Society of America (ITSA) that focuses on evaluating driving performance when drivers are engaging in secondary tasks using voice command technologies. The study will assess driving performance metrics that have a known association with crash occurrence (e.g., eyes-off-road metrics) and will incorporate device familiarity and training.

23. VTTI was a subcontractor to North Carolina A&T State University on its Tier 1 UTC submission for a Center for Advanced Transportation Mobility to address Americans with Disabilities Act (ACT) paratransit offerings. The study

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will focus on new and innovative methods of expanding public transportation access to vulnerable users, ensuring equitable and appropriate connectivity while allowing transit operators to improve the sustainability of their operations.

24. VTTI was a subcontractor to a Drexel-led NSF submission titled Predictive Analytics of Driver's Engagement for Transitioning to Semi-Autonomous Driving. The goal of this project is to leverage the SHRP 2 NDS database to develop predictive analytics tools that will address Level 2 automated-vehicle driving challenges by detecting a driver's disengagement from the driving task.

Innovative Technologies

1. A provisional patent was obtained for the VTTI-developed connected motorcycle helmet. The helmet system, which incorporates dedicated short-range communications (DSRC), allows motorcyclists to participate in a connected-vehicle network. The helmet was designed by VTTI so that motorcyclists can take advantage of the safety benefits that other vehicles gain when they are able to communicate with each other and with surrounding infrastructure. The helmet is able to receive messages so that it can alert the rider to traffic and road conditions, general emergency alerts, and any other scenario for which the system is programmed. The motorcycle helmet is also able to transmit messages.

2. VTTI is serving NHTSA in an active investigation of the range of heavy-vehicle configurations, including single-unit trucks, buses, and such combination vehicles as tractor-trailers and combination buses that may require alternative parameters to communicate vehicle operations among vehicle-

to-vehicle DSRC safety applications. A significant initiative in this project involves the development of a technology solution set to automatically measure trailer lengths among tractor-trailers. VTTI is leveraging its broad range of industry, trade association, and research affiliates to disseminate and deliver results that can serve our nation's entire heavy-vehicle transportation network.

3. VTTI is engaged in discussions with a heavy-vehicle manufacturer, suppliers, and technology providers to develop an automated tractor-trailer vehicle demonstrator that can be applied for testing and evaluation of a range of automated-vehicle control and monitoring capabilities.

4. VTTI has developed two alternative lighting measurement configurations for its internally developed Roadway Lighting Measurement System, including a towed version for tunnel lighting and a robot version for the measurement of sidewalks and in off-roadway conditions.

Enhancing Outreach and Education

1. VTTI, Transurban, and VDOT offered federal and state officials a hands-on experience with advanced vehicular technology during a demonstration held in Northern Virginia as part of the Virginia Connected and Automated Corridors initiatives. Participants traveled a 10-mile stretch of an interstate highway in automated and connected vehicles to learn how such vehicles can improve safety, increase mobility, enhance sustainability, and reduce congestion. U.S. Sen. Mark Warner, U.S. DOT Assistant Secretary for Research and Technology Greg Winfree, VT President Tim Sands, Virginia

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Secretary of Technology Karen Jackson, VDOT Commissioner Charles Kilpatrick, and Virginia Department of Motor Vehicles Commissioner Richard Holcomb were among the participants.

2. VTTI created a new center (the Center for Public Policy, Partnerships, and Outreach) to assist with the needed models of rules and regulations for advanced vehicles, provide research to ensure state and federal policies are based on relevant data, develop partnerships to assist in the development of new systems, and enhance VTTI research areas and sponsorship diversity. The center works with stakeholders whose interests are affected by governmental decisions on federal, state, local, or international levels in the development and implementation of automated-vehicle systems. The nature of this work is intended to inform policymakers, OEMs, and automotive suppliers on a range of issues related to transformational transportation technologies, including those associated with connected- and automated-vehicle systems; shared mobility networks; and the development of Smart City solutions, including the resiliency of these systems and networks.

3. Planning is well underway for the Fifth International Naturalistic Driving Research Symposium, which will be hosted by VTTI in late August 2016. Ron Medford of X (formerly Google[x]) and Dr. Bruce Simons-Morton of NIH will be keynote speakers. Eight sessions of panels and papers, plus a poster session, are scheduled for this biennial event

that attracts representatives from government, industry, and academia worldwide. The symposium will be followed by two additional conferences: the Motorcycle Research and Technology Workshop and the Women in Transportation Seminar – The Future of Transportation. Keynote speakers for the Women in Transportation Seminar are Deborah Hersman of the National Safety Council and Dr. Ann Brach of TRB.

4. With support from the VT Graduate School and in collaboration with affiliated faculty in civil and environmental engineering, industrial and systems engineering, psychology, and statistics, VTTI continues to offer the next generation of researchers the opportunity to gain in-depth understanding and hands-on experience and guidance in the area of transportation safety through the Human Factors of Transportation Safety Graduate Certificate Program. Four graduate students are currently enrolled in the certificate program, and three certificates have been awarded since the program began in 2014.

5. An NSTSCE project focused on disseminating results of completed studies was conducted and completed. Two-page fact sheets were created that summarized select studies to a non-technical audience. The fact sheets were made available on the VTTI website.

6. VTTI researchers worked with six students from various institutions of higher education in support of their

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submissions for the SHRP 2 Student Paper Competition. The winners of the competition will present the results of their research at the Naturalistic Driving Research Symposium in Blacksburg, Va.

7. GCAPS has provided internships for VT mechanical engineering students and has actively supported the Patrick Henry Community College Motorsports Program. Center representatives also sit on advisory committees for Danville Community College and host interns from the Danville-area Academy for Engineering and Technology program, which encompasses high school students interested in engineering careers.

8. A VT mechanical engineering senior design team, co-advised by VTTI, presented its work at the Insurance Institute for Highway Safety (IIHS) Roundtable. The team designed a bumper to limit damage to vehicles under-riding the back of tractor-trailers.

9. Several VTTI researchers completed the National Highway Institute Instructor Certification Program.

10. VTTI hosted the Direct Delivery Leadership Council (DDLC), during which several institute researchers gave presentations on leading-edge research being conducted at VTTI that would benefit DDLC members. Opportunities for collaborative research were also discussed.

11. As part of the relationship between VTTI, NSTSCE, and the NORA Oil and Gas Extraction Sector, VTTI spoke to the Oil and Gas Extraction Council, Motor Vehicle Working Group in Houston, Tex., about the VTTI and NIOSH In-Vehicle Monitoring System Project.

12. Following completion of the TCRP Project C-22 investigation into transit bus operator workstation design and procurement process, VTTI shared the project purpose and tools available with the transit industry during the following

meetings: NAS, TCRP Oversight and Project Selection (TOPS) Committee Meeting in June 2016 in Irvine, Cal.; the Washington State Transit Insurance Pool (WSTIP), 2nd Quarter Board Meeting in June 2016 in Walla Walla, Wash.; and the 1st Annual MTA Bus Safety Symposium in May 2016 in New York City, N.Y. These dissemination activities have provided opportunities to also discuss the needs of bus operators in the transit industry as our nation seeks to arrive at solutions that eliminate pedestrian fatalities related to public transportation. These solutions require novel approaches to bus design, collision avoidance applications, and deterministic testing protocols supported by government guidance based on performance standards.

13. VTTI researchers presented on truck- and bus-related safety topics nationally and internationally, including the 22nd Intelligent Transportation Systems World Congress in Bordeaux, France; the VDOT 2015 Richmond District Snow Conference; the Michigan 2015 Winter Operations Conference; and the Travelers/Northland Insurance Safety Day Symposium.

14. VTTI researchers used the first large-scale, crash-only naturalistic driving database (i.e., SHRP 2 NDS) to publish new findings in the Proceedings of the National Academy of Sciences. The study found that drivers more than double their crash risk when they choose to engage in distracting activities that require them to take their eyes off the road (e.g., using a handheld cell phone, reading or writing, or using touchscreen menus on a vehicle instrument panel). Drivers also engage in some type of distracting activity more than 50 percent of the time they are driving. The study also found that drivers increase their crash risk nearly tenfold when they get behind the wheel while observably angry, sad, crying, or emotionally agitated.

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15. VTTI researchers co-authored a manuscript published in the journal SLEEP. The paper, titled “Nonadherence with Employer-Mandated Sleep Apnea Treatment and Increased Risk of Serious Truck Crashes,” was a result of institute collaboration with the University of Minnesota, Harvard Medical School, and Schneider National Inc. on an obstructive sleep apnea case study project.

16. A VTTI researcher authored a systematic literature review on the prevalence of metabolic syndrome among commercial motor vehicle drivers in the United States. The manuscript was accepted to the Journal of Transport and Health and will be published in 2016.

17. In co-sponsorship with FMCSA, TRB, and the National Transportation Safety Board, VTTI will co-host the 10th International Conference on Managing Fatigue to be held in San Diego in March 2017. This conference series is an established and respected forum for research updates and discussions within the fatigue management community. Each conference has primarily focused on the effects of fatigue in the transportation sector and has involved support from government, industry, and academia. Sectors beyond transportation – including natural resources, mining, healthcare, and the military – have also played an important role in the event.

Additional Accomplishments

1. VTTI was named “Best of R&D in Virginia” by Southern Business & Development magazine, as selected by a group of approximately 50 economic developers, educators, economists, site consultants, and chief executive officers in the south.

2. Using the SHRP 2 NDS database, more than 20 new naturalistic study findings are in the process of being submitted to—or have already been submitted to—high-impact journals, including Accident Analysis & Prevention, Adolescent Health, Gerontology, and the New England Journal of Medicine.

3. VTTI researchers developed an award-winning automatic congestion identification model that can map and calculate the impact of weather and road visibility on traffic. The researchers recently received the best paper award for this model at the Second International Conference on Vehicle Technology and Intelligent Transport Systems in Rome, Italy.

4. Two graduate students working with VTTI each won a scholarship award from the Dwight David Eisenhower Transportation Fellowship Program.

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INSTITUTE ORGANIZATION

VTTI Centers, Groups, and Initiatives

Center for Advanced Automotive Research

(Created in 2013; Zac Doerzaph, Director)

The Center for Advanced Automotive Research focuses on the research, development, and evaluation of next-generation automotive systems. The center is staffed by a multidisciplinary team of dedicated individuals who are passionate about improving the safety and efficiency of our nation's transportation system. This team strives to solve a broad set of challenges associated with integrating cutting-edge technologies into the vehicles of tomorrow. The primary research areas of the center include crash warning/avoidance/mitigation systems, connected vehicles, driver-vehicle interfaces, crash causation, and vehicle automation.

Center for Automated Vehicle Systems

(Created in 2013; Shane McLaughlin, Director)

The Center for Automated Vehicle Systems uses an interdisciplinary approach to studying all aspects related to the automation life cycle in the field of transportation. The center conducts pragmatic research based on a

scientific approach that emphasizes the importance of safety, security, reliability, and user acceptance. The center is anchored in applied research and is strengthened by collaborations with national and international partners in vehicle automation, including Google, General Motors, and other groups involved in the research, planning, policy, and production of automated vehicles. The goal of this center is to strengthen the safety benefits of automation across all levels of the transportation industry.

Center for Data Reduction and Analysis Support

(Created in 2013; Miguel Perez, Director)

The Center for Data Reduction and Analysis Support provides standardized access to and analysis of naturalistic driving study data sets housed at the Institute; these data sets currently comprise 2.5 petabytes of information about real-world driver behavior and performance. Users include researchers within and outside of the Institute, government entities, and automotive manufacturers and suppliers. Center services include coding of video and audio data, data quality assurance, data standardization, data mining, event selection, and data analysis. The center actively supports data analysis collaborations with external institutions.

Center for Infrastructure-based Safety Systems

(Created in 2010; Ron Gibbons, Director)

The Center for Infrastructure-based Safety Systems focuses on roadway-based safety systems, such as lighting, visibility treatments, pavement markings, signage, signals, barriers, the interaction of visibility with roadway design,

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and weather considerations. The center is conducting research into myriad topics that include: increasing active sign legibility during foggy conditions; evaluating the effects of lighting source, type, and power on driver performance; assessing airport garage lighting; and determining the durability of pavement markings. The center contains the Eco-Transportation and Alternative Technologies Group, which is currently conducting an investigation into the potential use of paired types of commercially available vehicle detection technologies designed to reduce false readings at intersections that result in inefficient traffic flow.

Center for Injury Biomechanics

(Created in 2006; Warren Hardy, Director)

The Center for Injury Biomechanics is a partnership between VTTI, the Virginia Tech Department of Mechanical Engineering, and the Virginia Tech-Wake Forest University School of Biomedical Engineering and Sciences. The center conducts research into injury biomechanics, injury modeling, and transportation-related injury biomechanics. Center work includes an in-depth study of road-departure crashes in the U.S. to determine conditions such as speed and topography. Other transportation-related injury research includes car crash

tests, large-scale tissue testing, NASCAR-Indy restraint testing, advanced restraint tests, guardrail evaluations, child seat evaluations, airbag-induced eye injuries, the development of a synthetic eye, elbow joint injuries from side airbags, wrist injuries, upper extremity dummy design, posterior rib fractures from side airbags, child dummy neck evaluations, small female neck interactions with side airbags, airbag out-of-position testing, and the development of a pregnant occupant model.

Center for Public Policy, Partnerships, and Outreach

(Created in 2016; Myra Blanco, Director)

The Center for Public Policy, Partnerships, and Outreach assists with the needed models of regulations for advanced vehicles, such as driver assistance systems and connected and/or automated vehicles. The center provides research to ensure state and federal policies are based on relevant data, develops partnerships to assist in the advancement of new systems, and enhances the research areas and sponsorship diversity of VTTI. The center works with stakeholders whose interests are affected by governmental decisions on federal, state, local, or international levels in the development and implementation of automated-vehicle systems.

FY16



Center for Sustainable Mobility

(Created in 2004; Hesham Rakha, Director)

The Center for Sustainable Mobility conducts research relevant to society's transportation mobility, energy, environmental, and safety needs. The center translates the results of research into realistic and workable applications, creates and provides tools needed to apply developed knowledge and processes, and educates qualified engineers to meet today's transportation demands and tomorrow's transportation challenges in the areas of transportation network control, large-scale transportation system modeling, traffic state prediction using large data and artificial intelligence techniques, transit bus real-time routing and scheduling, vehicle energy and environmental modeling, transportation system modeling, and eco-transportation applications. The Center for Sustainable Mobility has worked and is currently working on numerous projects funded by the U.S. Department of Transportation, the U.S. Department of Energy, the Virginia Department of Transportation, and the Federal Transit Association. The center is developing eco-routing, eco-cooperative adaptive cruise control systems, and traffic signal control systems that enhance the efficiency, mobility, environmental impacts, and safety impacts of the transportation system.

Center for Sustainable Transportation Infrastructure

(Created in 2006; Gerardo Flintsch, Director)

The Center for Sustainable Transportation Infrastructure focuses on asset management; pavement design, analysis, rehabilitation, and safety; infrastructure management; civil engineering materials; non-destructive testing; and

life-cycle cost analyses. The center houses the Infrastructure Management Group and the Sensing, Modeling and Simulation Group. The center initiated a consortium of state highway agencies and equipment manufacturers dedicated to enhancing pavement surfaces. The center also tested a product that extends the life of the road surface and retains de-icing chemicals on the surface, giving road crews time to deploy during inclement weather. The center was instrumental in developing a way to include the environmental impact of road materials in the decision-making processes during road construction. In 2015, VTTI welcomed the first Sideway-force Coefficient Routine Investigation Machine to the United States in a project funded by the Federal Highway Administration; the project objective is to assist states in the development of Pavement Friction Management Programs and demonstrate continuous friction and macro-texture measurement equipment.

Center for Technology Development

(Created in 2003; Andy Petersen, Director)

The Center for Technology Development specializes in developing, implementing, and maintaining innovative systems for transportation research. The center includes the Mechanical Systems Group, which is responsible for mechanical fabrication to suit the needs of all research projects; the Data Acquisition Group, which is responsible for electronic hardware design; and the Advanced Development Group, which is responsible for software development. The Data Acquisition Group is a pioneer in distributed data acquisition systems. The Advanced Development Group includes specialists in machine vision, road tracking, and data analysis.

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Center for Technology Implementation

(Created in 2016; Mike Mollenhauer, Director)

The Center for Technology Implementation was created to facilitate technology deployment and leverage existing research investments. The center makes it possible for the Institute and its sponsors and clients to participate in early-stage technology implementation programs. Center personnel can help develop a toolbox of modular software solutions that can be applied in new jurisdictions, building smart solutions that combine the best commercial products with customization that can fully address agency goals.

Center for Truck and Bus Safety

(Created in 2005; Rich Hanowski, Director)

The Center for Truck and Bus Safety focuses on the research, development, and evaluation of heavy-vehicle systems. The center is dedicated to the design, delivery, and implementation of leading-edge research and development efforts aimed at improving the health and safety of heavy-vehicle drivers. The center comprises the Behavioral Analysis and Applications Group, the Human Factors and Advanced System Testing Group, and the Safety and Human Factors Group. Center research includes refining and testing rear-lighting configurations to reduce the number and severity of rear-end crashes,

determining safe hours of service for commercial motor vehicle drivers, evaluating causes of drowsiness and providing countermeasures, and developing education programs to keep drivers healthy and alert.

Center for Vulnerable Road User Safety

(Created in 2013; Jon Antin, Director)

The Center for Vulnerable Road User Safety conducts research and outreach designed to enhance safety for all vulnerable road users, including senior and teen drivers, bicyclists, and pedestrians. Vulnerable road users comprise all age groups and a variety of demographics; their one shared trait is an increased risk of suffering a traffic-related crash or injury. The center includes the Teen Risk and Injury Prevention Group and the Senior Mobility Awareness, Safety, and Health Group. Research includes a naturalistic driving study of novice teen drivers with the aim of providing real-time feedback, gathering information for driver training, and keeping teens' parents informed. The center has undertaken outreach initiatives designed to provide recommendations for coordinating public and private services for the aged, disabled, and indigent populations.

FY16



Connected Vehicle/Infrastructure University Transportation Center

(Created in 2012; Thomas A. Dingus, Director)

Virginia Tech/VTTI, the University of Virginia, Morgan State University, and the Virginia Department of Transportation teamed to develop a Tier 1 University Transportation Center headquartered at VTTI. Robust vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-device communication will enable applications addressing the U.S. Department of Transportation strategic goals of safety, state of good repair, economic competitiveness, livable communities, and environmental sustainability. The center conducts connected-vehicle research using the Virginia Connected Corridors, which comprise the Virginia Smart Road and Interstates 66 and 495, as well as U.S. 29 and 50. The corridors are equipped with wireless roadside communication technology. The center has more than 20 active research projects that include in-vehicle notifications of a stopped school bus ahead—especially when the bus is stopped over a hill or around a blind curve—and communication devices installed in safety vests worn by road workers to alert workers and vehicle operators when an on-foot worker is in danger of being struck.

Global Center for Automotive Performance Simulation

(Created in 2010, Opened in 2013; Frank Della Pia, Director)

The Global Center for Automotive Performance Simulation is a world-class facility that provides revolutionary services for both vehicle and tire, including testing, simulation, and modeling. The center comprises the National Tire Research Center, the Southern Virginia Vehicle Motion Labs, and the Virtual Design and Integration Laboratory. Collectively, these initiatives provide the full range of services essential for creating a more dynamic product through both virtual and physical development. The center is affiliated with Virginia Tech and VTTI and is located in Southern Virginia.

International Center for Naturalistic Driving Data Analysis at Virginia Tech

(Created in 2008; Clark Gaylord, Chief Information Officer)

The International Center for Naturalistic Driving Data Analysis incorporates Virginia Tech's petabyte-scale, high performance data storage system into the VTTI data infrastructure. This allows data from multiple naturalistic driving studies to be analyzed using high performance computational systems to perform more complex computational algorithms and data mining.

The 48-node compute cluster of the Institute moves data between the field and the data center, decrypts data, prepares data files for ingestion to a 500-terabyte scientific data warehouse, processes video files, and provides a platform for advanced analytical processing. A peta-scale archive file

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system will ultimately facilitate the long-term storage of numerous petabytes of data while maintaining data in an online state.

VTTI data center features include a computational cluster, the application of the Virginia Tech High Performance Computing Storage System, and a significant upgrade to the storage system supporting the scientific data warehouse environment at VTTI. These systems compose the foundation for data-intensive scientific research programs conducted at VTTI, particularly the Second Strategic Highway Research Program Naturalistic Driving Study.

Motorcycle Research Group

(Created in 2007; Shane McLaughlin, Group Leader)

The Motorcycle Research Group was born from a history in transportation research; concern about an increasing number of motorcyclist fatalities and injuries; and the excitement of a large number of VTTI engineers, staff, researchers, and family who are riders. The group focuses on riders and their machines while considering other factors in the surrounding transportation system. Group researchers have conducted the first large-scale naturalistic motorcycle study, the aim of which is to explore motorcycle crash causation and to develop crash countermeasures.

National Surface Transportation Safety Center for Excellence

(Created in 2006; Jon Hankey, Director)

The National Surface Transportation Safety Center for Excellence was established by the Federal Public Transportation Act of 2005 to develop and disseminate advanced transportation safety techniques and innovations in both rural and urban communities. Center research focuses on four major objectives: 1) To develop and test transportation devices and techniques that enhance driver performance; 2) To evaluate the roadway environment and infrastructure-based safety systems; 3) To address mobility for vulnerable road users; and 4) To examine driver impairment issues.

Sponsors, Clients, and Partners

The continued success of VTTI is due, in large part, to its sponsors, partners, clients, and stakeholders. VTTI would like to acknowledge the contributions and support of the following organizations:

- 3M
- AAA
- AAA Foundation for Traffic Safety
- AAA Mid-Atlantic
- Acclaro Research Solutions, Inc.
- ACF
- Alliance of Automobile Manufacturers
- American Association of Motor Vehicle Administrators
- American Association of State Highway and Transportation Officials
- American Transportation Research Institute
- Amoco
- Applied Research Associates
- Arete Associates
- Arlington County, Va.
- Association for Unmanned Vehicle Systems International
- Association of Global Automakers
- Assured Information Security
- Atkins Global
- Atlantic Construction Fabric
- Attention Technologies, Inc.
- Auburn University
- Autoliv
- Automotive Events
- B&W Pantex
- Battelle
- B-Con Engineering, Inc.
- Beam Brothers
- Bedford County, Va.
- Bekaert
- Betty Serian and Associates
- Bishop Consulting
- BMW
- Booz Allen Hamilton
- Bosch
- BP Amoco
- Bridgestone
- Brigham Young University
- California Department of Transportation
- Calspan
- Cambridge Systematics
- Canadian Council of Motor Transport Administrators
- Capital Area Transit System in Baton Rouge
- Carnegie Mellon Robotics Institute
- Carnegie Mellon University
- CARPI USA
- Case Western Reserve University
- Catapult Transport Systems
- Center for Innovative Technology
- Cernet Corp.
- Chen Ryan Associates
- Chrysler
- Cisco Systems
- City of Flagstaff
- City of Richmond
- Civilogix, Inc.
- Clanton & Associates, Inc.
- Clean Air Tech International
- Clear Roads
- Clemson University
- Cohda Wireless
- Colorado Department of Transportation
- Commercial Vehicle Safety Alliance
- Continental Automotive Systems, Inc.
- Con-Way
- Cooper Tire
- Corning Cable Systems
- Crack Sealant Consortium
- Crash Avoidance Metrics Partnership (CAMP)
- Crash Safety Research
- CUBRC
- Delaware Department of Motor Vehicles
- Delaware Technical and Community College
- Delft University of Technology
- Delphi Electronics
- Robert Denaro
- DENSO
- DGE, Inc.
- District Department of Transportation
- DLA Piper
- DMD & Associates
- Donovan Hatem
- Draper Laboratory
- Drexel University

- DRP Performance
- Duke University
- Dunlap and Associates, Inc.
- Dynamic Research, Inc.
- Eaton
- EMMES
- Enercon Services, Inc.
- Engineering & Software Consultants, Inc.
- Ergonomic Analysis, Inc.
- Erie Insurance
- ERTICO
- Escrypt
- European Commission
- Fairfax County Transit
- Fairfax County, Va.
- Federal Highway Administration
- Federal Motor Carrier Safety Administration
- FEV
- Fluor, Va.
- Ford Motor Company
- Foundation for Outdoor Advertising Research and Education
- Fugro Roadware
- General Motors
- General Motors OnStar Division
- George Mason University
- Georgia Department of Transportation
- Glenwood Consulting
- Goodyear
- Google
- Guard Rail of Roanoke, Inc.
- Halifax County, Va.
- Hankook Tire
- Harmonia
- HERE
- Honda
- Hoosier Racing
- Howard/Stein-Hudson Associates, Inc.
- Hubbell Lighting, Inc.
- Human Factors North
- Hume Center
- Hyundai Kia
- Hyundai Motor Company
- IAOV Chemnitz
- IDEA Programs
- Illinois Department of Transportation
- Illuminating Engineering Society of North America
- Institute for Critical Technology and Applied Science
- Institute for Transportation Research and Education at North Carolina State University
- Institute for Work Organizational and Transport Research
- Insurance Institute for Highway Safety
- Intelligent Automation, Inc.
- Intelligent Transportation Society of America
- Interactive Design and Development
- Iowa State University
- Iteris, Inc.
- Jacobs, Edwards, and Kelcey, Inc.
- Jaguar/Landrover
- John Horsley and Associates
- Johns Hopkins University
- Johnson Controls, Inc.
- Kapsch TrafficCom
- Kimley-Horn and Associates
- Korea Advanced Institute of Science and Technology
- Kumho Tire
- Last Resource
- Leidos
- Lisboa, Inc.
- Litton Network Access Systems
- Long Road Racing
- Lord Corporation
- Loughborough University
- Louisiana Public Transit Association
- Maccaferri
- MaineWay Services
- MCI Federal
- Mercedes-Benz
- Meritor WABCO
- Merritt C. Becker, Jr. University of New Orleans Transportation Institute
- Mesilla Valley Transportation
- Michelin
- Mid-Atlantic Broadband
- Minnesota Department of Transportation
- James A. Misener (Consultant)
- Mississippi Department of Transportation
- ModComp
- Montana State University – Western Transportation Institute
- Monterey Technologies, Inc.

- Montgomery County, Va.
- Morgan State University
- Motor Coach Industries
- Motorcycle Safety Foundation
- MRI Global
- Munich Reinsurance America, Inc.
- National Academy of Sciences
- National Academy of Sciences Transportation Research Board
- National Cooperative Highway Research Program
- National Highway Traffic Safety Administration
- National Institute for Occupational Safety and Health
- National Institute of Advanced Industrial Science and Technology in Japan
- National Institute of Aerospace
- National Institutes of Health
- National Parks
- National Private Truck Council
- National Renewable Energy Laboratory
- National Science Foundation
- National Surface Transportation Safety Center for Excellence
- National Transit Institute
- National Transportation Research Center, Inc.
- NAUTO, Inc.
- Navistar International
- NEC Laboratories
- New Orleans Amalgamated Transit Union
- New River Valley Planning District Commission
- Nexen Tire
- Nissan
- Nissan Research Center, Silicon Valley
- Norfolk Southern Railroad
- North American Fatigue Management Program
- North Carolina A&T State University
- North Carolina State University
- Oak Ridge National Laboratories
- Office of the Assistant Secretary for Research and Technology
- Ohio State University
- Oilcom
- Omni Weight Corporation
- Optimal CAE
- OptimumG
- OSRAM SYLVANIA
- Outdoor Advertising Association of America
- PACCAR, Inc.
- Pacific Northwest National Laboratory
- Pacific-Sierra Research
- Parsons Brinckerhoff
- PB Farradyne, Inc.
- PB World
- Peloton Technology
- Penn State University
- Pennsylvania Department of Transportation
- Performance Fuels System
- Philips Lighting
- Pitt Ohio
- Plymouth Rock Assurance
- Princeton Lightwave
- Professional Truck Driving Institute
- PSMJ Resources, Inc.
- Qatar National Research Fund
- Qualcomm
- Realtime Technologies, Inc.
- REI Safety Services, Inc.
- Research and Special Programs Administration
- RGS Associates, Inc.
- Ricardo, Inc.
- RoadSafe
- ROHO, Inc.
- Rowan University
- Rutgers, The State University of New Jersey
- SAE International
- Savari
- Schneider
- Science Applications International Corporation
- Science Museum of Western Virginia
- Scientex
- Scitor Corporation
- SEA Limited
- Security Innovation Company
- Shandong University
- Shenandoah Telephone
- Shentel Service Company
- Siecor/Corning
- Siemens
- Snow Economics

- Software Technology, Inc.
- South Carolina Department of Transportation
- Southwest Research Institute
- Spire Innovations
- Systems Technology, Inc.
- SwissRe
- Takata
- TASS
- Tesla
- Texas A&M Transportation Institute
- Texas Department of Transportation
- TNO Defense, Security and Safety
- TomTom
- TORC Robotics
- Town of Blacksburg
- Toyota
- TransAnalytics
- Transecurity
- Transport Canada
- Transurban
- Travelers Insurance
- TUV Rheinland Mobility, Inc.
- United Defense, L.P.
- University of Alabama at Birmingham
- University of Calgary
- University of Central Florida
- University of Idaho
- University of Illinois
- University of Iowa
- University of Maryland
- University of Massachusetts/Amherst
- University of Massachusetts – Lowell
- University of Massachusetts Medical Center
- University of Michigan Transportation Research Institute
- University of Minnesota
- University of Missouri
- University of Nevada, Reno
- University of New South Wales
- University of North Carolina
- University of North Florida
- University of Pennsylvania
- University of South Carolina
- University of South Dakota
- University of South Florida
- University of Texas at Austin
- University of Utah
- University of Virginia
- University of Washington
- University of Wyoming
- UPS
- U.S. Air Force
- U.S. Army Research Laboratory
- U.S. Department of Agriculture ChooseMyPlate.gov Program
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Department of Justice
- U.S. Department of Transportation
- Valeo Comfort and Driving Assistance Systems North America
- Vehicle Safety Communications 3 (VSC3)
- Veridian
- Virginia Center for Autonomous Systems
- Virginia Department of Conservation and Recreation
- Virginia Department of Environmental Quality
- Virginia Department of Motor Vehicles
- Virginia Department of Rail and Public Transportation
- Virginia Department of Transportation
- Virginia Department of Transportation Operations and Security Division
- Virginia Rail Policy Institute
- Virginia Tech Foundation
- Virginia Tech Parking Auxiliary
- Virginia Tourism Commission
- Virginia Transportation Research Council
- Visteon Corporation
- Volkswagen-Audi
- Volvo
- Volvo Technology of America, Inc.
- Volvo Trucks North America
- Washington State Department of Transportation
- Wayne State University
- Weigh-In-Motion
- West Virginia State
- WESTAT
- Western Research Institute
- Windwalker Corporation
- Wisconsin Department of Transportation
- Wyle Laboratories
- ZFTRW

Outreach and Community Engagement

During FY16, numerous partners, potential sponsors, marketing groups, and conference groups visited VTTI and/or spoke with institute representatives, including:

- American Association of Motor Vehicle Administrators
- Congressional staffers
- Continental Corporation (Mexico)
- Direct Delivery Leadership Council
- Ellen Partridge, Chief Consul, Federal Transit Administration
- Federal Aviation Administration (FAA)
- Girls in Transportation
- Syamal Gupta, Chairman, TCE Consulting Engineers Limited
- Major automobile manufacturers and suppliers
- NanoSonic
- National and local media (see Media Coverage)
- Nicholas Devereux, aide to Senator Mark Warner
- Ohio State University
- Roanoke Valley Governor's School
- Robert Bosch
- Senator Mark Warner
- Teen Safe Driving Summit
- Travelers Insurance
- U.S. Department of Transportation
- Valeo
- Virginia and North Carolina high school students
- Virginia Department of Transportation commissioner and engineers/staff
- Virginia Tech Board of Visitors and spouses
- Virginia Tech Center for Research and Development in International Education
- Virginia Tech Lifelong Learning Institute
- Virginia Tech Police Department Community Day (VTTI participated)
- Virginia Tech President Timothy Sands
- Virginia Tech Science and Engineering for Regional Growth Enterprise
- Virginia Tech students
- Virginia Transportation Research Council
- Virginia Unmanned Systems Commission
- Women's Transportation Seminar International

VTTI staff, in partnership with other employees from the Virginia Department of Transportation (VDOT), also hosted an open house for the general public and a school day event attended by more than 200 students in grades K-12.

VTTI was well represented at several international and national industry conferences, including:

- Direct Delivery Leadership Council Meeting
- ITS America Capitol Hill Tech Showcase
- ITS World Congress
- ITSA Annual Meeting
- Lifesavers Conference
- SAE Government Industry Meeting
- SAE World Congress
- Transportation Research Board Annual Meeting
- Travelers' Transportation Safety Symposium
- Virginia Department of Transportation Career Fair
- Virginia Department of Transportation Roadeo
- Virginia Science Festival

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- 9News
- ABC 10 News
- ABC 13 News Now*
- ABC 5 Eyewitness News
- ABC News*
- Aiken Standard
- Akron Beacon Journal
- Alaska Dispatch News
- Allembro Local
- Alphr
- American Trucker
- Arab News
- ASHE Scanner
- Asia One
- Augusta Free Press*
- The Australian Business Review
- Auto Connected Car News
- Auto World News
- Automated Vehicle Symposium
- Automotive News
- Awful Announcing
- AZCentral
- Bacon's Rebellion
- Baynet World Inc.
- Berkeley Register-Herald
- Beta Boston
- Better Roads
- Bharat Press
- Bidness Etc.
- Blue Mountain Eagle
- Brainerd Dispatch
- Bristol Herald Courier
- The Brownsville Herald
- Bulk Transporter
- Business Insider*
- Business Insurance
- Bustle
- Butler Eagle
- Canadian Underwriter
- Cantech Letter
- Cape Cod News
- Cape Cod Times
- Carrentals.co.uk
- CBC News
- CBS DC
- Charleston Gazette-Mail
- Charleston Post Courier
- Chicago Tribune*
- The Citizens' Voice
- The Christian Science Monitor
- City Lab
- Civil Engineering News Online
- Claims Journal
- Cleveland Sun Times
- Click On Detroit
- CNN Indonesia
- Cody Enterprise
- Collegiate Times*
- Computer World
- Constrution Manager
- Contexto
- Counsel & Heal
- Culpeper Star Exponent
- The Daily Athenaeum
- The Daily Courier
- Daily Herald
- Daily Journal of Commerce
- Daily Mail
- Daily News 724
- Daily News Journal
- Daily News*
- The Daily Progress*
- Daily Rx News
- The Daily Telegraph
- Daily Times Chronicle*
- DC Velocity
- Defense Video & Imagery Distribution Center
- Del Mar Times
- Delmarva Now
- Department of Motor Vehicles
- Digital Journal*
- The Dispatch
- East Oregonian
- eCanada Now*
- ECB Publishing, Inc.
- The Edwardsville Intelligencer
- EHS Today
- El Sol News
- Electronic Engineering Times
- Emergency Management
- Equipment World's Better Roads
- EurekaAlert!*
- Executive Biz
- Extreme Tech
- Eyewitness News
- Fairfax County Times
- Family Circle
- Faribault Daily News
- Fast Company
- Federal News Radio
- Fleet Equipment
- Fleet Owner*
- Fleet Point

- Fleet World
- For Construction Pros
- Fox 5
- Fredericksburg.com
- The Gainesville Sun
- Geek Wire
- glassBYTEs.com
- Global Construction Review
- Global News
- Go By Truck*
- Good Morning America
- Government Technology
- GPS World Magazine
- Hartford Courant
- Health Aim
- Health Canal
- Heavy Duty Trucking*
- Herald Wheels
- Higher Ed Jobs*
- HNGN
- Houston Chronicle*
- The Huffington Post*
- IEEE Spectrum
- Industry Today
- The Inquirer Daily News
- Inside NOVA
- Inside Science
- Inside Unmanned
- Systems
- Insurance Journal
- International Business Times
- Inverse
- Jamaica Gleaner
- The Japan Times
- The Journal of Commerce
- Just Auto
- The Kearney Courier
- The Keene Sentinel
- Keloland Television
- Korea Portal
- KTLA 5
- KX11 News 12
- Lab Manager
- Laboratory Equipment
- Lakeshore Weekly News
- Larry Brown Sports
- Lebanon Democrat
- LEDs Magazine
- Left Lane
- The Legal Examiner*
- The Lemoore Navy News
- Liberty Tribune
- Local Kicks
- Logistics Management*
- Los Alamos Daily Post
- Lost Lettermen
- Malaysia Chronicle
- MarketWatch
- Mashable
- Media Source
- Media Xpress
- Medical Daily
- MH&L News
- Miami Herald
- The Miami News-Record
- Midland Daily News
- The Millbury-Sutton Chronicle
- Minneapolis Star Tribune
- Mlive.com
- The Monitor
- Morrow County Sentinel
- Motherboard
- Murfreesboro Post
- My Journal Courier
- MyFOX8
- myhorrynews.com
- MyInforms.com
- National Post
- NBC Washington
- NBC29*
- New Kerala
- The New York Times*
- The New Yorker
- News 1130
- News 24
- News Channel 5 46
- News Everyday
- News Medical
- News Wise
- News Works
- news.de
- News247
- Newsmax Health
- NewsWise
- The Next Digit
- Next Impulse Sports
- Next Three Days
- Nextgov
- NPR
- NRV News
- NTSB Safety Compass
- Ocala
- The Olympian
- Omaha World Herald
- Opposing Views
- Overdrive
- Phys.org
- Pittsburgh Post-Gazette
- Point of Beginning
- PoliceOne
- Pop Herald

- Pork Network
- Post-Bulletin
- Prime Mover Magazine
- Property Casualty 360
- Providence Journal
- Pulse Headlines
- Quad-City Times
- Rancho Santa Fe Review
- Ravalli Republic
- Reading Eagle
- Reason
- The Recorder
- Richmond Times-Dispatch*
- The Roanoke Times*
- The Roanoker
- RVA News
- San Antonio Express News
- Sarasota Herald-Tribune
- Science Alert
- Science Codex*
- The Scranton Times Tribune
- Seating Chair
- The Seattle Times
- The Sentinel
- Sioux City Journal
- Sleep Review
- Smithsonian Magazine
- Software Development News
- The Spectrum
- Stonehame Patch
- Suffolk News Herald
- The Tampa Tribune
- TC Palm
- Tech Insider
- Tech Times*
- Techlicious
- The Telegraph*
- Three Rivers Publishing, Inc.
- TheTrucker.com*
- The Times Argus
- The Times of India
- Today's Trucking*
- Traffic Technology Today
- Transport Topics*
- Tree Angle
- Treehugger
- Tri-County Times
- TRNS: Talk Radio News Service
- Truck News
- Tucson.com
- Tulsa World
- UberTopic
- The Union
- Union-Bulletin
- University of Minnesota Morris
- USA Today*
- Valley News
- Vancity Buzz*
- Venture Beat
- The Verge
- Vice News
- The Villager
- Virginia Business
- Virginia Tech News*
- The Virginian-Pilot*
- Vocativ
- The Wall Street Journal
- The Washington Post*
- Waste 360
- Waterloo Region Record
- WDBJ7*
- The Weather Space
- Weather Wise
- The Week Magazine*
- The Western News
- WFJA Classic Hits 105.5
- White Mountain Independent
- Wicked Local*
- Wired
- Wireless Goodness
- WJHL11
- Work it SOVA
- World Highways
- World News
- WSAZ 3
- WSET/ABC 13
- WSU News
- WTOP-FM*
- WTVR (NBC 6)
- WVTF Public Radio
- Yahoo! Auto
- Yahoo! News
- YorkDispatch News*
- Your West Valley

*Denotes media outlets that covered VTTI more than once.

PRESENTATIONS, HONORS, MEDIA, AND AWARDS



Jon Antin

Antin, J. F. (2016). Mobility Issues for an Aging Population Panel Session. Presented at the SAE World Congress & Exhibition, Detroit, MI.

Rajaram Bhagavathula

Bhagavathula, R., & Gibbons, R. B. (2016). Driver Eye Glance Behavior at Roundabouts and Its Implications for Pedestrian Safety (No. 16-5469). Presented at the 95th Transportation Research Board 95th Annual Meeting, Washington, D.C.

Bhagavathula, R., & Gibbons, R. B. (2016). New Developments in the Lighting of Intersections. Presented at Lightfair International 2016, April 26, 2016, San Diego, CA.

Bhagavathula, R., & Gibbons, R. B. (2015). A new approach to analyze nighttime roadway visibility through distribution analysis of detection distances. Presented at the 28th Session of the International Commission on Illumination, Manchester, United Kingdom.

Received the Emerging Professional Sponsorship to attend the Illuminating Engineering Society Annual Conference 2015 in Indianapolis, IN.

Myra Blanco

Panelist (2015): Automated Roads, Automated Management, Automated Driving. ITS World Congress, October 2015, Bordeaux, France.

Panelist (2015): Driver Adaptation to Vehicle Safety Technologies. AAA Foundation for Traffic Safety Meeting, August 2015, Washington, D.C.

Panelist (2015): How I Did It: My Journey in the Transportation Field. WTS International Student Chapter Kickoff, September 2015, Blacksburg, VA.

Presenter (2016): The Future of Transportation: Achieving Equity and Mobility Through Self-Driving Vehicles. Japan-America Frontiers of Engineering, June 2016, Irvine, CA.

Presenter (2016): Mixed-Function Automation Naturalistic Driving Study. (Poster.) Japan-America Frontiers of Engineering, June 2016, Irvine, CA.

Presenter (2016): Naturalistic Study of Level 2 Automated Vehicle Functions. (Poster.) Transportation Research Board 95th Annual Meeting, January 2016, Washington, D.C.

Presenter (2015): Human Factors Evaluation of Level 2 and Level 3 Automated Driving Concepts. SIP-adus 2nd Workshop on Connected and Automated Driving Systems, October 2015, Tokyo, Japan.

Presenter (2016): Moving Ahead with Vehicle Automation. Society of Automotive Engineers 2016 Government/Industry Meeting, January 2016, Washington, D.C.

Hao Chen

Chen, H., Rakha, H. A., Loulizi, A., Almannaa M., & El-Shawarby, I. (2016). Development and Field Testing of an Eco-Cooperative Adaptive Cruise Control System in the Vicinity of Signalized Intersections. Presented at ITS America, June 12-16, San Jose, CA.

Tom Dingus

Invited panelist (2015): National Highway Traffic Safety Administration Drowsy Driving Forum, Washington, D.C.

Dingus, T.A., McGhee, C., & Gustafson, D. (2015). Invited panelists: Governor's Transportation Conference, Washington, D.C.

Invited panelist (2015): Virginia Governor's Unmanned Systems Commission, Washington, D.C.

Invited panelist (2015): ITS America Meeting, Pittsburgh, PA.

U.S. Drivers Are Distracted More Than Half the Time They're Behind the Wheel, CityLab, March 8, 2016, <http://www.citylab.com/commute/2016/03/major-distractions-for-drivers/472656/>

Driving while angry or sad increases your risk of crashing by nearly 10 times, ScienceAlert, February 26, 2016, <http://www.sciencealert.com/driving-while-angry-or-sad-increases-your-risk-of-crashing-by-nearly-10-times>

Reading This While You Drive Could Increase Your Risk of Crashing Tenfold, New York Times, February 24, 2016, http://www.nytimes.com/2016/02/24/science/driving-distractions-study.html?_r=0

Distracted Drivers Are Even More Dangerous Than You Thought, Huffington Post, February 24, 2016, http://www.huffingtonpost.com/entry/distracted-driving-study_us_56ccd2a9e4b041136f18a7aa

The biggest distractions that cause car crashes, CBS News, February 23, 2016, <http://www.cbsnews.com/news/biggest-distractions-that-cause-car-crashes/>

Emotional Driving Increases Crash Risk Nearly Tenfold, Study Says, ABC News, February 23, 2016, <http://abcnews.go.com/US/emotional-driving-increases-crash-risk-tenfold-study/story?id=37133840>

Phones Top Crash Risk Factors for Cars, IEEE Spectrum, February 22, 2016, <http://spectrum.ieee.org/cars-that-think/transportation/safety/phones-top-crash-risk-factors-for-cars>

Smart Road on the leading edge of driverless-vehicle efforts, Roanoke Times, October 25, 2015, http://www.roanoke.com/business/news/smart-road-on-the-leading-edge-of-driverless-vehicle-efforts/article_940a2975-f53b-5105-aefe-dfc5ee4c81ac.html

Virginia Seeks Autonomous Research Lead, Driverless Transportation, October 2015, <http://www.driverlesstransportation.com/virginia-seeks-autonomous-research-lead-11375>

The ultimate test for self-driving vehicles: The I-395 express lanes, WTOP, October 19, 2015, <http://wtop.com/sprawl-crawl/2015/10/the-ultimate-test-for-self-driving-vehicles-the-i-395-express-lanes/slide/1/>

Virginia Tech Transportation Institute Tests Automated Vehicle Technology on DC Interstate, Inside Unmanned Systems, October 2015, <http://insideunmannedsystems.com/virginia-tech-transportation-institute-tests-automated-vehicle-technology-on-dc-interstate/>

Zac Doerzaph

Doerzaph, Z. (2015). Advancing Automation in Surface Transportation. Paper presented at the ITS World Congress 2015, Bordeaux, France.

Invited speaker (2015): ITS Delivering Societal Changes. Presented at the ITS World Congress 2015, Plenary Session, October 5-9, Bordeaux, France.

Invited presenter (2015): Safety Pilot Integrated Vehicle Warning Research Overview. Presented at the SAE 2015 Active Safety Systems Symposium, November 4-5, Plymouth, Michigan.

Cristian Druta

Druta, C. (2016). Assessment of Roadway Surface Conditions Using On-Board Vehicle Sensors. Presented at the 95th Transportation Research Board 95th Annual Meeting, ADH010 Committee Session, Washington, D.C. Work sponsored by the Federal Highway Administration.

Druta, C. (2015). Energy Harvesting Technologies for Infrastructure Monitoring. Presented at the 10th Annual Energy Harvesting Workshop, September 15, The Inn at Virginia Tech and Skelton Conference Center, Blacksburg, VA.

Druta, C. (2015). Evaluation of a buried cable roadside animal detection system. Presented at the 2015 International Conference on Ecology and Transportation, Session 205 - Connectivity and safety: mitigation monitoring and analysis, September 2015, Raleigh, NC.

Jianhe Du

Du, J., Guo, F., & Rakha, H. (2016). Evaluation of high occupancy toll lane usage by single occupancy vehicles. Presented at the 95th Transportation Research Board Annual Meeting, Washington, D.C.

Du, J., Rakha H., & Gayah, V. (2015). Transportation Network Control using the Macroscopic Fundamental Diagram. Presented at the IEEE 18th International Conference on Intelligent Transportation Systems, September 15-18, Las Palmas de Gran Canaria, Spain.

Du, J., Rakha, H., & Gayah, V. (2015). Design and evaluation of network control strategies using the macroscopic fundamental diagram. Presented at the IEEE 18th International Conference on Intelligent Transportation Systems, Canary Islands, Spain.
2015 Taylor Technical Talent Award.

Mohammed Elhenawy

Elhenawy, M., Elbery, A., Hassan, A., & Rakha, H. (2015). An Intersection Game-Theory-Based Traffic Control Algorithm in a Connected Vehicle Environment. Presented at the IEEE 18th International Conference on Intelligent Transportation Systems, September 15-18, Las Palmas de Gran Canaria, Spain.

Elhenawy, M., Rakha, H., & Chen, H. (2016). A Unified Real-time Automatic Congestion Identification Model Considering Weather and Roadway Visibility Conditions. Presented at the 2nd International Conference on Vehicle Technology and Intelligent Transport Systems, April 23-24, Rome, Italy. Best Paper Award.

Gerardo Flintsch

Active member, Hispanic Caucus

Instructor (2015): Overview of Lifecycle Thinking Approach for Road Pavements (Transportation Infrastructure), Life Cycle Cost Analysis of Transport Infrastructure, and (Environmental) Life Cycle Assessment of Transport Infrastructure modules at the Summer School 2015 of the Sustainable Pavement & Railway International Training Network, Sept 16-23, 2015, University of Palermo, Palermo, Italy.

Invited presenter (2015): Impact of Pavement Management on the Sustainability of our roadway Networks. (Spanish translation: Impacto de la Gestión de Pavimentos en la Sostenibilidad de Nuestras Redes Viales). Presented at 10º Congreso de la Vialidad Uruguaya, Oct 15-17, 2015, Montevideo, Uruguay.

Member, American Society of Civil Engineers: Infrastructure Systems committee.

Member, American Society of Testing Materials: E-17 – Vehicle-Pavement Systems committee.

Member, Transportation Research Board: Sustainable Pavements AFD00(1) subcommittee (founder); and AFD80 Strength and Deformation Characteristics of Pavement Sections, AFD10(3) International Conferences on Managing Pavements, and AFD20 Pavement Data Collection committees.

Member, Virginia Department of Transportation Asphalt Research Advisory committee.

Member, Virginia Department of Transportation Pavement Research Advisory committee.

Member, Virginia Tech Department of Civil and Environmental Engineering, Curriculum committee.

Member, Virginia Tech College of Engineering, College Diversity committee.

Member, World Road Association/Permanent International Association of Road Congresses: TC D.1 Asset Management committee (secretary and vice-chair).

Speaker (2015): Road Asset Management in Latin-America in Comparison with Other Countries (Gestión de Activos Viales en Latinoamérica y el Caribe vis à vis a Otros Países) outreach seminar at the Inter-American Development Bank, October 7, 2015, Washington, DC.

Ronald Gibbons

Dirt Depreciation on LED Luminaires. (2015). Presented at the Street and Area Lighting Conference 2015, Savannah, GA.

Gibbons, R., Guo, F., Medina, A., Terry, T., Du, J., Lutkevich, P., & Li, Q. (2015). Received the Technical Taylor Talent Award for the best paper in Lighting from the Illuminating Engineering Society.

Lighting at Rural Intersections. (2016). Presented at LightFair International 2016, San Diego, CA.

Moderator (2015): Adaptive Lighting workshop, 28th Session of the International Commission on Illumination, Manchester, United Kingdom.

Nighttime Lighting Research. (2015). Presented to Holophane Lighting, Newark, OH.

Received the Illuminating Engineering Society Illumination 2015 Award of Merit for the design and Development of the Lighting on Demand system for the Smart Road.

Warren Hardy

Danelson, K.A., Kemper, A.R., Mason, M.J., Tegtmeyer, M., Swiatkowski, S.A., Bolte, J.H. IV, & Hardy, W.N. (2016). Comparison of ATD to PMHS Response in the Under-Body Blast Environment. Presented at the Human Injury Assessment in Vehicle Explosions Symposium, June 17, 2016, Imperial College London, London, U.K.

Danelson, K.A., Kemper, A.R., Mason, M.J., Tegtmeyer, M., Swiatkowski, S.A., Bolte, J.H. IV, & Hardy, W.N. (2015). Comparison of ATD to PMHS Response in the Under-Body Blast Environment. Presented at Stapp Car Crash Conference, November 2015, New Orleans, LA.

Hardy, W.N. (2015). ALF Testing: PMHS Procedures. Presented at the Warrior Injury Assessment Manikin Training Event, September 2015, Aberdeen, MD.

Hardy, W.N. (2015). Angular measures in testing, and their implications. Presented at the International Conference on the Biomechanics of Injury, IRCOBI-NOCSAE-PDB-Snell workshop, September 2015, Lyon, France.

Hardy, W.N. (2015). Head impact mechanics in cadavers and animals. Presented at Stapp Car Crash Conference, November 2015, New Orleans, LA.

Hardy, W.N. (2015). The Virginia Tech Center for Injury Biomechanics (video loop presentation). Presented at Stapp Car Crash Conference, November 2015, New Orleans, LA.

Hardy, W.N., Danelson, K.D., Bolte, J.H., & Frunfelker, T. (2016). Female PMHS Testing and Evaluation. Presented at ARL TRR, April 28, 2016, Aberdeen, MD.

Hardy, W.N., Danelson, K.D., Bolte, J.H., & Tice, J. (2015). Characterization of Occupant Response for Accelerative Loading Series 1 (CORALS1). Presented at ARL TRR, October 2015, Aberdeen, MD.

Howes, M.K., Agnew, A.M., Hallman, J.J., & Hardy, W.N. (2015). Evaluation of the Kinematic Responses and Potential Injury Mechanisms of the Jejunum during Seatbelt Loading. Presented at Stapp Car Crash Conference, November 2015, New Orleans, LA.

Howes, M.K., Gabler, H.C., Hallman, J.J., & Hardy, W.N. (2016). Abdominal Injury Patterns in Frontal Crashes: Analysis of Front and Rear Seat Occupants using NASS/CDS and CIREN. Presented at the SAE World Congress and Exhibition, April 2016, Detroit, MI.

Received the 2015 John Paul Stapp Award.

Jeff Hickman

Hickman, J. S., & Eichelberger, L. (2015). Australian Naturalistic Driving Study (ANDS) overview. Presented at the Direct Delivery Leadership Council Meeting, Blacksburg, VA.

Arash Jahangiri*

Jahangiri, A., & Rakha, H. (2015). Transportation Mode Detection using a Distributed Learning Approach. Presented at the 22nd ITS World Congress, October 5-9, Bordeaux, France.

Jahangiri, A., Rakha, H., & Dingus, T. (2015). Adopting Machine Learning Methods to Predict Red-light Running Violations. Presented at the IEEE 18th International Conference on Intelligent Transportation Systems, September 15-18, Las Palmas de Gran Canaria, Spain.

Andrew Kemper

Received the Elaine Wodzin Young Achiever Award from the Association for the Advancement of Automotive Medicine.

Received the distinction of "Leader in Research- Assistant Professor Level" from the Virginia Tech Department of Biomedical Engineering and Mechanics.

Charlie Klauer

Invited lecturer (2015): University of Saskatchewan, Department of Psychology.

Invited panelist (2015): November, 2015: National Highway Traffic Safety Administration Drowsy Driving Forum, Washington, D.C.

Invited presenter (2016): Canadian Council of Motor Transportation Administrators, Ottawa, Ontario, Canada.

Invited presenter (2016): Talking to Teens About Distracted Driving in a Way that Makes a Difference, Lifesavers Conference 2016, April 3-5, Long Beach, CA.

Invited presenter (2015): Managing Young Drivers and Your Fleet Risk. University Risk Management and Insurance Association Conference, October 10-14, Minneapolis, MN.

Invited presenter (2015): Third Annual Virginia Distracted Driving Summit, September 17-18, Virginia Beach, VA.

Member, Beyond Boundaries, Virginia Tech: Finding Funding committee.

Member, Blue Ridge Transportation Safety Board.

Member, International Organization for Standardization: Naturalistic Driving Studies committee.

Member, Transportation Research Board: Vehicle User Characteristics, Operator Education and Regulation committees and Young Driver subcommittee.

New Ways to Curb Distracted Driving, On Point, NPR, May 12, 2016, <http://www.wbur.org/onpoint/2016/05/12/new-ways-to-curb-distracted-driving>

Panelist (2016): National Science Foundation review panel.

Participant (2015): State Farm Electronic Data Interchange planning meeting.

Presenter (2016): Transportation Research Board, Young driver subcommittee.

Presenter (2015): Family and Domestic Court Judicial Conference, Williamsburg, VA.

Presenter (2015): Final briefing to Driver Coach, Toyota Technical Center.

Presenter (2015): International Organization for Standardization Eye Glance Committee.

Presenter (2015): Transportation Research Board, Young driver subcommittee.

Teenage Drivers? Be Very Afraid, The New York Times, March 19, 2016, <http://www.nytimes.com/2016/03/20/fashion/teenagers-driving-parents.html>

Alvaro J. Calle Laguna*

Laguna, A.J.C., Rakha, H., & Du, J. (2016). Optimizing isolated traffic signal timing considering energy and environmental impacts. Presented at the 95th Transportation Research Board Annual Meeting, Washington, D.C.

Shane McLaughlin

McCall, R., & McLaughlin, S. (2015). An Overview of Motorcyclist Naturalistic Data Collections and Experimental Approaches to Rider Safety. Presented at the 2015 National Motorcycle Safety Symposium by the National State Motorcycle Safety Administrators, October 9, Baltimore, MD.

McCall, R., & McLaughlin, S. (2015). An Overview of the MSF100 Naturalistic Riding Study. Invited talk at the Regional Rider Education and Training System, Lynchburg, VA.

McCall, R., McLaughlin, S., Fritz, S., Buche, T. (in press). Riding-day Motorcyclists Riding Frequencies. Presented at the Fifth International Symposium on Naturalistic Driving Research (podium presentation), Blacksburg, VA.

McCall, R., Rainey, C., Williams, McLaughlin, S. (in press). Curves as a Risk Factor for Motorcyclists. Presented at the Fifth International Symposium on Naturalistic Driving Research (podium presentation), Blacksburg, VA.

Williams, V., McLaughlin, S., Atwood, J., & Buche, T. (in press). Factors that Increase and Decrease Motorcyclist Crash Risk. Paper to be presented at The International Motorcycle Safety Conference, October 3-4, 2016, Köln, Germany.

Williams, V., McLaughlin, S., & Buche, T. (in press). Selected Lane Position as Motorcyclists Approach and Traverse Intersections. Paper to be presented at the Fifth International Symposium on Naturalistic Driving Research, August 30-Sept 1, 2016, Blacksburg, VA.

Williams, V., McLaughlin, S., McCall, R., & Buche, T. (in press). Motorcyclists' Self-Reported Riding Mileage Versus Actual Riding Mileage in the Following Year. Paper to be presented at the Fifth International Symposium on Naturalistic Driving Research, August 30-Sept 1, 2016, Blacksburg, VA.

Luke Neurauter

Advancing Transportation through Innovation (2016). Licensing Executives Society Webinar: Advanced Technology Sector.

Blind spots in cars could eventually be a thing of the past, The Washington Post, January 11, 2016, <https://www.washingtonpost.com/news/innovations/wp/2016/01/11/blind-spots-in-cars-could-eventually-be-a-thing-of-the-past/>

Cameras could replace mirrors on cars, Chicago Tribune, January 14, 2016, <http://www.chicagotribune.com/classified/automotive/ct-cameras-replace-mirrors-cars-20160114-story.html>

Demo of SAE Levels of Automation, <https://youtu.be/9PUPb-ks0Q4>

Demo of Virginia Automated Corridors and Virginia Connected Corridors, <https://vimeo.com/142905461>

In technology test, senator is along for the ride — the driver-less ride, The Washington Post, October 19, 2015, https://www.washingtonpost.com/local/trafficandcommuting/2015/10/19/9bc0e078-7697-11e5-a958-d889faf561dc_story.html

Invited panelist (2016): Virginia Tech Transportation Institute School Day.

Selecting the Right Environment when Evaluating HMIs: A Discussion of Methods and Proven Tactics (2016). Automotive Cockpit HMI USA, Ann Arbor, Michigan.

Self-driving car hits Va. highway for key test, FOX 5, October 19, 2015, <http://www.fox5dc.com/news/local-news/36242058-story>

Your next car might not have any blind spots, The Daily Herald, January 17, 2016, <http://www.dailyherald.com/article/20160117/business/160119296/>

Justin Owens

Vulnerable Road Users & ITS: Needs and Opportunities (2016). Transportation Research Board Annual Meeting, Invited Session: User Information Systems for Vulnerable Road Users.

Introduction to VTTI, the Smart Road, and the Senior Mobility, Awareness, Safety & Health Group (2015). Lifelong Learning Initiative, Blacksburg, VA.

Cognitive Distraction: Research Opportunities & Challenges (2015). Third Annual Virginia Distracted Driving Summit, Virginia Beach, VA.

Miguel Perez

Naturalistic Driving: Definitions, Datasets, and Findings (2016). I.DRR & V*Star User Forum, Hilton Harbor Island, San Diego, CA.

Keynote Speaker: Hispanic Americans: Energizing Our Nation's Diversity (2015). National Transportation Safety Board 2015 Hispanic Heritage Month Celebration, National Transportation Safety Board, Washington, D.C.

Virginia Tech study finds emotion spikes risk of car accidents, WFXR (Virginia First), February 2016, Roanoke, VA.

Hesham Rakha

Elbery, A., Rakha, H., El-Nainay, M., Drira, W., & Filali, F. (2015). Eco-Routing Using V2I Communication: System Evaluation. Presented at the IEEE 18th International Conference on Intelligent Transportation Systems, September 15-18, Las Palmas de Gran Canaria, Spain.**

Member, Consortium for Energy Efficiency: Honorarium and P&T committees.

Member, Intelligent Transportation Society of America, Benefits, Evaluation and Cost Committee.

Member, Transportation Research Board: Air Quality, Traffic Flow Theory, Highway Capacity, and Quality of Service committees and Traffic Modeling subcommittee.

Van Essen, M., Rakha, H., Vreeswijk, J., Wismans, L., & Van Berkum, E. (2015). Day-to-day route choice modeling incorporating inertial behavior. Presented at the International Association for Travel Behaviour Research, July 19-23, Windsor, United Kingdom.**

Tara Reel

Vice President of the Virginia Tech Graduate Student Assembly.

Selected as Member: Virginia Tech Graduate Student Representative, Board of Visitors (Appointment begins July 1, 2016).

Served as a teaching assistant for the Sustainable Policy Making and Planning in Europe course at Virginia Tech in summer 2016.

Miao Song

Song, M., McLaughlin, S., and Doerzaph, Z. (2016). An On-Road Evaluation of Connected Motorcycle Crash Warning Interface. Presented paper at the Transportation Research Board 95th Annual Meeting, January 11-15, Washington, D.C.

Tammy Trimble

Completed the National Highway Institute FHWA-NHI-420018 Instructor Development Course in November 2015.

Presenter (2016): Automated Driving Research at VTTI. Driverless (Autonomous) Cars: The Ethical, Legal, and Public Policy Implications. George Mason University, April 2016, Arlington, VA.

Received Virginia Tech's Ten Years of Service award.

*Denotes presentation made by a VTTI student author.

**Denotes presentation made by a lead author not affiliated with VTTI.



Publications

Includes technical reports, journal articles, and conference proceedings.



Ahn, K., Rakha, H., Kang, K., & Govindarajan, V. (2016). Multimodal Intelligent Transportation Signal System Simulation Model Development and Assessment. *Transportation Research Record: Journal of the Transportation Research Board*.

Ala, M. V., Yang, H., & Rakha, H. (2016). Sensitivity Analysis of Eco-Cooperative Adaptive Cruise Control at Signalized Intersections. *Transportation Research Record: Journal of the Transportation Research Board*.

Albert, D.L., Beeman, S.M., McNally, C., & Kemper, A.R. (in press). Short Communication: Evaluation of Rigid Polyurethane Foam as a Surrogate Material for Knee Bolsters and Knee Bolster Airbags in Full Scale Frontal Sled Tests. *Traffic Injury Prevention, Special Issue: Peer-Reviewed Journal for the 60th Annual Scientific Conference of the Association for the Advancement of Automotive Medicine, 2016*.

Antin, J., Owens, J., Foley, J., Ebe, K., & Wotring, B. (2016). Comparing the Driving Safety Benefits of Brain Fitness Training Programs for Older Drivers (SAE Technical Paper 2016-01-1441). doi: 10.4271/2016-01-1441

Antin, J.A., Owens, J.M., & Wotring, B.M. (2015). Comparing the driving safety benefits of brain fitness training programs for elderly drivers. Final report submitted to Toyota Collaborative Safety Research Center in fulfillment of contract.

Beeman, S.M., Kemper, A.R., & Duma, S.M. (in press). Neck Forces and Moments of Human Volunteers and Post Mortem Human Surrogates in Low-Speed Frontal Sled Tests. *Traffic Injury Prevention, Special Issue: Peer-Reviewed Journal for the 60th Annual Scientific Conference of the Association for the Advancement of Automotive Medicine, 2016*.

Blanco, M. et al. (in press). Investigating critical incidents, driver restart period, sleep quantity, and crash countermeasures in commercial operations using naturalistic data collection: Final report. Washington, DC: Federal Motor Carrier Safety Administration.

Blanco, M., Atwood, J., Russell, S., Trimble, T., McClafferty, J., & Perez, M. A. (2016). Automated vehicle crash rate comparison using naturalistic data. Blacksburg, VA: Virginia Tech Transportation Institute.

Bryant, C., Rakha, H., & El-Shawarby, I. (2015). Study of Truck Driver Behavior at the Onset of a Yellow Traffic Signal Indication for the Design of Yellow Timings. *Transportation Research Record: Journal of the Transportation Research Board*, 2488, 62-70. doi:10.3141/2488-07

- Burks, S.V. et al. (2016). Nonadherence with employer-mandated sleep apnea treatment and increased risk of serious truck crashes. *Sleep*, 39(5), 1-9.
- Calida, B., Perez, M.A., & Xu, H. (2016). Enhanced Prediction of Vehicle Fuel Economy and Other Vehicle Operating Cost [Data set]. doi:10.15787/VTT1X59J
- Calida, B., Perez, M.A., Ishak, S., Osman, O., & Ye, M. (2016). Exploring Naturalistic Driving Data for Distracted Driving Measures [Data set]. doi:10.15787/VTT1D59V
- Calida, B., Perez, M. A., Savolainen, P., Smadi, O., Russo, B., Gates, T., & Kay, J. (2015). Concept to Countermeasure- Research to Deployment Using the 2nd Strategic Highway Research Program (SHRP2) Naturalistic Driving Study (NDS) Data: The Interrelationships between Speed Limits' Geometry and Driver Behavior [Data set]. doi:10.15787/VTT16P4J
- Calida, B., Perez, M. A., Ahmed, M., Ghasemzadehkhoshgroudi, A., & Clapp, J. (2015). Concept to Countermeasure- Research to Deployment Using the 2nd Strategic Highway Research Program (SHRP2) Naturalistic Driving Study (NDS) Data: Adverse Weather and Speeding [Data set]. doi:10.15787/VTT1301S
- Calida, B., Perez, M. A., Brown, J., Richard, C., Liu, T., Stark, G., Divekar, G., Graving, J., & Milton, J. (2015). Concept to Countermeasure- Research to Deployment Using the 2nd Strategic Highway Research Program (SHRP2) Naturalistic Driving Study (NDS) Data: Examination of Episodic Speeding on Washington State Road [Data set]. doi:10.15787/VTT1BC7P
- Calida, B., Kady, J., Perez, M.A., Oneyear, N., & Hallmark, S. (embargoed until 2017). ISU: Evaluating the Relationship between the Driver and Roadway to Address Rural Intersection Safety using the SHRP 2 Naturalistic Driving Study Data [Data set]. doi:10.15787/VTT1MW2P
- Camden, M. C., Hickman, J. S., & Hanowski, R. J. (2015). Effective Use of Commercially Available Onboard Safety Monitoring Technologies: Guidance for Commercial Motor Vehicle Carriers (Report No. 15-UT-032). Blacksburg, VA: The National Surface Transportation Safety Center for Excellence. Retrieved from: https://vtechworks.lib.vt.edu/bitstream/handle/10919/51586/OnboardSafetyMonitoring_Final_Rev_Acknow.pdf?sequence=3&isAllowed=y
- Camden, M. C., Soccolich, S. A., Hickman, J. S., & Hanowski, R. J. (2015). Drug use and involvement in a safety-critical event: Pilot study using naturalistic truck data. *Transportation Research Record: Journal of the Transportation Research Board*, 2516, 75-80.
- Camden, M. C., Hickman, J. S., Soccolich, S. A., Miller, A., & Hanowski, R. J. (in press). Phase I: Crash Risk by Commercial Motor Vehicle Driver Schedules (Contract No. DTMC-75-14-D0001, Task Order #1). Washington, D.C.: Federal Motor Carrier Safety Administration.
- Carlson, P. J., Brimley, B. K. Miles, J. Chrysler, S., Gibbons, R. B. & Terry, T. (2016). Guidelines for Nighttime Visibility of Overhead Signs. (National Cooperative Highway Research Program Report No. 828). Retrieved from Transportation Research Board of the National Academies of Sciences website:http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_828.pdf
- Chen, H., & Rakha, H. A. (in press). Multi-step Prediction of Experienced Travel Times using Agent-based Modeling. *Transportation Research Part C: Emerging Technologies*.
- Chen, H., & Rakha, H. (2015). Real-time freeway travel-time prediction. *Engineering & Technology Reference*, 1(1), 9. doi:10.1049/etr.2015.0001
- Chen, H., Rakha, H. A., Loulizi, A., El-Shawarby, I., & Almannaa, M. (2016). Development and Preliminary Field Testing of a Connected Vehicle Eco-Speed Control System in the Vicinity of Signalized Intersections. *Proceedings of the 14th IFAC Symposium on Control in Transportation Systems*, Istanbul, Turkey.
- Chen, R., Kusano, K. D., & Gabler, H. C. (2015). Age and Gender Difference in Braking Behavior from the 100-Car Naturalistic Driving Study: The Implication for Autonomous Braking System Design. *Proceedings of the Third International Symposium on Future Active Safety Technology toward Zero-Traffic-Accidents*, Gothenburg, Sweden.
- Chen, R., Kusano, K. D., & Gabler, H. C. (2015). Driver Behavior during Overtaking Maneuvers from the 100-Car Naturalistic Driving Study. *Traffic Injury Prevention*, 16(2), S176-S181. doi: 10.1080/15389588.2015.1057281
- Chen, R., Sherony, R., & Gabler, H. C. (2016). Comparison of Time to Collision and Enhanced Time to Collision at Brake Application during Normal Driving (SAE Technical Paper 2016-01-1448).

Chiara, F., Ahn, K., & Rakha, H. A. (2016). Power-based electric vehicle energy consumption model: Model development and validation. *Journal of Applied Energy*, 257-268. doi: 10.1016/j.apenergy.2016.01.097

Danelson, K.A. et al. (2015). Comparison of ATD to PMHS Response in the Under-Body Blast Environment. *Stapp Car Crash Journal*, 59, 445-520.

de León Izeppi, E., Morrison, A., Flintsch, G.W., & McGhee, K.K. (2015). Best Practices and Performance Assessment for Preventive Maintenance Treatments for Virginia Pavements (VTRC 16-R3). Retrieved from Virginia Transportation Research Council: http://www.virginiadot.org/vtrc/main/online_reports/pdf/16-r3.pdf

Dingus, T. A., Guo, F., Lee, S., Antin, J. F., Perez, M., Buchanan-King, M., & Hankey, J. (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data. *Proceedings of the National Academy of Sciences*, 113(10), 2636-2641. doi:10.1073/pnas.1513271113*

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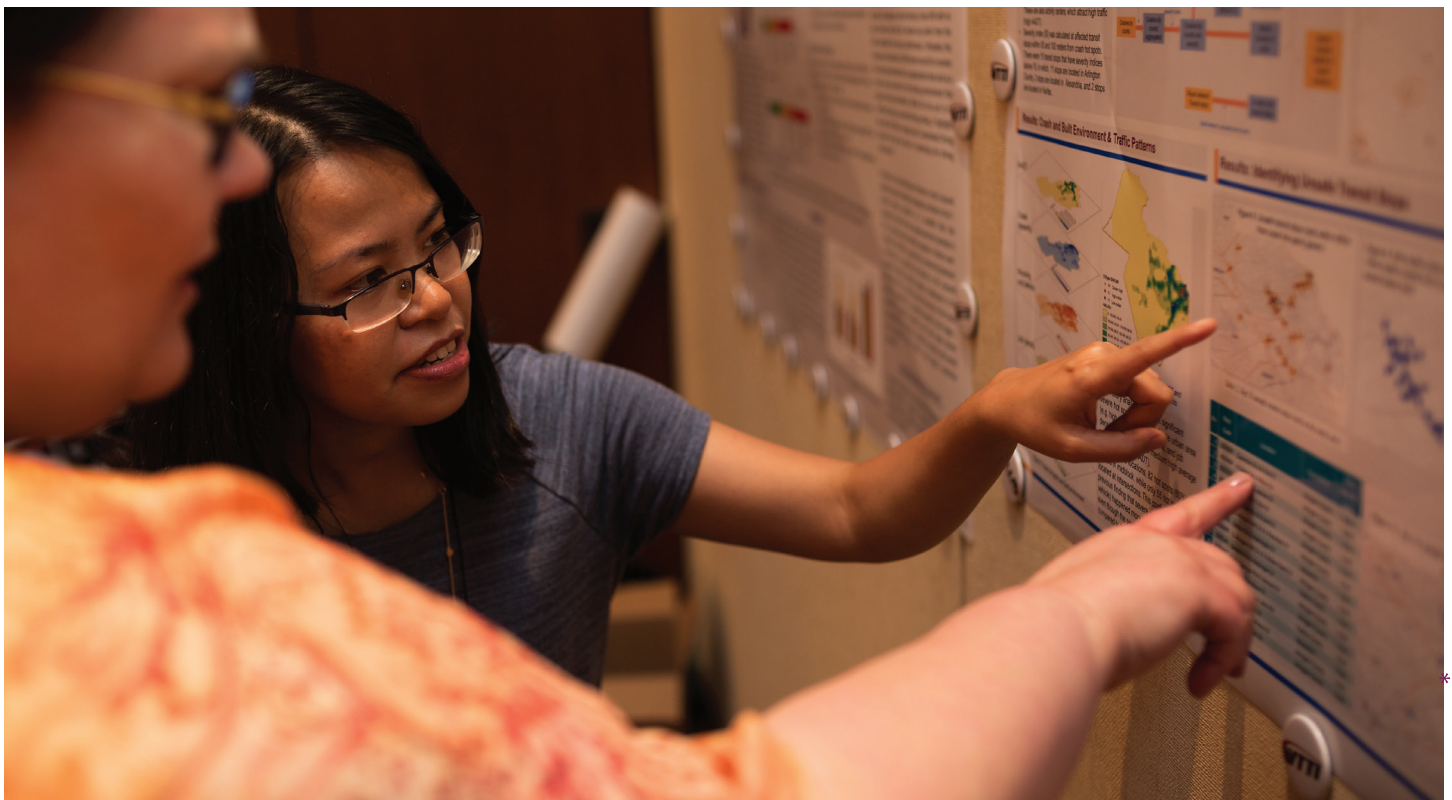
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*Denotes work published since the 2015 Annual Report or work published in a new format.



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